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Health Status as a Determinant for Pre-Retirement Savings

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Health Status as a Determinant for Pre-Retirement Savings

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Abstract:

The paper aims to find out whether health status determines the level of liquid savings among a pre-retirement (50-60 years old) segment of the Czech population as retrieved from the SHARE (Survey of Health, Aging and Retirement in Europe) database, Wave 5 using a 2SLS methodology. Other demographic, health and economic characteristics are considered. We find a significant positive relationship between health and savings. It suggests that careful design of preventive health programs could ease the public pension system because if healthy, individuals could secure themselves for retirement.

Keywords: Health status, savings, Czech Republic, 2SLS, SHARE Dataset
JEL: D14, I15

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1 Introduction

Consistent with life-cycle optimization behavior, individual savings should reach their maxima at the point of retirement (Curtis *et al.*, 2015). Earlier in life individuals usually support dependent children and thus do not save much. Later in life, savings are already being used up in retirement to cover individual's expenses. The pre-retirement cohort however increasingly suffers from health issues too and their health expenses escalate (Mana & Kalnicka, 2016). The effect of health status on savings thus should prove the strongest in the pre-retirement cohort.

The relationship between health and wealth accumulation/savings among the elderly has been widely analyzed in the literature. Smith (1999) analyzed a panel of individuals and proxied health by self-reported general health status finding out that in middle and older ages new health events significantly affect household income and wealth. Adams *et al.* (2003) analyzed a US panel of individuals aged 70+ and proxied health by a dummy variable indicating whether a doctor has ever told the respondent, one suffered from a particular illness. Health conditions were found to be associated with increased dis-saving from liquid wealth. Ricketts *et al.* (2013) carried out a 2SLS model analyzing the relationship between health outcomes and the willingness to save on a cross-section of individual data. They find that health outcomes are positively related to the individuals' willingness to save.¹

In addition, Pang & Warshawsky's (2010) results show that health spending risk drives household portfolios to shift from risky equities to safer assets and enhances the demand for annuities due to their increasing-with-age superiority over bonds in hedging against life-contingent health spending and longevity risks. Atella *et al.* (2012) suggests however that health risks affect portfolio choices only in countries without a protective full-coverage National Health Systems (NHS) suggesting that NHS act as a shelter preventing shifts to safe investments due to individual's health issues arising in older ages.

As the literature suggests, it is rather unlikely that specific health outcomes are exogenous to savings. The simultaneous relationship has been taken into account for instance in Adams *et al.* (2003), Meer *et al.* (2003), Salm (2010), Ricketts *et al.* (2013) or Michaud & van Soest (2004). Meer *et al.* (2003) applied an instrumental variable regression instead.

Even though the literature on the relationship between health and savings is quite extensive, it is missing for the Czech Republic. We will contribute to this stream of missing research by the analysis of the savings behavior of the Czech population aged 50–60, taking into account their health status, as well as other demographic, health and economic characteristics to account for heterogeneity in a considerably homogeneous sample. In the Czech Republic, this age cohort usually does not retire before the age of 60 although early retirement is also possible. A cross-section of Czech data of the SHARE (Survey of Health, Ageing and Retirement in Europe) database, Wave 5, is analyzed. Household savings data is normalized

¹The relationship between health status and savings has been analyzed also at the macroeconomic level. See for example Junji (2003) who found out that an increase in life expectancy has a positive effect on various saving rates. Sheshinski (2009) proved that increased longevity increases aggregates savings, but only in countries with universal pension coverage and retirement incentives. The effect was found to disappear in countries with pay-as-you-go systems and high replacement rates.

to individual level (divided by 2 for cohabitating partners).

The paper aims to investigate whether health status has an effect on the accumulation of quite liquid financial assets (current amount on bank accounts, the current amount saved in bonds, stocks and mutual funds and savings for long-term investment) at a certain point of time of the pre-retirement segment of the population who are assumed to be significantly concerned with savings for the years to come. At the same time, we assume that everyone wants to save some portion of their work-life income for retirement to optimize their life-time consumption behavior, consistent with the macroeconomic life-time optimization models. A 2SLS methodology is applied.

In the paper, we also test for the endogeneity problem between health and the level of pre-retirement savings among the Czech population. On one end, we assume that people with a high level of quite liquid financial assets are risk averse. Risk aversion characterizes their behavior and they are thus also sensitive to health risks. They invest into preventive health programs, go to the gym, eat healthy food, etc. which in the end increases their health status. On the other end, sicker people spend a lot of money on their health and thus save less because their primary goal is to get well now. If healthy, these consumers invest into other forms of consumption and wealth rather than health. The latter relationship has been empirically confirmed by Fu *et al.* (1999) who found that individuals who are not chronically ill are less willing to pay for low pesticide products in Taiwan compared to individuals who are chronically ill. Explanation of the endogenous relationship with income was rejected based on an insignificant correlation with the endogenous variables. This analysis uses income as an exogenous variable in a 2SLS similar to Ricketts *et al.* (2013).

We will answer the following questions:

- Does health play a role in explaining the level of savings in the pre-retirement segment of the population?
- Is there an endogenous relationship between health and savings at a micro-level?
- What other characteristics play a role in explaining the level of financial assets accumulated in the pre-retirement age cohort?

The paper is organized as follows: Section 2 theoretically explains the methodology used, Section 3 introduces the dataset, Section 4 reports empirical results and Section 5 discusses and concludes.

2 Methodology

To account for the bi-directional relationship between health outcomes and savings, we use the Two-Stage model (Greene, 2002). This approach ensures that error terms in the dependent variables are uncorrelated with the independent variables. A similar approach was taken by Meer *et al.* (2003) or Ricketts *et al.* (2013).

A two-stage model rests on the idea that first, two reduced form equations are estimated, such that each endogenous variable is expressed as a function of only exogenous variables

(instruments). Fitted values of the endogenous variables (health outcomes, savings) are obtained, and consequently plugged into the structural equations. For a two-stage least squares estimation, consider the following model:

$$y_1 = \alpha_1 y_2 + \sum_{i=1}^k \beta_i x_i + u \quad (1)$$

where y_2 is an endogenous variable of a structural equation for y_1 , $x_1 \dots x_k$ are exogenous independent variables and α_1 and β_1, β_k are coefficients to be estimated. In addition, there is a vector of instruments $\mathbf{z} = (1, x_1, \dots, x_k, z_1 \dots z_m)$ that are correlated with endogenous y_2 . In other words, vector \mathbf{z} covers both exogenous independent variables and instruments. For illustration, the reduced form equation for y_2 takes:

$$y_2 = \delta_0 + \sum_{i=1}^k \delta_i x_i + \sum_{i=1}^m \gamma_i z_i + \epsilon \quad (2)$$

thus we get

$$y_2 = \hat{y}_2 + \epsilon, \quad (3)$$

where \hat{y}_2 is a linear projection of y_2 with all exogeneous variables that are not correlated with u in Equation 1. The projection \hat{y}_2 is thus not correlated with u , and ϵ takes up all the correlation with u . In a two-step estimation, \hat{y}_2 is then plugged into equation 1. However, in such a two-stage procedure where predicted variables are used, standard errors are usually smaller than if estimated in a single step. We thus consider only vectors \mathbf{x} and \mathbf{z} and estimate all in one step.

In order for the structural equations to be identified, exclusion restriction has to be satisfied (Greene, 2002), i.e. at least one variable has to be excluded from each structural equation to be identified.

3 Data

The dataset used for the analysis was retrieved from the SHARE database, Wave 5. It comprises only the Czech part of the survey of individuals aged 50-60, i.e. those born after 1951. Only individuals living with a partner are covered, i.e. single households are excluded due to homogeneity of the sample. The final dataset used for the main analysis covers 1,405 observations. A robustness check restricts the dataset to 920 observations.

Variables used in the model shall be divided into endogenous variables and exogenous variables, the latter of which includes demographic factors, health factors and economic factors. If available, imputed variables were preferred (Börsch-Supan, 2016) due to a large number of missing observations in the original dataset.

3.1 Endogenous variables:

Household gross financial assets (S_G) represents the dependent variable of the model. Is is obtained as a sum of the current amount on bank accounts, the current amount saved

in bonds, stocks and mutual funds and savings for long-term investment, all for both co-habiting partners together. The resulting sum is normalized to an individual level since co-habiting partners share the costs of living and make investment decisions jointly. **Household net financial assets** (S_N) normalized for an individual level was tested as an alternative dependent variable. It was obtained as household gross financial assets net of liabilities.

Self-perceived health status (H_{PHS}) is an endogenous variable proxying health. It takes on values 0-5, with 0 being the worst and 5 being the best. If sick, one saves less, because she wants to get better as soon as possible and thus invests in her health. If healthy, individuals have a wide choice to invest in other forms of consumption and wealth/savings. It is assumed that in the pre-retirement cohort, preference should be given to liquid financial assets, thus a positive relationship is expected similar to Ricketts *et al.* (2013). **Long-term illness** (H_{L-TI}) represents an alternative proxy for health status. It is a dummy variables taking value of 1 if present, and zero otherwise. Long-term illness may be chronic or may limit an individual in certain activities, including labor market activities, for a longer period of time. Similar as above, a presence of a long-term illness and thus worse health status is expected to decrease one's pre-retirement savings.

3.2 Exogenous variables:

Education of the respondent ('edu') in years is an ordered variable representing the level of education, i.e. human capital one has accumulated. It is assumed that more educated individuals are more concerned with their health and have a positive attitude towards savings, thus increasing both.

Income ('income') represents a sum of an average monthly income of a household in the year prior to the interview and an average monthly income from rents on real estate in the last year. It expresses heterogeneity in the earning capacity that influences how much money can be substituted between savings and other investment/consumption having satisfied basic needs. We assume that income has a positive effect on savings as found by Ricketts *et al.* (2013) or Fioroni (2010).

Assets ('assets') represents household's real assets. It was obtained as a sum of the value of main residence owned, value of own business, value of cars owned, value of other real estate, net of mortgages. Real assets represent another dimension of savings which suggests a that a negative effect will result. In other words, if sold, the money would probably be saved, thus subsequently increasing liquid savings. If, however, preferences to hold different kinds of assets do not differ much, suggesting their complementarity rather than substitutability, the resulting effect of real assets on liquid financial assets will be positive. Note also that in the pre-retirement age, many people invest in their homes not to have to do so when old. Even though primary residence and secondary real estates and cars are expected to behave differently from the economic point of view, such that the former is a necessity, while the latter is a luxury goods, aggregation is not considered to hamper the relationship anyhow.

Perceived life-expectancy ('lifex') expresses respondent's probability of living in 10 years. It is assumed that a higher probability of living in 10 years increases current savings one has accumulated.

Table 1. Descriptive statistics

	n	mean	median	min	max	sd
H_{PHS}	1405	2.90	3	1	5	1.07
H_{L-TI}	1403	0.41	0	0	1	0.49
S_G	1405	9574	4995	0	159365	12476
S_N	1405	8951	4524	-13448	159365	12663
age	1405	55.97	57	26	61	4.39
gender	1405	1.43	1	1	2	0.49
edu	1405	12.37	12	1	25	2.97
income	1405	13109	11757	0	52330	8039
bmi	1405	27.89	27.25	15.88	71.75	4.97
lifesat	1405	7.31	8	0	10	1.93
assets	1405	91777	60322	-13852	835390	104502
lifex	1405	55.57	50	0	100	29.28
edu_p	1405	12.50	12	1	25	2.96

Partner’s education (‘edu_p’) in years is included under the assumption that the level of education is a proxy for a certain type of human (economic) behavior and that partners usually influence each other’s behavior.

Age (‘age’) is assumed to decrease health outcomes but the effect on savings is not expected to play a significant role due to a very homogenous cohort as to savings behavior. Preliminary analysis excluded also partner’s age as unimportant due to sample homogeneity. In other words, partners are usually of a similar age in this cohort (women may be a few years younger than men). Outliers characterized by enormous age differences between partners do not represent distributional issues for the analysis.

As found by Borchers & Gershwin (2012), and Whitaker *et al.* (2012) or Knoll *et al.* (2012) individual’s savings plan tend to be influenced by gender. On the other hand, Ricketts *et al.* (2013) find that there is not significant difference between males and females. Our preliminary results also suggested an insignificant effect. A variable **SEX** (‘SEX’) thus will be included only in the health equation.

Body mass index (‘bmi’) is an indicator reducing/increasing health, rather than an indicator of poor self-control which would reduce savings (such an effect is assumed to be rather rare in the Czech context). It will thus be included only in the ‘health’ equation.

Life-satisfaction (‘lifesat’) is used similar to Ricketts *et al.* (2013) who included job satisfaction under the assumption that psychological factors also determine ones health. It takes value 0-10, with 0 being absolutely dissatisfied and 10 being absolutely satisfied and happy. This variable enters only the ‘health’ equation.

Table 1 reports descriptive statistics, correlation matrix is provided in Table A1.

The model was estimated in the econometric software R (R Development Core Team,

2006), packages IVREG and SYSTEMFIT and the econometric software STATA.

4 Empirical results

To satisfy the exclusion restriction, from each structural equation, we exclude variables, which are only indirectly related to the particular equation, similar to Ricketts *et al.* (2013).

The structural equations take the following form:

$$S = \beta_0 + \alpha_1 \hat{H} + \beta_1 \text{edu} + \beta_2 \text{income} + \beta_3 \text{assets} + \beta_4 \text{lifex} + \beta_5 \text{edu_p} + u \quad (4)$$

$$H = \beta_0 + \alpha_1 \hat{S} + \beta_1 \text{age} + \beta_2 \text{gender} + \beta_3 \text{edu} + \beta_4 \text{income} + \beta_5 \text{bmi} + \beta_6 \text{lifesat} + u \quad (5)$$

where H defines a dependent variable representing health (perceived health status, or alternatively presence of a long-term illness), S denotes gross financial assets, or alternatively net financial assets attributable to an individual. Parameter u denotes the error term.

All of the independent variables from equation 4 and equation 5 serve as instruments in the reduced form equations for health and savings.

Results of the four alternative specification of equation 4 are provided in Table 2 and Table 3.²

Model 1 and model 3 use gross savings (S_G) as a dependent variable, whereas model 2 and model 4 employ net savings (S_N) as a dependent variable, i.e. gross savings net of household debt. Perceived health status (H_{PHS}) is an instrumented variable in models 1 and 2, while a presence of a long-term illness (H_{L-TI}) stands for a health status variable in models 3 and 4.

All four models reveal consistent results as to the direction and significance of exogenous variables. Sizes of the effect of the exogenous variables are not very different across models either, suggesting that selected alternative dependent and instrumented variables may be used as robust substitutes.

Additional years of education of both partners in the household increase the level of financial assets. Income also has a positive effect on financial assets accumulated as expected. Possession of real assets complements accumulation of financial assets rather than it would substitute it. That is, individuals who own real assets have also accumulated liquid financial assets which points out to their risk-aversion. Life expectation, i.e. one's probability of living in 10 years, decreases the level of current financial assets already accumulated. If one expects to stay alive during these 10 coming years, she probably believes that she will stay in the labor market for some more time and be able to accumulate additional financial assets for retirement.

Better health, as expressed either by self-perceived health status or by the presence of a long-term illness, increases current financial assets as initially expected. Note that signs of the coefficient of these two variables differ because of opposite interpretation of the variables.

²Other specifications of the model were also tested due to a large choice of exogenous variables available from the SHARE dataset. The selected specification was chosen as the most appropriate reflecting parsimonious and efficiency principle.

A higher value of self-perceived health status denotes better health, whereas the presence of a long-term illness takes the value 1, while absence of a long-term illness is denoted by 0. A similar approach was taken for example by Ricketts *et al.* (2013).

R-squared in Table 2 and Table 3, by definition, does not bring much information for the 2SLS model. All consistency tests necessary for the 2SLS model are reported in Table 4. To test **endogeneity** we applied the Wu-Hausman test which in all cases rejected the null hypothesis that OLS and 2SLS are equally consistent. Thus 2SLS here is consistent and OLS is not, therefore 2SLS is preferred. Note that if OLS is BLUE, 2SLS has larger standard errors for the coefficient estimates. Additionally, we extracted residuals from each reduced form equation. A residual from a reduced form health equation was plugged into a structural savings equation and a residual from a reduced form savings equation was plugged into a structural health equation. If the residual is significant, the variable from which reduced form equation was extracted is endogenous. Table 4 reveals that health is endogenous with respect to savings which confirms the results of the Wu-Hausman test.

Weak instrument test and an F-test for a joint significance of instruments which was applied on reduced form equations consistently **reject the null hypothesis that the instrument is weak**, i.e. jointly 0. In other words, results reveal that the instruments selected are sufficiently correlated to the endogenous variable.

Sargan test and the LM overidentification test confirm that **all exogenous instruments are exogenous** and thus uncorrelated with the model residuals. Specifically, the Sargan test here accepts the null hypothesis that the model is not overidentified. To carry out the LM test, we regress residuals extracted from the structural savings equation on all instruments. Since the null hypothesis is accepted, the model is not overidentified.³

A test for **heteroscedasticity** is essential for the 2SLS model. The Breush-Pagan test for heteroscedasticity rejects homoscedasticity at a border level for all four models. The White test rejects homoscedasticity for model 3 and model 4 completely. Since robust standard errors are appropriate even under homoscedasticity, Table 2 and Table 3 report also heteroscedasticity-robust standard errors. Since homoscedasticity was rejected at a border level only, robust standard errors do not differ much from the heteroscedasticity non-adjusted robust standard errors.

Model 2 was subject to an additional robustness check where the behavior of only household heads was analyzed. Such an approach reduces the sample to 920 observations, but gets rid of the potential bias which may result from normalization of financial assets accumulated to an individual level. Thus, the same amount of financial assets accumulated does not appear twice in the analysis if partners live together. Only model 2 was selected since it analyzes net financial assets (without liabilities) and uses self-perceived health status (which is not a dummy) as an instrumented variable. Results of the robustness check are reported in Table 5. The direction of the effect of the explanatory variables confirm the results of the main analysis. However, years of own education loses significance completely and the amount of real assets accumulated is less significant than before.

³An R-squared insignificantly different from 0 and an F test already reveals the like, however, they assume normality. Thus the LM test is more appropriate.

Table 2. Instrumental variables (2SLS) regression: Model 1 and model 2

	Model 1					Model 2									
	Wald chi2(6) = 323.14	Prob > chi2 = 0.0000	R-squared = 0.1512	Root MSE = 11490	No. obs = 1405	Wald chi2(6) = 268.95	Prob > chi2 = 0.0000	R-squared = 0.1512	Root MSE = 11490	No. obs = 1405	Wald chi2(6) = 331.24	Prob > chi2 = 0.0000	R-squared = 0.1461	Root MSE = 11697	No. obs = 1405
	Robust					Robust					Robust				
	coef	st. Error	p-value	st. Error	p-value	coef	st. Error	p-value	st. Error	p-value	coef	st. Error	p-value	st. Error	p-value
<i>H_{PHS}</i>	2233.22	969.4397	0.021	1098.996	0.042	2673.099	986.9043	0.007	1136.927	0.019	1136.927	0.007	1136.927	0.019	*
edu	337.7014	133.2966	0.011	140.7427	0.016	355.094	135.698	0.009	143.0458	0.013	355.094	135.698	0.009	143.0458	*
income	.3727432	.0433988	0.000	.0522707	0.000	.3517675	.0441806	0.000	.0535569	0.000	.3517675	.0441806	0.000	.0535569	***
assets	.0113795	.0032223	0.000	.0036723	0.002	.0128469	.0032804	0.000	.0037148	0.001	.0128469	.0032804	0.000	.0037148	***
lifex	-48.79993	13.78197	0.000	14.49788	0.001	-52.12735	14.03026	0.000	14.82062	0.000	-52.12735	14.03026	0.000	14.82062	***
edu_p	564.6936	121.9206	0.000	132.6152	0.000	586.4932	124.117	0.000	135.796	0.000	586.4932	124.117	0.000	135.796	***
_cons	-11351.45	1957.987	0.000	1986.84	0.000	-13410.88	1993.261	0.000	2071.158	0.000	-13410.88	1993.261	0.000	2071.158	***
	dependent var: <i>S_G</i>					dependent var: <i>S_N</i>					dependent var: <i>S_N</i>				

Note: Signif. codes: 0 '***' 0.01 '**' 0.05 '*' 0.1 '.'

Table 3. Instrumental variables (2SLS) regression: Model 3 and model 4

	Model 3										Model 4															
	Wald chi2(6) = 303.91					Wald chi2(6) = 250.58					Wald chi2(6) = 307.87					Wald chi2(6) = 253.95										
	Prob > chi2 = 0.0000					Prob > chi2 = 0.0000					Prob > chi2 = 0.0000					Prob > chi2 = 0.0000										
	R-squared = 0.0938					R-squared = 0.0938					R-squared = 0.0799					R-squared = 0.0799										
	Root MSE = 11878					Root MSE = 11878					Root MSE = 12148					Root MSE = 12148										
	No. obs = 1403					No. obs = 1403					No. obs = 1403					No. obs = 1403										
						Robust										Robust										
	coef	st. Error	p-value			st. Error	p-value			coef	st. Error	p-value			st. Error	p-value			coef	st. Error	p-value					
H_L-TI	-7291.776	3336.63	0.029	*		3627.334	0.044	*		-8335.151	3412.349	0.015	*		3779.036	0.027	*		-8335.151	3412.349	0.015	*		3779.036	0.027	*
edu	319.49	142.1404	0.025	*		151.8232	0.035	*		341.6254	145.3661	0.019	*		155.3176	0.028	*		341.6254	145.3661	0.019	*		155.3176	0.028	*
income	.3980163	.0427107	0.000	***		.0501341	0.000	***		.3816994	.0436799	0.000	***		.0511477	0.000	***		.3816994	.0436799	0.000	***		.0511477	0.000	***
assets	.0118187	.0032794	0.000	***		.0037391	0.002	**		.0134814	.0033538	0.000	***		.0037989	0.000	***		.0134814	.0033538	0.000	***		.0037989	0.000	***
lifex	-50.85521	15.33122	0.001	**		15.75123	0.001	**		-53.51938	15.67914	0.001	**		16.20761	0.001	**		-53.51938	15.67914	0.001	**		16.20761	0.001	**
edu_p	582.5412	125.3112	0.000	***		134.0191	0.000	***		608.3647	128.1549	0.000	***		137.4332	0.000	***		608.3647	128.1549	0.000	***		137.4332	0.000	***
_cons	-2107.362	3535.153	0.551			3943.12	0.593			-2685.307	3615.377	0.458			4077.081	0.510			-2685.307	3615.377	0.458			4077.081	0.510	
	dependent var: SG										dependent var: S_N															

Note: Signif. codes: 0 '***' 0.01 '**' 0.05 '*' 0.1 '.'

Table 4. 2SLS consistency tests

Model 1							Model 2						
	df1	df2	statistic	p-value			df1	df2	statistic	p-value			
Wu-Hausman	1	1397	8.388	0.00384	**		1	1397	10.574	0.00117	**		
Endogeneity test				0.70523		health				0.79605		health	
Endogeneity test				0.003837	**	savings				0.001299	**	savings	
Weak instrument test	3	1395	43.067	< 2e-16	***		4	1394	32.301	< 2.2e-16	***		
F-test joint sign. Instr.	9	1395	50.1	< 2.2e-16	***	health	9	1395	50.1	< 2.2e-16	***	health	
F-test joint sign. Instr.	9	1395	38.11	< 2.2e-16	***	savings	9	1395	40.07	< 2.2e-16	***	savings	
Sargan	3	NA	3.498	0.32106	*		3	NA	7.908	0.04794	*		
LM overident. test				0.967176						0.7530647			
Breusch-Pagan heterosc. Test	6	1398	2.367	0.02799	*		6	1398	2.201	0.04053	*		
White homosced. Test	2	1402	3.881	0.02085	*		2	1402	3.302	0.03711	*		
Model 3							Model 4						
Wu-Hausman	1	1395	6.955	0.00845	**		1	1395	8.667	0.00329	**		
Endogeneity test				0.324332		health				0.355105		health	
Endogeneity test				0.0311	*	savings				0.003293	**	savings	
Weak instrument test	4	1392	10.990	8.92e-09	***		3	1393	14.250	3.78e-09	***		
F-test joint sign. Instr.	9	1393	18.01	< 2.2e-16	***	health	9	1393	18.01	< 2.2e-16	***	health	
F-test joint sign. Instr.	9	1393	38.3	< 2.2e-16	***	savings	9	1393	40.24	< 2.2e-16	***	savings	
Sargan	3	NA	3.607	0.30712	*		3	NA	6.777	0.07937	*		
LM overident. test				0.9753524						0.7463513			
Breusch-Pagan heterosc. Test	6	1396	2.732	0.01214	*		6	1396	2.646	0.01481	*		
White homosced. Test	2	1400	1.988	0.1373			2	1400	1.451	0.2347			

Note: Signif. codes: 0 '***' 0.01 '**' 0.05 '*' 0.1 '.'

Table 5. Instrumental variables (2SLS) regression: Robustness check model 2

	Wald chi2(6) = 192.60			Wald chi2(6) = 166.94		
	Prob >chi2 = 0.0000			Prob > chi2 = 0.0000		
	R-squared = 0.0934			R-squared = 0.0934		
	Root MSE = 12431			Root MSE = 12431		
	No. Obs = 920			No. Obs = 920		
				Robust		
	coef	st. Error	p-value	st. Error	p-value	
PHS	3629.984	1248.938	0.004	** 1385.762	0.009	*
edu	272.5381	176.4413	0.122	185.7433	0.142	
income	.3438024	.0572063	0.000	*** .059625	0.000	***
assets	.0110207	.0043727	0.012	* .00486	0.023	*
lifex	-62.71932	17.40387	0.000	*** 17.04647	0.000	***
edu_p	596.18	158.2233	0.000	*** 176.6748	0.001	**
_cons	-14346.32	2653.517	0.000	*** 2679.206	0.000	***

dependent var: S_N

Note: Signif. codes: 0 '***' 0.01 '**' 0.05 '*' 0.1 '.'

Table 6. 2SLS consistency tests - robustness check model 2

	df1	df2	statistic	p-value	
Wu-Hausman	1	912	12.89	0.000347	**
Endogeneity test				0.9888	health
Endogeneity test				0.000357	** savings
Weak instrument test	4	909	23.96	< 2e-16	***
F-test joint sign. Instr.	9	910	33.27	< 2.2e-16	*** health
F-test joint sign. Instr.	9	910	24.01	< 2.2e-16	*** savings
Sargan	3	NA	2.31	0.510540	
LM overident. test				0.9951037	
Breush-Pagan heterosc. Test	6	913	1.309	0.2504	
White homosced. Test	2	917	1.322	0.2672	

Consistency tests for a robustness check in Table 6 confirm that a 2SLS methodology is appropriate. Perceived health status remains endogenous to the current level of financial assets accumulated and it is appropriately instrumented within the model. Homoscedasticity is now accepted both through Breush-Pagan and White tests. Still, Table 5 reports also heteroscedasticity-robust standard errors.

5 Conclusion

The paper investigated the relationship between the level of short-term liquid financial assets and a health status of the pre-retirement age cohort in the Czech Republic. A SHARE Wave 5 dataset of 1,405 individuals aged 50-60 was analyzed using a 2SLS methodology because the relationship between health and savings proved endogenous. The effect of other socio-demographic and economic factors was considered. This paper is the first attempt to analyze savings behavior of the pre-retirement segment of the population in the Czech Republic.

Additional education and income were found to increase savings. Possession of real assets apparently complements the accumulation of short-term financial assets rather than it would substitute it. In other words, it appears that the people who own real assets always want to own a proportionate level of liquid financial assets as well. Life-expectation, i.e. one's perceived probability of living in 10 years decreases the current level of financial assets. If one believes in an optimistic outlook of one's own life, she probably believes that she will accumulate additional financial assets, and not yet retire. In this respect, a lagged variable may uncover additional information.

Most importantly, we find that a better health status significantly increases the level of current liquid financial assets one has accumulated in the years prior to retirement. Our micro-economic analysis should thus motivate policy-makers to give priority and carefully design preventive health programs because healthy individuals could financially secure themselves for retirement.

Consistent with increasing life expectancy ⁴ which is expensive for the pension system, upon our scenario where preventive health programs increase personal savings, a well-designed reform of the pension system which increases private participation, should ease the currently tight public pension system

The healthcare system would also benefit from well-designed preventive health programs because prevention is cheaper than treatment. In addition, if the individuals save, interest rates fall, investments rise which stimulates economic growth in aggregate.

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Appendix

Table A1. Correlation matrix

	L-TI	income	assets	S_G	S_N	edu	edu.p	H_{PHS}	lifex	age	gender	bmi	lifesat
L-TI	1												
income	-0.09742	1											
assets	-0.09404	0.316886	1										
S_G	-0.03629	0.332513	0.23379	1									
S_N	-0.04888	0.329878	0.247973	0.986019	1								
edu	-0.14387	0.240699	0.246961	0.25676	0.261065	1							
edu.p	-0.10825	0.2398	0.235191	0.281393	0.290403	0.483456	1						
H_{PHS}	-0.55342	0.205275	0.185073	0.111498	0.127488	0.222599	0.195149	1					
lifex	-0.22226	0.03737	0.067821	0.003043	0.00553	0.071144	0.061609	0.282725	1				
age	0.101011	-0.06709	0.014708	0.003318	0.016518	-0.0407	-0.02587	-0.12612	-0.00519	1			
gender	0.008037	0.077258	0.013739	0.028136	0.022075	0.067245	-0.05318	-0.05241	-0.03792	0.141093	1		
bmi	0.127183	-0.02981	-0.05825	-0.0615	-0.06561	-0.10678	-0.08731	-0.16233	-0.11188	0.053831	0.063578	1	
lifesat	-0.24484	0.168106	0.142043	0.132785	0.158292	0.17714	0.150547	0.353913	0.236461	0.02196	0.026689	-0.02679	1

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