Multidimensional health modeling: Association between socioeconomic and psychosocial factors and health in Latvia

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Abstract

This research aims at estimating association between socioeconomic and psychosocial factors on the one hand and health in Latvia on the other hand. While information on association between socioeconomic determinants of population health in Latvia is scarce, effect of psychosocial resources on individual health in this country hasn't been estimated before. We find empirical support for the association between different psychosocial factors and physical health in Latvia.

This paper proposes new approach for modelling self-assessed health. We find that the concept of health is too complicated to measure effects of health determinants using a one-dimensional econometric model. We apply two-dimensional stereotype logistic model that allows capturing nonmonotonicity in effects of factors and revealing significant effects that remain unseen if single dimension models, such as ordered logit or ordered probit, are used. Modelling self-assessed health using multi-dimensional stereotype logit provides higher model goodness of fit and quality measures in comparison to ordered probit model.

JEL-Code: I10, I18, C52

Keywords: self-assessed health; socioeconomic determinants; psychosocial factors; nonmonotonicity; stereotype logit

1. Introduction

Reducing socioeconomic health inequalities is one of the main challenges within the public health sector in Europe. Nature of health inequalities differs among EU member states and Consortium of Partners for Equity in Health admits that there is no a single rule for tackling health inequalities, and country-specific data are essential to elaborate efficient policy.

Health inequalities exist not only within, but also between EU member states. There is an 11 year difference in life expectancy at birth between countries such as Switzerland and Italy (82 years) on the one hand and Latvia (71 year) on the other hand (WHO, 2010).

Poor population health indicators and significant social stratification[1] in Latvia defines the necessity of action to tackle health inequalities and to promote overall population health level. Only using country-specific information on main health determinants can provide development of efficient national health policy, however econometric analysis of socioeconomic health determinants in Latvia is scarce (Monden, 2004; Mackenbach, 2006; Mackenbach et.al., 2008).

While income, education, employment status etc. are commonly seen as the main health determinants in the literature, the idea that material determinants may not explain all social health inequalities is admitted and large interest is paid to so called psychosocial resources. To the best of our knowledge, this is the first paper that sheds light on association between psychosocial and socioeconomic factors from the one side and self-assessed health (SAH) in Latvia from the other side.

Association between health and psychosocial factors was revealed in numerous studies. Review of 9 published articles on the link between social capital and individual health was prepared by Islam et al. (2006). After this Dunn et al. (2006) provided empirical evidence on the relationship between SAH status and perceived position in the reference group based on Canadian data. Lavis and Stoddart (2003) find social cohesion to be strongly correlated with health in Canada. Jusot et. al. (2007) provide empirical support for the link between set of psychosocial resources and SAH in France. Iversen (2008) divides social capital into two groups – individual social capital and community social capital, finding positive association between health and voting participation in local elections as well as health and religious activity at the community-level in the cross-sectional survey conducted in Norway.

[1] For example, in 2009 Gini index in Latvia was the greatest among EU member states – 37.4 (Eurostat data).

According to our preliminary research, a major part of population of Latvia is exposed to a substantial psychosocial burden. For example, in 2005 more than a half of population of Latvia was suffering from high stress level[2]. Level of life satisfaction in Latvia in 2003 was the lowest among EU-25 countries (Bohnke, 2005) and only slightly improved relative to other countries in 2007 showing the 3rd lowest result among EU member states (Anderson et.al., 2008). Level of satisfaction with some basic life domains in Latvia was one of the lowest as well (Bohnke, 2005). This indicates that psychosocial burden in a case of its causality can aid to substantial health loss in the country.

In this paper we provide empirical support for the association between psychosocial factors and self-assessed health in Latvia. We do not try to present some fundamentally new psychosocial resources, however our approach to analysis of some psychosocial factors slightly differs from one commonly used in health literature[3]. We analyse impact of stress, sense of control over own life, life satisfaction and expectations on SAH.

This paper proposes new approach to modelling health. We see possible problems in measuring association between socioeconomic determinants and SAH using single-dimension models. Respondents might assess their health status not just along single dimension, but rather thinking of two or more latent variables. This proposes that health might not be monotonically related to underlying latent variables. If this is true, the model should be able to specify multiple equations to capture effects of these variables. Stereotype logistic model developed by Anderson (1984) provides possibility to measure effects of factors in more than one dimension. In a multinomial logistic model, the categories cannot be ranked, while in ordered logistic model the categories follow a natural ranking scheme. Stereotype logistic model can be seen as a compromise between those two models.

Stereotype logistic models are useful when researcher is not sure of the relevance of the ordering; this problem is common when SAH is used – if some two health outcomes are similar to respondent, he or she might be randomly picking between the two. One alternative is to combine these categories and use multinomial logistic model, however in this paper we offer a flexible alternative – stereotype logistic model. The model allows indicating whether all categories are distinguishable and which are not.

[2] "Life quality in Latvia 2005" survey data
[3] Please see the next section

In this paper we use two-dimensional stereotype logistic model to estimate association between socioeconomic determinants and psychosocial factors on the one hand and SAH on the other hand.

While use of self-assessed health status as a measure of health is common in empirical research, many authors admit that Likert type SAH scales should be used cautiously for the assessment of health inequalities. Some studies indicate that this type of SAH scale implies heterogeneity bias. When SAH and more 'objective' health indictors (McMaster Health Utility Index or clinical health) were used, it was found that in Canada and Britain lower income individuals were more likely to report poor level of SAH than higher income groups (Humphries and van Doorslaer, 2000; Hernandez-Quevedo et al., 2004). At the same time in Germany richer respondents for a given level of clinical health provide lower health assessment (Jürges, 2008). In France reporting heterogeneity was found for the choice between the medium labels i.e. "fair" vs. "good" and for high-income individuals (Etile and Milcent, 2006). In USA given similar diagnosed health conditions and severity levels females rate their health levels lower than males; divorced, widowed or separated individuals provide lower health assessment than married or never married individuals (Dodoo, 2006).

Another problem of the very good to very poor health scale is its nonstability (Crossley and Kennedy, 2000); people often face difficulties in assessing their health in terms of good/fair or fair/poor health and are usually randomly picking between two categories.

In our research we use less subjective SAH scale which allows reducing reporting bias and respondent's perception odds thus helping to provide more reliable results for SAH status[4].

Some authors try to avoid mentioned SAH bias using binary logit or probit models for dichotomized multiple-category responses and compare respondents with good health to those who report their health to be "less than good" (Etile and Milcent, 2006; Mackenbach, 2006; Jusot et.al., 2007; Jürges, 2008). But it obviously results in a loss of information and requires the introduction of an arbitrary cut-off point (Wagstaff and van Doorslaer, 1994). Another popular approach is modelling health using ordered logit and probit models (van Doorslaer and Jones, 2003; Bockerman and Ilmakunnas, 2009; Bos and Bos, 2007; Iversen, 2008). Both principles find support in handbook for health researchers by WHO and IBRD for surveys that use SAH as dependent variable (O'Donnell et.al. 2008). In this paper we introduce another approach that uses full ordered health scale, helps to identify and cope with the above

[4] Please see the next section

discussed random category picking problem, and allows for nonmonotonicity in the effects of factors – multi-dimensional stereotype logistic model.

We indicated only one study where stereotype logit was applied for modelling SAH: Abreu et al. (2009) analysed stereotype logit among other ordinal regression models. However the author didn't discuss multidimensional effects (one-dimensional stereotype logit model was used) and included into analysis three factors only – age, diabetes and skin colour.

This paper is the first with higher-dimension (two-dimensional) stereotype logit model applied to estimate association between SAH and socioeconomic health determinants.

According to our best knowledge, the phenomenon of nonmonotonicity hasn't been discussed in this field before. In this paper we show that SAH is nonmonotonically related to some variables which may imply restrictions on use of ordered logit and probit models for modelling health.

2. Data and Methodology

This research is based on population survey that was supported by a grant from the CERGE-EI /GDN. The questionnaire employed in the survey was prepared by the author; helpful comments on questionnaire were provided by Mihails Hazans, specialists of BISS and CERGE-EI. The survey was implemented in March-April 2008; it's representative of the Latvian population and covered residents aged 15 to 74; in this research we analyse adults only, i.e. respondents aged 18-74.

Data were collected in face-to-face interviews. While information is available only for one household member, the dataset has enough valid observations for our purposes. After omitting all observations with missing values for health and independent variables we obtain a sample of 921 observations.

Self-assessed health is used as a dependent variable. Respondents were asked to describe the state of their health choosing one of the six possible answers: "I never ail/ ail very rarely", "I have had only minor sicknesses", "I have had serious sicknesses that are cured", "I have had serious sicknesses, injuries and I still suffer from them", "I have chronic diseases", "I am disabled[5]". We use a five point scale for our model, combining the last two categories (the last

[5] Officially recognized

category is too small – 4.1%; furthermore according to our preliminary findings the last two groups are not statistically different).

Using stereotype logistic model we estimate association between socioeconomic and psychosocial factors and self-assessed health in Latvia. List of socioeconomic determinants includes gender, age, labour status, marital status, income per one household member, education, place of residence and ethnicity (see Table A1 with descriptive statistics).

In our paper we also analyse association between health and various psychosocial factors. The first psychosocial factor examined indicates presence of serious emotional problems that have been experienced by person within the last twelve months and caused problems at work or in everyday life. To be short further in the text we will call this factor "stress".

The next factor examined describes person's average level of satisfaction with three life domains: present job/studies[6], family life, own and family's material well-being. These domains were used to calculate life satisfaction index; we divide the index into three categories – high, average and low level of satisfaction. The three life domains used can be considered as basic domains that determine overall life satisfaction level in Latvia since the three domains have the strongest effect on overall life satisfaction of residents of Latvia among 24 different life domains (Hazans, 2006). These domains are also marked out by the European Foundation for the Improvement of Living and Working Conditions (Bohnke, 2005) as the main domains that contribute to overall life satisfaction.

In distinction from some other authors who examine sense of control at work (Bobak et. al., 2007; Jusot et. al., 2007), in this paper we analyse perceived sense of control over own life in general. Respondents evaluated their sense of control over their own lives on a 10 point scale. We divide the scale into 3 parts: low level of control (1-5), average (6-7) and high (8-10) level of control.

We also analyse whether expectations are associated with individual health. We consider anticipated changes in quality of life of a reference group ('people like you') within next 2-3 years.

As it was already mentioned, stereotype logistic regression model (Anderson, 1984) applied in this research allows specifying multiple equations to capture the effects of variables. Unlike

[6] Satisfaction with present job/studies is not taken into account when counting average for nonworking retirees, housewives, disabled and unemployed who are not looking for job. For these respondents life satisfaction index was calculated as an average from the two remaining life domains

with multinomial logit, the number of equations one specifies could be less than m–1, where m is the number of categories of the dependent variable.

In the multinomial logistic model, you estimate m–1 parameter vectors β_k, $k = 1 \ldots m$–1. In the stereotype logistic model there are d parameter vectors, where d is between one and min(m–1, p), and p is the number of regressors. The relationship between the stereotype model's coefficients β_j, $j = 1, \ldots d$, and the multinomial model's coefficients is

$$\beta_k = -\sum_{j=1}^{d} \phi_{jk} \beta_j \,. \tag{1}$$

The ϕs are scale parameters to be estimated along with the $\beta_j s$.

Given a row vector of covariates x, let $\eta_k = \theta_k - \sum_{j=1}^{d} \phi_{jk} x \beta_j$.

The probability of observing outcome k is

$$\Pr(Y_i = k) = \begin{cases} \dfrac{\exp(\eta_k)}{1 + \sum_{l=1}^{m-1} \exp(\eta_l)} & k < m \\ \dfrac{1}{1 + \sum_{l=1}^{\mathrm{m\text{-}1}} \exp(\eta_l)} & k = m. \end{cases} \tag{2}$$

If $d = m$–1, the stereotype logistic model is just a reparameterization of the multinomial logistic model. To identify the ϕs and the βs, at least d^2 restrictions on the parameters are essential. By default stereotype logit uses the "corner constraints" $\phi_{jj} = 1$ and $\phi_{jk} = 0$ for $j \neq k$, $k \leq d$, and $j \leq d$ (StataCorp LP, 2005).

3. Results

The model developed analyses impact of the factors in two different dimensions. This allows revealing nonmonotonicity in effects of variables and capturing significant effects of some factors that would be seen as statistically insignificant if a one-dimensional model is used.

The first dimension of the model describes effects of factors when the second health outcome (Might have only minor sicknesses) is compared to the first health outcome (Never ails/ ails very rarely) (see Table A in the Appendix). The effects of the second dimension are measured when the third, fourth and fifth health outcomes are compared to the base outcome, i.e. the first health category. Equal coefficients for the fourth and the fifth outcomes in the second

dimension state that the difference between the categories is statistically insignificant (Table A). This proposes that the two categories are hardly distinguishable for respondents and they could be randomly picking between them.

3.1. Association between Health and Socioeconomic Determinants

Table 1 presents results of two-dimensional stereotype logistic model designed to estimate impact of socioeconomic factors on health. Marginal effects show increase or decrease of probability of according health outcome for each factor after accounting for all other factors[7]. Percent above each health category shows average probability of according health outcome. To be simple and to avoid too long expressions further we will use definition "very good health" to describe group of respondents who never ail / ail rarely, "good health" will be used to describe those who have had only minor sicknesses etc. However please bear in mind that the original scale used in the survey was not a Likert health scale.

Most studies addressing SAH in different countries record large gender differences with women reporting significantly worse health than men (Walters and Suhrcke, 2005). Gender health gap is also observed in Latvia with lower SAH level for females[8]. However we do not find statistically significant difference between male and female reported health when all other socioeconomic factors are controlled (see Table 1). This means that despite in absolute terms gender disparities are still present in Latvia, the source of these disparities is found in unequal distribution of favourable socioeconomic factors, as well as in different impact of specific variables on male and female health. According to the obtained results, marital status and psychosocial factors are in the list of such factors. Effects of these factors are described below.

Place of residence affects male and female health in a different manner as well. In the model we compare residents of Riga and Riga district to those who live outside the district. This analysis might be more interesting than urban-rural comparison since economic activity in Latvia is highly concentrated in Riga and about a third of all residents of Latvia live in this city (the number of residents in the second greatest city of Latvia is 5-6 times smaller than in Riga).

[7] Precise levels of significance are provided in Table A3 in the Appendix
[8] Author's calculations using "Health Survey 2008" data

Table 1. Association between socioeconomic factors and self-assessed health in Latvia[9]

Factors		Association between each factor and health (comparison with the reference category, impact of other factors is excluded)				
Mean probabilities		29%	32%	15%	10%	14%
		Very good Never ails/ ails very rarely	**Good** Has had only minor sicknesses	**Fair** Has had serious sicknesses that are cured	**Poor** Has had serious sicknesses, injuries and still suffers from them	**Very poor** Has chronic diseases/ is disabled
		dP/dX	dP/dX	dP/dX	dP/dX	dP/dX
Female		1.6%	-1.8%	0.4%	-0.1%	-0.1%
Lives in Riga or Riga district (ref. cat.: lives outside Riga district)		0.5%	4.6%	-1.7%	-1.4%	-2.1%
Lives in Riga or Riga district, male		**19.6%****	**-17.2%*****	2.1%	-1.8%	-2.7%
Age		**7.8%****	-5.0%	0.5%	-1.3%	-2.0%
Age^2/100		**-21.4%*****	10.7%	-0.4%	**4.5%***	**6.6%***
Age^3/1000		**1.6%*****	-0.8%	0.0%	**-0.4%***	**-0.5%***
Single (ref. cat.: married or lives with a partner)		-3.9%	3.4%	-0.6%	0.4%	0.7%
Single, female		2.2%	-11.3%	3.5%	2.3%	3.4%
Divorced or widowed, female		4.8%	**-21.5%*****	**6.5%*****	**4.1%***	**6.1%***
Labour status (ref. cat.: employed / student)	**Economically inactive**	**-23.3%*****	**-10.6%***	2.5%	**12.7%*****	**18.7%*****
	Unemployed	-2.3%	-8.9%	3.1%	3.3%	4.8%
Ethnic non-Latvian		-2.2%	4.6%	-1.3%	-0.5%	-0.7%
Education (ref. cat.: higher / incomplete higher education)	**Below secondary**	8.1%	**-19.4%*****	**5.4%*****	2.4%	3.5%
	Secondary / vocational secondary	**6.8%***	-2.5%	-0.2%	-1.7%	-2.5%

Notes: Asterisks *, **, *** indicate a statistically significant difference from the base group at 10%, 5%, 1% level respectively.
Other factors controlled: Average income per household member

While the difference in SAH between women living in Riga or Riga district and women living outside the district is not observed, the effect of place of residence for males is rather strong. According to the results, the variable is nonmonotonically related to health and its effect is significant only in the first dimension: male residents of Riga have greater chance to have very good health, but lower probability of good health (other parameters equal). In the second dimension of the model, impact of place of residence is not significant.

The effect of the place of residence variable might have its rise in the process of labour force migration that was rather intensive before crisis – major part of young active people living in different regions of Latvia (Kurzeme, Vidzeme, Latgale) has moved to the capital or abroad, which resulted in increase of proportion of very healthy males in the capital and its district and decrease of proportion of such males in other regions. However this still doesn't provide a comprehensive explanation for the negative effect of place of residence variable for the second health outcome. Deeper analysis that is out of means of the survey data employed needs to be applied to study the source of this phenomenon.

[9] Author's calculations using „Health Survey 2008" data

In this model we use three age variables – linear, squared and cubed. Significance of effects for all the three variables proposes presence of two bending points in the effect of age; these points are found at about 30 and 60 years with an increasing rate of health loss after 30 years and decreasing rate after 65. The second effect might be explained by survivor bias – those who have reached age of retirement can be characterised by comparatively strong organism which reduces health risks and health loss[10].

Despite marriage is generally considered to be positively related to health, we find no statistically significant difference in health between married (or living with partner) and single. No empirical evidence for significant association between SAH and being married was found for residents of Germany and Norway as well (Iversen, 2008; Jürges, 2008).

While the effect for divorced or widowed males is not statistically significant (this might be due to small size of the group in the sample), we find a negative effect for divorced or widowed females: this status for females reduces the probability of good health by 21.5 percent points (which is impressive taking into account that mean probability of this health outcome is 31.6%). According to our preliminary findings, the third health outcome (fair health) according to perception of residents of Latvia is closer to poor health rather than to good health. Taking this into account we can see that status of divorced or widowed female is associated with increase of negative health outcomes.

Absence of negative effect of status of divorced or widowed for the females in case of very good health can be explained as follows: very healthy women might go through negative psychological and economical effects of divorce relatively easier than less healthy women. When health is already undermined, impact of such burden may be noticeably stronger. Healthy women obviously are more confident about themselves in terms of prospects for future marriage, job opportunities etc. Due to this divorce in healthy women's life might not provide significant negative effect.

Strong association between economic activity and health has been observed in Latvia in late 1990s (Monden, 2004). As the model results propose, status of economically inactive[11] still has a particularly strong negative effect on health. The probability of very good health for the group is 23.3 percent points lower than for employed and students which is oppressive taking into account that the mean probability of very good health is 29.3%. The effects in the second

[10] One should keep in mind that life expectancy in Latvia is only 71 year (WHO, 2010).
[11] The group includes nonworking retirees, women on a maternity leave, housewives and disabled.

model's dimension are negative and strong as well. Association between health and economic inactivity is one of the strongest in the model developed.

The effect of status of unemployed is not found as statistically significant. This can be explained by fact that job possibilities in early 2008 were still comparatively good, and a large part of those found in this group were frictional unemployed. Rate of unemployment in spring of 2008 was rather low (for Latvia) – about 6.3%[12] (Central Statistical Bureau of Latvia, 2010) and shift from one job to another or short term unemployment didn't provide negative impact on health then. However if the survey was conducted a year later (in April 2009), the strong negative effect could be expected taking into account high unemployment rates – 16,7%[13] (Central Statistical Bureau of Latvia, 2010),– and serious economic and psychological burden experienced by unemployed in 2009.

We have also tested whether retirement has a statistically significant impact on health; when labour status with the three categories is controlled for (one of this categories is economically inactive, which includes nonworking retirees), the effect of dummy for status of retired is not significant.

We find no statistically significant difference between non-Latvians and Latvians when all other socioeconomic factors are controlled. In 1990s ethnic differences were not identified for SAH in general, although some gap was found for long-standing health problems among women (Monden, 2004). In absolute terms (i.e. without control for other factors), however, in 2008 just as in 1990s Latvians on average reported slightly better health than non-Latvians. Obviously these differences have their rise from other socioeconomic circumstances.

Level of education has a significant effect on population health in Latvia. In late 1990s impact of education was less noticeable; after adjusting for income, educational differences were significant only for women (Monden, 2004). In 2008 we do not find difference in impact of education on SAH between males and females (other factors controlled).

According to the obtained results, the difference between residents with higher or incomplete higher education and a group of residents with lower than secondary education is not significant for the extreme outcomes, but it is considerable when we analyse good and fair health: we observe strong negative effect – decrease of probability of good health and increase of probability of fair health – for residents with lower than secondary education.

[12] 2nd quarter of 2008, official data
[13] 2nd quarter of 2009, official data

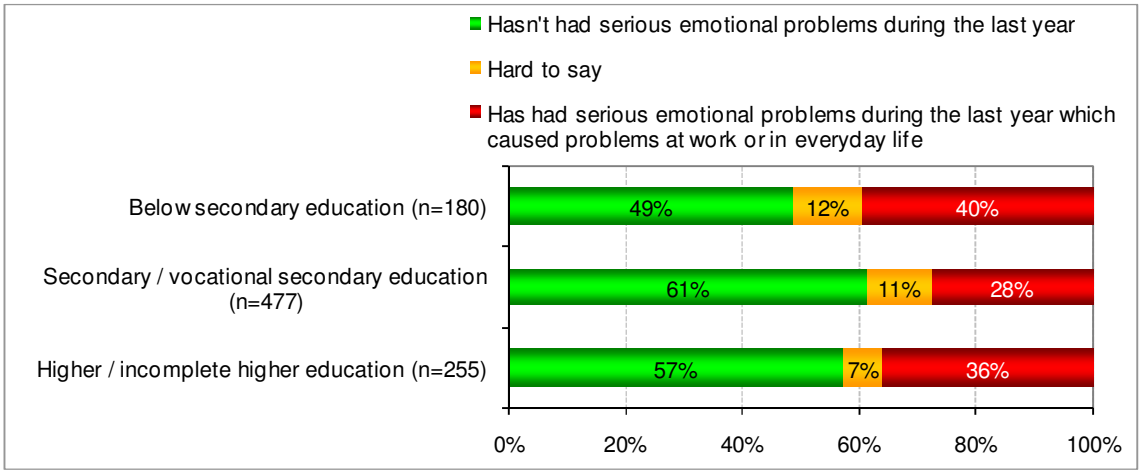

Figure 1. Exposure to serious emotional problems in different education groups in Latvia, 2008[14]

Higher education doesn't seem to provide advantage in chances to maintain good health in comparison to secondary education in Latvia (other parameters controlled). Quite the contrary – despite one's expectations, the effect of higher education is even negative: those with secondary or vocational secondary education have greater probability of very good health than those with higher or incomplete higher education.

Support for negative effect for less educated is mostly shown in the health economics literature (Jusot et. al., 2007; Jürges, 2008). In Latvia the negative effect observed for the group of residents with lower than secondary education and relative advantage of those with secondary education in comparison to the most educated resident partly can be explained by differential exposure to serious emotional problems like stress, unrest etc. (Figure 1). According to the survey data, residents with secondary or vocational secondary education are exposed to stress less often than the other two groups.

We do not find convincing empirical support for less educated to have more pronounced adverse behaviour in comparison to residents with secondary education in Latvia. However another possible explanation for the less favourable state of residents with higher education could be found in more intensive work and less time devoted for rest (see Figure 2). The data propose that residents with higher or incomplete higher education on average devote to rest less time than the other two groups; this reduces possibility for the former to maintain very good health.

[14] Author's calculations using „Health Survey 2008" data

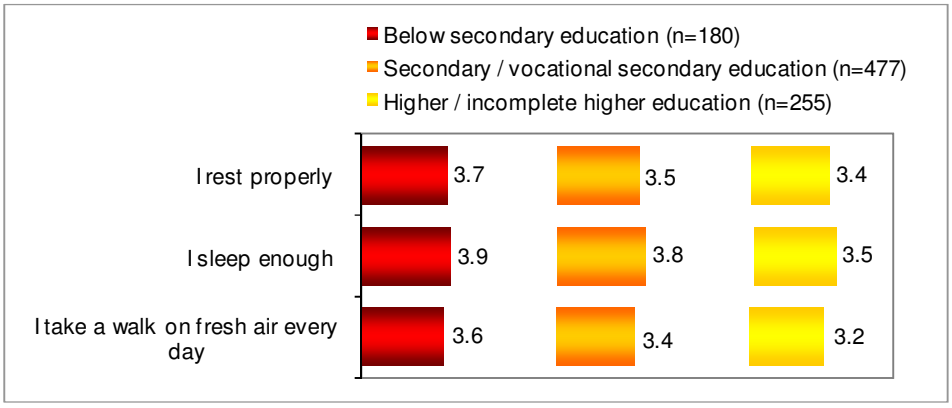

Figure 2. Evaluation[15] of rest in different education groups in Latvia, 2008[16]

In this paper we do not examine impact of income since data on household income obtained in the survey were not persuasive – level of income was underreported and to avoid providing misleading results we do not analyse income effect here. However average income per household member is controlled in all the models included into this paper. According to earlier research, income effect is significant in Latvia and seems to be strongly associated with access to psychosocial resources: when psychosocial factors are controlled for, income effect becomes insignificant (Zujeva[17], 2008).

3.2. Ordered Probit vs Two-Dimensional Stereotype Logit

Table 2 provides comparison of the results of two models – ordered probit and two-dimensional stereotype logit. Since ordered probit assumes that dependent variable is monotonically related to factors, while stereotype logistic model allows for nonmonotonicity in effects of variables, we find substantial difference in the results of the two models. For example, according to the stereotype model we find that effect for males who live outside the Riga district is particularly strong for the two first health outcomes (very good and good health). The model proposes that the variable is nonmonotonically related to health: the effect changes its sign – from positive effect on very good health to negative on good health, but moving further along the health scale it doesn't provide statistically significant impact. In the ordered probit model the effect of the variable is seen as significant as well, however the model distributes the effect along the health scale proposing completely different nature of association between health and the factor.

[15] Evaluation on a 5 point scale (1 – very rarely/never; 5 – always)
[16] Author's calculations using „Health Survey 2008" data
[17] The author of this paper

Table 2. Association between socioeconomic factors and SAH – comparison of results of two-dimensional stereotype logit model and ordered probit model[18]

Factors			Association between each factor and health (comparison with the reference category, impact of other factors is				
Mean probabilities			29%	32%	15%	10%	14%
			Very Never ails/ ails very rarely	**Good** Has had only minor sicknesses	**Fair** Has had serious sicknesses that are cured	**Poor** Has had serious sicknesses, injuries and still suffers from them	**Very** Has chronic diseases/ is disabled
			dP/dX	dP/dX	dP/dX	dP/dX	dP/dX
Female		slogit	1.6%	-1.8%	0.4%	-0.1%	-0.1%
		oprobit	0.7%	0.1%	-0.2%	-0.2%	-0.4%
Lives in Riga or Riga district (ref. cat.: lives outside Riga district)		slogit	0.5%	4.6%	-1.7%	-1.4%	-2.1%
		oprobit	2.9%	0.5%	-1.0%	-1.0%	-1.5%
Lives in Riga or Riga district, male		slogit	**19.6%****	**-17.2%*****	2.1%	-1.8%	-2.7%
		oprobit	**12.0%***	0.6%	**-4.1%***	**-3.7%****	**-4.9%****
Age		slogit	**7.8%****	-5.0%	0.5%	-1.3%	-2.0%
		oprobit	**5.4%****	**1.1%****	**-1.8%****	**-1.9%****	**-2.8%****
Age2/100		slogit	**-21.47%*****	10.7%	-0.4%	**4.5%***	**6.6%***
		oprobit	**-14.9%*****	**-3.0%****	**4.9%****	**5.2%****	**7.8%*****
Age3/1000		slogit	**1.6%*****	-0.8%	0.0%	**-0.4%***	**-0.5%***
		oprobit	**1.1%*****	**0.2%****	**-0.4%****	**-0.4%****	**-0.6%*****
Single (ref. cat: married or lives with a partner)		slogit	-3.9%	3.4%	-0.6%	0.4%	0.7%
		oprobit	-2.0%	-0.4%	0.6%	0.7%	1.1%
Single, female		slogit	2.2%	-11.3%	3.5%	2.3%	3.4%
		oprobit	-1.6%	-0.4%	0.5%	0.6%	0.9%
Divorced or widowed, female		slogit	4.8%	**-21.5%*****	**6.5%*****	**4.1%***	**6.1%***
		oprobit	-5.9%	-1.7%	1.8%	2.2%	3.6%
Labour status (ref. cat: employed / student)	**Economically inactive**	slogit	**-23.3%*****	**-10.6%***	2.5%	**12.7%*****	**18.7%*****
		oprobit	**-21.5%*****	**-9.8%*****	**5.3%*****	**8.3%*****	**17.7%*****
	Unemployed	slogit	-2.3%	-8.9%	3.1%	3.3%	4.8%
		oprobit	-5.9%	-1.8%	1.8%	2.2%	3.7%
Ethnic non-Latvian		slogit	-2.2%	4.6%	-1.3%	-0.5%	-0.7%
		oprobit	-0.2%	0.0%	0.1%	0.1%	0.1%
Education (ref. cat: higher / incomplete higher education)	**Below secondary**	slogit	8.1%	**-19.4%*****	**5.4%*****	2.4%	3.5%
		oprobit	-1.6%	-0.3%	0.5%	0.6%	0.9%
	Secondary / vocational secondary	slogit	**6.8%***	-2.5%	-0.2%	-1.7%	-2.5%
		oprobit	**5.0%***	1.0%	**-1.6%***	**-1.7%***	-2.6%

Notes: Asterisks *, **, *** indicate a statistically significant difference from the base group at 10%, 5%, 1% level respectively.
Other factors controlled: Average income per household member

Thanks to multidimensional approach stereotype logistic regression is able to grasp significant effects for some variables that are seen as statistically insignificant if a single-dimension model is used. For example, ordered probit is not able to reveal significance of the effect of being divorced or widowed for females and the effect of below secondary education. Both factors are nonmonotonically related to health and due to this reason they are not found as significant by ordered probit model. Thus multi-dimensional approach allows revealing nonmonotonicity in effects of some variables, disclosing significant effects for some variables that cannot be seen when a one-dimensional model is used.

[18] Author's calculations using „Health Survey 2008" data

Table 3. Model selection criteria[19]

	Two-dimensional stereotype logit	Ordered probit	Difference
Log pseudolikelihood	-1226.36	-1263.92	37.56
Lacy R^2_O	22.85%	20.68%	2.17%
AIC	2540.72	2573.83	-33.12
BIC	2752.60	2684.59	68.01
Number of statistically significant effects	11	9	2

When a factor is monotonically related to dependent variable, two-dimensional stereotype logit model and ordered probit model provide similar results as it is, for example, for the effect of economic inactivity. If stereotype logit doesn't find significant effect for some variable, ordered probit also doesn't find it (e.g., gender, ethnicity). In the models specified there are two socioeconomic factors that are found as statistically significant in the stereotype model, but are not significant in the ordered probit model (see Tables 2 and 3).

Table 3 provides measures of goodness of fit and selection criteria for the developed two-dimensional stereotype logit model and ordered probit model. Log pseudolikelihood is calculated instead of log likelihood since we use population weights and robust standard errors are estimated in the models. We also use R^2_O, an explained variation measure for ordinal response models, which is based on ordinal dispersion measure (Lacy, 2006). In this paper we use both AIC (Akaike Information Criterion) (Akaike, 1973) and BIC (Bayesian Information Criterion) (Schwarz, 1978) indicators. In practise when one of the criteria (AIC or BIC) improves (becomes smaller). All the parameters analysed (Table 3) except BIC indicate that two-dimensional approach fits the data better. This proposes that two-dimensional stereotype logit model in comparison to ordered probit is more appropriate methodology for analysing association between socioeconomic determinants and SAH. Comparison of the results of the two models point at greater potential of stereotype logit for modelling SAH.

3.3. Association between Health and Psychosocial Factors

The model presented in Table 4 introduces effects of two psychosocial factors – life satisfaction (calculated as average from satisfaction with three domains – see Section 2) and perceived sense of control over one's life.

[19] Author's calculations using „Health Survey 2008" data

Table 4. Association between life satisfaction and sense of control and SAH in Latvia[20]

Factors		Association between each factor and health (comparison with the reference category, impact of other factors is excluded)				
Mean probabilities		29%	32%	15%	10%	14%
		Very good Never ails/ ails very rarely	**Good** Has had only minor sicknesses	**Fair** Has had serious sicknesses that are cured	**Poor** Has had serious sicknesses, injuries and still suffers from them	**Very poor** Has chronic diseases/ is disabled
		dP/dX	dP/dX	dP/dX	dP/dX	dP/dX
Female		11.7%	-1.8%	-1.1%	-3.6%	-5.1%
Lives in Riga or Riga district (ref. cat.: lives outside Riga district)		1.4%	3.0%	-1.3%	-1.3%	-1.8%
Lives in Riga or Riga district, male		**19.7%****	**-17.8%*****	2.4%	-1.8%	-2.5%
Age		**9.8%*****	**-5.9%***	0.5%	-1.9%	-2.6%
Age^2/100		**-25.6%*****	13.0%	-0.6%	**5.4%****	**7.7%****
Age^3/1000		**1.9%*****	-0.9%	0.0%	**-0.4%****	**-0.6%****
Single (ref. cat.: married or lives with a partner)		-2.4%	1.7%	-0.2%	0.4%	0.6%
Single, female		3.3%	-8.7%	2.6%	1.2%	1.7%
Divorced or widowed, female		8.0%	**-20.1%*****	**5.9%*****	2.6%	3.6%
Labour status (ref. cat.: employed / student)	**Economically inactive**	**-20.4%*****	-9.9%	3.0%	**11.3%*****	**16.0%*****
	Unemployed	9.3%	-8.6%	1.4%	-0.8%	-1.2%
Ethnic non-Latvian		-1.9%	6.1%	-1.9%	-1.0%	-1.3%
Education (ref. cat.: higher / incomplete higher education)	**Below secondary**	**12.2%****	**-19.1%*****	**4.9%****	0.9%	1.3%
	Secondary / vocational secondary	**8.2%****	-2.5%	-0.4%	-2.2%	-3.1%
Life satisfaction level (ref. cat.: low)	**Average**	**9.9%****	6.2%	**-3.7%****	**-5.1%*****	**-7.2%*****
	High	**22.1%*****	-10.4%	-1.5%	**-4.2%****	**-5.9%****
High life satisfaction level, female		**-15.0%****	**33.3%*****	**-9.6%*****	-3.6%	-5.1%
Control over life level (ref. cat.: low)	**Average**	**24.0%*****	-7.4%	-2.7%	**-5.7%*****	**-8.1%*****
	High	**14.6%****	7.8%	**-5.6%****	**-7.0%*****	**-9.8%*****
Average control over life level, female		**-14.2%***	-1.1%	1.0%	5.9%	8.4%
High control over life level, female		-7.2%	**-19.0%*****	**6.5%*****	**8.1%****	**11.5%****

Notes: Asterisks *, **, *** indicate a statistically significant difference from the base group at 10%, 5%, 1% level respectively.
Other factors controlled: Average income per household member

Low life satisfaction has strong negative effect on health – those with average and high level of life satisfaction have considerably greater chances to maintain very good health and have much lower probability of negative health outcomes in comparison to less satisfied with their lives.

As the model proposes, gender differences in effect of life satisfaction level are observed: the positive effect of high life satisfaction level is not that strong for females when very good health is considered, however already for good health (and fair health) the positive effect is particularly strong – in case of high life satisfaction level the probability of good health for females goes up by 33.3 percent points and probability of fair health (which is closer to poor health rather than to good health) goes down by 9.6 percent points.

[20] Author's calculations using „Health Survey 2008" data

Association between sense of control and SAH was revealed in some previous researches; however authors mostly turn their attention to sense of control at work (Bobak et. al., 2007; Jusot et. al., 2007). In this paper we analyse sense of control over own life in general.

Association between health and perceived sense of control over own life has some different nature than association between health and level of life satisfaction described above. From one side, just as it is in case of life satisfaction, individuals with average and high level of control have greater chance to keep good health and avoid unfavourable health outcomes. From the other side, there are some peculiarities in the effect of sense of control for females: high level of control over own life provides negative effect on female health. This can be explained as follows: high level of control over one's life is associated with greater intellectual and emotional efforts, harder work etc., which might result in some health loss; for females necessity to be very strong and willingness to control all life domains, especially if it's related to the lack of balance between family and work, might become a burden rather than a positive factor.

The model proposes that the two psychosocial factors described – level of satisfaction and perceived control over life – affect health mediating with some other factors. Thus negative effect we observe for divorced and widowed females for poor and very poor health outcomes becomes insignificant when the psychosocial factors are controlled for. This proposes that increase of probability of poor and very poor health in this group of females is to a great extent associated with psychosocial burden.

Negative effect for economically inactive residents described in section 3.1. decreases when life satisfaction and sense of control are included into the model. This suggests that lower health parameters of representatives of this group are related to their psychosocial state.

The health model developed for employed population in France by Jusot et. al. (2007) shows that increase of probability of ill health in case of primary education becomes insignificant after adding psychosocial factors into the model. Our model proposes that in case of Latvia, the negative effect for most educated (observed for very good health only) becomes stronger when psychosocial factors are controlled. This could be anticipated since access to such psychosocial resources as life satisfaction and control over life is greater for well educated.

In this paper we also examine effect of another psychosocial factor on health – expectations on changes in living standards of people of the reference group ('people like you') within the next 2-3 years (see Table 5).

Table 5. Association between expectations and SAH in Latvia[21]

Factors		Association between each factor and health (comparison with the reference category, impact of other factors is excluded)				
Mean probabilities		29%	32%	15%	10%	14%
		Very good Never ails/ ails very rarely	**Good** Has had only minor sicknesses	**Fair** Has had serious sicknesses that are cured	**Poor** Has had serious sicknesses, injuries and still suffers from them	**Very poor** Has chronic diseases/ is disabled
		dP/dX	dP/dX	dP/dX	dP/dX	dP/dX
Female		0.2%	3.1%	-1.0%	-0.8%	-1.5%
Lives in Riga or Riga district (ref. cat.: lives outside Riga district)		-3.3%	**11.7%***	**-3.3%***	-1.9%	-3.3%
Lives in Riga or Riga district, male		**19.0%****	**-22.0%*****	4.0%	-0.4%	-0.7%
Age		**8.5%****	-5.1%	0.5%	-1.5%	-2.5%
Age^2/100		**-22.6%*****	10.4%	-0.4%	**4.6%***	**8.0%***
Age^3/1000		**1.7%*****	-0.7%	0.0%	**-0.4%***	**-0.6%***
Single (ref. cat.: married or lives with a partner)		-2.4%	5.5%	-1.4%	-0.6%	-1.1%
Single, female		2.7%	**-16.7%****	**4.8%****	3.4%	5.9%
Divorced or widowed, female		7.0%	**-27.3%**	**7.6%*****	**4.6%***	**8.0%***
Labour status (ref. cat.:	**Economically inactive**	**-24.0%*****	**-10.4%***	1.9%	**11.9%*****	**20.6%*****
	Unemployed	-2.9%	-8.4%	2.7%	3.2%	5.5%
Ethnic non-Latvian		-1.8%	4.9%	-1.3%	-0.6%	-1.1%
Education (ref. cat.: higher / incomplete higher education)	**Below secondary**	9.3%	**-17.8%*****	**4.4%*****	1.5%	2.6%
	Secondary / vocational secondary	**7.1%***	0.3%	-1.0%	-2.3%	-4.0%
Living standards of people like you in Latvia within 2-3 years... (ref. cat: will become worse)	**Will improve**	**11.8%****	-7.0%	0.5%	-1.9%	-3.3%
	Will remain on the same level	1.6%	-1.0%	0.1%	-0.2%	-0.4%

Notes: Asterisks *, **, *** indicate a statistically significant difference from the base group at 10%, 5%, 1% level respectively.
Other factors controlled: Average income per household member

After accounting for socioeconomic factors, optimistic expectations on living standards of the reference group provide strong positive effect on health, however the difference between those with optimistic and pessimistic views is significant only for very good health. The positive effect can be interpreted as follows: from the one side, positive future prospects provide noticeable emotional animation that can drive one's state of health up (and also smooth impact of negative factors); from the other side, optimistic people are less exposed to depression, nervousness etc., as a consequence they have less need for smoking and alcohol as measures for reduction of negative pressure of external psychosocial factors etc.

Psychosocial factors can affect health through a biological pathway and through behavioural patterns (Evans et. al., 1994; Marmot and Wilkinson, 2005). It was scientifically proved that stress, fear, depression and similar psychological states stimulate production of

[21] Author's calculations using „Health Survey 2008" data

adrenocorticotrophic hormones that increase probability of heart attacks and even cancer (Kvetnoy and Konovalov, 2004). Association between psychosocial problems and adverse health behaviours was highlighted in a recent study by Bobak et al. (2005) showing a significant inverse relationship between the effort/reward balance at work and all indicators of alcohol consumption and problem drinking in Novosibirsk (Russia), Krakow (Poland) and Karvina (Czech Republic).

In contradiction to what we have seen for life satisfaction and sense of control, we do not find statistically different impact of expectations on male and female health. However when expectations factor is controlled, we find the negative effect for single females to become statistically significant.

Endogeneity test (Rivers and Vuong, 1988) was performed for each variable (life satisfaction, sense of control and expectations). Two-step probit with instrumental variables was used for this purpose (see results in Table A8, A9 and A10) for the two dimensions of the stereotype logistic model: the first dimension – good health is compared to very good health; the second dimension – fair, poor and very poor health outcomes are combined into one category and compared to very good health. Two variables were used as instruments for the test of life satisfaction variable: respondents' reported satisfaction with possibilities to implement personal ideas and plans and expectations on changes of living standards in Latvia within 2-3 years in comparison to EU average. Satisfaction with possibilities to implement personal ideas and satisfaction with own professional qualification variables were used as instruments for endogeneity test of control over life. The expectations variable was tested using two instruments – expectations on living standards in Latvia within 2-3 years in comparison to EU average and satisfaction with job possibilities. All mentioned instrumental variables have significant impact on 'suspicious' factors and are positively related to them. At the same time none of the instrumental variables has statistically significant effect on health when included into the model.

The theoretical ground for choice of the instrumental variables can be as follows: one is not likely to be really satisfied with job and family life if both do not leave a chance to implement personal plans. Thus satisfaction with possibility to implement personal ideas and plans should be positively related to satisfaction with job and family life. Another variable, i.e. expectations on changes of life quality in Latvia, can have twofold action. If one's expectations on overall future life prospects in Latvia are pessimistic, this might provide some moral pressure and reduce life satisfaction level. From the other side pessimistic attitudes as

such should be negatively related to possibilities to reach success in various life domains ("They can, because they think they can", Publius Vergilius Maro).

We find positive relationship between sense of control and instrumental variables used for endogeneity test; this relationship can be explained as follows: lack of possibility to implement personal ideas and plans should mean great pressure of external factors that are out of one's control; this would have negative impact on person's sense of control over own life (and otherwise). Higher level of satisfaction with one's professional qualification is associated with greater job opportunities, better prospects of professional growth, higher income level etc.; that should be positively associated with one's sense of control.

The hypothesis of exogeneity was not rejected for the three tested factors (Table A8, A9, A10).

The endogeneity test was implemented also for the stress variable. It was instrumented using two variables – satisfaction with possibilities to implement personal ideas and plans and expectations on living standards in Latvia within 2-3 years in comparison to EU average. According to the test results one cannot exclude endogeneity of the depression variable. Ordered probit model was applied to estimate first order regression model with stress as dependent variable and socioeconomic factors and instrumental variables as independent variables. Predicted variable 'propensity to suffer from stress' was included into the health model (two-dimensional stereotype logit). Bootstrap procedure was used to estimate standard errors. The model developed doesn't reveal statistically significant association between the propensity to suffer from stress and SAH in Latvia. Due to this reason we do not provide the model results in this paper.

We should note that we measured short term effect of stress on health, while effect of stress on physical health through biological and behavioural pathways might be more tangible in the long run. Despite we do not find statistically significant association between stress and health in Latvia, major part of population of Latvia is exposed to this health risk.

Social capital and other psychosocial factors are often perceived as determinants of mental health (Kawachi and Berkman, 2001; McKenzie et. al., 2002). However the models developed in this research provide empirical support for association between psychosocial factors and physical health in Latvia. According to the obtained results, this association is particularly strong.

Unfavourable psychosocial factors could be seen as a major health risk in Latvia even before crisis and should be treated even more seriously in terms of present economic situation. As it was already mentioned above, Latvia is characterised with one of the lowest levels of life satisfaction in EU (Anderson et.al., 2008). In terms of economic crisis the psychosocial situation in Latvia is expected to deprive (both in absolute terms and comparative to the other EU countries). Since we observe strong negative effect of low life satisfaction, the long term life dissatisfaction might result in substantial health loss, especially in specific social groups. One third of adult population of Latvia in 2008 evaluated ability to control own life as low[22]; as the model results propose this has negative consequences for physical health. Also pessimistic evaluation of future prospects is associated with lower chances to keep good health. According to the survey results about a third of adult population was exposed to stress in spring of 2008 and we believe that the numbers if measured later would be even more dramatic. All above mentioned allows us making a conclusion that psychosocial burden is a major health risk factor in Latvia due to great population exposure to this risk and its strong association with physical health.

4. Summary and conclusions

Results of the two-dimensional stereotype logistic model developed suggest that some socioeconomic and psychosocial factors are nonmonotonically related to SAH. This may imply restrictions on use of one-dimensional ordered models for modelling SAH.

Multidimensional approach (two-dimensional stereotype logit) allows revealing some significant factor effects that remain unseen if one-dimensional models, e.g. ordered probit, are used.

Analysed goodness of fit and selection criteria for the two-dimensional stereotype logit model and ordered probit model propose that multidimensional approach is more appropriate for modelling self-assessed health.

We have examined impact of economic, social and psychosocial determinants on population health in Latvia. In contradiction to what is mostly found in other countries, in Latvia gender health disparities were not detected (holding all other socioeconomic parameters equal). However in absolute terms we observe difference in SAH between males and females in

[22] The survey was conducted in April 2008 and we expect the proportion of this group to increase within the next years

Latvia with lower average indicators for females, which may be explained by differential access to socioeconomic and psychosocial resources for man and women as well as by different nature of impact of some factors on male and female health: according to the obtained results, marital status, place of residence, life satisfaction and sense of control have different effect on male and female health.

The three variables for age – linear, squared and cubed – are significant in the models; this proposes existence of two binding points in the effect of age and different rate of health deprivation – increasing rate of health loss after 30 years and decreasing rate after 65 years.

The model reveals significant disparities between economically inactive residents and a group of employed and students with strong negative effect for former (other parameters equal).

The stereotype logistic model uncovers strong negative effect for widowed or divorced females; the effect is nonmonotonic and can be revealed only when multidimensional approach is applied – results of ordered probit probit, for example, do not provide evidence of statistically significant effect for this factor. The same conclusion can be made about the difference between the group of less educated (below secondary education) and the group with higher or incomplete higher education; the disparities are revealed as statistically significant only when multidimensional model is applied.

The results of two-dimensional stereotype logit models developed propose that psychosocial factors may be of central interest when one analyses determinants of health in Latvia. The association between SAH and the three psychosocial factors analysed – life satisfaction, perceived control over own life and expectations – is significant and particularly strong. Relationship between the former two factors and health differs for males and females.

The paper accentuates that tackling health inequalities in Latvia should involve tackling not only income, education, occupation or other 'classic' inequalities, but also inequalities in access to psychosocial resources. The paper provides new evidence about the importance of psychosocial factors in explaining individual differences in health and improving population health in Latvia.

References

Akaike, H. (1973). Information theory and an extension of the maximum likelihood principle. In Proc. 2nd Int. Symp. Info. Theory, Eds.: Petrov B.N., Csaki F., Akademia Kiado, Budapest, 267-281.

Anderson, J.A. (1984). Regression and ordered categorical variables. *Journal of the Royal Statistical Society*, B.46: I-30.

Anderson, R., Mikulic, B., Vermeylen, G., Lyly-Yrjanainen, M., & Zigante V. (2008). Second European Quality of Life Survey - Overview. European Foundation for the Improvement of Living and Working Conditions.

Bobak, M., Pikhart, H., Kubinova, R., Malyutina, S., Pajak, A., Sebakova, H., Topor-Madry, R., Nikitin, Y., Caan, W., & Marmot, M. (2005). The association between psychosocial characteristics at work and problem drinking: a cross-sectional study of men in three Eastern European urban populations. *Occupational and Environmental Medicine*, 62, 546-550.

Bockerman, P., & Ilmakunnas, P. (2009). Unemployment and self assessed health: Evidence from panel data. *Health Economics*, 18: 161–179.

Bohnke, P. (2005). First European Quality of Life Survey: Life satisfaction, happiness and sense of belonging. European Foundation for the Improvement of Living and Working Conditions.

Bos, A., & Bos, A. (2007). The socio-economic determinants of older people's health in Brazil: the importance of marital status and income. Cambridge University Press.

Crossley, T., & Kennedy, S. (2000). The Stability of Self Assessed Health Status. Discussion Paper Nr.421, Centre for Economic Policy Research, Australian National University.

Dodoo, M. (2006). Differential reporting of health status by sub-groups of the U.S. population. Paper presented at the annual meeting of the Economics of Population Health: Inaugural Conference of the American Society of Health Economists, TBA, Madison, WI, USA, accessed through http://www.allacademic.com/meta/p91338_index.html on August 25, 2009.

Dunn, J.R., Veenstra, G., & Ross, N. (2006). Psychosocial and neo-material dimensions of SES and health revisited: Predictors of self-rated health in a Canadian National Survey. *Social Science and Medicine*; 62(6), 1465-1473.

Etile, F., & Milcent, C. (2006). Income-related reporting heterogeneity in self-assessed health: Evidence from France. *Journal of Health Economics*, 15, 965-981.

Evans, R.G., Barer, M.L., & Marmor, T.R. (1994). Why are some people healthy and others not? The determinants of health of populations. New York: Aldine de Gruyter.

Hazans, M. (2006). Job satisfaction and its impact on life satisfaction in Latvia. In: Tisenkopfs, T., Bela, B. (Eds). Quality of life in Latvia. (pp. 237-264). Riga: Zinatne (In Latvian). Available at: http://www.president.lv/images/modules/items/PDF/item_1124_Dzives_kvalitaate_Latvija.pdf

Hernandez-Quevedo, C., Jones, A.M. & Rice, N. (2004). Reporting bias and heterogeneity in self-assessed health. Evidence from the British Household Panel Survey. University of York, mimeo.

Humphries, K.H. & van Doorslaer, E. (2000). Income-related health inequality in Canada. *Social Science and Medicine*, 50, 663-671.

Islam, K., Merlo, J., Kawachi, I., Lindstrom, M., & Gerdtham, U.G. (2006). Social capital and health: Does egalitarianism matter? A literature review. *International Journal for Equity in Health*, 5(3), doi:10.1186/1475-9276-5-3.

Iversen, T. (2008). An exploratory study of associations between social capital and self-assessed health in Norway. *Health Economics, Policy and Law*, Cambridge University Press, vol. 3(04), 349-364, October.

Jürges, H. (2008). Self-assessed health, reference levels, and mortality. *Applied Economics*, Taylor and Francis Journals, 40(5), 569-582.

Jusot, F., Grignon, M., & Dourgnon, P. (2007). Psychosocial resources and social health inequalities in France: Exploratory findings from a general population survey. Working paper, IRDES, 4-6.

Kawachi, I., & Berkman L.F. (2001). Social ties and mental health. *Journal of Urban Health*, 78(3), 458-67.

Kvetnoy, I., & Konovalov, S. (2004). Magical molecules of health. SPb: Praim Evroznak (In Russian), 80-95.

Lacy, M. G. (2006). An explained variation measure for ordinal response models with comparisons to other ordinal R^2 measures. *Sociological Methods and Research*, 34:469-520.

Lavis, J., & Stoddard, G. (2003). Social cohesion and health. In L. Osberg (Ed), The Economic Implications of Social Cohesion (pp. 121-149). Toronto ON: University of Toronto Press.

Mackenbach, J.P. (2006). Health inequalities: Europe in profile. Independent expert report commissioned by the UK Presidency of the EU.
Mackenbach, J.P., Stirbu, I., Roskam, A.J.R., Schaap, M.M., Menvielle, G., Leinsalu, M., Kunst. A.E. (2008). Socioeconomic Inequalities in Health in 22 European Countries. *The New England Journal of Medicine,* 358, 2468-81.

Marmot, M., & Wilkinson, R.G. (2005) Social determinants of health. Oxford: Oxford University Press.

McKenize, K., Whitley, R., & Weich, S. (2002). Social capital and mental health. *British Journal of Psychiatry*, 181, 280-283.

Monden, C. (2004). Socioeconomic health inequalities in Latvia: a cross-sectional study. *Scandinavian Journal of Public Health*, 32(3), 217-23.

O'Donnell, O., van Doorslaer, E., Wagstaff, A., & Lindelow, M. (2008). Analyzing health equity using household survey data. A guide to techniques and their implementation. The International Bank for Reconstruction and Development / The World Bank, 55-65.

Rivers, D., & Vuong, Q.H. (1988). Limited information estimators and exogeneity tests for simultaneous probit models. *Journal of Econometrics*, 39, 347–366.

Schwarz, G. (1978). Estimating the dimension of a model. Annals of Statistics, 6: 461-464.

StataCorp LP. (2005) User Manual. Release 9. College Station: Stata Press.

Van Doorslaer, E., & Jones, A. (2003). Inequalities in self-reported health: Validation of a new approach to measurement. *Journal of Health Economics*, 22, 61–87.

Wagstaff, A., & van Doorslaer, E. (1994). Measuring inequalities in health in the presence of multiple-category morbidity indicators. *Journal of Health Economics*, 3, 281–291.

Walters, S., & Suhrcke, M. (2005). Socioeconomic inequalities in health and health care access in central and eastern Europe and the CIS: a review of the recent literature. Venice, World Health Organization European Office for Investment for Health and Development; Working paper 2005/1.

Whitehead, M., & Dahlgren, G. (2006). Levelling up: a discussion paper on concepts and principles for tackling social inequities in health. Copenhagen, WHO Regional Office for Europe.

Zujeva[23], I. (2008). The direct and indirect impact of economic factors on population health in Latvia. Acta Universitatis Latvensis, series of Economics, University of Latvia, p. 251-262.

Central Statistical Bureau of Latvia. Accessed through www.csb.lv on July 8, 2010.

World Health Organization. (2010). World Health Statistics 2010.

Eurostat

Norbalt II survey data

Life quality in Latvia 2005 survey data

Health Survey 2008 data

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Appendix.

Table A1. Descriptive statistics: socio-demographic characteristics of the sample

Characteristics	Items	N (unweighted)	% (weighted)
Self-assessed health	I never ail	286	29%
	There might be only minor sicknesses	294	32%
	I have had more serious illnesses that have been cured	137	15%
	I have had serious illnesses or injuries, and I still suffer from them	85	10%
	I have chronic illnesses	86	10%
	I am disabled	33	4%
Gender	Male	429	46.5%
	Female	492	53.5%
Age	18-24	238	15.8%
	25-34	145	18.4%
	35-44	147	16.3%
	45-54	163	20.4%
	55-64	106	14.6%
	65-74	122	14.4%
Place of residence	Riga and Riga region	623	31.0%
	Outside Riga region	239	69.0%
	Males living in Riga or Riga region	119	12.6%
Labour status	Employed / student	677	71.1%
	Economically inactive	195	23.0%
	Unemployed	49	5.9%
Marital status	Married / lives with partner	513	60.5%
	Single	270	22.5%
	Divorced / lives separately / widowed	138	17.0%
Ethnicity	Ethnic Latvian	623	58.2%
	Ethnic non-Latvian	298	41.8%
Education	Below secondary education	180	19.8%
	Secondary / vocational secondary education	477	52.5%
	Higher / incomplete higher education	255	26.4%
	Unknown	9	1.2%
Average income per household member	I quintile	159	17.3%
	II quintile	138	15.0%
	III quintile	159	17.3%
	IV quintile	148	16.1%
	V quintile	146	15.9%
	Unknown	171	18.6%

Table A2. Descriptive statistics: psychosocial determinants of health

Characteristics	Items	N (unweighted)	% (weighted)
Life satisfaction index Average level of satisfaction with ... your current job (studies) in general ... your family life ... your and your family's material well-being	Low level of satisfaction	261	30.0%
	Average level of life satisfaction	484	52.3%
	High level of life satisfaction	169	17.1%
	Unknown	7	0.6%
Sense of control Please, evaluate, to what extent you control your own life? Please, give your evaluation on scale from 1 to 10, where "1" means – "I don't have influence on it at all", "10" – "I have great influence on it".	Low level of control (1-5)	270	30.4%
	Average level of control (6-7)	265	28.8%
	High level of control (8-10)	375	39.3%
	Unknown	11	1.4%
Expectations on living standards of the group To your mind, within the next 2-3 years living standards of people like you in Latvia...	Will improve	296	29.7%
	Will remain on the same level	252	27.5%
	Will be worse	277	32.2%
	Unknown	96	10.6%
Stress During the last year, have you had serious emotional problems (depression, anxiety, unrest) which caused problems at work or in everyday life?	No	540	57.5%
	Hard to say	90	10.0%
	Yes	291	32.6%

Table A3. Scale parameters of two-dimensional stereotype logistic model[24]

1st dimension	/phi1_1	Never ails/ ails very rarely	0	(base outcome)
	/phi1_2	Has had only minor sicknesses	1	
	/phi1_3	Has had serious sicknesses that are cured	omitted	
	/phi1_4	Has had serious sicknesses, injuries and still suffers from them	omitted	
	/phi1_5	Has chronic diseases/ is disabled	omitted	
2nd dimension	/phi2_1	Never ails/ ails very rarely	0	(base outcome)
	/phi2_2	Has had only minor sicknesses	omitted	
	/phi2_3	Has had serious sicknesses that are cured	1	
	/phi2_4	Has had serious sicknesses, injuries and still suffers from them	1.9	
	/phi2_5	Has chronic diseases/ is disabled	1.9	

[24] See formulas 1 an 2 at page 8.

Table A3. Association between socioeconomic factors and self-assessed health in Latvia (two-dimensional stereotype logit)

Number of observations	Wald chi2(50)	Log pseudolikelihood	df	AIC	BIC	Lacy R2O
912	114.95	-1228.012	43	2542.02	2749.10	22.85%

Factors		**Association between each factor and health** (comparison with the reference category, impact of other factors is excluded)									
	Mean probabilities	29%		32%		15%		10%		14%	
		Very good Never ails/ ails very rarely		**Good** Has had only minor sicknesses		**Fair** Has had serious sicknesses that are cured		**Poor** Has had serious sicknesses, injuries and still suffers from them		**Very poor** Has chronic diseases/ is disabled	
		dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.
Female		1.6%	0.050	-1.8%	0.052	0.4%	0.016	-0.1%	0.016	-0.1%	0.024
Lives in Riga or Riga district (ref. cat.: lives outside Riga district)		0.5%	0.050	4.6%	0.059	-1.7%	0.018	-1.4%	0.017	-2.1%	0.025
Lives in Riga or Riga district, male		**19.6%****	0.083	**-17.2%*****	0.059	2.1%	0.030	-1.8%	0.024	-2.7%	0.035
Age		**7.8%****	0.033	-5.0%	0.033	0.5%	0.012	-1.3%	0.011	-2.0%	0.017
Age^2/100		**-21.4%*****	0.001	10.7%	0.001	-0.4%	0.000	**4.5%***	0.000	**6.6%***	0.000
Age^3/1000		**1.6%*****	0.000	-0.8%	0.000	0.0%	0.000	**-0.4%***	0.000	**-0.5%***	0.000
Single (ref. cat: married or lives with a partner)		-3.9%	0.061	3.4%	0.074	-0.6%	0.024	0.4%	0.027	0.7%	0.039
Single, female		2.2%	0.084	-11.3%	0.072	3.5%	0.026	2.3%	0.036	3.4%	0.053
Divorced or widowed, female		4.8%	0.071	**-21.5%*****	0.054	**6.5%*****	0.018	**4.1%***	0.025	**6.1%***	0.037
Labour status (ref. cat: employed / student)	**Economically inactive**	**-23.3%*****	0.044	**-10.6%***	0.057	2.5%	0.027	**12.7%*****	0.027	**18.7%*****	0.040
	Unemployed	-2.3%	0.073	-8.9%	0.069	3.1%	0.022	3.3%	0.030	4.8%	0.045
Ethnic non-Latvian		-2.2%	0.036	4.6%	0.039	-1.3%	0.012	-0.5%	0.012	-0.7%	0.017
Education (ref. cat: higher / incomplete higher education)	**Below secondary**	8.1%	0.057	**-19.4%*****	0.049	**5.4%*****	0.017	2.4%	0.021	3.5%	0.030
	Secondary / vocational secondary	**6.8%***	0.038	-2.5%	0.045	-0.2%	0.015	-1.7%	0.015	-2.5%	0.022

Notes: Asterisks *, **, *** indicate a statistically significant difference from the base group at 10%, 5%, 1% level respectively.
Other factors controlled: Average income per household member

Table A4. Association between socioeconomic factors and self-assessed health in Latvia – comparison of results of two-dimensional stereotype logit model and ordered probit model

	Number of observations	Wald chi2(50)	Log pseudolikelihood	AIC	BIC	Lacy R2O
Two-dimensional stereotype logit model (slogit)	912	114.95	-1228.01	2542.02	2749.10	22.85%
Ordered probit model (oprobit)	912	248.45	-1263.92	2573.83	2684.59	20.68%

Factors			**Association between each factor and health** (comparison with the reference category, impact of other factors is excluded)									
Mean probabilities			29%		32%		15%		10%		14%	
			Very good Never ails/ ails very rarely		**Good** Has had only minor sicknesses		**Fair** Has had serious sicknesses that are cured		**Poor** Has had serious sicknesses, injuries and still suffers from them		**Very poor** Has chronic diseases/ is disabled	
			dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.
Female		slogit	1.6%	0.050	-1.8%	0.052	0.4%	0.016	-0.1%	0.016	-0.1%	0.024
		oprobit	0.7%	0.038	0.1%	0.008	-0.2%	0.012	-0.2%	0.013	-0.4%	0.020
Lives in Riga or Riga district (ref. cat.: lives outside Riga district)		slogit	0.5%	0.050	4.6%	0.059	-1.7%	0.018	-1.4%	0.017	-2.1%	0.025
		oprobit	2.9%	0.038	0.5%	0.006	-1.0%	0.013	-1.0%	0.013	-1.5%	0.019
Lives in Riga or Riga district, male		slogit	**19.6%****	0.083	**-17.2%*****	0.059	2.1%	0.030	-1.8%	0.024	-2.7%	0.035
		oprobit	**12.0%***	0.063	0.6%	0.007	**-4.1%***	0.022	**-3.7%****	0.017	**-4.9%****	0.020
Age		slogit	**7.8%****	0.033	-5.0%	0.033	0.5%	0.012	-1.3%	0.011	-2.0%	0.017
		oprobit	**5.4%****	0.025	**1.1%****	0.005	**-1.8%****	0.008	**-1.9%****	0.009	**-2.8%****	0.013
Age2/100		slogit	**-21.47%***'	0.001	10.7%	0.001	-0.4%	0.000	**4.5%***	0.000	**6.6%***	0.000
		oprobit	**-14.9%*****	0.001	**-3.0%****	0.000	**4.9%****	0.000	**5.2%****	0.000	**7.8%*****	0.000
Age3/1000		slogit	**1.6%*****	0.000	-0.8%	0.000	0.0%	0.000	**-0.4%***	0.000	**-0.5%***	0.000
		oprobit	**1.1%*****	0.000	**0.2%****	0.000	**-0.4%****	0.000	**-0.4%****	0.000	**-0.6%*****	0.000
Single (ref. cat: married or lives with a partner)		slogit	-3.9%	0.061	3.4%	0.074	-0.6%	0.024	0.4%	0.027	0.7%	0.039
		oprobit	-2.0%	0.049	-0.4%	0.012	0.6%	0.016	0.7%	0.017	1.1%	0.027
Single, female		slogit	2.2%	0.084	-11.3%	0.072	3.5%	0.026	2.3%	0.036	3.4%	0.053
		oprobit	-1.6%	0.056	-0.4%	0.014	0.5%	0.018	0.6%	0.020	0.9%	0.032
Divorced or widowed, female		slogit	4.8%	0.071	**-21.5%*****	0.054	**6.5%*****	0.018	**4.1%***	0.025	**6.1%***	0.037
		oprobit	-5.9%	0.042	-1.7%	0.017	1.8%	0.013	2.2%	0.017	3.6%	0.030
Labour status (ref. cat: employed / student)	**Economically inactive**	slogit	**-23.3%*****	0.044	**-10.6%***	0.057	2.5%	0.027	**12.7%*****	0.027	**18.7%*****	0.040
		oprobit	**-21.5%*****	0.032	**-9.8%*****	0.026	**5.3%*****	0.008	**8.3%*****	0.016	**17.7%*****	0.040
	Unemployed	slogit	-2.3%	0.073	-8.9%	0.069	3.1%	0.022	3.3%	0.030	4.8%	0.045
		oprobit	-5.9%	0.052	-1.8%	0.022	1.8%	0.015	2.2%	0.020	3.7%	0.038
Ethnic non-Latvian		slogit	-2.2%	0.036	4.6%	0.039	-1.3%	0.012	-0.5%	0.012	-0.7%	0.017
		oprobit	-0.2%	0.027	0.0%	0.005	0.1%	0.009	0.1%	0.009	0.1%	0.014
Education (ref. cat: higher / incomplete higher education)	**Below secondary**	slogit	8.1%	0.057	**-19.4%*****	0.049	**5.4%*****	0.017	2.4%	0.021	3.5%	0.030
		oprobit	-1.6%	0.041	-0.3%	0.010	0.5%	0.013	0.6%	0.014	0.9%	0.023
	Secondary / vocational secondary	slogit	**6.8%***	0.038	-2.5%	0.045	-0.2%	0.015	-1.7%	0.015	-2.5%	0.022
		oprobit	**5.0%***	0.030	1.0%	0.007	**-1.6%***	0.010	**-1.7%***	0.010	-2.6%	0.016

Notes: Asterisks *, **, *** indicate a statistically significant difference from the base group at 10%, 5%, 1% level respectively.
Other factors controlled: Average income per household member

Table A5. Association between life satisfaction and sense of control and self-assessed health in Latvia (socioeconomic factors controlled)

Number of observations	Wald chi2(50)	Log pseudolikelihood	df	AIC	BIC	Lacy R2O
894	140.04	-1171.77	57	2457.54	2730.90	25.00%

Factors		**Association between each factor and health** (comparison with the reference category, impact of other factors is excluded)									
Mean probabilities		29%		32%		15%		10%		14%	
		Very good Never ails/ ails very rarely		**Good** Has had only minor sicknesses		**Fair** Has had serious sicknesses that are cured		**Poor** Has had serious sicknesses, injuries and still suffers from them		**Very poor** Has chronic diseases/ is disabled	
		dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.
Female		11.7%	0.076	-1.8%	0.080	-1.1%	0.025	-3.6%	0.023	-5.1%	0.033
Lives in Riga or Riga district (ref. cat.: lives outside Riga district)		1.4%	0.051	3.0%	0.060	-1.3%	0.019	-1.3%	0.017	-1.8%	0.024
Lives in Riga or Riga district, male		**19.7%****	0.084	**-17.8%*****	0.062	2.4%	0.031	-1.8%	0.023	-2.5%	0.033
Age		**9.8%*****	0.034	**-5.9%***	0.034	0.5%	0.013	-1.9%	0.011	-2.6%	0.016
Age^2/100		**-25.6%*****	0.001	13.0%	0.001	-0.6%	0.000	**5.4%****	0.000	**7.7%****	0.000
Age^3/1000		**1.9%*****	0.000	-0.9%	0.000	0.0%	0.000	**-0.4%****	0.000	**-0.6%****	0.000
Single (ref. cat.: married or lives with a partner)		-2.4%	0.065	1.7%	0.074	-0.2%	0.025	0.4%	0.026	0.6%	0.037
Single, female		3.3%	0.084	-8.7%	0.078	2.6%	0.029	1.2%	0.034	1.7%	0.047
Divorced or widowed, female		8.0%	0.075	**-20.1%*****	0.060	**5.9%*****	0.020	2.6%	0.025	3.6%	0.035
Labour status (ref. cat: employed / student)	**Economically inactive**	**-20.4%*****	0.047	-9.9%	0.061	3.0%	0.026	**11.3%*****	0.027	**16.0%*****	0.039
	Unemployed	9.3%	0.079	-8.6%	0.073	1.4%	0.024	-0.8%	0.021	-1.2%	0.030
Ethnic non-Latvian		-1.9%	0.037	6.1%	0.041	-1.9%	0.013	-1.0%	0.012	-1.3%	0.017
Education (ref. cat.: higher / incomplete higher education)	**Below secondary**	**12.2%****	0.058	**-19.1%*****	0.050	**4.9%****	0.019	0.9%	0.019	1.3%	0.027
	Secondary / vocational secondary	**8.2%****	0.039	-2.5%	0.046	-0.4%	0.016	-2.2%	0.015	-3.1%	0.022
Life satisfaction level (ref. cat.: low)	**Average**	**9.9%****	0.043	6.2%	0.047	**-3.7%****	0.017	**-5.1%*****	0.014	**-7.2%*****	0.020
	High	**22.1%*****	0.079	-10.4%	0.068	-1.5%	0.027	**-4.2%****	0.018	**-5.9%****	0.025
High life satisfaction level, female		**-15.0%****	0.060	**33.3%*****	0.093	**-9.6%*****	0.031	-3.6%	0.023	-5.1%	0.032
Control over life level (ref. cat.: low)	**Average**	**24.0%*****	0.078	-7.4%	0.073	-2.7%	0.028	**-5.7%*****	0.021	**-8.1%*****	0.027
	High	**14.6%****	0.068	7.8%	0.072	**-5.6%****	0.025	**-7.0%*****	0.021	**-9.8%*****	0.026
Average control over life level, female		**-14.2%***	0.073	-1.1%	0.103	1.0%	0.031	5.9%	0.042	8.4%	0.057
High control over life level, female		-7.2%	0.082	**-19.0%*****	0.074	**6.5%*****	0.025	**8.1%****	0.039	**11.5%****	0.054

Notes: Asterisks *, **, *** indicate a statistically significant difference from the base group at 10%, 5%, 1% level respectively.
Other factors controlled: Average income per household member

Table A6. Association between expectations and self-assessed health in Latvia (socioeconomic factors controlled)

Number of observations	Wald chi2(50)	Log pseudolikelihood	df	AIC	BIC	Lacy R2O
816	122.57	-1082.51	47	2259.03	2480.13	22.46%

Factors		**Association between each factor and health** (comparison with the reference category, impact of other factors is excluded)									
Mean probabilities		29%		32%		15%		10%		14%	
		Very good Never ails/ ails very rarely		**Good** Has had only minor sicknesses		**Fair** Has had serious sicknesses that are cured		**Poor** Has had serious sicknesses, injuries and still suffers from them		**Very poor** Has chronic diseases/ is disabled	
		dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.	dP/dX	S.E.
Female		0.2%	0.053	3.1%	0.054	-1.0%	0.015	-0.8%	0.017	-1.5%	0.028
Lives in Riga or Riga district (ref. cat.: lives outside Riga district)		-3.3%	0.054	**11.7%***	0.066	**-3.3%***	0.019	-1.9%	0.018	-3.3%	0.030
Lives in Riga or Riga district, male		**19.0%****	0.093	**-22.0%*****	0.056	4.0%	0.028	-0.4%	0.028	-0.7%	0.048
Age		**8.5%****	0.036	-5.1%	0.036	0.5%	0.012	-1.5%	0.012	-2.5%	0.020
Age^2/100		**-22.6%*****	0.001	10.4%	0.001	-0.4%	0.000	**4.6%***	0.000	**8.0%***	0.000
Age^3/1000		**1.7%*****	0.000	-0.7%	0.000	0.0%	0.000	**-0.4%***	0.000	**-0.6%***	0.000
Single (ref. cat: married or lives with a partner)		-2.4%	0.064	5.5%	0.078	-1.4%	0.024	-0.6%	0.025	-1.1%	0.042
Single, female		2.7%	0.096	**-16.7%****	0.069	**4.8%****	0.023	3.4%	0.039	5.9%	0.066
Divorced or widowed, female		7.0%	0.081	**-27.3%**	0.050	**7.6%*****	0.016	**4.6%***	0.027	**8.0%***	0.045
Labour status (ref. cat: employed / student)	**Economically inactive**	**-24.0%*****	0.047	**-10.4%***	0.062	1.9%	0.030	**11.9%*****	0.027	**20.6%*****	0.047
	Unemployed	-2.9%	0.076	-8.4%	0.073	2.7%	0.021	3.2%	0.030	5.5%	0.052
Ethnic non-Latvian		-1.8%	0.040	4.9%	0.043	-1.3%	0.012	-0.6%	0.012	-1.1%	0.021
Education (ref. cat: higher / incomplete higher education)	**Below secondary**	9.3%	0.060	**-17.8%*****	0.053	**4.4%*****	0.017	1.5%	0.019	2.6%	0.033
	Secondary / vocational secondary	**7.1%***	0.042	0.3%	0.047	-1.0%	0.015	-2.3%	0.015	-4.0%	0.026
Living standards of people like you in Latvia within 2-3 years... (ref. cat: will become worse)	**Will improve**	**11.8%****	0.053	-7.0%	0.048	0.5%	0.017	-1.9%	0.016	-3.3%	0.026
	Will remain on the same level	1.6%	0.045	-1.0%	0.049	0.1%	0.014	-0.2%	0.014	-0.4%	0.024

Notes: Asterisks *, **, *** indicate a statistically significant difference from the base group at 10%, 5%, 1% level respectively.
Other factors controlled: Average income per household member

Table A7. Results of exogeneity test for life satisfaction (probit models for 2 dimensions of stereotype logit model)

Factors		1st dimension		2nd dimension	
		dP/dX	S.E.	dP/dX	S.E.
Life satisfaction level (ref. cat.: low)	**Average**	17.7%	0.729	-82.9%	0.577
	High	-0.6%	0.538	-95.3%	0.465
Female		7.5%	0.183	-19.0%	0.196
Lives in Riga or Riga district		32.0%	0.199	4.9%	0.231
Lives in Riga or Riga district, male		-95.6%	0.281	-29.6%	0.312
Age		-25.5%	0.129	-30.1%	0.124
Age^2/100		66.4%	0.003	81.9%	0.003
Age^3/1000		-5.0%	0.000	-6.2%	0.000
Single (ref. cat.: married or lives with a partner)		33.8%	0.223	14.0%	0.251
Single, female		-55.7%	0.274	9.9%	0.315
Divorced or widowed, female		-93.3%	0.305	-0.2%	0.251
Labour status (ref. cat.: employed / student)	**Economically inactive**	9.5%	0.295	82.9%	0.231
	Unemployed	0.5%	0.316	-4.9%	0.342
Ethnic non-Latvian		8.9%	0.135	-20.4%	0.153
Education (ref. cat.: higher / incomplete higher education)	**Below secondary**	-57.3%	0.201	-28.5%	0.223
	Secondary / vocational secondary	-13.3%	0.147	-19.0%	0.167
Constant		3.0	1.746	3.4	1.716
Instrumented: Level of live satisfaction Instruments: Gender, age, place of residence, labour status, income, marital status, ethnicity, education, **expectations on living standards in Latvia within 2-3 years in comparison to EU average, satisfaction with possibilities to implement personal ideas and plans**		Wald test of exogeneity: chi2(2) = 0.21 Prob > chi2 = 0.8985		Wald test of exogeneity: chi2(2) =1.57 Prob > chi2 = 0.4554	

Notes: Other factors controlled: Average income per household member
Dependent variable is binary in both dimensions: in the first dimension 0 is for very good health and 1 is for good health; in the second dimension 0 is for very good health and 1 is for fair, poor and very poor health combined together.

Table A9. Results of exogeneity test for sense of control (probit models for 2 dimensions of stereotype logit model)

Factors		**1st dimension**		**2nd dimension**	
		dP/dX	S.E.	dP/dX	S.E.
Control over life level (ref. cat.: low)	**Average**	-149.2%	1.417	6.8%	1.503
	High	-90.8%	0.763	-104.7%	0.594
Female		-1.5%	0.187	-7.7%	0.203
Lives in Riga or Riga district		5.1%	0.198	10.3%	0.221
Lives in Riga or Riga district, male		-57.8%	0.292	-53.1%	0.303
Age		-27.9%	0.136	-31.2%	0.128
Age^2/100		69.5%	0.003	84.3%	0.003
Age^3/1000		-5.2%	0.000	-6.3%	0.000
Single (ref. cat.: married or lives with a partner)		11.2%	0.233	16.4%	0.264
Single, female		-33.0%	0.278	2.6%	0.320
Divorced or widowed, female		-79.2%	0.303	-6.3%	0.271
Labour status (ref. cat.: employed / student)	**Economically inactive**	8.6%	0.259	60.4%	0.277
	Unemployed	-22.7%	0.309	6.1%	0.399
Ethnic non-Latvian		2.3%	0.149	-9.2%	0.152
Education (ref. cat.: higher / incomplete higher education)	**Below secondary**	-49.9%	0.211	-18.7%	0.226
	Secondary / vocational secondary	-27.5%	0.146	-28.7%	0.171
Constant		4.7	1.749	3.4	1.764
Instrumented: Control over own life level Instruments: Gender, age, place of residence, labour status, income, marital status, ethnicity, education, **satisfaction with own professional qualification, satisfaction with possibilities to implement personal ideas and plans**		Wald test of exogeneity: chi2(2) = 1.13 Prob > chi2 = 0.5686		Wald test of exogeneity: chi2(2) =1.79 Prob > chi2 = 0.4078	

Notes: Other factors controlled: Average income per household member
Dependent variable is binary in both dimensions: in the first dimension 0 is for very good health and 1 is for good health; in the second dimension 0 is for very good health and 1 is for fair, poor and very poor health combined together.

Table A80. Results of exogeneity test for expectations (probit models for 2 dimensions of stereotype logit model)

Factors		1st dimension		2nd dimension	
		dP/dX	S.E.	dP/dX	S.E.
Living standards of people like you in Latvia within 2-3 years... (ref. cat.: will become worse)	**Will improve**	-42.8%	0.380	-59.5%	0.399
	Will remain on the same level	27.6%	0.968	12.6%	0.888
Female		12.4%	0.211	-9.1%	0.209
Lives in Riga or Riga district (ref. cat.: lives outside Riga district)		26.1%	0.219	-8.0%	0.268
Lives in Riga or Riga district, male		-93.1%	0.300	-16.7%	0.349
Age		-31.5%	0.138	-31.0%	0.131
Age^2/100		79.8%	0.003	83.7%	0.003
Age^3/1000		-6.1%	0.000	-6.3%	0.000
Single (ref. cat.: married or lives with a partner)		29.1%	0.235	1.8%	0.260
Single, female		-53.1%	0.348	-7.3%	0.442
Divorced or widowed, female		-92.3%	0.311	-1.2%	0.276
Labour status (ref. cat.: employed / student)	**Economically inactive**	34.4%	0.315	93.6%	0.278
	Unemployed	4.5%	0.354	62.5%	0.382
Ethnic non-Latvian		10.9%	0.164	-22.3%	0.167
Education (ref. cat.: higher / incomplete higher education)	**Below secondary**	-57.9%	0.243	-11.6%	0.228
	Secondary / vocational secondary	-19.7%	0.155	-17.5%	0.177
Constant		3.9	1.860	3.0	1.758
Instrumented: Level of live satisfaction Instruments: Gender, age, place of residence, labour status, income, marital status, ethnicity, education, **expectations on living standards in Latvia within 2-3 years in comparison to EU average, satisfaction with job possibilities in the region one lives in**		Wald test of exogeneity: chi2(2) = 1.66 Prob > chi2 = 0.4360		Wald test of exogeneity: chi2(2) =1.58 Prob > chi2 = 0.4546	

Notes: Other factors controlled: Average income per household member

Dependent variable is binary in both dimensions: in the first dimension 0 is for very good health and 1 is for good health; in the second dimension 0 is for very good health and 1 is for fair, poor and very poor health combined together.