ASSESSING THE EFFECT OF ECONOMIC GROWTH ON WELL-BEING IN THE EU-27. A PARETO-OPTIMUM APPROACH[1]

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Abstract

In various fields of research self-perceived health has been defined and analyzed as a significant measure of well-being and also as a predictor of health status. This paper examines the economic determinants of self-perceived health in the EU-27 area in order to find whether a common set of governmental policies could improve the self-perceived health and whether this positive effect would remain positive and significant on other measures of well-being as well as across the quintiles of income distribution. In subsidiary, the effect of economic growth on well-being is also examined. A number of panel regression models using the first-difference GMM estimator are applied to comparatively analyze self-perceived health together with other measures of health status and well-being, based on Eurostat data from 2003 to 2012. The empirical results of the paper could provide useful insights for the European health policy and other common actions and policies in the field of economic growth and well-being.

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I. Background

Self-perceived health is an interdisciplinary topic of research, being often approached in the framework of different research fields such as epidemiology, psychology, sociology, health economics, health care and demography. This

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subjective measure could be seen as both a measure of well-being (Diener *et al*, 1999; Sposito *et al.*, 2010; Kriston *et al*, 2012; Gilmour, 2012) as well as a predictor of future health, mortality and healthy life expectancy (Jylhä, 2009; Mohan *et al*, 2011; Tareque, Saito and Kawahara, 2015). The rich significance of self-perceived health explains the growing interest in it in interdisciplinary empirical studies. In the field of health economics, most studies focusing on the variable "self-perceived health" have a microeconomic focus. In contrast to them, this paper takes a macroeconomic approach by examining this variable aggregated at the EU-27 country level[2]. The main objective of this paper is to find out whether a set of common governmental policies adopted by the EU-27 Member States could effectively target both the improvement of self-perceived health across all income quintiles and the improvement of other well-being measures. Effective policy measures considered here are in defined upon the Pareto-optimum criteria, i.e. are those policies aiming at the improvement of self-perceived health, without negatively affecting other measures of well-being or the self-perceived health of a certain income group.

To answer the research question presented above, an empirical analysis was conducted in two steps. First, the determinants of self-perceived health across the income quintiles were comparatively examined by means of five separate models. This allowed finding out whether a set of common policy measures could facilitate better health for all or at least for the bottom income quintiles without causing side effects for other income groups. Second, a subset of significant determinants of self-perceived health found during the previous step was comparatively analyzed along with the determinants of other well-being measures. This will reveal the policy measures which are effective not only across the income quintiles, but also across different well-being measures, including self-perceived health.

This paper is structured into four sections. The first section includes the introduction and the literature review, the second section presents the methodology and data, the third section is concerned with the presentation of empirical results and their interpretation, and the fourth section is devoted to the discussion of main results and the concluding remarks.

In the EU countries the organisation and delivery of health care services is the responsibility of national governments. The EU only has a complementary role, namely to help countries achieve shared objectives and tackling common challenges. However strengthening health-related common actions has recently become a priority at the EU level and, therefore, Health 2020 is the new European health policy framework. Its aim is to support action across governments and society, to significantly improve the health and well-being of populations, and reduce health inequality and ensure centred health systems for the people (World Health Organization, 2012a). Improving health for all and reducing health inequalities are among the strategic objectives of the Health 2020 policy. In this context, the analysis of the self-rated health determinants could provide useful insights for the EU-27 policy makers and for the success of the 2020 Health policy.

[2] *The EU-27 term refers at the EU-27 Member States of the European Union: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom..*

Self-perceived health and subjective well-being

According to the World Health Organization (WHO, 2012b), well-being stands for „an individual's experience of their life as well as a comparison of life circumstances with social norms and values". This definition highlights the two dimensions of well-being – the objective and the subjective ones. Given its subjective nature, well-being is typically measured with self-reports (Larsen et al., 2008). However, objective measures are often used to assess well-being, so that it is commonly agreed that the well-being measurement should include both subjective and objective measures, especially for public policy purposes (Diener et al., 2009).

Self-perceived health is often referred to as a measure of psychological well-being (Kriston et al., 2012), the latter being widely acknowledged in literature as a domain of well-being (Diener et al., 1999; Diener, 2000; Frey and Stutzer, 2002, Eid, 2008). Other studies simply consider self-rated health as a direct measure of well-being (Campbell et al., 1976; Gilmour, 2012). To sum up, in the literature on well-being, self-rated health is generally approached either as a direct or as an indirect measure of well-being.

However, the empirical evidence about the relationship between self-perceived health and well-being is broad and diverse. The association between subjective well-being and self-reported health status is found to be a strong one (Larson, 1978; George and Landerman, 1984; Mroczek and Spiro, 2005; Haller and Hadler, 2006). In contrast, the association between objective health measures and subjective well-being was found to be weaker (Watten *et al.*, 1997). An explanation of these different results is provided by Diener *et al*. (1999), who find that the relationship between self-perceived health and subjective well-being, which generally does not exclusively reflect the actual physical health condition, is inflated by one's level of emotional adjustment.

According to the OECD Guidelines (2013), this paper conceptually addresses self-perceived health as a measure of subjective well-being, which also encompasses other subjective measures (e.g. satisfaction with the financial status) or measures of "meaningfulness" and "purpose".

The self-perceived health, as an indicator of general health

The self-perceived health could be seen as a concept which builds a bridge between health and well-being (Stoll et al., 2012). It is not only a measure of well-being (Sposito *et al.*, 2010), but also a widely used indicator of general health, being used in many studies as a good predictor of the future health, functional decline, disability, healthy life expectancy and mortality **(**Szwarcwald et al., 2005; Jylhä, 2009; Mohan *et al*, 2011; Arnadottir et al., 2011; Tareque et al., 2015**)**. But as suggested above, the self-evaluation of health has a subjective nature and therefore refers not only to the physical dimension of the health status, but also to well-being, satisfaction with life and to the psychological and social consequences of having a health problem (Blank et al., 1996; Szwarcwald et al., 2005). We therefore find self-perceived health in both the measurement of health and the measurement of well-being.

In 1946 the WHO admitted the limits of objective indices and suggested that health was “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”, thus emphasizing, for the first time, the relationship between health and well-being. Since then, a wide range of subsequent literature has comparatively examined the effectiveness of the objective and subjective measures of health. The empirical findings are slightly different but ultimately convergent. Epidemiologic studies have revealed that self-perceived health is generally realistic, being close to the objective health status, as confirmed by the doctors’ evaluation (Hunt et al., 1980). When the objective and subjective health status are different, the self-evaluation of health is found to be an important predictor of future health problems (Blank and Diderichsen, 1996; Froom et al., 2004). Bourne (2009) examines whether self-reported health is a good indicator of objective health by comparing the objective and subjective health indices. He comes to the conclusion that the objective health indices (e.g. life expectancy and mortality) ensure a high degree of precision in measuring health, and they therefore allow measuring health as the absence of disease. From the moment of WHO’s revolutionary definition of health, subjective indices have gained substantial popularity among researchers, being used alongside objective measures to assess the level of health. In the literature on well-being, the most significant subjective measures of health are considered to be: happiness, life satisfaction, and self-perceived health (Diener, 1984; Hutchinson *et al.*, 2004; Bourne, 2009).

Socio-economic determinants of self-perceived health

According to the Commission on Social Determinants of Health (2007) the social determinants of health are context and structural determinants. The labour market, educational system and political institutions are context determinants, while income, education, occupation, social class, gender and race are structural determinants. In particular, a body of literature examines the social determinants of self-perceived health, sometimes with a focus on the comparison with the social determinants of other measures of well-being. The health inequality, social class, employment status and income mobility are usually considered when analyzing the determinants of self-perceived health.

The relationship between increasing socio-economic position and better health is found to be a positive one (e.g. Adler and Ostrove, 1999). A number of factors explain this relationship; they are work-related factors and behavioural factors (Borg and Kristensen, 2000), as well as health behaviours and psychological job characteristics (Mustard *et al*., 2003). Within this body of literature, social class has been found to be a significant predictor of worsening self-reported health, but not of improved self-reported health (Orpana *et al*., 2007).

The complex relationship between income inequality and health inequality has been extensively explored in the literature, but the results are mixed and not conclusive, which makes it difficult to formulate policy recommendations (Mellor and Milyo, 2002). The impact of income inequality on self-perceived health has also been analyzed in the literature, but to a lesser extent than the reverse causality. After examining a number of individual socio-economic characteristics, Lopez (2004) finds

that for each 1 point rise in the Gini index, the risk of reporting poor self-perceived health increased by 4%. Given that self-perceived health is a predictor of morbidity and mortality, Lopez concludes that in the metropolitan area income inequality is a determinant of adults' health. In contrast, when analyzing income inequality at the individual, county and state levels, Blakely et al. (2002) find, on average, a small association between self-perceived health and income inequality. A meta-analysis of cohort studies conducted on a number of 60 million participants found a direct association between regional income inequality and the risk of premature mortality, independent of the socio-economic status, age and sex, while a meta-analysis of cross-sectional studies indicated a direct relation between high regional income inequality and poor self-perceived health (Kondo et al., 2009). The results revealed by the meta-analyses conducted by Kondo et al. (2009) are in line with the Report of the WHO Commission on Social Determinants of Health (2007), which suggests that policy makers should take into account the impact of macroeconomic conditions, reflected onto the level of income inequality on individual health.

The relationship between self-perceived health and employment status has also been investigated in the health and well-being literature (Kaleta et al., 2008; Lim et al., 2015). For instance, Lim et al. (2015) find that the household income has a moderating effect on self-perceived health in the sense that higher income buffers the link between unstable employment status and low self-perceived health, while unstable employment combined with low income is related to the wage workers' precariously perceived health.

Bourne et al. (2014) examines the social determinants of health by age cohort differentials, young adults and aged people to explain the contribution of each determinant to different age cohort models and the factor differentials between the two age cohort models.

The differences in the perceived health status between different social strata or income quartiles/ quintiles, which is the research question examined in this paper, have seldom been approached in the literature. Borg and Kristensen (2000) explain the differences in work environment and life style factors between social classes in Denmark and their impact on the differences regarding self-perceived health between social classes in Denmark. Other studies examine how class differences in material and life style factors, psychosocial occupational risk factors as well as in work characteristics and employment conditions explain a part of the identified class differences in health and mortality (Chandola, 2000; Chandola and Jenkinson, 2000; Rocha, 2014).

A body of well-being literature focuses on examining the joint determinants of self-perceived health and well-being. Individual education, social connections and income are found to be their strongest common predictors (Subramanian et al., 2005 Easterlin, 1997). However, many studies find that income, education and employment status, age, race, friendship and marital status are significant determinants of self-perceived health (Lane, 1994; Kawachi and Kennedy, 2003; Szwarcwald, 2005; Kaleta et al., 2008; Lim, 2015). Apart from the socio-economic factors above, neighbourhood safety and physical activity play important roles in self-perceived health (Meyer et al., 2014), as well as social isolation and social disadvantage (Morgan, 2014). Macroeconomic factors such as economic growth, unemployment

and inequality are found to be significant determinants of health, when this is illustrated by aggregated indexes like the Health Human Development Index (Lopez-Casasnovas and Soley-Bori, 2014). Cultural determinants play an important role in explaining both health and well-being by amplifying or moderating the effect of socio-economic factors through the same psychosocial pathways by which socio-economic factors are thought to influence health (Eckersley, 2001). Tax and transfer policies as well as race, labour market and workplace policies were found to be amongst the most effective measures for improving the access to as well as the quality of medical care (Fiscella et. al., 2000; Wagstaff and van Doorslaer, 2000), which are themselves determinants of the self-perceived health.

Use in policy

As explained above, the relationship between well-being and health, measured *inter alia* by self-perceived health, is a bidirectional one. However, improving subjective well-being and self-perceived health is a policy objective aimed by all governments (World Health Organization, 2012) and particularly followed at the EU level (*see* the Health 2020 Strategy). This is because a policy focus on well-being can lead to improved well-being and improved health outcomes which ultimately reduce the health burden (UK Department of Health, 2014).

Despite its subjective nature, self-perceived health should be considered a useful social indicator for governmental policy purposes. From another perspective, targeting self-perceived health involves joined-up policies and services because only through marginal changes of a wide range of policies and services, subjective well-being can be improved (UK Department of Health, 2014). Besides being relevant for policy purposes as highlighted above, the self-rated health may open the way to prevention in behavioural medicine (Kriston et al., 2012).

Although in the literature self-rated health has been often referred to as an indicator or domain of subjective well-being, the governmental policies targeting different dimensions of subjective well-being are expected to not necessarily generate positive effects on self-rated health, and vice versa. For instance, the effect of a set of common policy measures on different well-being dimensions in the EU area is found not to be similar so that effective measures adopted in one well-being domain could generate negative effects for other well-being domains (Răileanu-Szeles, 2015). However, health indicators have not been included in such type of analyses to date.

II. Methods

As mentioned in Background, the goal of this paper is to analyze the determinants of self-perceived health across the income quintiles, and in comparison with the determinants of other well-being measures, in the EU. This empirical exercise allows examining whether a set of common policy measures could be effective across all income quintiles and all well-being measures considered in our analysis. Two other measures of well-being are compared here with self-perceived health: the self-

reported unmet need for medical examination or treatment, and inability to make ends meet[3].

The analysis is conducted in the EU-27 area, from 2003 to 2012, based on Eurostat data, and develops into two stages, according to the research issues presented above. First, the aggregated levels of self-perceived health set against the five income quintiles are explained by a number of potential determinants. In the second step, the variables "self-reported unmet need for medical examination or treatment", and "inability to make ends meet" are comparatively set against self-perceived health according to a set of common determinants. A number of dynamic panel regression models using the Arellano-Bond one-step difference GMM estimator are applied in the empirical section. This technique allows overcoming the econometric problems associated to our working dataset.

2.1 Sources of data and variables

The empirical analysis is conducted at the macroeconomic level, so that all indicators used here are aggregated measures at the EU-27 country level. The variables of our empirical study are Eurostat data, and the period of analysis is from 2003 to 2012. The main variable of our analysis, which is the "self-perceived health", indicates the percentage of population reporting a bad or a very bad status of health. The self-perceived health is also separately examined upon each quintile of income distribution through five distinct variables (see Tab.2). The variables "self-reported unmet need for medical examination or treatment", denoted here as "unmet medical need", and "inability to make ends meet", denoted here as "ends meet", are other variables of interest which are comparatively set against self-perceived health according to a set of common determinants. The variables "public expenditure on labour market policies", as percentage of GDP (denoted "labour expenditure"), at-risk poverty rate, Gini coefficient, economic growth rate, unemployment, "population with tertiary education attainment (% of population)" (denoted "tertiary education"), "inability to face unexpected financial expenses" (denoted "unexpected expenses"), "transition to one income decile up within one year" (denoted "transition to one income decile up") and "health care expenditure provided by the general government" as percentage of GDP (denoted "health expenditure") form together the set of independent (explanatory) variables.

The main variables of our analysis, which are further explained by their common determinants, are summarized below upon the status of New Member State (NMS) or Old Member State (OMS).

[3] *These variables are often refered to as indicators of well-being (e.g. Kettner, 2012) or are included into well-being indexes (e.g. the Gallup-Healthways Well-Being Index).*

Tab. 1

Descriptive statistics, EU-27, 2003-2012

Variables	EU-27		NMS		OMS	
	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.
Self-perceived health	5.22	2.43	7.78	1.52	4.06	1.79
Unmet medical needs	3.37	3.68	6.08	5.04	2.13	1.82
Ends meet	34.87	15.45	51.06	15.40	27.79	8.66

Notes. The means and standard deviations have been derived for the EU-27, NMS (New Member States) and OMS (Old Member States) countries, based on Eurostat data, ranging from 2003 to 2012.

The means of the three variables of interest are two to three times higher in the case of the NMS, in comparison with the OMS. This suggests a high heterogeneity with regard to the well-being measures across the EU-27 countries, especially between the NMS and OMS. The heterogeneity also continues to be higher among the NMS for two out of three dimensions of well-being, the variable "unmet medical needs" indicating the most important variability between the NMS[4]. Despite these differences between and within the NMS and OMS, they all form together the EU-27 dataset, being therefore subject to common European economic and social policies.

To provide a comprehensive overview of the self-rated health in the EU-27, this variable has also been analyzed in the empirical section upon the quintiles of income distribution. According to Tab. 2, there is a large heterogeneity in self-rated health across the income distribution quintiles.

Tab. 2

Self-perceived health across the quintiles of income distribution

Variable	Mean	Std.dev.	Min.	Max.
Self-perceived health: First quintile	8.10	3.55	1.65	17.6
Self-perceived health: Second quintile	7.09	3.52	1.65	17.25
Self-perceived health: Third quintile	4.91	2.67	0.9	12.9
Self-perceived health: Fourth quintile	3.45	1.93	0.6	9.6
Self-perceived health: Fifth quintile	2.19	1.11	0.3	5.6

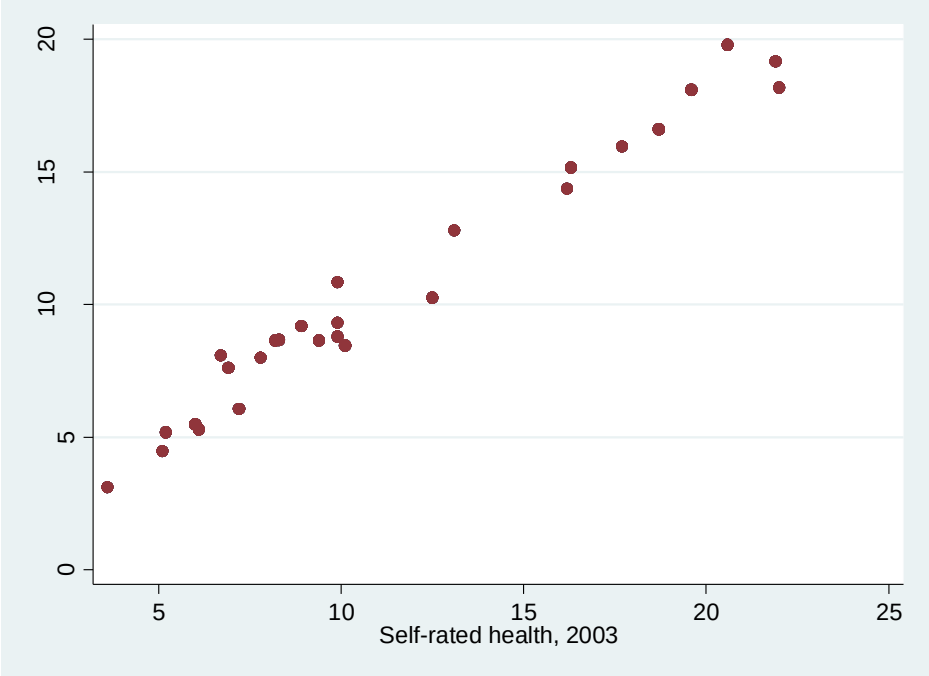
In Figure 1 below, for each EU-27 country, the averages of the "self-perceived health" variable in the period 2002-2012 are plotted on the vertical axis against the initial levels of this variable in 2002 on the horizontal axis. This chart could give insights into the formation of a convergence path at the EU-27 level with respect to the self-assessment of health. Although the convergence of the self-perceived health across the EU countries has not been investigated in the literature, our interest for this

[4] *Even though the high heterogeneity depicted within the EU-27 would suggest separately running the econometric models for the NMS and OMS groups, the dataset constraints (small sample) would weaken the GMM tests and results. In the empirical section, all models are applied only on the whole EU-27 dataset.*

research question is motivated by the fact that the process of Europeanization[5] (particularly the high immigration and labour movement within the EU) could lead to the convergence of subjective measures as well. Only the convergence in self-perceived health over time in different age groups has been examined in the literature, and the empirical evidence is mixed, some papers indicating the existence of a convergence process (Beckett, 2000; Lynch, 2003) and others indicating divergence trends (Cutler and Lleras-Muney, 2006).

Fig.1

Self-rated health EU-27 countries, 2003-2012



Note. Eurostat data, 2003-2012

The chart suggests the absolute lack of convergence in self-perceived health within the EU-27. Moreover, this indicator shows that self-perceived health is constant within countries over time, so that those countries having low initial levels of aggregated self-perceived health also have low averages over the period of analysis 2003-2012 while countries having higher initial levels also have higher annual averages. The "rigidity" of this subjective indicator of well-being suggests that the improvement of self-perceived health in the EU-27 countries should be targeted in the

[5] *In the literature of European integration, the process of Europeanization has been described as "a process by which domestic policy areas become increasingly subject to European policy-making" (Borzel, 1999).*

framework of national governmental policies and that the formulation of EU-level measures would be ineffective

2.2 Model

The empirical analysis mainly uses panel data regressions and develops into two steps. First, separate regression models are built for each income quintile to explain the influence of a set of determinants on different income quintile self-perceived health. Second, separate regression models are used to examine the impact of a restrained set of determinants on three measures of well-being, comprising *inter alia*, the self-perceived health. The panel data regression models applied here allow considering the longitudinal dimension of our dataset. This could give insight into the dynamics of self-perceived health and other well-being measures in the EU-27 area.

Before running the regression analysis it is necessary to decide upon what estimator to use. This decision, which represents the central piece into the regression analysis, is based on the examination of panel data specific problems such as endogeneity, serial correlation or heterokedasticity. When endogeneity is suspected and then confirmed by specific tests, the method of instrumental variables (IV) allows the derivation of consistent estimates. In this case the Ordinary Least Squares estimation (OLS) produces biased and inconsistent estimates. Selecting “good” or suitable instruments is particularly important at this point because, with weak instruments, the IV estimators are as biased as the OLS. When there are an equal number of endogenous and instrumental variables, the endogenous variables are considered to be just identified. When there are more instrumental variables than endogenous ones, the endogenous variables are over-identified, and in this case the two-stage least squares (2SLS) could be used. Both the OLS and 2SLS are particular cases of the Generalized Method of Moments (GMM).

In recent years, the difference GMM (Arellano and Bond, 1991) and the extended-GMM (Arellano and Bover, 1995; Blundell and Bond, 1998) have been extensively used in empirical studies. The Arellano-Bond estimation uses the GMM and transforms all regressors according to the method of differencing, being therefore known as difference-GMM. In comparison with the OLS, within-groups and the Anderson-Hsiao difference and level estimators, the difference GMM produces the least amount of bias and variance in estimating the parameters (Arellano and Bond, 1991). But the first-differenced GMM is found to be subject to large downward finite-sample bias when the number of available time periods is small (Blundell and Bond, 1998). The Arellano-Bover (1995) and Blundell-Bond (1998) use additional moment conditions in which lagged differences of the dependent variable are orthogonal to the levels of disturbances, by assuming that the panel level effect is independent of the first observable first-difference of the dependent variable (Drukker, 2008). This is because they found that the lagged levels are weak instruments when the autoregressive process is too persistent. Their model consists of two equations (the original equation and the transformed one) and is known as the system-GMM. Overall, the Arellano-Bover (1995) and Blundell-Bond (1998) estimators allow for an improved efficiency when more instruments are introduced.

According to Roodman (2009), there is a number of reasons which would suggest using the GMM difference and system estimators: (1) The self-reported health status is a dynamic process whose current observations of the dependent variable depend on past ones; (2) The data are supposed to be affected by endogeneity and/ or heteroskedasticity and/ or serial correlation; (3) Internal instruments (based on lags of instrumented variables) are available in our dataset; (4) Idiosyncratic disturbances are presumed to be uncorrelated across individuals; (5) Time-invariant country characteristics (fixed effects) might be correlated with the explanatory variable, and (6) The panel dataset has a short time component (10 years in our dataset) and a large country dimension (27 countries). These estimators assume that the only available instruments are "internal", i.e. the lags of the instrumented variables, but external instruments can also be included in the model. However, given that finding outside instruments could be a difficult task, the use of the system GMM instead of the first-differenced GMM might be preferred (Bond et al., 2011).

The general model that we use in the empirical section takes the following form:

$$y_{it} = \alpha y_{i,t-1} + x_{it}^{'}\beta + z_{it}^{'}\delta + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = u_i + v_{it} \quad (2)$$

In the general case, $x_{it}^{'}$ is a vector of exogenous regressors, $z_{it}^{'}$ is a vector of endogenous regressors (being correlated with u_i), β and δ are two column vectors of coefficients, and y_{it} and ε_{it} are random variables.

As shown in eq.2, the disturbance term ε_{it} has two orthogonal components: u_i are the fixed effects, and v_{it} are the idiosyncratic shocks.

The model presented in eq. 1 can be also written for the level of *y*:

$$\Delta y_{it} = (\alpha - 1) y_{i,t-1} + x_{it}^{'}\beta + z_{it}^{'}\delta + \varepsilon_{it} \quad (3)$$

The lagged first-differences are used as instruments in the levels' equations. Their validity is tested using the Sargan test of the over-identifying restrictions or the Difference Sargan between the first-differenced GMM and the GMM system results. The results of these tests are reported with the output regression in the empirical section.

III. Results and interpretation

As mentioned in section "Methods", the empirical analysis unfolds in two stages. First, the aggregated levels of self-perceived health set against the five income quintiles are explained by a number of potential determinants. In the second stage, the explanatory variables which are found to be the most relevant in the first stage of our analysis are used to further explain the difference between the determinants of self-perceived health and two other measures of well-being, aggregated this time at country level. Our variables defining the well-being indicators, as well as the set of explanatory variables, have been selected from a larger set of

variables provided by the Eurostat dataset, in such a way as to be suggestive for the purpose of our analysis.

In this section, presentation and discussion of empirical results is preceded by a short discussion of the standard tests whose results allow identifying the appropriate estimator to be used in the regression analysis and then correctly building the regression models. After discussion of empirical results, a short conclusion is formulated for each regression model.

As emphasized in the previous section, before deciding what estimator to use in the panel regression models, autocorrelation, heterogeneity and endogeneity are analyzed in relation to our working dataset. The presence of heterokedasticity in our working dataset is confirmed by the likelihood test, while autocorrelation is revealed by the Woolridge test. Apart from the presence of heterokedasticity and autocorrelation, endogeneity is suspected in relation with most explanatory variables used in our panel regression models. All these problems related to the dataset and diagnosed in the preliminary analysis suggest using the GMM estimator[6].

Models 1 and 2 use both the first and the second lags of endogenous variables as instruments. Using two lags increases the number of instruments which reduces sample size, and therefore weakens the Sargan test, given that our dataset is not a large one[7]. Despite this constraint, the second lag is still used because it is not correlated with the current error term, while the first lag is.

The output provided by models 1 and 2 is accompanied by the results of two tests, i.e. Sargan and Arrelano-Bond. The Sargan test is a test for identifying restrictions and is used here to test the validity of instrumental variables in models 1 and 2. This test has the null hypothesis that the instruments as a group are exogenous, i.e. the instrumental variables are uncorrelated to a set of residuals. The statistical confirmation of this hypothesis leads to the conclusion that the instruments are valid. The Arellano-Bond test for AR(1) and AR(2) in first differences is applied to the differenced residuals and is based on the null hypothesis of no autocorrelation. In all the regressions reported in Tab. 3 and 4, the test for the AR (1) process in first differences rejects the null hypothesis, which was to be expected. However, the test for AR (2) in first differences, which is more important because it identifies autocorrelation in levels, does not reject it.

The estimates from the difference GMM are generally presented together with the estimates from the system GMM. This comparative approach is not undertaken here for two reasons. First, the system GMM uses level equations which increases efficiency and provides additional instruments as opposed to the difference GMM. Consequently, the system GMM is useful especially when the lagged levels of explanatory variables are poor instruments. Secondly, when the dataset is rather small (as it is in our case) the use of the system GMM, which uses more instruments than the difference GMM, becomes problematic.

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[6] *A detailed presentation of the GMM estimator is provided in the section "Methods".*

[7] *The analysis is conducted at the macroeconomic level, based on a number of 27 EU countries over a time span of 10 years.*

Tab. 3

Determinants of self-perceived health by income quartiles

Regressors	Model1	Model2	Model3	Model4	Model5
Self-perceived health in the previous year (L1.)	0.11	-.28***	0.21**	0.08	-0.46***
Unexpected expenses	-0.004	0.06***	0.06*	0.01	0.05***
L1.	-0.05	0.01	-0.07**	-0.01	-0.001
L2.	0.009	0.02**	0.005	-0.04***	-0.009
Gini index	-0.12	-0.18***	0.25***	0.08*	-0.27***
L1.	0.09	0.10	0.19***	0.11***	0.06
L2.	-0.06	0.19***	0.16**	0.008	0.07**
At risk poverty rate	0.31**	0.09	-0.42***	-0.20***	0.05
L1.	-0.18	-0.02	-0.04	0.02	-0.04
L2.	-0.05	-0.17*	-0.17	-0.09	-0.07
Growth rate	0.07	-0.001	0.01	0.06***	-0.01
L1.	0.15***	-0.04**	-0.06*	-0.02	0.009
L2.	0.01	-0.02*	-0.07**	-0.03**	-0.01
Transition to one decile up	-0.02	-0.03	-0.24***	-0.11***	0.03
L1.	-0.12*	-0.10***	-0.10***	-0.14***	0.01
L2.	-0.04	0.008	0.04	0.04	0.02
Health expenditure	1.74***	0.97***	0.21	0.55***	-0.13
L1.	0.28	0.96***	0.50***	-0.06	0.57***
L2.	0.86**	1.45***	0.87*	0.63***	0.47**
Labour expenditure	-0.006	-1.09***	0.04	0.38	0.12
L1.	0.32	-1.06***	-0.81**	-0.35*	-0.11
L2.	-1.23*	0.13	0.36	-0.007	-0.02
Tertiary education	-0.72***	-0.65***	0.04	-0.27***	-0.14*
L1.	0.23	-0.04	-0.51***	-0.11	-0.43***
L2.	0.02	0.12***	0.03	0.13***	0.05
Unmet medical needs	0.20***	0.009	-0.08*	-0.05	0.15***
L1.	-0.07**	-0.01	-0.09***	-0.04**	0.02
L2.	-0.05	-0.04	-0.08***	-0.03	0.08***

*Notes. (1) Model1: dep. variable - self-perceived health (1st quartile); Model2: dep. variable - self-perceived health (2nd Q); Model3: dep. variable - self-perceived health (3rd Q); Model4: dep. variable - self-perceived health (4th Q); Model5: dep. variable - self-perceived health (5th Q). (2) Dynamic panel regression model, Arellano-Bond one-step difference GMM estimator; (3) *** p<0.01, ** p<0.05, * p<0.1.(4) Eurostat data, 2003-2012. (5) L1 and L2 denote the first and second lags of explanatory variables.*

The estimates reported in Tab.3 allow making comparisons between the effects of a set of explanatory variables which are suggestive for a set of governmental policies on self-perceived health when the latter is aggregated at the EU-27 country level upon income quintiles. This comparative approach could reveal the factor differentials between the five income quintiles models, which could further provide useful insights for policy purposes.

In models (2), (3) and (5), the self-perceived health in the previous year seems to have significant, but different effects on its current level across the income quintiles. For instance, the highest income quintile is characterized by significant fluctuations from one year to another in self-perceived health status, which indicates that the richest individuals are likely to often experience changes in self-perceived health over time. Given that, according to epidemiologic studies self-perceived health is an accurate predictor of the future objective health status (Blank and Diderichsen, 1996; Froom et al., 2004), our empirical findings could at this point suggest that by having easy access to medical services, the richest individuals often successfully solve their health problems so that their self-rated health status is likely to change together with the overcoming of real health problems.

The difficulty of facing unexpected expenses is found to be a significant predictor of bad or very bad self-perceived health status in models 2, 3 and 5. When considering one or two lags, the effect reverses for most income quintiles, which might suggest the volatility of the effect that this explanatory variable has on self-perceived health. However, in the light of this result, stimulating the saving activity seems to be an effective policy measure targeting a better self-rated health with positive effects in the very short term. This is because saving activity allows people facing unexpected expenses. This effect prevails only in the short term, because the sign of the regression coefficient changes when also considering one or two lags.

The increase of income inequality determines the decline of self-perceived health for most income quintiles, and this effect persists for one or two years. The increase of income inequality has an immediate positive effect only in models 2 and 5. In the case of the highest income quintile for instance, a deeper inequality could represent a stimulus for the richest, thus indirectly contributing to the improvement of their self-rated health. But the overall effect of this variable is a positive one so that the decrease of income inequality determines the improvement of self-perceived health.

The poverty rate has a negative effect on self-perceived health in model 1 and a positive one in models 2-4. As expected, in the case of the first income quintile, which is likely to fall below the poverty line, the increase of poverty rate determines the worsening of self-rated health while in the case of the middle income quintiles, the increase of poverty rate has a positive effect on self-perceived health.

Economic growth seems to lead to the improvement of self-rated health in the case of the middle income quintiles while having a negative effect on the lowest income quintile. This result suggests that the economic growth is not directed towards raising the subjective well-being of the poor. Moreover, it enhances the improvement of the middle class self-perceived health but with the side effect of worsening the poor self-rated health.

The upward income transitions are in turn an effective solution to improve self-perceived health across the income quintiles, because it involves positive effects for almost all income categories, as shown by models 1-4. As expected, this variable has no significant effect on the highest quintile because transition to one decile up would bring no significant improvements upon the well-being of the rich.

Another empirical finding which is significant and consistent across all income quintiles is that the increase of health expenditure leads to the decline of self-rated health. Although the relationship between health care expenditure and self-rated

health is not a popular topic in the health economics, most papers find that the expensive and technologically advanced healthcare system in some developed countries (especially in the US) does not yield the population health outcomes (including self-rated health) comparable to those in countries with much lower spending (Blendon, 2003; Kaplan, 2004). Kaplan's (2004) conclusion concerning the US health system seems to also apply here: the Europeans spend more, but feel worse.

Similar to health expenditure, labour expenditure carries a significant and consistent effect for almost all income quintiles but, in contrast to health expenditure, its effect is a positive one. Excepting the highest income quintile, which is not significantly affected by the labour expenditure, for the other income quintiles the increase of labour expenditure results in the improvement of self-perceived health. Although this positive effect occurs with a delay of two years in the case of the lowest income quintile, it is a powerful one, not only in the case of this quintile, but for other bottom to middle ones as well. It is not surprising that labour expenditure has no significant effect for the highest quintile because the rich usually do not need this kind of social policy measures.

Tertiary education has a significantly positive effect on the improvement of the self-perceived health status of all income quintiles when no lag or one lag is accounted for. This is in line with other empirical findings which generally address the relationship between educational attainment and health through several interrelated pathways such as: health knowledge and behaviour, employment and income as well as social and psychological factors (Leganger and Kraft, 2003; Grzywacz et al., 2004; Rouse and Barrow, 2006). Additionally, after two years, the effect of tertiary education becomes negative for two middle income quintiles which could suggest a nonlinear effect of education on health. However, fairly little is known in the literature about the linear versus nonlinear effect of education and health (Groot and van den Brink, 2006).

The effect of the unmet medical needs on self-perceived health is not consistent across the income quintiles. While being a factor explaining the deterioration of the self-rated health for the highest income quintile as expected, it entails an opposite effect on the other quintiles. Improving the access to medical services is not likely to also produce an overall improvement of self-perceived health.

In conclusion, the effect of our set of explanatory variables on self-perceived health is not always constant and significant across all income quintiles, which indicates that some policy measures aimed to improve the overall or at least the poor's self-rated health could bring about negative effects on other income categories. Based on our data, increasing labour expenditure, facilitating upward income transitions and encouraging the access to tertiary education are the only policy measures that are able to determine the amelioration of self-perceived health for most income quintiles without generating negative side effects for the others. Besides, reducing poverty and improving access to medical services would improve the self-rated health of the first quintile but have negative effects on other income quintiles. For middle income quintiles, the reduction of social inequality as well as the economic growth is found to also improve the self-rated health.

The next step of our empirical analysis consists of analyzing comparatively the determinants of three indicators of well-being which are a subjective measure of well-being (*ends meet*), a subjective measure of health and well-being (*self-perceived health*) and an objective measure of health (*unmet medical needs*) in order to examine whether a common set of governmental policies could effectively target these three well-being measures together or at least one of them, without negatively affecting the others (*see* Tab.4). The reason for comparing them is that the "ends meet" and "self-perceived health" variables are indicators of the subjective well-being, while "self-perceived health" and "unmet medical needs" are indicators of the health status, all of them being covered by the broad term of "well-being". The explanatory variables are selected among the determinants revealed by the regression models 1-5 reported in Tab.3 which are significant in at least two models in Tab.4.

Tab. 4

The determinants of self-perceived health and other two well-being measures, EU-27 countries

Explanatory variables	**Ends meet (model1)**	**Self-perceived health (model 2)**	**Unmet medical needs (model 3)**
Dependent variable L1.	0.32*** (0.13)	0.12* (0.06)	0.14 (0.15)
Economic growth L1. L2.	-0.15 (0.11) -0.17** (0.09) -0.42*** (0.10)	0.03* (0.02) -0.01 (0.01) -0.04*** (0.01)	0.08* (0.05) 0.04 (0.05) 0.08* (0.04)
Labour expenditure L1. L2.	2.19 (1.62) -0.87 (1.36) -0.60 (1.22)	0.11 (0.32) -0.96*** (0.22) 0.09 (0.19)	0.16 (0.59) -0.86*** (0.36) 0.56 (0.49)
Health expenditure L1. L2.	-1.24 (1.16) -2.00* (1.25) -0.40 (1.86)	1.09*** (0.30) 0.84*** (0.28) 1.64*** (0.28)	0.82 (0.68) 0.37 (0.51) -0.78 (0.59)
Transition to one income decile up L1. L2.	0.56** (0.27) -0.24 (0.19) 0.31 (0.22)	-0.11*** (0.03) -0.15*** (0.04) 0.08*** (0.03)	-0.12 (0.09) 0.18** (0.08) -0.06 (0.06)
Tertiary education L1. L2.	-2.12*** (0.67) 0.96 (0.64) 0.39 (0.50)	-0.89*** (0.10) -0.09 (0.14) 0.18 (0.12)	0.29 (0.21) 0.33 (0.31) -0.09 (0.25)

*Notes. (1) Dynamic panel regression model, Arellano-Bond one-step difference GMM estimator; (2) Standard errors are reported in brackets; (3) *** p<0.01, ** p<0.05, * p<0.1. (4)Model 1: AR(1): z = -1.29 Pr > z = 0.196; AR(2) z = -0.56 Pr > z = 0.577; Model2: AR(1): z = -1.94 Pr > z = 0.053, AR(2): -1.09 Pr > z = 0.276; Model 3: AR(1): z = -0.95 Pr > z = 0.34; AR(2): z = -1.38 Pr > z = 0.168; (5) Eurostat data, 2003-2012; (6) L1 and L2 denote the first and second lags of explanatory variables.*

The three regression models reported in Tab.4 use the Arellano-Bond difference GMM estimator. The Sargan test of over-identifying restrictions as well as the Arellano-Bond test is applied for each model. In the case of the Sargan test, the output suggests that the null hypothesis that the instruments as a group are exogenous has not been rejected, and therefore confirms the joint validity of the instruments. The Arellano-Bond test for AR(1) and AR(2) in first differences which is applied to the differenced residuals being based on the null hypothesis of no autocorrelation is reported in Tab.4 (see the *Notes*). The group of endogenous variables in the regression models 1-3 is formed by the variables "labour expenditure" and "health expenditure". As in the regression models reported in Tab.3, they are instrumented by their first and second lags. The first lag of each dependent variable is also included in the models.

The effect and significance of explanatory variables is not the same for the three measures of well-being as shown in the models 1-3 by the regression output. The lag of the dependent variable is significant only when dependent variable is a subjective one (models 1 and 2), which suggests that perceptions usually change more slowly in comparison with the objective needs. Economic growth initially worsens self-perceived health but significantly improves it after two years. The same positive effect of economic growth occurs in the case of the "unmet medical needs" variable, which leads to the conclusion that the overall effect of economic growth on health is a positive one. Furthermore, economic growth has a negative influence on the ability to make ends meet, which prevails for two years. Again, the effect of another variable, i.e. labour expenditure, is similar for the two indicators of health in the sense that increasing labour expenditure helps improve both the access to medical needs and the self-perceived health status. Health expenditure is a powerful determinant of self-perceived health, which is consistent with the output regression reported in Tab.3. Increasing the health care expenditure provided by the general government has a negative effect on self-rated health. The explanation could be that a positive effect induced by the health expenditure on the objective health status would lead to an improvement of self-rated health over a longer period of time which is not accounted for here. Surprisingly, health expenditure stimulates the ability to make ends meet but has no significant effect on the access to medical services. The transition to one income decile up has a mixed effect on the three well-being indicators. It improves self-rated health in the first year, but this effect reverses in the second year. A higher percentage of population who experience a positive income transition has in turn a negative impact on both the access to medical services and the ability to make ends meet. Encouraging access to tertiary education seems to be an effective policy measure with positive effects for both the ability to make ends meet as well as for the access to medical services.

The conclusion at this point of the analysis is that it is difficult for governmental policies to target, at the same time, both the subjective and objective indicators of well-being, as well as the objective and subjective indicators of health. While increasing health expenditure is likely to improve the population's levels of self-rated health as well as access to medical health, increasing health expenditure has a slightly significant positive effect only for the ability to make ends meet, while also having negative side effects on self-perceived health. The upward income transitions

improve the population's levels of self-rated health but also bring about negative effects for the other well-being measures. Based on our data, entering tertiary education and increasing labour expenditure are the only effective policy measures which contribute to the increase of the population's levels of well-being without generating negative outcomes.

IV. Discussion and conclusions

The central point of this paper was the analysis of self-perceived health in the EU-27 area. The interest in this indicator is threefold: (1) as an indicator of health and well-being; (2) as a predictor of the real health status; (3) as subject of recent common EU actions in the field of health (such as the Health 2020 policy). The self-perceived health has been analyzed here through its determinants, in comparison with other well-being measures and across the quintiles of income distribution. This comparative approach allows finding whether a set of common policy measures could effectively target not only the improvement of self-perceived health but the improvement of other well-being measures as well, and whether this positive effect would be consistent and significant across the income distribution range.

The novelty of our approach consists in finding a set of effective policy measures aimed both at the improvement of self-perceived health across all income quintiles and at the improvement of self-perceived health along with other measures of well-being. In this light, the macroeconomic analysis conducted at the EU-27 level could bring new evidence for policy makers at the national and EU level, in the sense that it could allow designing a set of effective policy measures useful for improving not only health satisfaction, but other well-being measures as well.

The most important empirical findings with regard to the analysis of self-perceived health across the income distribution quintiles and along with other well-being measures are summarized below, and presented in comparison with the existing literature.

Few papers in the literature examine the differences in self-perceived health among different income groups, and significant differences in all aspects of perception of health care among different income groups are generally found (Šućur and Zrinščak, 2007).

The upward income transitions, the increase of labour expenditure and the access to tertiary education are the only policy measures found to significantly improve the self-perceived health of most income quintiles without causing negative side effects for the others. In the literature, in comparison with the labour expenditure and the access to tertiary education, much less attention has been paid to income dynamics. In this light, our study adds empirical evidence to an under-explored research issue. At this point our results are in line with Miething and Åberg Yngwe (2014) who showed that in the case of Sweden, individual income change is an important determinant for health, independent of level of income. Moreover, as also shown by Kondo et al. (2009), the lagged income has a significant role, but only when data are aggregated at community- or national- level.

Reducing poverty and improving the access to medical services are found to generate additional positive effects just for the lowest income quintile. These findings

are in line with the existing literature, which is, however, very scarce in this respect. The access to medical services is shown to be particularly important for the poor (Šućur and Zrinščak, 2007), and those with low income at baseline and income increase are found to be notable health beneficiaries (Gunasekara et al., 2011).

Reducing income inequality and stimulating economic growth trigger additional positive effects only for middle income quintiles. While the relationship between income inequality and self-rated health has been broadly discussed in the literature (Deaton, 2007; Gunasekara et al., 2011), just few studies approach the relationship between economic growth and self-perceived health. They find that economic growth reduces health satisfaction (Mellor and Milyo, 2002; Deaton, 2007; Lora, 2012). Our analysis therefore confirms the reverse relationship between income inequality and economic growth, but produces contrary results with regard to the impact of economic growth. The explanation could be that, in contrast to most studies examining this issue, our analysis examines self-perceived health when this is disaggregated upon income quintiles.

The self-rated health of the highest quintile particularly improves by facilitating the access to medical services and stimulating the ability to face unexpected expenses. This finding is not surprising, given that in the literature the evidence about health and income inequality is contradictory (Blakely, Lochner and Kawachi, 2002; Mellor and Milyo, 2002; Lopez, 2004).

Like other research on the advanced healthcare system in some developed countries, especially the US (Blendon, 2003; Kaplan, 2004), our research also shows that increasing health expenditure is likely to lead to the decline of self-perceived health for all income quintiles. In our case, this suggests that the Europeans spend more but feel worse.

Health and well-being are important objectives on the EU agenda (*see* the Health Youth Initiative), but what mix of European policies would be able to ensure rising well-being, improved access to medical services and increased self-rated health in the EU-27 area at the same time? Or, what measures would allow improving at least one well-being indicator without producing negative side effects for another indicator? The answer provided by our analysis at this point is that the improvement of the overall level of well-being is an idealistic aim that can only be partially targeted by policy measures. This is because different measures of well-being and health status should be addressed by specific policies, which unfortunately often generate negative side effects on different population categories or on other measures of well-being.

Based on our data, attaining tertiary education and increasing labour expenditure are the only effective policy measures which contribute to the increase of the population's levels of well-being in the sense of improving some indicators of well-being, without generating negative outcomes for the others. This result is consistent with other empirical findings that consider education and employment among the most important joint determinants of several well-being measures (Lane, 1994; Kawachi and Kennedy, 2003; Subramanian et al., 2005; Szwarcwald, 2005; Kaleta et al., 2008; Lim, 2015). However, the novelty of our approach at this point consists in introducing labour expenditure into analysis.

To sum up, based on our data, there are only two policy measures able to target both the improvement of self-perceived health across all income quintiles and the improvement of self-perceived health along with other dimensions of well-being: encouraging access to tertiary education and increasing labour expenditure. Moreover, they do not produce any negative side effects for any income group or well-being measure.

The general policy recommendation that can be derived from our set of empirical findings could be summarized as follows: (1) The effectiveness of a set of health policy measures should be analyzed in relation with several dimensions of well-being and health, to account for their multidimensionality and negative side effects that they could involve (2) In the broad field of well-being and health policy, the effects of a policy measure should be approached and explained in conjunction with other policy measures (3) the side effects of policy measures in the field of well-being and health should always be included into the analysis of their effectiveness.

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