Duration of Unemployment and Self-Perceived Health in Europe

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I. ABSTRACT

This study investigates the potential impact of employment loss on self-perceived health according to the duration of national levels of unemployment in EU member states during 2004-2012. The principal findings were that the total unemployment rate, long-term unemployment (LTU) rate and very long-term unemployment (VLTU) rate were all strongly related to increased reports of bad and very bad self-perceived health. In fact, the impact of unemployment (i.e., effects based on the coefficients) increased in a 'dose-response' manner with the total unemployment rate showing the smallest coefficient, the LTU rate showing a greater coefficient, and the VLTU rate showing the strongest impact in terms of increasingly bad and very bad self-reported health. The findings complement existing evidence that identified unemployment as an important risk factor for heart disease mortality at the start of the 2008/2009 recession (Brenner, 2013).

II. EXECUTIVE SUMMARY

Background

The few recent studies that have examined the relation between unemployment and self-perceived health (SPH) have generally assumed that poor SPH actually reflects poor physiological and psychological health. Further, they have usually built their hypothesis on the premise that poor health (which would lead to poor SPH) makes it more likely that job loss would follow. There has been little consideration of the probability that, from a causal standpoint, the relation between unemployment and SPH is bi-directional or that the major causal pathway between unemployment and poor SPH is that unemployment increases the probability of health deterioration. This is despite the fact that a large number of studies, over several decades, have supported the proposition that unemployment is an important risk factor for morbidity and mortality.

Study aims

This study assumes that the relation is bi-directional and that the primary sequence is that poor health, and thus poor SPH, is often increased as a result of prior unemployment. This hypothesis is tested by examining whether there are lags between unemployment and subsequent "bad" and "very bad" SPH in European Union populations over 2004-2012. Most important, the study seeks to determine whether long durations of unemployment—especially over one year and over two years—increase the likelihood that the effect size of unemployment in relation to poor SPH will become larger.

Methods in the present study

The present study seeks to minimize the methodological shortcomings of the previous literature on unemployment and SPH in the following manner:

- The impacts of unemployment, long-term unemployment over 1 year and very long-term unemployment over 2 years are separately examined.
- Lag relations up to two years were separately analysed in the impact of unemployment and SPH
- The impact of sex and age groups were separately studied.
- The impact of education levels was separately studied.
- Controls were used for economic growth and development—GDP per capita, proportion of the labour force employed in service industries.
- Risk factors were used as controls for the major chronic diseases:
  1. Alcohol and tobacco consumption, and body mass index > 30
  2. For the younger working populations (especially), HIV prevalence was also used as a risk factor under statistical control.
- Controls were also used as categorical variables (or "dummy" variables), identifying groups of countries with relatively high or low SPH, independent of other predictive factors.

Thus, macro-level pooled cross-sectional time-series analysis with random effects were used as the multiple linear regression method. This allows relations with slow-moving variables to be accurately estimated and takes categorical (dummy variables) into account.

Findings

The unemployment rate 15 – 74 at lags 0, 1, 2 years is positively related to the proportion of the population stating that their SPH is "bad" or "very bad." The longer the lag estimated (from 0 to 2 years), the greater the impact (i.e., coefficient or effect size). The long-term unemployment rate over 1 year at lag 0, 1, 2 years is positively related to the proportion of the population stating "bad" or "very bad" self-perceived health. The longer the lag estimated, the greater the impact. The very long term unemployment rate (over 2 years) at lag 0, 1, 2 years is positively related to the proportion of the population stating that their SPH is "bad" or "very bad."

Conclusions

1. Unemployment increases bad and very bad SPH in European countries over 2004 – 2013.
2. The longer the duration of unemployment, the stronger is the effect on increases in bad and very bad SPH.
3. This relation is somewhat stronger for females than for males; it is only significant in both sexes over age 45 – 65 and the strongest in those over 65.
4. This relation, by educational category, is strongest in populations with less than secondary education, continues to be strong in populations with tertiary education; and is weakest among those with secondary but no tertiary education.

Policy

This study will enable us to measure more comprehensively the impact of the crisis, unemployment and inactivity on not just the health of individuals, but as well on government budgets. In keeping with previous findings of the significance of unemployment, especially of long duration, to health, and the potential findings of the proposed study, it would be important for Ministries of Labour and Health to engage in dialogue as to the possibilities for mutually reinforcing policies that produce outcomes supporting both employment and health objectives.

III. LITERATURE REVIEW

For both EU countries and the US, literature shows contemporaneous negative (inverse) relations between unemployment and self-perceived health (Drydakis, 2015; Burgard, Kalousova, Seefeldt, 2012). The basic understanding, supported with some evidence, is that self-perceived illness actually reflects physiological and psychological illness; and actual prevalence of illness brings about increased unemployment rates (van Rijn, Robroek, Brouwer, Burdorf, 2013; Minton, Pickett, Dorling, 2012). It is argued that this is especially true during the Great Recession of 2007-2010 in Europe, where individuals in poor health bore an especially high burden of losing employment (Reeves, et al., 2014).

In the recent European literature where several studies (Huijts, et al. 2015; Drydakis, 2015; Schuring et al., 2015) showing the inverse relation—i.e., the higher the unemployment, the lower the self-perceived health—between unemployment and self-perceived health (SPH), none of these studies argues that the relation between unemployment and SPH may be bi-directional (as in a simultaneous equation) meaning that unemployment can be both elevated by and, in turn, lead to increases in the rates of SPH.

Importance of controls, lagged relations, and duration of unemployment

In these studies of unemployment and SPH, little attempt was made to control for the most prevalent risk factors to debilitating illness—namely, high tobacco, alcohol consumption, BMI > 30 or prevalence of HIV. Had they done so, much of the impact of debilitating illness on unemployment would have been under statistical control, allowing the influence of unemployment on subsequent SPH to be measured.

None of the previous studies of unemployment and SPH measured potential lagged effects of the occurrence of unemployment to subsequent illness. Few of the previous studies of unemployment and SPH did examine the differences among age groups in the relation between unemployment and SPH. The finding was that the older (working) populations showed the strongest effects. However, in the most recent study published on unemployment and mental depression (Andreeva, et al., 2015) for the first time it is demonstrated that the relation between unemployment and ill health is bi-directional (in Sweden, during the Great Recession).

Virtually all of the recent studies, concentrating on European countries, appear unaware of the considerable number of macro- and micro studies, over many years, which demonstrate the relation of unemployment to mortality—especially based on cardio-vascular disease—in which the mortality lagged behind unemployment rates by at least 2-3 years (Brenner, 2015; 2013; 1997; 1987a; 1987b; Brenner and Mooney, 1982).

Equally important, two recent studies, supported by the European Commission (Brenner 2014, 2015), found that in European countries the relation of unemployment to heart disease and stroke mortality is positive and can be seen at lags of up to 3 years in the period covered by the Great Recession. These studies support the influence of an impact of unemployment on subsequent mortality. Further, similar relations are seen for labour force participation and GDP per capita—strongly inversely related to heart disease and stroke mortality with both lagged and unlagged relations.

No previous study has examined the impact of unemployment on self-perceived health by duration of unemployment—especially the comparison with long-term (over 1 year) and very long-term (over 2 years) unemployment. Moreover, it is necessary to control for GDP per capita, the most important economic variable influencing population health. But no previous studies of self-perceived health have done so while avoiding the collinearity inherent in the causal relations between GDP and unemployment when examined contemporaneously. The problem is that when GDP and unemployment time series are observed at the same time point (in relation to each other), they reflect coincident experiences and reciprocal relations; this is demonstrated by the fact that they

are the two most prominent business cycle indicators. From a business cycle frame of reference, GDP is the principal indicator of recessions, and is a fundamental source of change in the demand for labour—and therefore the unemployment rate.

No previous study of unemployment and SPH has established the effects of education on this relationship in European countries, although the issue of education has most recently received renewed attention in the policy debate on prolonging working life (Schuring, et al., 2015). An earlier single country study of, specifically, the Netherlands (Huisman van Lenthe & Mackenbach, 2007) observed only a limited impact of educational attainment. This is despite the fact that lower educational levels are a prime source of unemployment. Education is also a major indicator of the "social gradient" in health (usually measured by income, education and occupation skill level). In this "gradient" socio-economic status (SES) is generally inversely related to morbidity and mortality rates for virtually all diagnoses in industrialized and developing countries.

However, the literature does find that SES (the social gradient) is an important factor discriminating levels of SPH, just as it does biological and psychological diagnoses of illness and mortality. Additionally, literature generally shows an inverse correspondence between SPH and mortality. While there are several theories, there is no consensus about possible mechanism(s) (Foraker, et al., 2011; Dowd and Zajacova, 2007; Benjamins, et al., 2004). Finally, there is evidence that countries with more generous safety net regimes fared better in SPH changes resulting from the Great Recession (Ferrarini, et al., 2014) as they did in previous recessions (Bambra & Eikemo, 2008).

Question of a bi-directional relation

Analysis at the multi-national (or macro) level of European countries begins with the assumption that at the individual (or micro) epidemiological level, the relation we wish to test already has been documented or can be inferred, i.e. that there is confirmatory evidence at the micro level. Further, the majority of micro and macro studies assume that self-perceived health (SPH) inversely reflects (or describes) a true state of physiological and/or psychological illness. This illness then (a) causes subsequent unemployment or (b) makes it more likely that the previously ill will become unemployed in a recession. In other words, the ill are more likely than the non-ill to suffer from recession-induced unemployment.

The majority of these studies do not even assume a bi-directional relation between unemployment and illness. An exception is a study by Huijts, et al., 2015. This is despite the recently published data for Sweden showing a bi-directional relation between job loss and clinical depression (Andreeva, et al., 2015).

Now, at the macro (i.e., national) level, it is extremely unlikely that the relation involves backward causation. Backward causation in the macro case refers to the situation where subsequently increased illness, in the short- medium term, causes damage to GDP or greatly increases the unemployment rate. This can, of course, occur even in modern times as a result of epidemics, such as HIV, or disasters (e.g., hurricanes, earthquakes, tsunamis, civil conflict), where substantial illness or disability or death in the population results in the reduction of labour force participation and thus damages the GDP.

However, for industrialized high-income countries, such as in the EU there is no professional economic literature on business cycles, in which national episodes of illness raise the probability of recessions. On a practical level, as is widely understood, monetary and fiscal policy, as well as active labour market policies are the instruments for moderating the GDP loss and unemployment aspects of a recession.

It is only in reference to low-income developing countries that the suggestion is made that epidemic illnesses, such as HIV, or endemic illnesses such as malaria or diarrheal disease, can significantly influence national unemployment or labour force participation rates. It is therefore clear that if a contemporaneous relation is found at the national

level between unemployment and increased illness or mortality rates, then the causal direction should be that the higher unemployment rate has increased the probability of damage to population health. Further, if there is a lag of 1-3 years between increased unemployment and increased illness or mortality, then the evidence is considerably stronger that unemployment is a risk factor for subsequent health damage.

If it is further assumed that deteriorations in SPH, at the population level, reflect actual damage to physical or psychological health, then, at the national level higher unemployment in recessions should be linked to poorer population health.

As is widely known, the most visible increases in unemployment at the national level have been attributed to business cycles—including the Great Recession—and long-term structural changes involving technological developments and globalization. These national, and often international, economic changes cannot be attributed to the activities of unorganized and unrelated individuals who lose employment (and suffered damaged health, or self-perceived health). The economic literature does not indicate that recession or structural changes in employment (at least in industrialized countries) tend to result from routine fluctuations in illness rates. This supports the assumption that the principal relation between unemployment rates, at the national level, and rates of bad and very bad self-perceived health, at the individual level, originates largely with unemployment rates as the major independent variable. The above interpretation can be further affirmed by a potential finding that in relation to self-perceived health (1) long-term unemployment > 1 year shows a higher coefficient than the standard unemployment rate, and (2) that the long-term unemployment rate > 2 years shows a greatly elevated coefficient as compared to long-term unemployment > 1 year. Further, with respect to the standard unemployment rate, it could be found that the longer the lag of unemployment from 0 – 2 years, the higher is the coefficient of unemployment. This would imply that long-term unemployment rates, for the most part, precede increases in "bad" or "very bad" self-perceived health. On the other hand, if the relation between unemployment, or long-term unemployment, and damaged self-perceived health were only to be found at no lag (i.e., contemporaneously), then there would be difficulty in distinguishing the input from the outcome variable. Nevertheless, there is also evidence that once employment loss stimulates declines in health, those health declines, in turn, result in further vulnerability to unemployment in a feedback relationship (Andreeva et al., 2015 BMC).

Hypotheses

Key Economic Variables

1. A higher **unemployment rate** predicts higher levels and increases in bad and very bad SPH rates. Levels refer to cross-sectional bad and very bad SPH rate differentials among EU countries. Changes refer to trends and fluctuations over 2004 – 2012. Unemployment refers to persons experiencing job loss and new entrants into the labour market who are seeking, and are capable of, work. In addition, the duration of unemployment should predict increasingly large declines in SPH rates.

2. **GDP per capita** predicts higher rates of bad and very bad SPH in the short, medium and long-term. GDP per capita is the basic indicator of national income and wealth, as well as the level of economic development. Economic growth is a function of the development of physical and human capital and thus of innovation, education, and knowledge development. European societies are heavily dominated by service industries. GDP per capita is the basis of expenditure on health, education and welfare, social insurance and investments in new technologies that elevate worker and environmental safety. Thus, GDP per capita is a fundamental source of increased population health and life expectancy. It is also the primary (positive) indicator of business cycles and thus, inversely, of recession. It is therefore also a principal predictor of (reduced) unemployment rates and therefore of economic instability

Control variables

1. **Smoking prevalence** is predicted to increase bad and very bad SPH rates, but the time lag is uncertain. It is possible that reduced smoking prevalence would predict decreases in SPH in highly vulnerable age groups—in the short term. However, there is greater consensus in the literature on the impact of smoking in cohorts, ranging as long as 20 years in duration. In this study smoking prevalence is used as a control only in short-term time lags, given data availability and the requirement to focus on unemployment and labour force participation as key predictor variables.

2. **Dietary factors** potentially influencing cardiovascular health have traditionally tended to be focused on fat consumption and vegetable consumption. Saturated fat consumption has been identified as a harmful risk factor, whereas vegetable fat consumption (especially as identified in the Mediterranean diet and including olive oil) has been found to reduce cardiovascular illness, including stroke. Fruit and vegetable consumption in general has also been found epidemiologically to be an important source of reduction of chronic disease. Overall, however, the nutritional literature has tended in the direction of implicating body mass index over >30 in an international epidemic of obesity that is reported to have become a major risk for cardiovascular health, cancer and diabetes.

3. High **levels of alcohol consumption per capita** are widely understood to increase the risk of cardiovascular illness, certain malignancies, depression, aggression, occupational injuries and motor vehicle accidents is therefore a major risk factor to population health.

4. **HIV prevalence** has also been an important risk factor for several infectious illnesses, especially tuberculosis, in early and mid-life, and has been a significant source of decline in labour force participation. HIV prevalence is the only direct indicator of physical illness that is used in this study.

IV. RESEARCH METHODS

The present study seeks to minimize the methodological shortcomings of the previous literature on unemployment and SPH in the following manner:

- The impacts of unemployment, long-term unemployment over 1 year and very long-term unemployment over 2 years are separately examined.
- Lag relations up to two years were separately analysed in the impact of unemployment and SPH.
- The impact of sex and age groups were separately studied.
- The impact of education levels was separately studied.

National level analysis

The main reason for using national-level (or macro) research designs, as compared to those at the individual level, is that the national level analyses allow us to investigate the behaviour of nations as distinctive entities. This means, for example, that factors that only pertain to the national level, but have enormous implications for the lives of individuals, can be investigated. Economic policies involving monetary and fiscal actions and, in particular, labour market policies (especially active labour market policies), and austerity measures can be studied in terms of the implication for health or self-perceived health of individual members of society when treated as population aggregates. Similarly, the effects of cultural factors and political developments that separate the social environments of different societies can be investigated at the macro level. This, obviously, cannot be done if we confine our analysis of health or labour market factors to the affected individual persons alone.

The most important advantage of the macro study is that it enables the investigation of phenomena that occur at the national level and are subject to national market forces or national policy. Typical of these phenomena is the study of recessions and economic growth which are differently experienced by individuals because (1) they may or may not be affected—or greatly benefited or harmed—by volatility in national income, national unemployment or industrial changes. As seen in the present study, for example, individuals are differently affected by unemployment depending on whether or not the unemployment arises from the fit of individuals to the requirements of their work place (for personality reasons), or as a consequence of national (or international) recession. Not only are the individual experiences vastly different—e.g., in terms of unemployment duration—but the policy implications are entirely different.

Moreover, the nature of unemployment, depending on its national-level causes, will have very different consequences for the health and well-being of the individuals subject to it. The traditional distinctions, at the national level, among frictional unemployment, cyclical unemployment, structural unemployment (due to technological changes), and globalization-based unemployment, lead to entirely different life consequences, at the individual level. Thus, our understanding of these different classes of unemployment—in psychological and physical terms—requires analyses with input and outcome variables at the national level. To be sure, we benefit from individual level studies when in-depth life experiences from different persons yield deep psychological information. And we can often investigate the impact of a larger number of predictors, subpopulations and interactions when we have a larger sample size that is usually provided by individual-level analysis. Additionally, some scholars would argue that more precise causal inferences can be made from microanalyses, though both micro and macro observational studies usually require control variables to adjust for potentially omitted variable bias.

It is increasingly recognized that crucial information in economic and epidemiological studies is gained from multiple levels of analysis. And where data are available, multi-level analysis, simultaneously estimating macro- and micro-effects are often seen to be optimal. For example, even in fully micro level studies involving the Great Recession, it has been found that the Great Recession's impact on company downsizing in Europe—i.e., elevating the unemployment rate resulted in mental depression even among employees who retained their jobs (Brenner, 2014).

Limitations and advantages of macro-level analyses

Since this is an observational (i.e., correlation) study, the principal limitation is that only associations can be claimed. In econometric analysis an effort is usually made, however, to enhance the potential of causal interpretation by controlling for variables that could be confounders. In this case, in addition to economic growth we control for other labour force variables—especially those that are related to long-term economic growth (GDP per capita) and economic development, namely: the proportion of the labour force employed in service industries. Economic development, the fundamental source of enhanced population SES, involves transfers from employment in economies that are dominated by agricultural (i.e., primary) industries, to those heavily in manufacturing (i.e., secondary) industries and finally by those in services (i.e., tertiary) industries—especially retail, finance and information technology based on the "knowledge economy."

Other controls for confounders are for life-style risks to major chronic diseases (high levels of alcohol and tobacco consumption, and body mass index), and especially illnesses such as HIV that influence labour force participation of the population under 65.

These controls, of course, are not exhaustive, and it is always possible that another factor—absent from the model—could present problems of omitted variable bias. The classic method of minimizing the causation issue is to utilize experimental designs. Of course, in studies of labour market factors' potential influences on health, ethical problems would be raised if population harm were to be caused—e.g., in producing job loss—as in classical experimental designs.

A further advantage in the present type of observational study is that sampling biases are at a minimum because European Union population samples (estimated via Eurostat) are sufficiently large, comprehensive and systematic so as to avoid over- or underrepresentation of important population subgroups.

An additional advantageous feature of the present study design is that it is not based on micro, i.e., individual-level, relationships. This has allowed us to observe that the national unemployment and long-term unemployment rates are related to increases in national rates of higher bad and very bad self-perceived health among persons not in the labour force—specifically those over 65. Indeed, the over 65 population shows the greatest tendency toward higher rates of bad and very bad self-perceived health in relation to elevated unemployment and long-term unemployment rates. This finding supports the hypothesis that unemployment and long-term unemployment rates do damage to self-perceived health through social networks. In other words, it is damage to the economic position of entire families, including the elderly, that is much the basis of harm to health resulting from employment loss. This is also observed in studies of the impact of national unemployment rates on heart disease and stroke mortality in the EU, since the preponderant cardiovascular mortality rates occur among the over age 65 population.

Pooled cross-sectional time-series analysis

- This study uses pooled cross-sectional time-series analysis (often referred to as panel analysis) as the basis for modelling the effect of unemployment rates on SPH in European countries. This method combines traditional cross-sectional analysis and temporal analysis over multiple years—in this case 2004 – 2012. The analyses thus include space and time components simultaneously. The cross-sectional aspect of this method allows a comparison, at a point in time, among countries, of how different levels of unemployment rates, under different national conditions of severity, duration, welfare compensation, Active Labour Market Policies and health care availability, can influence SPH. In fact, it is often assumed, that, given the extensive social safety net and welfare state systems of European countries, sufficient protection is available to fundamentally prevent unemployment rates from influencing health in a significant manner.

- Multiple years (of cross-sectional analysis) are included for several reasons: (1) to assure that the results of any specific year's analysis are not unusual (i.e., idiosyncratic) with respect to the relation of unemployment to SPH. (2) The analysis also includes a time-series analytic component—as well as time trends, cycles, and other fluctuations in unemployment and SPH over 9 years. This especially allows us to observe much of the impact of the Great Recession prior to its onset and during its occurrence—in terms of its effects on unemployment and its health implications. (3) Several control variables are included in the model. These take account of overall GDP—the most powerful factor affecting mortality rates—and most frequently used measure by economists to indicate the starting and ending dates and severity of recessions.

- Controls were used for economic growth and development—GDP per capita, proportion of the labour force employed in service industries.

    - Risk factors were used as controls for the major chronic diseases
        1. Alcohol and tobacco consumption and body mass index > 30.
        2. For the younger working populations (especially), HIV prevalence was also used as a risk factor under statistical control.

    - Controls were also used as categorical variables (or "dummy" variables), identifying groups of countries with relatively high or low SPH, independent of other predictive factors.

        - In order to include these control variables in the predictive model for SPH, we require sufficient degrees of freedom to perform adequate tests of

significance. Clearly, there are important restrictions in the degrees of freedom available from one year of cross-sectional analysis with a sample size of 28 units (i.e., countries). Using 9 years of cross-sections provides the necessary expanded degrees of freedom.

Random versus fixed effects

Two standard methods of modelling with a pooled cross-sectional time-series designs are commonly used. The choice of method depends largely on the nature of the variables used with respect to their time-series properties. In brief, if the model contains variables that do not vary at all (e.g., dichotomous), or are "slow moving," in the sense that they vary little from one time period to another or have very strong time trends, then the random effects method is required (Wooldrige, 2002). In the case of this study, the control variables of smoking prevalence and BMI > 30 are slow-moving; thus, methodological rigor requires use of the random effects model. Further, the model contains "dummy" i.e., dichotomous variables identifying specific groups of countries that are at relatively high (or low) average rates of "bad" or "very bad" SPH. In this case, the model should be estimated via random effects.

It was therefore thought unnecessary to perform a Hausmann test which can occasionally help to decide between the fixed and random effects approach when there are questions related to comparative confidence intervals of key covariates. Use of the Hausmann test requires that a comparison be made of the relations estimated by the fixed and random effects models. In this case, such a comparison was not feasible since a complete fixed effects model cannot be calculated in the presence of region-specific dummy variables. These dummy variables are necessary in the present study in order to deal with extreme country outliers and thus substantially contribute to overall explanation of variance. The regional dummies can also provide important contributions to the explanation of European self-perceived health—an issue that should be explored in subsequent research.

Nonetheless, to be certain that the use of fixed effects would not result in significantly different coefficients, or confidence intervals, for the specific relationship between unemployment and self-perceived health, the main models (based on random effects) were rerun using fixed effects regression. The coefficients for unemployment LTUR and VLTUR, in relation to self-perceived health, were virtually the same using fixed effects. This was the case even though the overall R-square for the model using fixed effects was two thirds smaller than was true of the random effects model (including regional dummy variables).

Deductive logic of model construction

We start with the most ubiquitous and pervasive finding in all of modern epidemiology, referred to as the "social gradient" in health. This finding is that increased socioeconomic status (SES) measured by income, educational level, occupational skill level (in graduated scales)—and most recently by unemployment rates (inverse relation)—is closely related to lower levels of illness and mortality, regardless of diagnosis, age, sex, and nationality (Galobardes, Smith and Lynch, 2006; Frankel, Smith, and Gunnell, 1991; Kaplan and Keil,1993; Brenner and Mooney, 1982; Gallo, Teng, Falba, Kasl et al., 2006; Hendriksson, Lindblad, Agren et al., 2003; Morris, Cook, Shaper, 1994; Sorlie and Rogot, 1990; Crombie, Kenicer, et al. 1989).

These findings are at micro—or individual—level whilst the analysis in this paper utilizes a macro-level perspective. Hence, the position taken in this research paper is that findings at the macro-level—if they are to represent, and elaborate, well-established causal relations, cannot contradict findings at the micro (individual) level, at which the effects of unemployment and mortality are thought to occur.

Continuing with this logic, if declines in income, or increases in unemployment, are found to occur at the individual level, or aggregated to the level of the population, then it

follows that declines in population health should similarly occur. Such declines in population health should involve the major diagnostic categories of illness and mortality. If we assume, further, that bad or very bad SPH reasonably accurately reflects higher rates of illness in the population, then declines in SPH should increase following increased unemployment rates.

In summary, given the extensive individual-level epidemiologic evidence of the inverse relation of income and employment to population health, it follows that national increases in unemployment and the declines in income are plausibly followed by deteriorated SPH at the national level. In addition, in this research we attempt to confirm this logic by determining whether duration of unemployment is predictive of the extent of damage to SPH.

In order to construct a comprehensive model that follows the logic of the universal SES-health relation (as described in the literature review above), it would be important to include as many socioeconomic variables as practical on economic and statistical grounds. These would involve, at the national level, unemployment rates and GDP per capita as having short- to medium-term impacts on SPH.

A major type of control for potential confounding involved the most important behavioural risk factor associated with poor health, namely smoking prevalence. There are other behavioural risk factors for poor health such as high alcohol consumption, poor nutrition, and overweight. These variables are included in the major models to control for potential confounding.

Adding GDP while taking account of Okun's Law

A minimal model for SPH in industrialized countries would at least include one major proxy variable for aggregate population SES in addition to the unemployment rate. At the national level GDP per capita is the closest we come to an aggregate variable that represents the national standard of living as well as the sources of national investment. As an aggregate measure, the GDP per capita does considerably more than measure the "average" of SES for a national population. It also signifies the potential for investment in national health services, education and social welfare, including pensions and support of the disabled.

The great problem, however, in adding GDP per capita to a model of SPH already involving the unemployment rate is that, like the unemployment rate itself, the GDP is a fundamental indicator of business cycle fluctuations. Thus, concurrently – i.e., at zero years' lag – GDP per capita and the unemployment rate will be directly and robustly inversely related to each other. The principal reason is that even a decline in the growth rate of GDP per capita has a causal relation to increased unemployment due to the decline in demand for goods and services. Declines in consumer demand signal to employers that fewer employees will be needed for firms to remain profitable at their previous rate.

So regular is the relation between GDP per capita and the unemployment rate that a rule of thumb stating the extent of GDP growth that is needed to produce a one percent decrease in the unemployment rate has been in use since the 1960s. It is referred to as Okun's Law, offered by Arthur Okun who proposed the relationship in 1962. The relationship varies depending on the country and the time period under consideration. In Okun's original statement of his law, a two percent increase in output corresponds to a one percent decline in the rate of cyclical unemployment; a 0.5 percent increase in labour force participation; a 0.5 percent increase in hours worked per employee; and a one percent increase in output per hours worked (labour productivity).

We therefore have the situation that GDP per capita declines can have a damaging effect on health through their impact on the unemployment rate. In that case, GDP per capita is the more distal causal variable while unemployment is the more proximal cause of health

decline. In this scenario, however, unemployment is an intermediate component of the more general relation of GDP to health. This common cyclical concurrence produces difficulty for adding GDP per capita to the unemployment rate in order to produce a more complete and plausible model for e.g. SPH.

Our solution is based on the fact that the relationship of GDP per capita to health levels occurs over multiple years – i.e. there are strong lengthy, medium- and short-term relations of GDP per capita to health. This is because GDP per capita is a foundational variable which includes aggregate SES at the national level. This relation involves implications for long-term investments, such as in education, health care and infrastructure, as well as short-term consequences for personal household and government expenditures.

On the other hand, the most important effects of unemployment on physical health outcomes are empirically observed at 2-3 year's lag, and especially at a two-year lag. Therefore, we observe empirically that if we wish to examine a short-medium term relation of unemployment rates to SPH, and include the medium-long term impact of GDP per capita in the model, then we usually require at least a five-year lag of the GDP to mortality. If we place both the GDP per capita and the unemployment rate at 2 year's lag or less, the presence of the GDP will often force the unemployment rate into insignificance. Therefore, to avoid multi-collinearity, and at the same time to preserve GDP per capita as a control variable in the final model, GDP per capita is inserted at a five-year lag.

Logic of the Sequence of Analysis

1. The first step was to construct a model with the smallest number of variables, but reasonably complete in respect to the overall theory as discussed above.
    - As an outcome variable this involved the self-perceived health of persons who reported bad or very bad health in population samples of the EU countries over 2004 – 2012.
    - Predictive variables were the unemployment rate at lag zero, GDP at a 5-year lag, and HIV prevalence as the only control for the presence of a major illness and its functional (social, psychological) implications.
2. Having determined that this relatively small model showed the expected effects for overall unemployment contemporaneously in relation to poor SPH, lag estimations were made for unemployment at one and two years. It was found that longer lags for unemployment were associated with higher levels of statistical significance as well as larger effect sizes (coefficients) for the relations to the combined bad and very bad health responses.
3. This form of analysis with the minimally-sized model was then used to examine the impact poor SPH of unemployment with durations of over one year and over two years. It was found that the longer the duration of unemployment, the higher the level of significance to poor SPH, and the stronger the effect size.
4. This modelling procedure was then used to distinguish age groups 16-24, 25-44, 45-64 and over 65. It was observed that only the age groups of 25-64 and 65 plus showed the major relations, and the older the age group the stronger was the effect size.
5. The general model was then elaborated to control for behavioural risk factors: alcohol and tobacco consumption, and BMI >30. This model was applied separately to males and females, where it was seen that the larger models showed similar effects to the original small model with only two major control variables.
6. The larger model was then used to distinguish the effect of unemployment by duration on different educational groups on the assumption that the lowest educational group, with only a primary school education would have the most difficult time adapting to unemployment (with the fewest economic resources and greatest

difficulty of re-employment). This was indeed the case: the population with the lowest level of education showed the highest effect size of the relation of unemployment—at all extents of duration—to bad and very bad SPH.

V. DATA SOURCES AND ANALYSES

Proportion of population self-perceived health as fair in total population: European Commission. Eurostat Database.

Proportion of population self-perceived health as bad to very bad in total population: European Commission. Eurostat Database.

Proportion of population self-perceived health as very good and good in total population: European Commission. Eurostat Database.

GDP in thousands of 2005 inter. $/capita: University of Washington. Institute for Health Metrics and Evaluation.

Total health expenditure (THE) % Gross Domestic Product: World Health Organization. Global Health Expenditure Database.

Value added in services as a percentage of GDP: World Bank national accounts data and OECD National Accounts data files.

Unemployment rate in total active population: European Commission. Eurostat Database. Labour Data.

Very long-term unemployment in active population 15-74: European Commission. Eurostat Database. Labour Data.

Prevalence of obese (BMI >30) population in total population 20 +: University of Washington. Institute for Health Metrics and Evaluation.

Smoking Prevalence (%) in total both sexes population: University of Washington. Institute for Health Metrics and Evaluation.

Alcoholic Beverages supply (kcal/capita/day): Food and Agriculture Organization of the United Nations

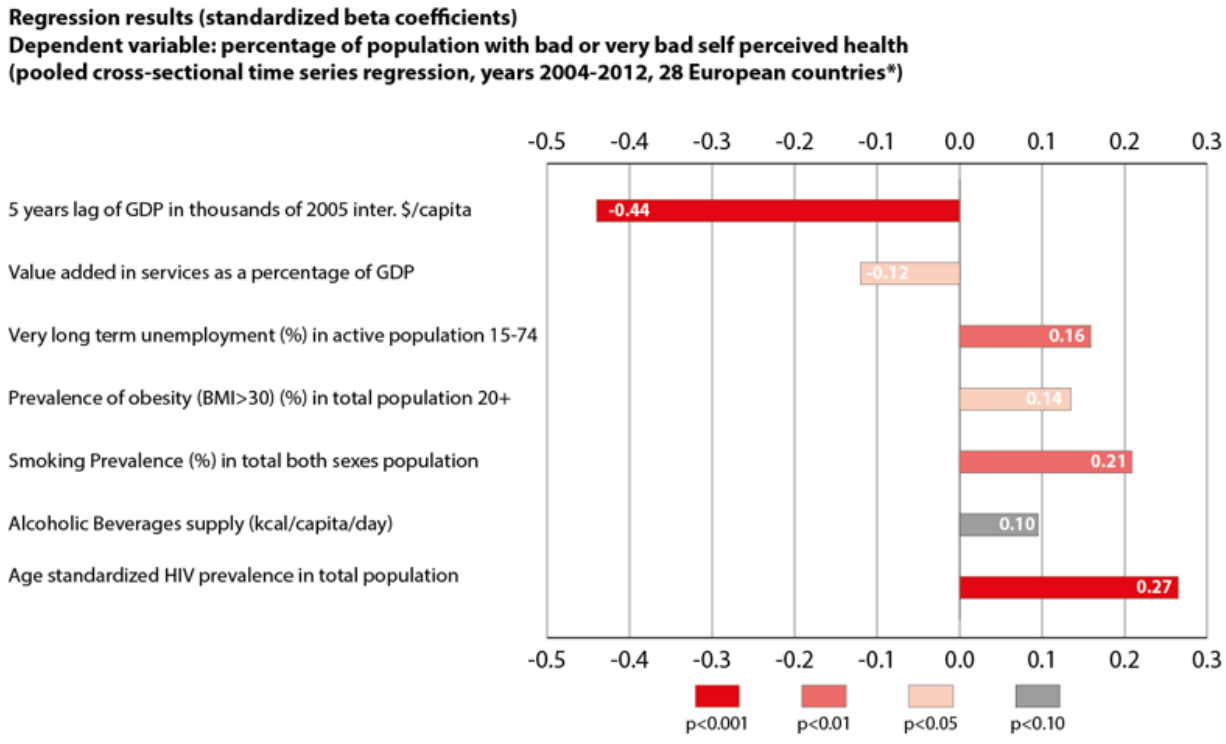
Age standardized HIV prevalence in total both sexes population: University of Washington. Institute for Health Metrics and Evaluation.

VI. FINDINGS

The fundamental finding is that self-perceived health is inversely related to unemployment in European countries, and the longer the duration of unemployment, the greater is the damaging impact of unemployment on self-perceived health of the population aggregate. In other words, when self-perceived health is categorized as either (1) very good, (2) good, (3) neither good nor bad, (4) bad or (5) very bad, the proportion saying their health is bad or very bad increases as unemployment duration rises. And, that proportion (saying their health is bad or very bad) becomes further enlarged as the percentage of unemployed remains without work for an entire year (i.e. long-term unemployed); the proportion of those with bad or very bad health is highest when the duration of unemployment is greater than two years (i.e. very long-term unemployed). The indication that there is a stronger impact of unemployment with longer duration is based on a higher coefficient (effect size) and smaller confidence interval and p-value (See Figure 1 and Annex Tables 1-3 and Annex Figures 7-9).

Figure 1

Comparative effect sizes of key variables predictive of bad and very bad self-perceived health



*26 EU member countries (excluding Luxembourg and Croatia) and 2 Non-EU countries (Norway and Iceland)

The second critical finding concerns the lag between unemployment and deteriorated self-perceived health—i.e. how long it takes for higher unemployment to result in statistically significant increases in damage to self-perceived health. The first indication that self-perceived health has declined can be seen during the same year that unemployment increases—i.e. within 12 months. But if one examines a period one year later than the unemployment increase (i.e. a lag of one year), then the impact of unemployment is seen to be greater than if the observation were at the contemporaneous year. And if the increase in deteriorated self-perceived health is measured two years after the initial increase in unemployment (i.e. a 2-year lag), then the damaging impact of unemployment is usually still greater.

These two principal findings are independent of each other but exist in conjunction. In other words, (1) the longer the duration of unemployment, the greater the impact on self-perceived health deterioration; and (2) the longer the period (lag) over which the inverse relation of unemployment to self-perceived health is measured, the greater is the damage to self-perceived health related to unemployment. Thus, for example, the combination of a two year lag between very long-term unemployment rates (over two years) and self-perceived health shows the greatest damaging effect of unemployment on self-perceived health.

These relations control for: GDP per capita; proportion of the labour force in service industries; alcohol, tobacco consumption per capita, BMI > 30, HIV prevalence. GDP per capita was entered into the model at a five year lag whereas all other control variables were entered at zero lag. Controls for the major risk factors to chronic disease are usually positive and significantly related to poor SPH. The GDP, a measure of national income gains (or potential losses during recessions), is usually the most powerful variable in the predictive model for SPH (see Figure 1).

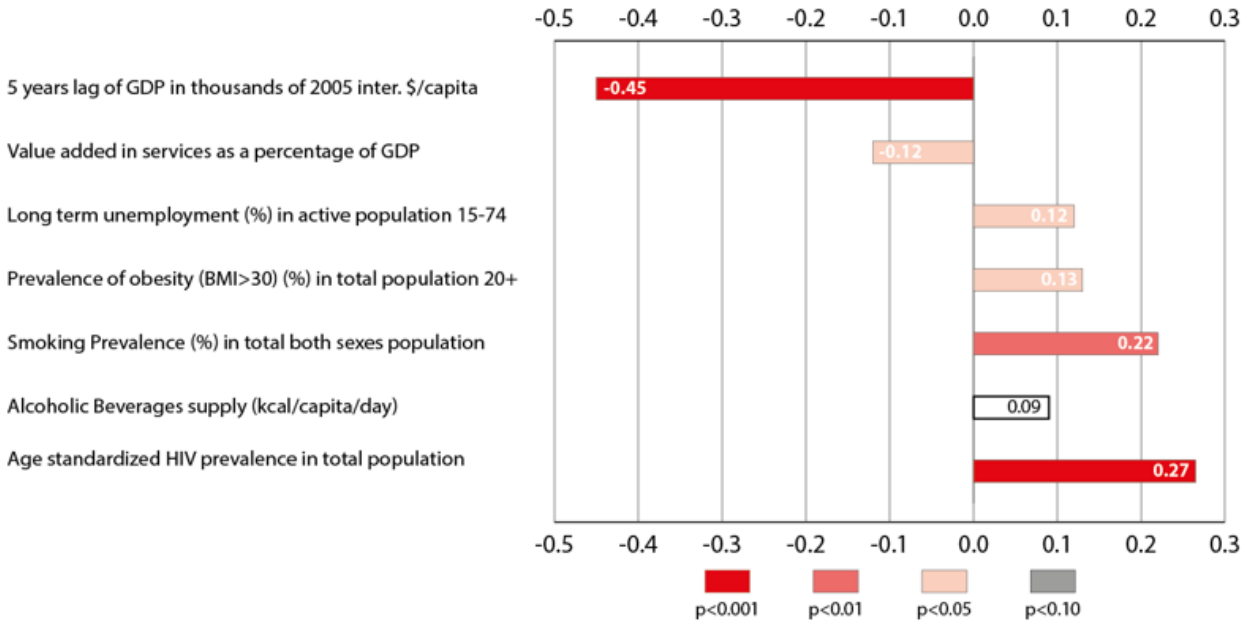
The overall findings can be stated according to its components:

(1) The unemployment rate 15 – 74 at lags 0, 1, 2 years is positively related to the proportion of the population stating that their SPH is "bad" or "very bad." The longer the lag estimated (from 0 to 2 years), the greater the impact (i.e., coefficient or effect size). See Annex Tables 1-3 and Annex Figures 7-9.

(2) The long-term unemployment rate over 1 year at lag 0, 1, 2 years is positively related to the proportion of the population stating "bad" or "very bad" self-perceived health. The longer the lag estimated, the greater the impact. See Figure 2.

Figure 2

Relation between long-term unemployment rate and both bad and very bad self-perceived health with controls for economic, life-style and regional factors



*26 EU member countries (excluding Luxembourg and Croatia) and 2 Non-EU countries (Norway and Iceland)

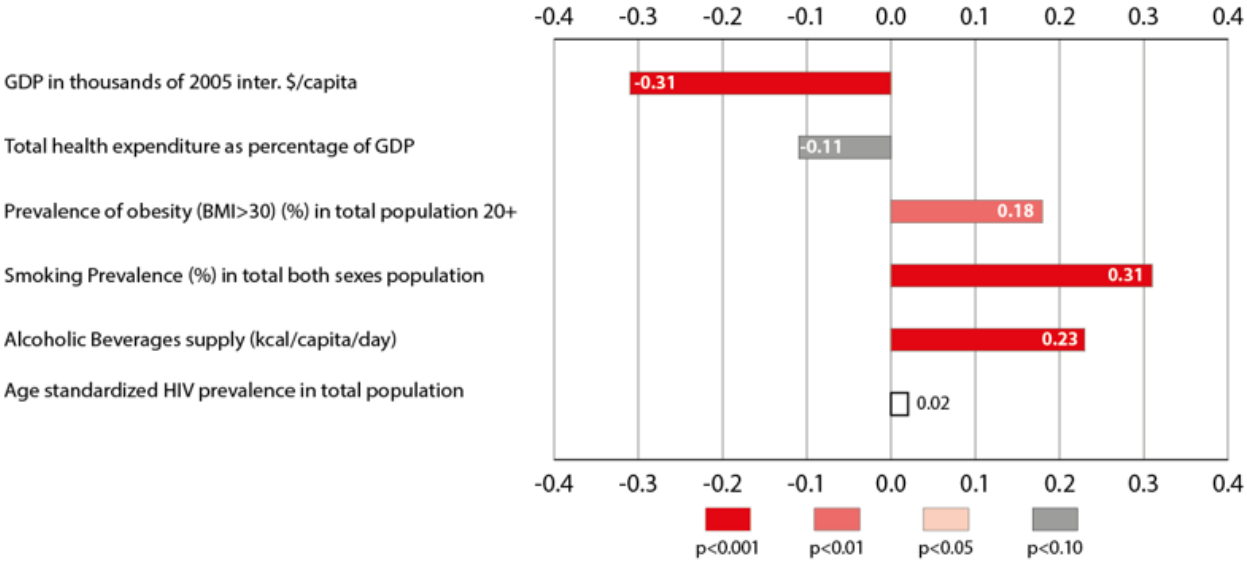
(3) The very long term unemployment rate (over 2 years) at lag 0, 1, 2 years is positively related to the proportion of the population stating that their SPH is "bad" or "very bad." See again Figure 1.

National health expenditures are not significantly related to SPH in any model in which unemployment is present. See Annex Tables 1-3 and Annex Figures 7-9. However, if unemployment is not in the model, then national health expenditures are significantly inversely related to SPH that is "bad" or "very bad"—i.e., health expenditures reduce the proportion of bad or very bad health. See Figure 3.

Figure 3

Relation between national health expenditures and both bad and very bad self-perceived health

Regression results (standardized beta coefficients)
Dependent variable: percentage of population with bad or very bad self perceived health
(pooled cross-sectional time series regression, years 2004-2012, 30 European countries*)



*26 EU member countries (excluding Luxembourg and Croatia) and 4 Non-EU countries (Switzerland, Norway, Iceland and Macedonia)

Age-specific findings

One of the more salient findings of this study relates to the impact of long-term unemployment rates on self-perceived health according to age groups (see Annex Tables 4-7 and Annex Figures 10-13). Among the four age groups in this study, the 15 – 24 segment does not show a significant relationship for unemployment at any duration. For the remaining age groups, the older the group, the stronger are the effect sizes (coefficients) for unemployment and long-term unemployment, and the smaller the confidence interval (indicating higher reliability). The 25 – 44 group shows statistically significant relations at the 10 per cent level of confidence, while the 45 – 64 and 65+ groups exhibit greater impact as well as highly reliable relations at (lower than the) 1 per cent level of confidence. By far the strongest relation occurs at over age 65. This finding clearly indicates that the impact of long-term unemployment rates among the working population also has a very important deleterious effect on self-perceived health among the non-working older population. This is partly due to the fact that the effects of unemployment are experienced not simply by the working population but by those who depend on the employed—i.e., older family members.

Findings according to educational level

The fundamental inverse relation between long-term unemployment rates and poor self-perceived health is distinguished by educational level. The basic findings are as follows. Overall, the lower the educational level of the population, the greater the impact of unemployment on bad and very bad self-perceived health. The impact is estimated by coefficient size, taking account of the confidence interval (i.e., reliability). This finding holds for total unemployment, long-term unemployment and very long-term unemployment, regardless of the length of lag from 0 – 2 years.

Among the population with primary and minimal secondary education, the strongest relationship based on both effect size and narrow confidence intervals is observed (see Annex Table 8 and Annex Figure 14). This relationship for the lowest educational level group remains very pronounced regardless of the number and types of control factors, including life-style and environmental factors, that are entered into the model. Somewhat weaker effect sizes and larger confidence intervals (that are statistically significant) are found for the population with secondary education but minimal tertiary education. These findings become slightly weaker, however, where extensive life style risk factors are used as controls in the model (see Annex Table 9 and Annex Figure 15). In the case of the population with secondary education, the effect sizes and confidence intervals are robust and significant even when extensive life style risk factors are used in the model, including smoking prevalence and body mass index (see Annex Table 10 and Annex Figure 16).

It is worthwhile to bear in mind the significance of the control variables. The reason that the life style risk factors were added as controls is that they tend to be the strongest predictors in the epidemiological literature on chronic diseases, in addition to socioeconomic status. Thus the evidence is firm that smoking prevalence and high body mass index are substantial causal factors in the major chronic diseases, even though the prevalence of smoking and high body mass index are substantially influenced by low socioeconomic status in industrialized country populations (Wilkinson and Marmot, 2003). Since these life style risk factors ordinarily influence the presence of major chronic diseases, they will, presumably, reflectively influence self-perceived health in a damaging manner.

The existence of an inverse relation between national health expenditures and poor SPH disappears when unemployment is among the predictors of SPH. It is therefore possible that the health of the unemployed or their older dependents, who experience greater illness following national job loss, is not protected by added health care expenditures. Alternatively, the population that suffers as a result of the stress of high national unemployment rates may not make adequate use of health care, or may cope with those stressors by harmful life style changes (e.g., alcohol, tobacco, weight gain, drugs, etc.).

VII. EXPLANATIONS

Primary explanations

The initial hypotheses that were the basis of this study originated with the "social gradient" (or the "health gradient")—i.e., the universal observation that socioeconomic status (SES) is inversely related to illness and mortality rates, regardless of diagnosis in industrialized countries. This implies the following dynamic: declines in SES are followed by increased illness and mortality rates. This is generally observed, at the individual level, in epidemiological studies, for example, of the relation of unemployment to heart attack and stroke. Three mechanisms are usually suggested as explanations of the social gradient: (1) reduced resources that would otherwise enable adaptation to, or control of, the physical and human environment; (2) reduced access to health care; and (3) psychosocial stress experienced at the firm, employee and family levels.

The psychophysiological linkages between stress and major illnesses have been very well described since the 1930's by Walter Cannon (cardiovascular disturbances) and during the 1950 by Hans Selye (including immunological diseases, infection and malignancy). These theoretical and research traditions have resulted in a very extensive medical and epidemiological literature on this subject of emotional stress and health.

Thus, the position underlying this study is that while the outcome measure in this study is self-perceived health, the true outcome is actual physiological or psychological illness that is—cognitively or emotionally—reflected in the perceptions of the study population.

Duration of unemployment and self-perceived health

In order to attempt a plausible explanation of the far stronger relation of long-term and especially very long-term unemployment rates to deteriorated self-perceived health as compared to unemployment of minimal duration, it is necessary to understand the structural basis of long-duration unemployment. Standard explanations in the business cycle literature include: (1) unusually lengthy and deep recession, such as the Great Recession, with extensive duration in several European countries; (2) second or third smaller recessions following that of 2008–2009—i.e., providing minimal time for employment to recover after the initial recession; (3) a slow recovery period after the 2008–2009 crisis with diminished demand serving to maintain continuously high unemployment rates. These reasons alone could account for unusually sustained unemployment rates greater than one and two years; (4) The trend of structural (technological) changes interacting with the recessional crisis and its aftermath—requiring heightened job skills not possessed by the unemployed; and (5) out-sourcing of employment to non-European countries in the course of globalization.

These well-known structural factors help to explain the exceptionally lengthy duration of unemployment that characterized and followed the Great Recession. The existence of these factors lends considerable support to the argument that the relations found in this paper, that longer durations of unemployment result in increasingly poorer self-perceived health, are not spurious. Rather, the circumstances implicit in high duration unemployment—including reduced socioeconomic status of family members, disruption of family relations, and longer-term damage to incomes, employment careers and pensions—are probable causal links to damaged actual, and perceived, health.

However, given the findings of this study on the relation of long-term unemployment rates to declines in self-perceived health, and earlier studies on the impact of unemployment on mental depression, and suicide—within a year—and on heart disease and stroke mortality within two years, an additional explanation is possible. It is reasonable to infer that mental and physical illness made more likely by unemployment, lead to further unemployment over the longer term. This could occur as a result of decreased motivation (due to mental depression) or actual physical disability resulting from cardiovascular (or other) reactions (see Andreeva, et al., 2015). The findings of this study and other recent studies on unemployment and health in Europe make it clear that a deeper understanding of unemployment, even under conditions of very severe recession is needed.

"Spread" Effects

Among the most important discoveries in recent years regarding marco-level analyses is that they frequently reveal "spread" effects. The study of unemployment, for example, at the purely individual level assumes that the critical unit of analysis is the individual person in a state of employment or unemployment. But if the outcome variable is health or mortality, the more accurate unit of analysis may well be the family. While it is true that a single person in the family may lose work—i.e., the "head" of household—the spouse or children of that family head may indeed may suffer more from the head's job loss, since this loss involves deterioration of wages, breakdown in family relations, loss of ability to support parents and children, loss of contact with fellow workers and friends (Moser, et al., 1984; Moser, et al., 1986). In general, then, we can understand

employment at specified skill levels or loss of it as a standard marker of socioeconomic status (SES). The SES of the principal family job holder is conferred on an entire household or family unit, including parents even if they all do not reside at the same location. In health outcome studies, the principal epidemiological risk (or benefit) factor is SES since it is the most consistent predictor of illness and mortality, regardless of diagnosis.

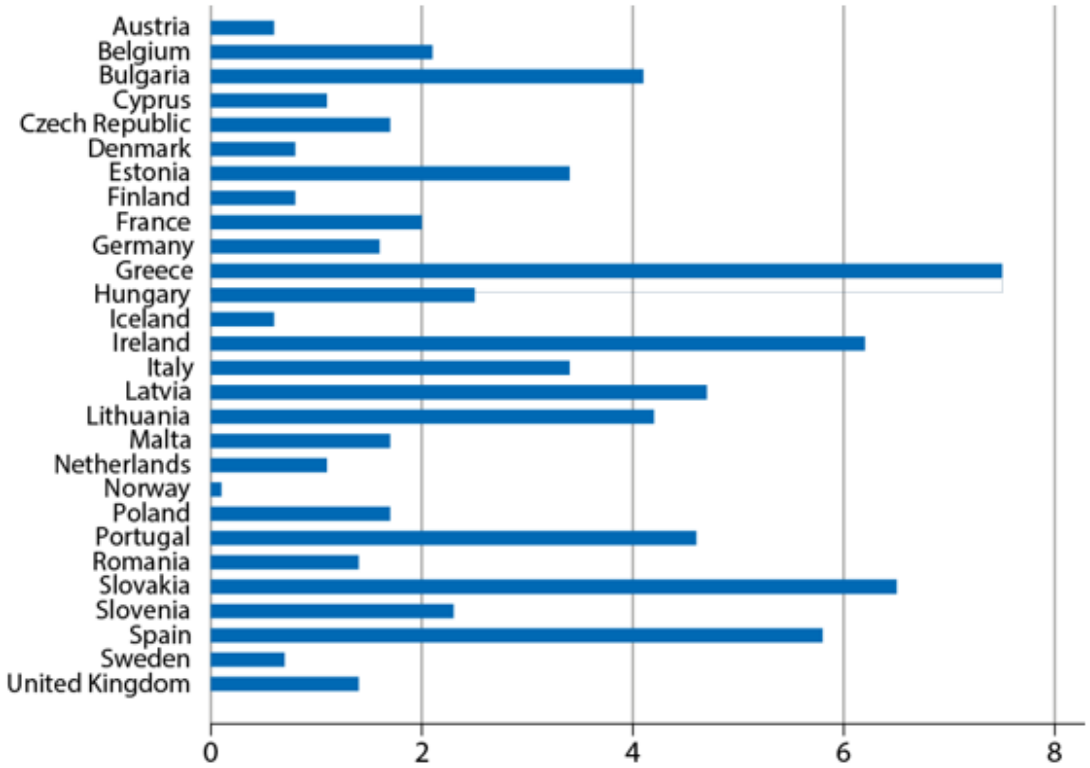
Finally, the recent development of network analysis, especially promoted by sociologists, indicates that clustering of illness outcomes and risk (e.g., smoking, body mass index, alcohol pathology) is probably not limited to family units, but equally to groupings of peer

Distribution of very long-term unemployment rates

In examining European countries according to the range of very long-term unemployment rates over two years, there is—with some outliers—a broad increase that approximates a North to South distribution. This distribution forms three clusters where the rates are extremely low in the most Northern countries, moderately low in the centrally located countries and high in Southern European regions (see Figure 4)

Figure 4

Very long-term unemployment in active population age 15 – 74, year 2012



Within the Northern cluster with unemployment rates over two years at 0.1 to 0.8, the Nordic countries, without exception, show very low unemployment rates (Denmark, Finland, Iceland, Norway and Sweden). However, slight outliers, with somewhat higher very long-term unemployment rates over two years, are Austria and Netherlands, countries that are centrally located. Like the Nordic countries, the latter two centrally located countries also have traditionally high levels of social protection. A major outlier, according to regional location, however, is Cyprus (at 1.1) despite being a Southern European country.

Within the centrally-located cluster, nearly all countries have unemployment rates over two years at 1.4 to 2.5 percent in 2012 (Eurostat). These countries include: Belgium,

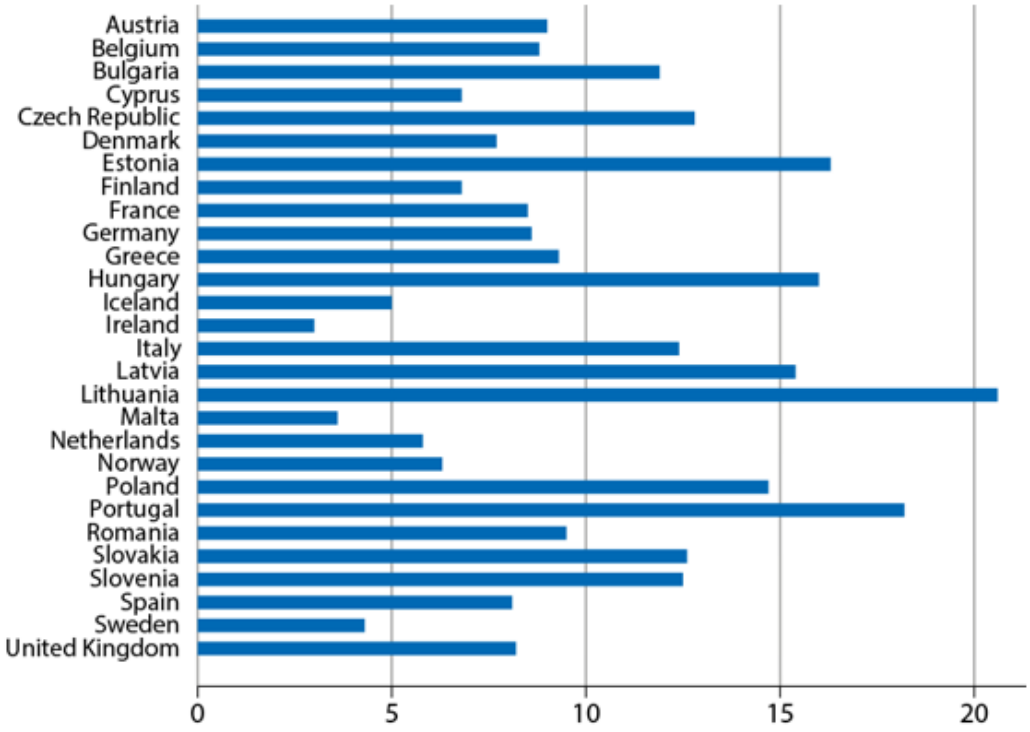
Czech Republic, France, Germany, Hungary, Poland, Romania, Slovenia and the United Kingdom. The single outlier is Malta, with a quite low very long-term unemployment rate (at 1.7 percent).

In general, the Southern European cluster and the Baltic States show the highest unemployment rate over 2 years ranging over 3.4 to 7.5; these countries include Bulgaria, Greece, Italy, Portugal and Spain. The Baltic countries with unemployment over two years at 3.4 to 4.7, are Estonia, Latvia and Lithuania. Outlier countries not in the Southern cluster but with comparatively high unemployment rates over 2 years are Ireland and Slovakia.

The north to south pattern of increasingly high very long-term unemployment rates might lead to the assumption that poor self-perceived health (bad and very bad) would also be seen in an increasing north-south gradient. This is clearly not the case (see Figure 5)

Figure 5

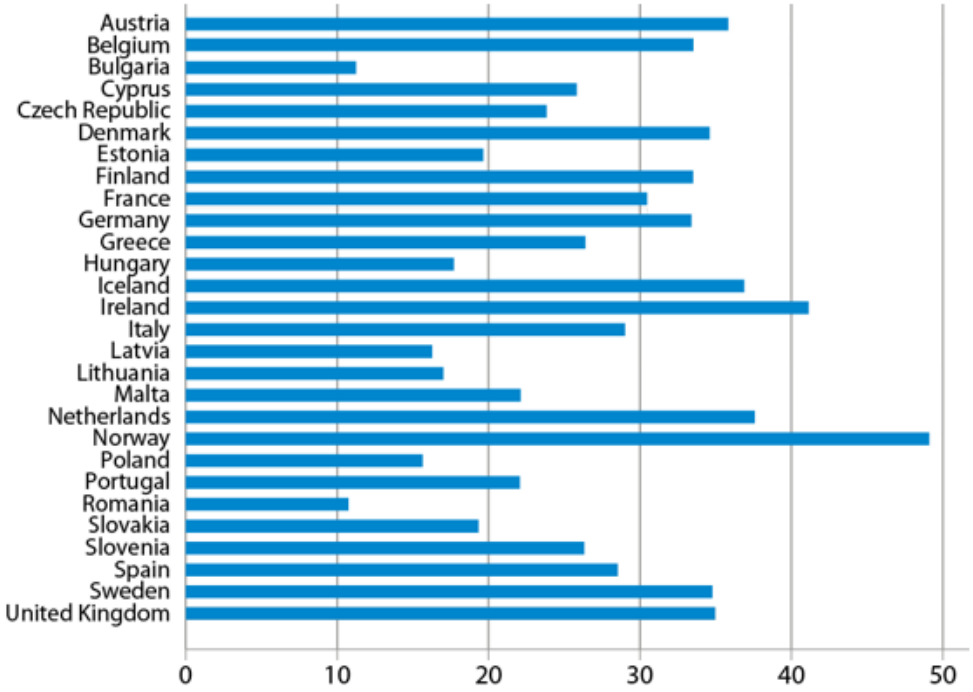
Percentage of population with bad or very bad self-perceived health, year 2012



Rather, as we have seen in virtually all the statistical analyses of this study, low GDP per capita is the principal predictor of poor self-perceived health. This is reflected in the fact that the lowest income European countries, essentially in Eastern Europe (except for Italy) have the highest rates of bad and very bad self-perceived health (see Figures 5, 6).

Figure 6

5 years lag of GDP per capita in thousands of 2005 international dollar, year 2012



Thus, while unemployment, long-term unemployment and very long-term unemployment are highly significantly related to higher levels of poor self-perceived health, other economic variables, and health-risk factors must be taken into account when one is interested in developing a full predictive model of self-perceived health for use in European Union countries. Further, it is often assumed that lower GDP is related to higher levels of unemployment and long-term unemployment. This has not been the case in European countries, at least on a cross-sectional basis, in the period following the Great Recession (see Figures 4, 6).

Outlier countries on the issue of self-perceived health

Beyond the relatively high rates of very long-term unemployment, outliers can also be observed among countries ranked according to self-perceived health. Countries with relatively high self-perceived health, independent of other predictors, are the Mediterranean Isles of Cyprus and Malta and the Atlantic Islands of the United Kingdom, Ireland and Iceland.

In a second major model, the high self-perceived health outlier countries were (1) the Eastern European countries of Bulgaria and Romania and (2) the Southern European countries of Cyprus, Greece, Malta, Portugal and Spain.

Further research will be required to develop a more thorough understanding of why, apart from the North-Central-South continuum, specific outlier countries can be found. Similarly, the reasons for specific outliers with an apparently high level of protection from "bad" or "very bad" self-perceived health will need to be investigated. Cultural factors may well prove important to this explanation.

VIII. MAIN CONCLUSIONS

Unemployment increases the level of bad and very bad SPH in European countries over 2004 – 2012. The longer the duration of unemployment, the stronger is the effect on increases in bad and very bad SPH. When self-perceived health is categorized as either (1) very good, (2) good, (3) neither good nor bad, (4) bad or (5) very bad, the proportion saying their health is bad or very bad increases as unemployment duration rises. Moreover, the proportion of people saying their health is bad or very bad becomes further enlarged as the percentage of unemployed remains without work for an entire year (i.e. long-term unemployment); the proportion of those with bad or very bad health is highest when the duration of unemployment is greater than two years (i.e. very long-term unemployment). This relation is somewhat stronger for females than for males; it is significant in both sexes over age 25 and strongest in those over 65. By educational category, the relation is strongest in populations with less than secondary education, continues to be strong in populations with tertiary education; and is weakest among those with secondary but no tertiary education.

Given the findings of this study on the relation of long-term unemployment rates to declines in self-perceived health, and earlier studies on the impact of unemployment on mental depression, and suicide—within a year—and on heart disease and stroke mortality within two years, an explanation involving a sequential feedback loop is plausible. One can infer that mental and physical illness made more likely by unemployment, leads to further unemployment over the longer term. This could occur as a result of decreased motivation (due to mental depression) or actual physical disability resulting from cardiovascular (or other) reactions. The findings of this study and other recent studies on unemployment and health in Europe make it clear that a deeper understanding of the mental and physical harm brought about by unemployment, especially under conditions of severe recession, required for optimal economic and health policy, is needed.

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X. ANNEX TABLES AND FIGURES

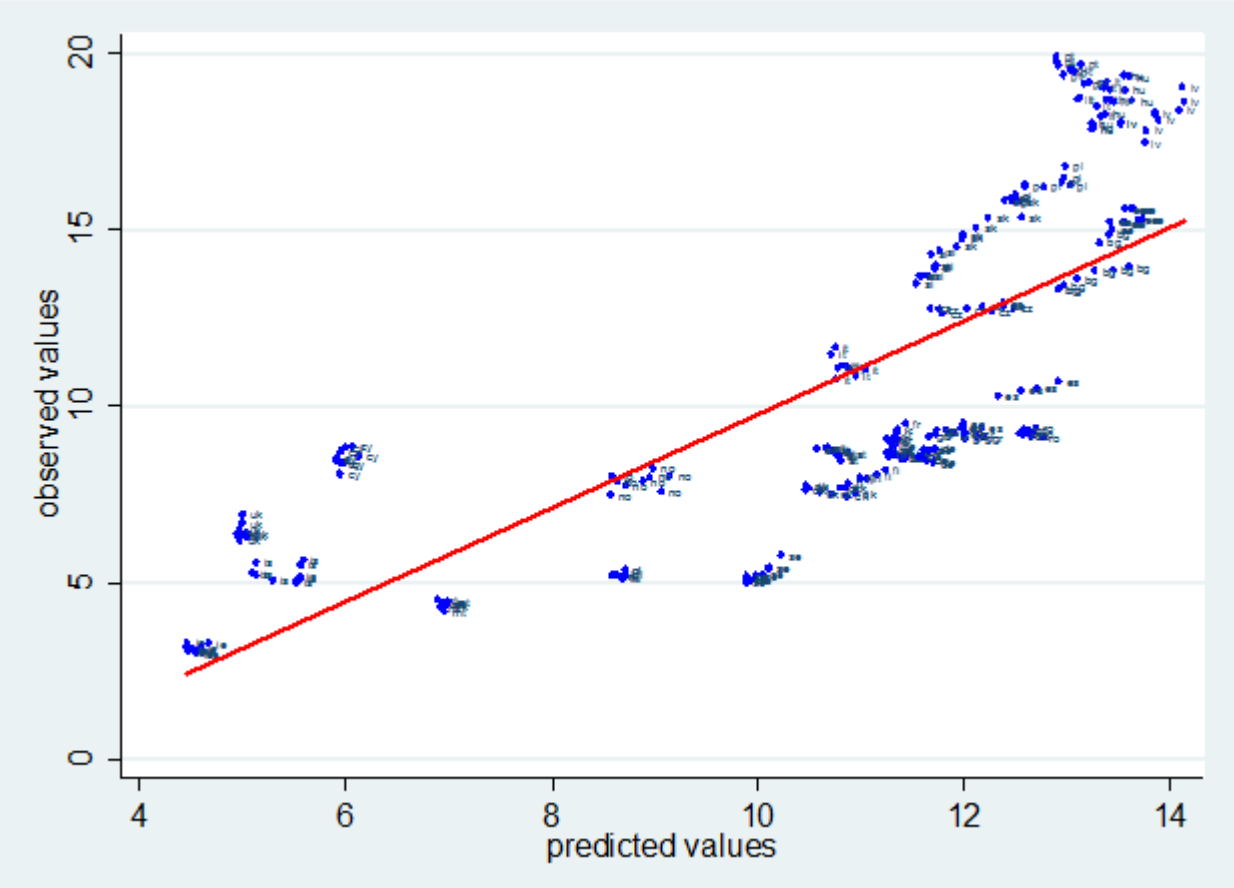
Annex Table 1 Prediction of self-perceived health

Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total both sexes population in pooled analyses 2004-2012 for 26 EU members (excluding Croatia) and 2 non EU countries (Norway & Iceland).

Robust random-effects GLS regression — Number of obs = 252
Group variable: numcod — Number of groups = 28
R-sq: within = 0.2662 — Obs per group: min = 9
between = 0.5969 — avg = 9.0
overall = 0.5955 — max = 9
Wald chi2(9) = 79.05 — corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000
(Std. Err. adjusted for 28 clusters in numcod)

	Robust					
Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]
5 years lag of GDP per capita in 2005 int. $ (World Bank)	-0.083	0.026	-3.160	0.002	-0.135	-0.032
Total health expenditure (THE) % Gross Domestic Product	0.001	0.051	0.020	0.980	-0.099	0.102
2 years lag of Unemployment rate in both sexes LF 15-74	0.027	0.010	2.810	0.005	0.008	0.046
Prevalence of obese (BMI>30) pop. in both sexes pop. 20+	0.246	0.096	2.570	0.010	0.058	0.433
Smoking Prevalence (%) in total both sexes population	0.044	0.032	1.360	0.174	-0.019	0.107
Alcoholic Beverages Supply in kcal/capita & day	0.003	0.001	1.880	0.060	0.000	0.006
Age standardized HIV prevalence in total both sexes pop.	0.002	0.005	0.380	0.707	-0.007	0.011
Dummy (1=Mediterran. Island States, 0=rest of the World)	-6.520	2.137	-3.050	0.002	-10.709	-2.332
Dummy (1=Atlantic Island States, 0=rest of the World)	-6.750	1.103	-6.120	0.000	-8.912	-4.588
Constant	6.868	2.090	3.290	0.001	2.772	10.963

Annex Figure 7 Prediction of self-perceived health

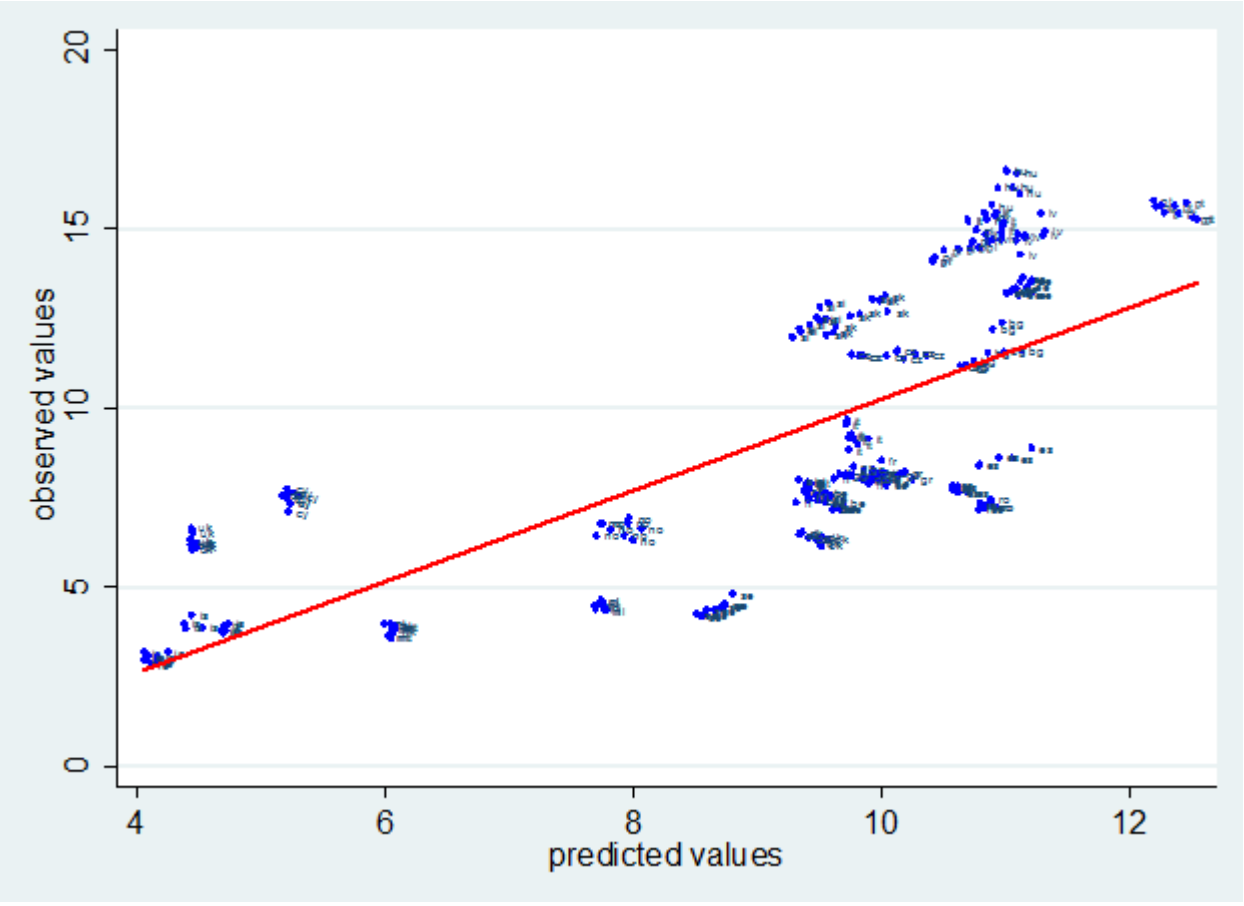


Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total male population in pooled analyses 2004-2012 for 26 EU members (excluding Croatia) and 2 non EU countries (Norway & Iceland).

Robust random-effects GLS regression — Number of obs = 252
Group variable: numcod — Number of groups = 28
R-sq: within = 0.1861 — Obs per group: min = 9
between = 0.5362 — avg = 9.0
overall = 0.5347 — max = 9
Wald chi2(9) = 52.19 — corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000
(Std. Err. adjusted for 28 clusters in numcod)

	Robust					
Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]
5 years lag of GDP per capita in 2005 int. $ (World Bank)	-0.072	0.025	-2.920	0.003	-0.120	-0.024
Total health expenditure (THE) % Gross Domestic Product	0.015	0.049	0.310	0.759	-0.082	0.112
2 years lag of Unemployment rate in male LF 15-74	0.021	0.008	2.740	0.006	0.006	0.036
Prevalence of obese (BMI>30) pop. in male pop. 20+	0.161	0.092	1.750	0.081	-0.019	0.342
Smoking Prevalence (%) in total male population	0.015	0.027	0.550	0.579	-0.038	0.068
Alcoholic Beverages Supply in kcal/capita & day	0.002	0.001	1.600	0.110	0.000	0.004
Age standardized HIV prevalence in total male pop.	0.003	0.003	1.120	0.262	-0.002	0.008
Dummy (1=Mediterran. Island States, 0=rest of the World)	-5.311	1.954	-2.720	0.007	-9.141	-1.480
Dummy (1=Atlantic Island States, 0=rest of the World)	-5.487	1.060	-5.180	0.000	-7.566	-3.409
Constant	7.356	1.902	3.870	0.000	3.629	11.083

Annex Figure 8 Prediction of male self-perceived health

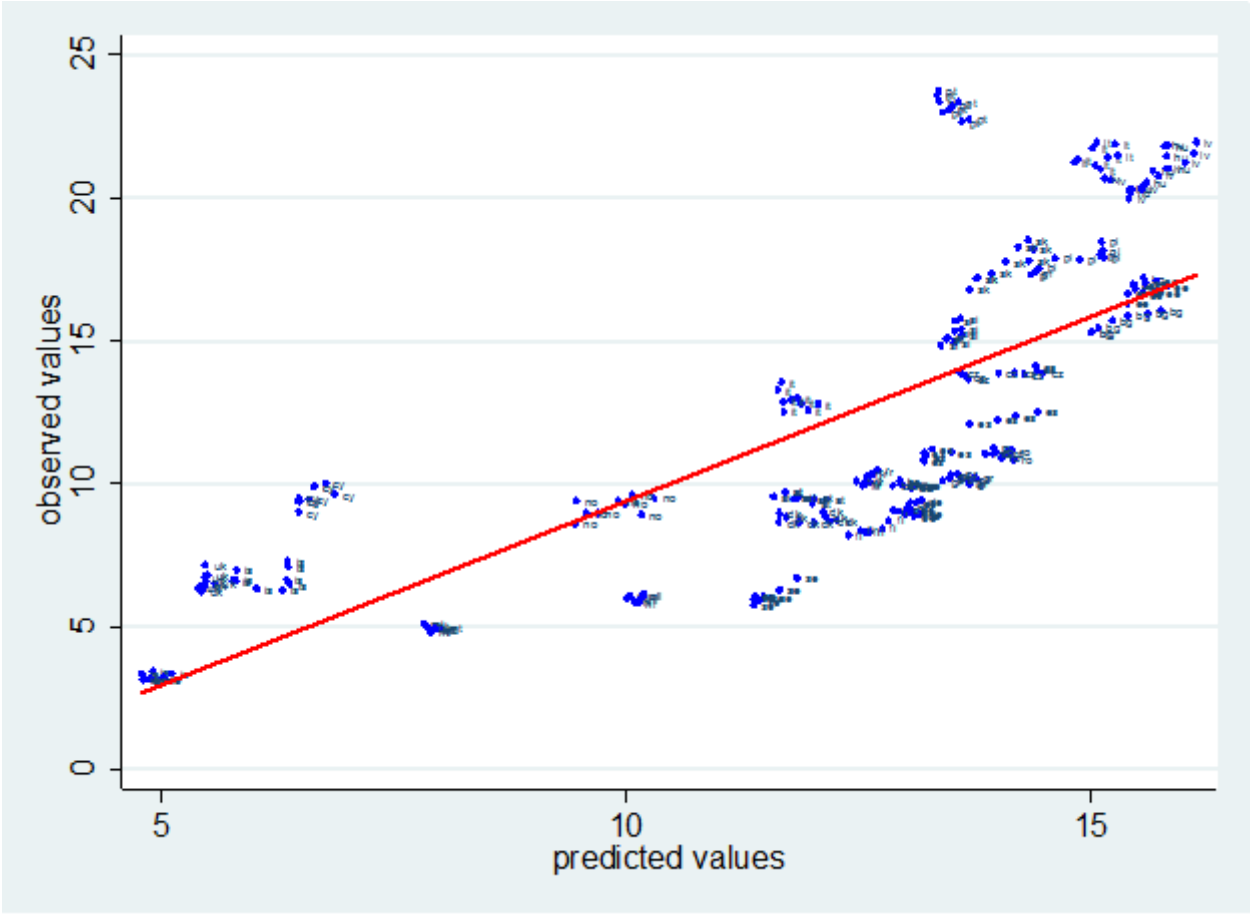


Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total female population in pooled analyses 2004-2012 for 26 EU members (excluding Croatia) and 2 non EU countries (Norway & Iceland).

Robust random-effects GLS regression			Number of obs	=	252
Group variable:	numcod		Number of groups	=	28
R-sq: within	= 0.3156		Obs per group: min	=	9
between	= 0.5642		avg	=	9.0
overall	= 0.5631		max	=	9
Wald chi2(9) = 90.15		corr(u_i, X) = 0 (assumed)	Prob > chi2	=	0.0000
(Std. Err. adjusted for 28 clusters in numcod)					

	Robust					
Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]
5 years lag of GDP per capita in 2005 int. $ (World Bank)	-0.093	0.026	-3.590	0.000	-0.143	-0.042
Total health expenditure (THE) % Gross Domestic Product	-0.014	0.053	-0.270	0.786	-0.118	0.089
2 years lag of Unemployment rate in female LF 15-74	0.032	0.012	2.590	0.010	0.008	0.056
Prevalence of obese (BMI>30) pop. in female pop. 20+	0.285	0.098	2.910	0.004	0.093	0.476
Smoking Prevalence (%) in total female population	0.062	0.032	1.950	0.051	0.000	0.124
Alcoholic Beverages Supply in kcal/capita & day	0.003	0.002	1.970	0.049	0.000	0.007
Age standardized HIV prevalence in total female pop.	-0.003	0.008	-0.370	0.710	-0.019	0.013
Dummy (1=Mediterran. Island States, 0=rest of the World)	-7.018	2.357	-2.980	0.003	-11.638	-2.398
Dummy (1=Atlantic Island States, 0=rest of the World)	-7.880	1.182	-6.670	0.000	-10.196	-5.564
Constant	7.576	2.215	3.420	0.001	3.234	11.917

Annex Figure 9 Prediction of female self-perceived health



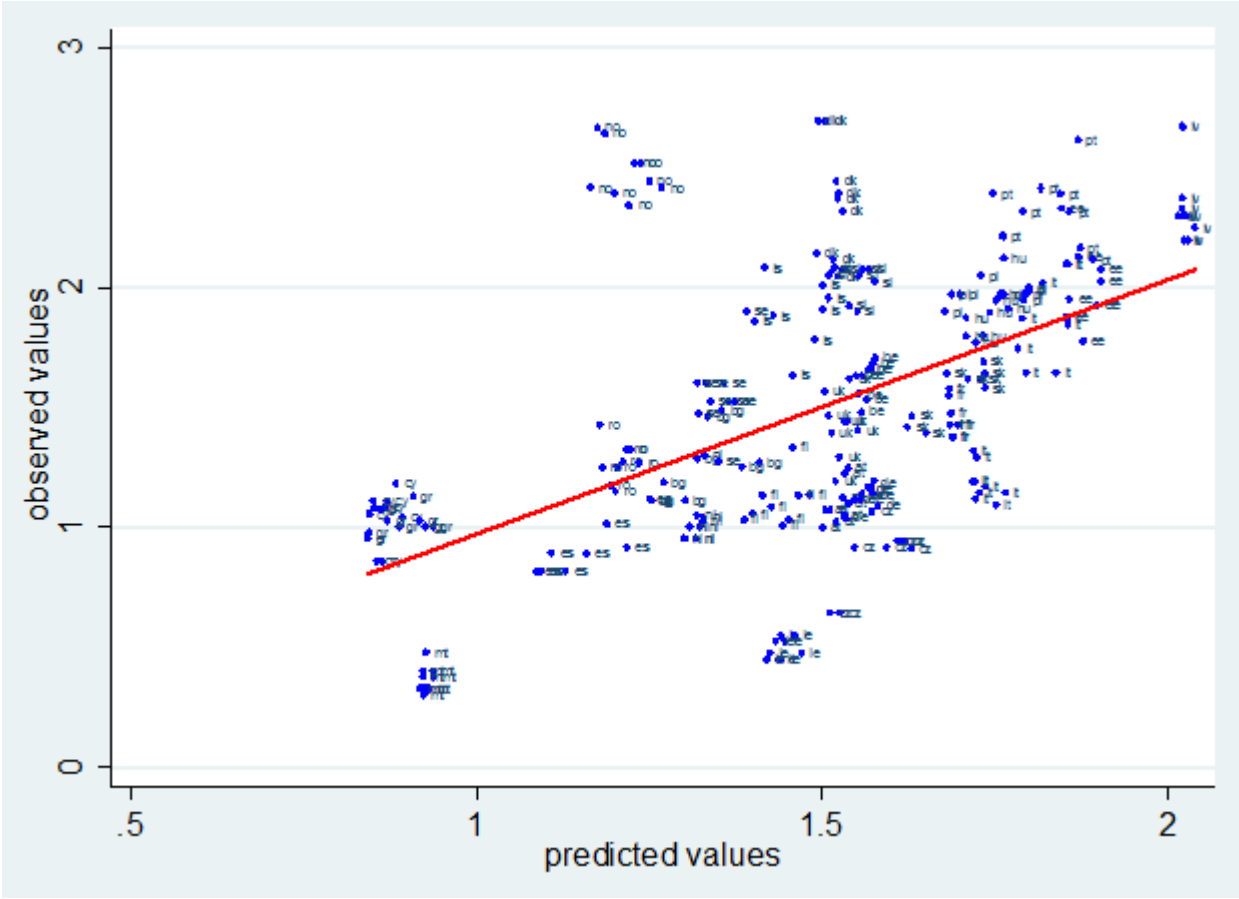
Annex Table 4 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by age: 16-24 years with controls for economic, life-style and regional factors

Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total population 16-24 years old in pool analyses 2004-2012 for 26 EU members (excl. Luxembourg and Croatia) and 2 non EU countries (Norway and Iceland).

Random-effects GLS regression			Number of obs	=	252
Group variable:	numcod		Number of groups	=	28
R-sq: within	= 0.0648		Obs per group: min	=	9
between	= 0.3097		avg	=	9.0
overall	= 0.3003		max	=	9
Wald chi2(9) = 25.74	corr(u_i, X) = 0 (assumed)		Prob > chi2	=	0.0023

Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]	Beta
5 years lag of GDP in thousands of 2005 inter. $/capita	-0.012	0.006	-2.140	0.033	-0.023	-0.001	-0.204
Total health expenditure as a % Gross Domestic Product	0.000	0.005	-0.020	0.981	-0.010	0.010	-0.002
2 year lag of very long term (24+ months) unemployment rate	0.016	0.010	1.510	0.130	-0.005	0.036	0.102
Prevalence of obese (BMI>30) pop. in total pop. 20+	0.000	0.000	0.840	0.404	-0.000	0.001	0.001
Smoking Prevalence (%) in total both sexes population	0.006	0.007	0.960	0.338	-0.007	0.020	0.074
Alcoholic Beverages supply (kcal/capita/day)	0.000	0.000	-0.070	0.946	-0.001	0.001	-0.004
Age standardized HIV prevalence in total both sexes pop.	0.002	0.001	2.530	0.011	0.001	0.004	0.171
Dummy (1=Bulgaria and Romania; 0=the rest of the World)	-0.553	0.379	-1.460	0.144	-1.295	0.189	-0.092
Dummy (1=Spain, Portugal, Greece, Cyprus, Malta; 0=the rest)	-0.760	0.270	-2.800	0.005	-1.280	-0.230	-0.190
Constant	1.319	0.541	2.440	0.015	0.259	2.379	.

Annex Figure 10 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by age: 16-24 years



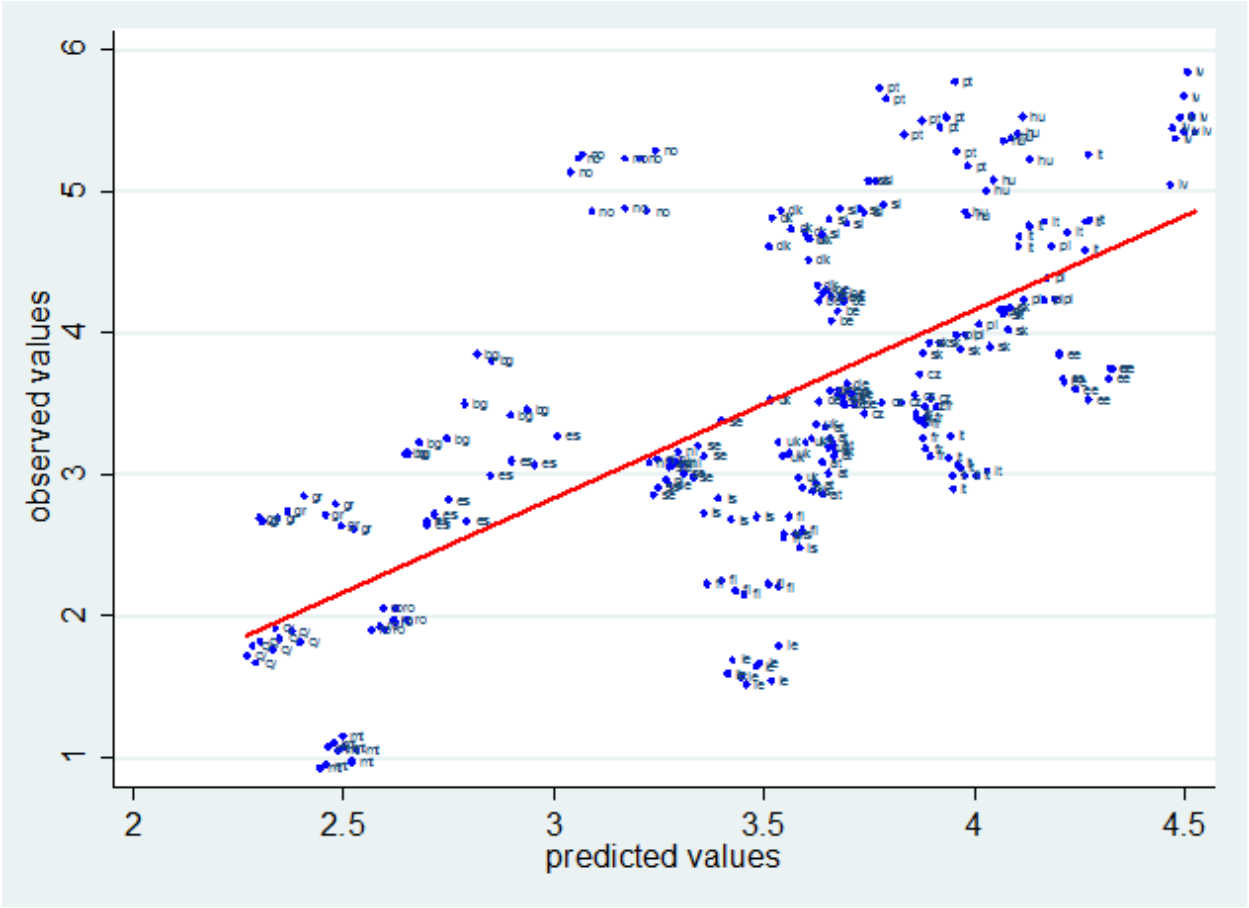
Annex Table 5 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by age: 25-44 years with controls for economic, life-style and regional factors

Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total population 25-44 years old in pool analyses 2004-2012 for 26 EU members (excl. Luxembourg and Croatia) and 2 non EU countries (Norway and Iceland).

Random-effects GLS regression			Number of obs	=	252
Group variable:	numcod		Number of groups	=	28
R-sq: within	= 0.1414		Obs per group: min	=	9
between	= 0.4347		avg	=	9.0
overall	= 0.4298		max	=	9
Wald chi2(9) = 52.77	corr(u_i, X) = 0 (assumed)		Prob > chi2	=	0.0000

Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]	Beta
5 years lag of GDP in thousands of 2005 inter. $/capita	-0.023	0.008	-2.950	0.003	-0.038	-0.008	-0.281
Total health expenditure as a % Gross Domestic Product	-0.006	0.006	-0.860	0.392	-0.018	0.007	-0.062
2 year lag of very long term (24+ months) unemployment rate	**0.024**	**0.013**	**1.810**	**0.071**	**-0.002**	**0.050**	**0.116**
Prevalence of obese (BMI>30) pop. in total pop. 20+	0.000	0.000	0.870	0.383	-0.000	0.001	0.001
Smoking Prevalence (%) in total both sexes population	0.014	0.009	1.570	0.117	-0.003	0.031	0.115
Alcoholic Beverages supply (kcal/capita/day)	0.000	0.001	-0.250	0.800	-0.001	0.001	-0.016
Age standardized HIV prevalence in total both sexes pop.	0.004	0.001	2.740	0.006	0.001	0.007	0.178
Dummy (1=Bulgaria and Romania; 0=the rest of the World)	-1.574	0.706	-2.230	0.026	-2.958	-0.190	-0.132
Dummy (1=Spain, Portugal, Greece, Cyprus, Malta; 0=the rest)	-1.460	0.490	-2.960	0.003	-2.420	-0.490	-0.180
Constant	3.752	0.744	5.040	0.000	2.294	5.210	.

Annex Figure 11 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by age: 25-44 years



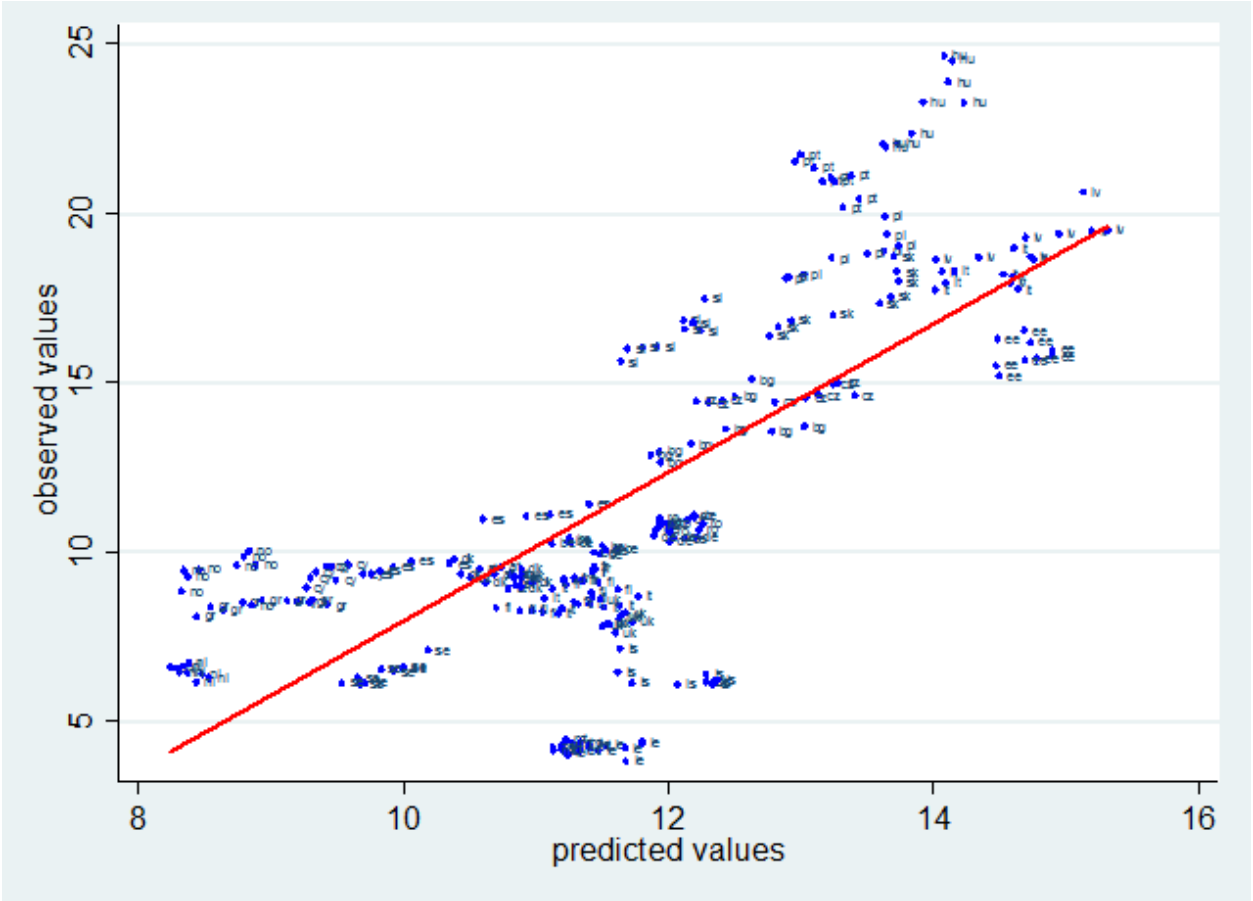
Annex Table 6 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by age: 45-64 years with controls for economic, life-style and regional factors

Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total population 45-64 years old in pool analyses 2004-2012 for 26 EU members (excl. Luxembourg and Croatia) and 2 non EU countries (Norway and Iceland).

Random-effects GLS regression			Number of obs	=	252
Group variable:	numcod		Number of groups	=	28
R-sq: within	= 0.2760		Obs per group: min	=	9
between	= 0.5566		avg	=	9.0
overall	= 0.5497		max	=	9
Wald chi2(9) = 102.55	corr(u_i, X) = 0 (assumed)		Prob > chi2	=	0.0000

Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]	Beta
5 years lag of GDP in thousands of 2005 inter. $/capita	-0.112	0.024	-4.740	0.000	-0.159	-0.066	-0.421
Total health expenditure as a % Gross Domestic Product	-0.026	0.019	-1.350	0.178	-0.064	0.012	-0.090
2 year lag of very long term (24+ months) unemployment rate	0.124	0.040	3.110	0.002	0.046	0.201	0.185
Prevalence of obese (BMI>30) pop. in total pop. 20+	0.003	0.001	3.180	0.001	0.001	0.004	0.002
Smoking Prevalence (%) in total both sexes population	0.027	0.026	1.030	0.305	-0.025	0.079	0.070
Alcoholic Beverages supply (kcal/capita/day)	0.005	0.002	2.800	0.005	0.001	0.008	0.159
Age standardized HIV prevalence in total both sexes pop.	0.007	0.004	1.660	0.097	-0.001	0.015	0.100
Dummy (1=Bulgaria and Romania; 0=the rest of the World)	-1.635	2.283	-0.720	0.474	-6.110	2.841	-0.039
Dummy (1=Spain, Portugal, Greece, Cyprus, Malta; 0=the rest)	-2.620	1.580	-1.660	0.098	-5.730	0.480	-0.090
Constant	9.202	2.257	4.080	0.000	4.778	13.626	.

Annex Figure 12 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by age: 45-64 years



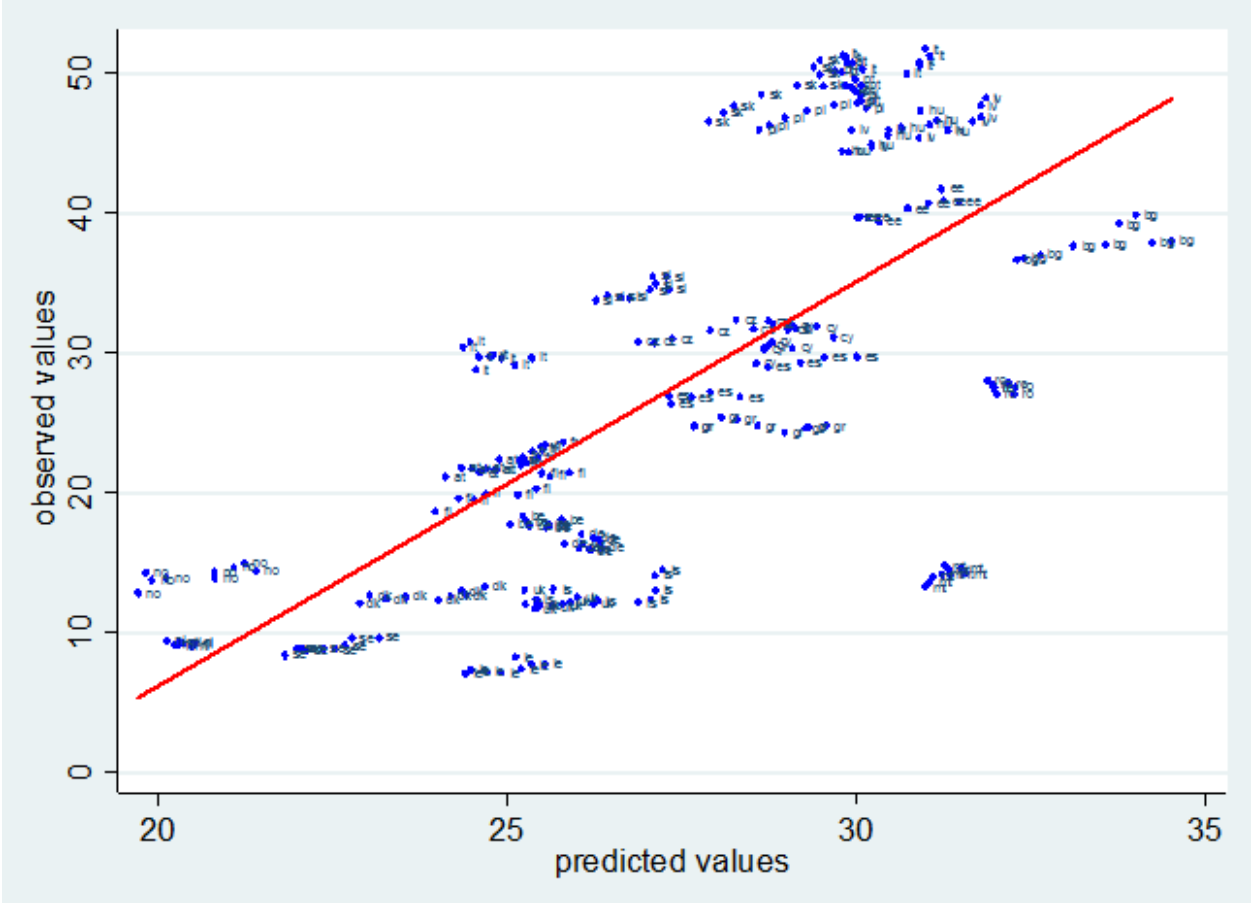
Annex Table 7 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by age: 65+ years with controls for economic, life-style and regional factors

Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total population 65+ years old in pool analyses 2004-2012 for 26 EU members (excl. Luxembourg and Croatia) and 2 non EU countries (Norway and Iceland).

Random-effects GLS regression			Number of obs	=	252
Group variable:	numcod		Number of groups	=	28
R-sq: within	= 0.4117		Obs per group: min	=	9
between	= 0.4987		avg	=	9.0
overall	= 0.4930		max	=	9
Wald chi2(9) = 138.55	corr(u_i, X) = 0 (assumed)		Prob > chi2	=	0.0000

Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]	Beta
5 years lag of GDP in thousands of 2005 inter. $/capita	-0.210	0.040	-5.280	0.000	-0.288	-0.132	-0.455
Total health expenditure as a % Gross Domestic Product	-0.047	0.032	-1.480	0.138	-0.110	0.015	-0.095
2 year lag of very long term (24+ months) unemployment rate	0.127	0.065	1.970	0.049	0.000	0.254	0.112
Prevalence of obese (BMI>30) pop. in total pop. 20+	0.004	0.001	3.020	0.003	0.001	0.007	0.002
Smoking Prevalence (%) in total both sexes population	0.127	0.043	2.930	0.003	0.042	0.212	0.190
Alcoholic Beverages supply (kcal/capita/day)	0.004	0.003	1.410	0.158	-0.002	0.010	0.076
Age standardized HIV prevalence in total both sexes pop.	0.002	0.007	0.320	0.749	-0.012	0.017	0.018
Dummy (1=Mediterranean Islands; 0=the rest of the World)	1.868	4.824	0.390	0.699	-7.586	11.323	0.020
Dummy (1=Atlantic Islands (UK, Ireland, Iceland, 0=rest)	1.075	3.311	0.320	0.746	-5.414	7.563	0.017
Constant	22.139	3.869	5.720	0.000	14.557	29.722	.

Annex Figure 13 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by age: 65+ years



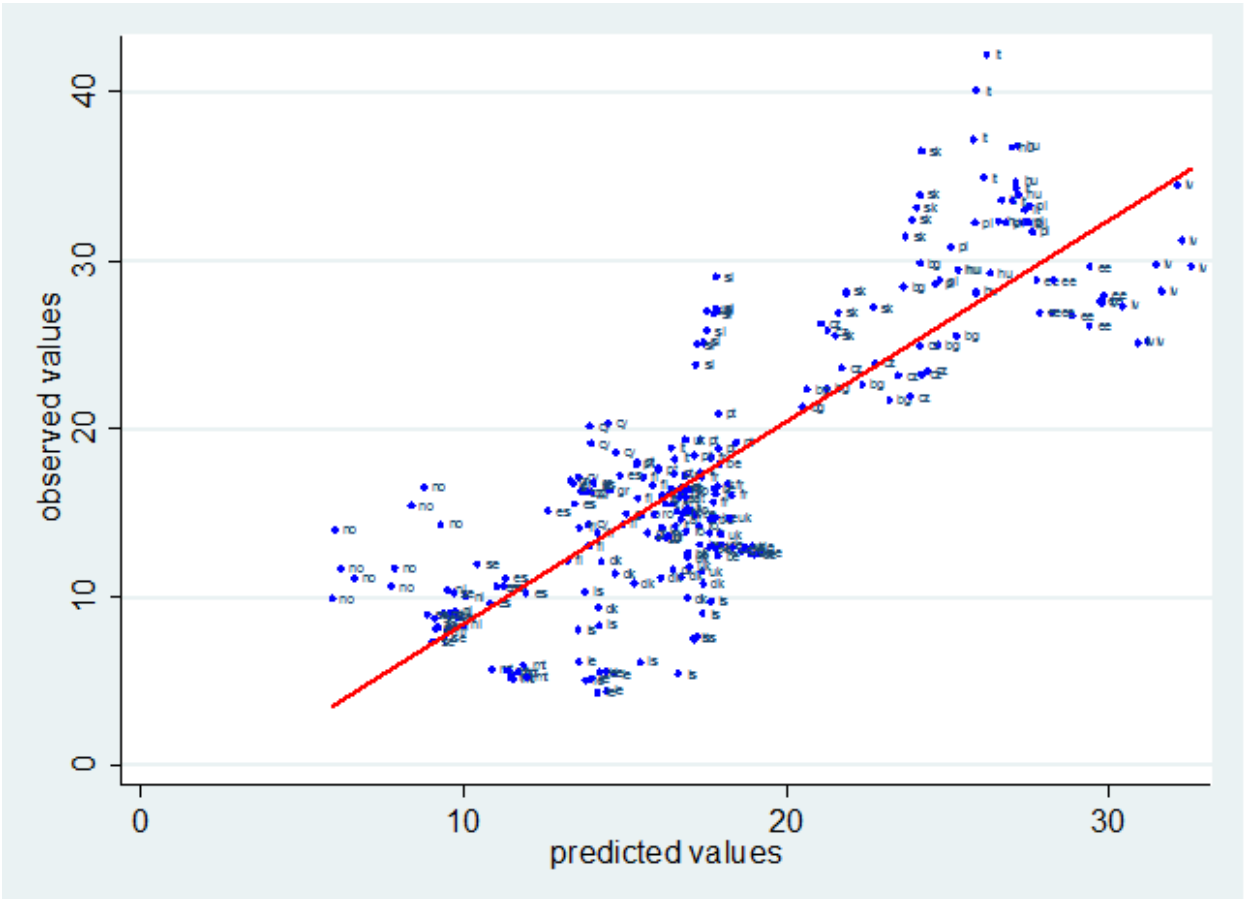
Annex Table 8 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by education level: basic, pre-primary and lower secondary education with controls for economic, life-style and regional factors

Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total both sexes population with basic, pre-primary, primary and lower secondary education (ISCED level 0-2) in pooled analyses 2004-2013 for 26 EU members (excluding Luxembourg & Croatia) and 2 non EU countries (Norway & Iceland).

Random-effects GLS regression			Number of obs	=	252
Group variable:	numcod		Number of groups	=	28
R-sq: within	= 0.1256		Obs per group: min	=	9
between	= 0.7214		avg	=	9.0
overall	= 0.6913		max	=	9
Wald chi2(10) = 108.63		corr(u_i, X) = 0 (assumed)	Prob > chi2	=	0.0000

Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]	Beta
5 years lag of GDP in thousands of 2005 inter. $/capita	-0.431	0.088	-4.870	0.000	-0.604	-0.258	-0.443
Value added in services as a percentage of GDP	-0.059	0.080	-0.730	0.464	-0.216	0.098	-0.051
Age standardized mean years of education /cap. in pop. 25 +	1.590	0.594	2.680	0.007	0.426	2.754	0.285
2 years lag of very LT unemployment in active pop. 15-74	0.436	0.175	2.490	0.013	0.093	0.778	0.150
Prevalence of obese (BMI>30) pop. in total pop. 20+	0.521	0.239	2.180	0.029	0.053	0.989	0.001
Smoking Prevalence (%) in total both sexes population	0.437	0.100	4.350	0.000	0.240	0.634	0.301
Alcoholic Beverages supply (kcal/capita/day)	0.009	0.007	1.210	0.228	-0.006	0.023	0.071
Age standardized HIV prevalence in total both sexes pop.	0.024	0.010	2.360	0.018	0.004	0.043	0.144
Dummy (1=Romania & Bulgaria, 0=the rest of the World)	-8.488	3.369	-2.520	0.012	-15.091	-1.885	-0.150
Dummy (1=Spain, Portugal, Greece, Cyprus, Malta; 0=rest)	-6.636	2.861	-2.320	0.020	-12.243	-1.030	-0.175
Constant	-10.294	7.719	-1.330	0.182	-25.424	4.835	.

Annex Figure 14 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by education level: basic, pre-primary and lower secondary education



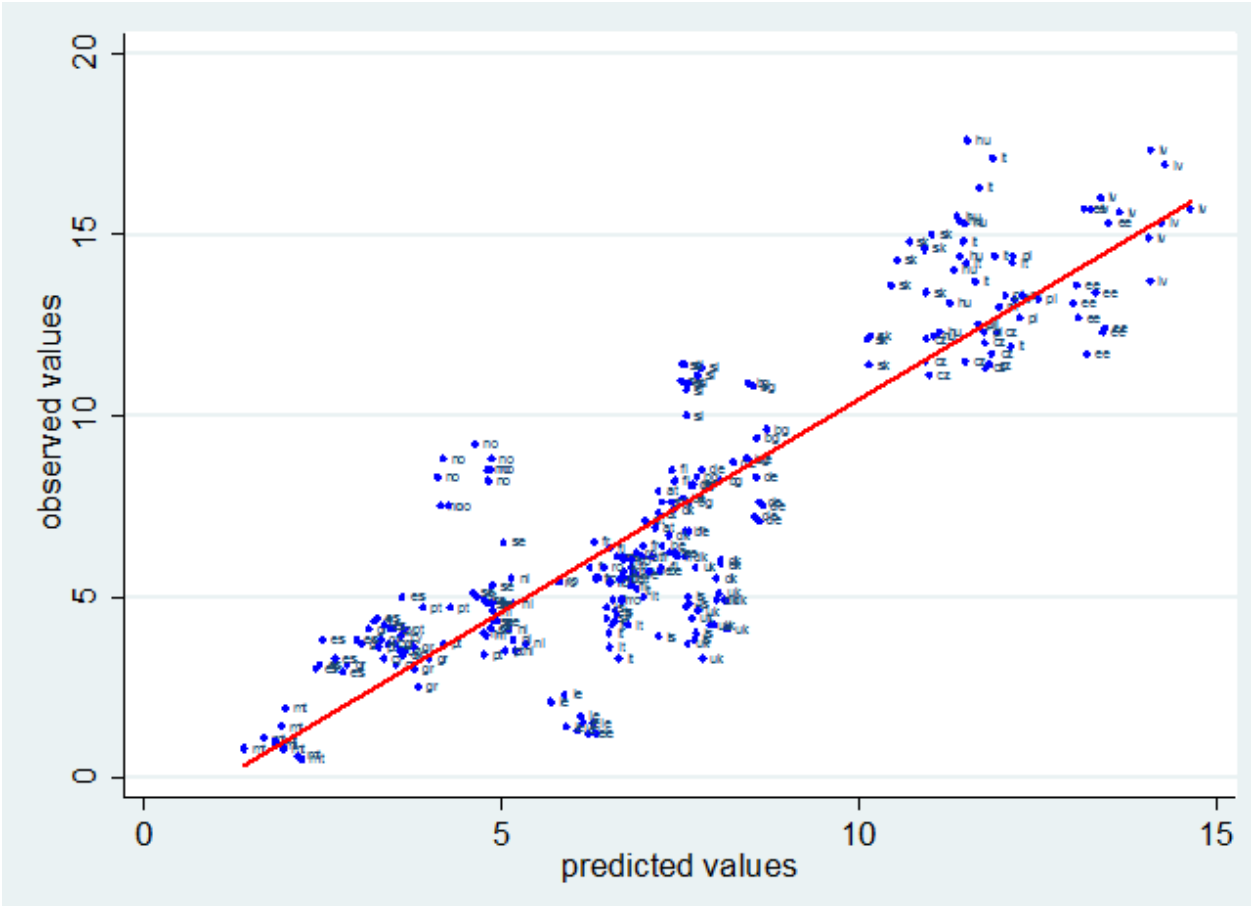
Annex Table 9 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by education level: secondary and post-secondary education with controls for economic, life-style and regional factors

Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total both sexes population with upper secondary and post-secondary non-tertiary education (ISCED level 3-4) in pooled analyses 2004-2013 for 26 EU members (excluding Luxembourg & Croatia) and 2 non EU countries (Norway & Iceland).

Random-effects GLS regression			Number of obs	=	252
Group variable:	numcod		Number of groups	=	28
R-sq: within	= 0.0359		Obs per group: min	=	9
between	= 0.7955		avg	=	9.0
overall	= 0.7657		max	=	9
Wald chi2(10) = 122.86		corr(u_i, X) = 0 (assumed)	Prob > chi2	=	0.0000

Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]	Beta
5 years lag of GDP in thousands of 2005 inter. $/capita	-0.211	0.039	-5.450	0.000	-0.286	-0.135	-0.478
Value added in services as a percentage of GDP	-0.068	0.036	-1.900	0.057	-0.139	0.002	-0.131
Age standardized mean years of education /cap. in pop. 25 +	1.376	0.262	5.250	0.000	0.863	1.890	0.540
2 years lag of very LT unemployment in active pop. 15-74	0.167	0.079	2.110	0.035	0.012	0.322	0.125
Prevalence of obese (BMI>30) pop. in total pop. 20+	0.150	0.104	1.440	0.150	-0.054	0.353	0.001
Smoking Prevalence (%) in total both sexes population	0.148	0.045	3.300	0.001	0.060	0.236	0.225
Alcoholic Beverages supply (kcal/capita/day)	0.007	0.003	2.080	0.038	0.000	0.013	0.120
Age standardized HIV prevalence in total both sexes pop.	0.012	0.004	2.790	0.005	0.004	0.021	0.168
Dummy (1=Romania & Bulgaria, 0=the rest of the World)	-5.127	1.444	-3.550	0.000	-7.957	-2.297	-0.209
Dummy (1=Spain, Portugal, Greece, Cyprus, Malta; 0=rest)	-3.870	1.235	-3.130	0.002	-6.290	-1.449	-0.235
Constant	-7.031	3.427	-2.050	0.040	-13.747	-0.314	.

Annex Figure 15 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by education level: secondary and post-secondary education



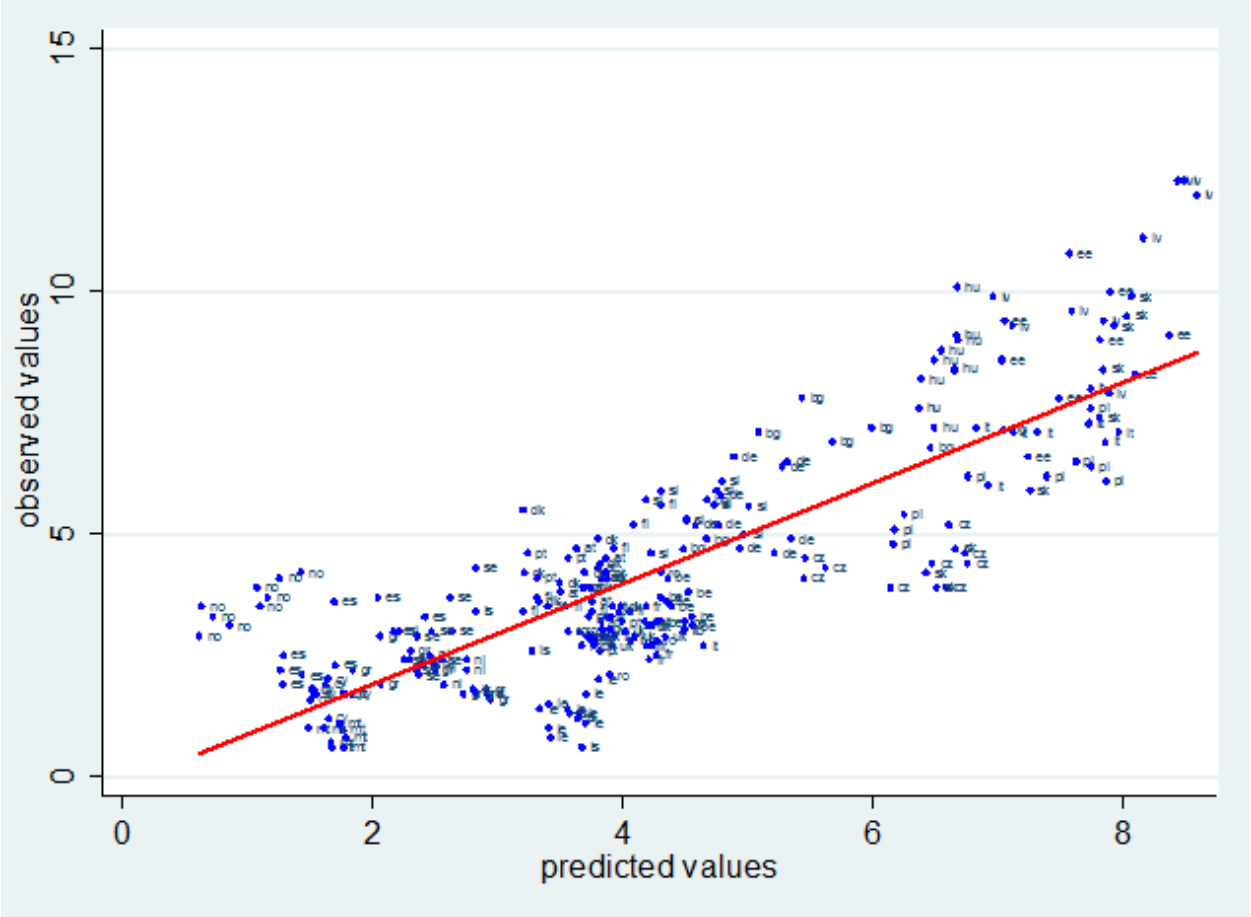
Annex Table 10 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by education level: tertiary education with controls for economic, life-style and regional factors

Prediction of Proportion (%) of population self-perceived their health as bad and very bad in total both sexes population with tertiary education (ISCED level 5-6) in pooled analyses 2004-2013 for 26 EU members (excluding Luxembourg & Croatia) and 2 non EU countries (Norway & Iceland).

Random-effects GLS regression			Number of obs	=	252
Group variable:	numcod		Number of groups	=	28
R-sq: within	= 0.2074		Obs per group: min	=	9
between	= 0.7445		avg	=	9.0
overall	= 0.6918		max	=	9
Wald chi2(10) = 126.58		corr(u_i, X) = 0 (assumed)	Prob > chi2	=	0.0000

Predictors	Coef.	Std. Err.	t	P>|t|	[95% C.	Interval]	Beta
5 years lag of GDP in thousands of 2005 inter. $/capita	-0.132	0.030	-4.470	0.000	-0.191	-0.074	-0.380
Value added in services as a percentage of GDP	0.000	0.029	0.000	0.999	-0.056	0.056	0.000
Age standardized mean years of education /cap. in pop. 25 +	0.284	0.205	1.380	0.166	-0.118	0.686	0.138
2 years lag of very LT unemployment in active pop. 15-74	0.339	0.065	5.180	0.000	0.211	0.467	0.305
Prevalence of obese (BMI>30) pop. in total pop. 20+	0.080	0.079	1.010	0.312	-0.075	0.235	0.001
Smoking Prevalence (%) in total both sexes population	0.056	0.036	1.550	0.120	-0.015	0.126	0.106
Alcoholic Beverages supply (kcal/capita/day)	0.005	0.003	2.050	0.040	0.000	0.011	0.119
Age standardized HIV prevalence in total both sexes pop.	0.003	0.003	0.980	0.325	-0.003	0.010	0.060
Dummy (1=Romania & Bulgaria, 0=the rest of the World)	-2.656	1.075	-2.470	0.014	-4.763	-0.548	-0.147
Dummy (1=Spain, Portugal, Greece, Cyprus, Malta; 0=rest)	-2.758	0.931	-2.960	0.003	-4.584	-0.933	-0.227
Constant	-0.058	2.718	-0.020	0.983	-5.385	5.268	.

Annex Figure 16 Relation between very long-term unemployment rate and both bad and very bad self-perceived health by education level: tertiary education



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