The Effects of Business Cycle on Health

Hilal AKINCI

Supervisor: Prof Konstantinos TATSIRAMOS

This thesis is submitted in partial fulfilment of the Master of Science in Economics and Finance

Luxembourg University

September 2018

Abstract

This study uses aggregate data for 30 OECD countries for the period 1990-2015, following Gerdtham and Ruhm's (2006) estimation methodology for the purpose of understanding the effect of macroeconomic conditions on mortality. In addition to augmenting the number of countries analyzed and extending the period of time in authors' research, mortality causes are also gender-specifically examined. Not only cause-specific mortality rates but also gender and cause-specific ones are examined. Another contribution of this thesis is to underline that estimation decisions regarding that using fixed-effects and/or country-specific time trends may cause even sign change of coefficient. The study not only supports that mortality is procyclical in total and for both genders as well however it is weaker than it was before, but also demonstrates that the estimation method severely affects the results.

Key Words: Mortality, Business Cycles, Unemployment, Fixed-effect, Regression Analysis

Table of Contents

Dedicated to my beloved mother, father, brother, sister in law, and nephew…

Section I. Introduction and Previous Research

The effect of economic conditions on the mortality rate has been discussed for many years in the literature by not only economists but also sociologists and historians, not surprisingly since it is a sophisticated topic as being related to multiple disciplines. There is a variety of studies in macro and micro level as well not only because of it is an intersection among different sciences but also the complex structure of modelling it due to many factors affecting this association. This study is examining the reflections of economics on the number of deaths in aggregate level data by exploiting a fixed-effect regression model. After underlining some major previous studies in the literature, the research is organized to cover data and methodology, results, discussion of results, sensitivity and conclusion sections. This research is simply an empirical analysis to inspect whether mortality has a procyclical behaviour or not by using fixed-effect estimation model for the period between 1990 and 2015 over across 30 OECD countries by following Gerdtham and Ruhm's methodology (2006). In addition, on the background of the study, there is an inspection regarding how the application way of fixed-effects method tends to create change in the results.

In the literature, the relationship between mortality and business cycle is a matter of discussion. The lack of clarity in this relationship quietly stems from the fact that estimations are sensitive to model specifications and they may indicate contradictory results (Neumayer, 2004; Granados and Ionides, 2011). In addition to suffering from method choice, there are also many factors included in this relationship. One of the reasons for the ambiguity depends on the reciprocity of the association and complication of diagnosing which aspect of economic status is determining (Barik et al., 2018). Controversies take place at both micro and macro levels

regarding the position of mortality due to economic reflection on it. For instance, some researchers claim that total mortality rate and cause-specific mortality rates are relatively countercyclical indicating that when there is an economic downturn, as mortality rates increase as a result (Hexter, 1925; Bunn,1979; McAvinchey, 1984; Watkins, 1985; Catalano, 1991). Thomas Malthus (1766-1834) was one of the first researchers in this research field by pointing out economics recessions results with a tendency to rise sharply for mortality rates (Hernández-Murillo, 2010). Brenner (1971,1976,1980,1993,1995) also contributes to the literature by stressing that an economic downturn causes a rise in the number of deaths. But, Brenner's studies are criticized by many researchers pointing that his research is misleading by severe technical flaws (Gravelle et al., 1981; Stern, 1983; Cook and Zarkin,1986; Ruhm, 2000). In addition, some researchers also support criticisms because they could not reach the same results by replicating Brenner's study because of his method to choose the lag length, the decision of covariates, and unclear demonstration of methods and results (McAvinchey, 1988; Joyje and Mocan,1993). Ruhm also stresses Brenner's time selection (four decades following great depression) in one of his study results with a significant reduce in the unemployment rate and during that period health improvement occurred due to enhancement in the availability of antibiotics and better food (2006; Freeman, 1999). He suggests that lack of control for these factors causes a negative reflection of unemployment on health. In fact, the first approach indicating a procyclical association is probably belongs to William Ogburn and Dorothy Thomas (1922). They suggest that the number of deaths has a procyclical tendency. However, the the author's study could not draw much attention probably because people in general tend to have counter intuition (Granados, 2005). If the first simple intuition is in the opposite direction, the privileged question is that how an increase in unemployment may leads a better health. The answer is possibly and simply "time, food, and physical activity". Ruhm pay attention to that unemployment provides with people more leisure time to adopt a healthier life

style such as engaging in physical activities, consuming homemade foods, having time to visit doctors (Ruhm,2000). For instance, in case of motor vehicle accidents, it is relatively possible to say that employed people are doomed to spend some time in the traffic, which not only may create the potential for a traffic accident, but also reduce in leisure time supporting Ruhm's thought. Thus, Ruhm suggests fixed-effects models for a panel data so that omitted variable bias problem can be handled exploiting within-state(country/county/industry) changes and control time-invariant effects regarding economic situations (Gerdtham and Ruhm, 2006).

The recent studies also indicate that procyclical status of mortality has weakened by time. While some of them claim that there is a weakening attitude probably starting in last half of the 1980s (Ruhm, 2015), some points out the relationship have practically become zero by suggesting a two-way association between health and economic activity recently has become less remarkable (Tekin, 2013).

The literature in the case of the relationship between mortality and business cycle confirms that estimation results are influenced by estimation methods which cause an ambiguity in this topic. However, Ruhm's researches draw attention to some controls and time-invariant effects which are required to be fixed to create a control for different countries, time periods, and even within countries (2000, 2006). Thus, the main aim of this study, not only examine the impact of the business cycle on mortality by practising a fixed-effect panel data regression but also try to show how country-specific time trends affect the results of estimations.

The following sections II, III, IV, and V, respectively, cover data and methodology; explaining data sources, variables, and estimation technique, results; demonstrating estimations, discussion; interpretation of results considering the previous researches, sensitivity analysis; checking the dataset effect, and conclusion.

Section II. Data and Methodology

In this chapter, firstly, the data which is used for analyses will be described in detail. Then, the methodology and estimation technique used for analyzing the effect of the business cycle on mortality rates is going to be introduced.

For this study, the first intention was to include OECD countries. However, due to missing data for independent and dependent variables in several years of the study period, Czech Republic, Estonia, Iceland, Latvia, Lithuania, and Turkey are excluded from the study. Regression models in this thesis paper use aggregate data for 30 OECD (Organization for Economic Cooperation and Development) countries, namely Australia, Austria, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States over the 1990-2015 period. The period is chosen by not only aiming to cover the longest period of time but also avoiding missing data for countries in this period. A sensitivity analysis takes place in results section using a balanced version of data set.

The data of annual mortality rates, total and cause-specific, unemployment rates, Gross Domestic Product (GDP) growth rates, demographic controls, and consumptions of tobacco and alcohol are gathered from related sections in OECD statistics database (2018). GDP income extracted from related sections in the World Health Organization database (2018).

2.1 Dependent Variables

Total mortality and nine specific mortality causes are included for the purpose of empirical estimations in this study. Total mortality rates and ten cause-specific mortality rates namely malignant neoplasm (cancer), ischaemic (heart) disease, pneumonia and influenza, chronic liver disease and cirrhosis, motor vehicle accidents, other accidents, intentional self-harm (suicide), assault, infant deaths and neonatal deaths (both per 1 000 live births) are dependent variables. The mortality rates in the form of age-standardized per 100,000 population to be able to compare them across countries and over time by considering different age structure of countries (OECD, 2018). All dependent variables are in the form of the natural logarithm. The ten mortality causes and covers approximately 80 per cent of all fatalities (Ruhm, 2000). The study period of time includes transitions of International Classification of Disease (ICD)-9 to 10 for different countries. There are researches arguing that mortality rates may be elevated or depressed due to this switch (Grifiths et al. 2004; Brock et al. 2004) Although this situation may cause data to be exposed to slight contamination, the impact on the estimations' result is expected to be minor at broad causes of death (Ruhm, 2015). ICD transition information is available on OECD website for a detailed information.

2.2 Independent and Control Variables

The variable income refers to net national disposable income per capita in thousands of U.S.$ in constant prices and constant PPP with OECD base year, 2010. Population density is a

number of people per kilometre square. Alcohol consumption is in a unit of litres per capita (15+ age). Daily consumption is in the unit kilocalorie per capita per day.

2.3 Estimation strategy

This study is applied by using a fixed-effect linear regression to examine macroeconomic effects on mortality rates. The equation excluding country-fixed time trends is given by:

$$M_{it} = \alpha_t + X_{it}\beta + E_{it}\gamma + C_i + \varepsilon_{it}$$

where i and t are indexes of, respectively, country and year. M_{it} is the natural logarithm of the mortality rate, α_t indicates year-specific effects, X_{it} is the control variables which are mentioned in the control variables part above, γ is the coefficient of interest, E_{it} is the explanatory variables, unemployment rate, and others mentioned above, C_i is the country fixed-affect, and ε_{it} is the error term.

A country-specific linear time trends ($C_j \times T$) is also included in the model to control within-state factors, for instance, education level (Gerdtham and Ruhm, 2006). Trend (T) is a constant vector starting by 1 to 26 as the study covers the period of 26 years as 1990-2015. Thus, the previous regression equation is altered to:

$$M_{jt} = \alpha_t + X_{jt}\beta + E_{jt}\gamma + C_i + C_j \times T + \varepsilon_{jt}.$$

Selection of the fixed-effect estimation technique is based on the literature as it is already mentioned. However, a Hausman test is also applied to check if the model is better than using a random-effect model regression model. The result of the Hausman test, shown below, indicates that using the fixed-effect method does not show any statistical problem.

Table 1

Hausman Test Results	Coefficients			
	(b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Unemployment Rate	0,00165	0,00247	-0,00082	0,00027
Male Share of Population (%)	-12,63159	-14,01446	1,38287	0,64330
Population Density	-0,00193	-0,00059	-0,00134	0,00025
Alcohol Consumption	0,01200	0,01776	-0,00576	0,00156
Daily Kilocalori Consumption	-0,00011	-0,00010	-0,00001	0,00001
Health Expenditure Share (% of GDP)	-0,05127	-0,05496	0,00369	0,00103
Population under 15 (%)	-4,24818	-4,12169	-0,12649	0,11224
Population 65 and over (%)	-2,60919	-2,66656	0,05737	0,09614

b = consistent under Ho and Ha; obtained from xtreg
B = insonsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 63.24
Prob>chi2 = 0.0000

Table 2 below demonstrates a descriptive summary of the data used in this study. The extent of observations is 780, however, the data set is unbalanced due to missing data in explanatory and control variables for some countries. After the results section, a sensitivity analysis takes part with a balanced data set to observe if the results of the study suffer from unbalanced data.

In general, a descriptive summary of the data points out that mortality rate, total and cause-specific ones, is greater for men than it is for women. That is why the controlling the male share of the population is important in regression models. Using male share of the population helps to eliminate elevation of estimations in case of total mortality due to male deaths. The square root of the population is used for weighing in regression analysis to reflect the size of the sample in a country. Since the study uses fixed effects, unobserved within-country effects are far from changing aggregate results.

Table 2

Descriptive Statistics					
Variables					
Dependent Variables	Observations	Mean	Std, Dev,	Min	Max
Country	780	16	8660995	1	30
Year	780	2003	7504812	1990	2015
All Causes Mortality Rate - Female	762	776,555	159,336	432,300	1340,600
All Causes Mortality Rate - Male	762	1210,130	275,817	770,000	2238,800
All Causes Mortality Rate	762	956,989	201,679	575,700	1704,600
Malignant Neoplasm (Cancer) - Female	762	176,675	30,339	103,200	260,100
Malignant Neoplasm (Cancer) - Male	762	303,652	58,633	128,100	500,000
Malignant Neoplasm (Cancer)	762	226,864	36,556	113,100	352,400
Ischaemic (Heart) Disease - Female	762	113,547	68,788	20,000	375,100
Ischaemic (Heart) Disease - Male	762	204,821	110,261	33,500	557,600
Ischaemic (Heart) Disease	762	151,680	85,019	25,600	439,900
Influenza and Pneumonia - Female	744	26,887	18,919	2,200	108,600
Influenza and Pneumonia - Male	737	42,171	28,799	4,400	154,600
Influenza and Pneumonia	753	32,329	22,161	3,000	126,700
Liver Disease And Cirrhosis - Female	762	8,742	6,393	1,500	43,200
Liver Disease And Cirrhosis - Male	762	24,414	21,393	3,500	135,000
Liver Disease And Cirrhosis	762	15,921	13,037	2,600	84,100
Motor Vehicle Accidents - Female	760	5,837	3,305	1,300	27,000
Motor Vehicle Accidents - Male	760	19,068	10,451	4,400	75,700
Motor Vehicle Accidents	760	12,129	6,519	2,800	49,000
Other Accidents - Female	760	10,389	7,183	0,500	51,700
Other Accidents - Male	760	17,500	10,742	2,200	62,000
Other Accidents	760	13,691	8,607	1,300	57,100
Intentional Self-Harm (Suicide) - Female	760	6,494	3,717	0,700	22,800
Intentional Self-Harm (Suicide) - Male	760	21,932	10,889	4,600	68,700
Intentional Self-Harm (Suicide)	760	13,669	6,696	2,800	42,300
Assault - Female	758	1,039	0,838	0,000	5,400
Assault - Male	759	3,319	6,434	0,200	49,300
Assault	760	2,140	3,423	0,200	26,000
Infant Mortality	768	5,808	3,758	1,600	32,500
Neonatal Mortality	743	3,791	2,300	0,800	16,600
Explanatory Variables					
Unemployment Rate(%)	715	7,689	4,015	1,658	27,492
GDP Growth (%)	690	2,416	2,806	-9,132	25,117
GDP Income per capita	780	14530.24	0,000	97864.2	33902.39
Control Variables					
Population Density	773	141,257	131,277	2,220	512,910
Alcohol Consumption	780	9,703	2,707	1,500	15,400
Daily Kilocalori Consumption	695	3307,858	257,274	2569,000	3828,000
Health Expenditure Share (% of GDP)	742	8,117	2,001	3,434	16,816
Population between 15-64 (%)	780	0,667	0,024	0,578	0,731
Population under 15 (%)	780	0,190	0,044	0,125	0,379
Population 65 and over (%)	780	0,143	0,036	0,043	0,268
Male Share of Population (%)	780	.0057247	.4747326	.5037277	.4907402
For Weighting					
Square Rooted Population	780	4914,795	3512,799	617,940	17926,590

Section III. Results

In this chapter, all estimations for regression models including four specifications will be mentioned.

3.1 Total age-standardized mortality

Table 3 below summarizes the results of different models with specifications. The dependent variable is age-standardized total mortality rate and in natural logarithm. Age-standardized data helps to avoid age variations across countries in addition to population age-related control variables which are introduced in the data part.

The top part of *Table 3* indicates the effects of total mortality on unemployment rate exploiting four specifications. Specification (a) is basic regression model only controlling year fixed-effect. Estimation result indicates that a 1% decrease in the unemployment rate increases the number of total deaths by 0.24% at the one per cent level while year and country factors are fixed, all other variables are controlled and taking within country time trends into account. Moreover, a slight rise in the coefficient of unemployment rate occurs, too.

The second regression model on *table 3* (bottom) demonstrates estimation results when the natural log of income is added as an alternative specification. Controlling for income slightly reduces coefficients. It also decreases the significance level in the specification (d). Since the estimations excluding income are more consistent, this study focuses on them (specifications (a) & (b)) while including remaining with income per capita control (in specifications (c) & (d)) to provide readers with the opportunity of comparing results with previous researches.

Table 3

Estimated macroeconomic effects on total mortality rates

Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00508*** (.00164)	.00324** (.00139)	-.00225*** (.00066)	-.00260*** (.00062)
Control variables	No	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	No	No	Yes	Yes
Country-specific time trends	No	No	No	Yes

Note: Number of observations are respectively for specifications 699, 601, 601, 601. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

Estimated macroeconomic effects on total mortality rates

Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00502*** (.00165)	.00342** (.00142)	-.00218*** (.00067)	-.00246*** (.00062)
Natural Log of income	.00590 (.00997)	-.13243*** (.01147	.05333*** (.01967)	-.07490** (.03778)
Control variables	No	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	No	No	Yes	Yes
Country-specific time trends	No	No	No	Yes

Note: Number of observations is 696, 598, 598, 598. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.2 Cause-specific age-standardized mortality

Estimations regarding cause-specific mortality rates are summarized in *Table 4*. Malignant neoplasm, chronic liver diseases and cirrhosis, motor vehicle accidents, and infant mortality have positive coefficients as result of estimations practising regression model with all control variables also taking fixed effects, year effects, and country time trend into account. The greatest negative coefficient belongs to the motor vehicle accidents, while the greatest positive one to suicide, respectively -0.01061 and 0.01016. Both are at the 99% confidence interval.

For causes of intentional self-harm and assault estimated values as coefficients for unemployment are very close.

Table 4

Estimated macroeconomic effects on cause-specific mortality

Malignant Neoplasms (Cancer)				
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00251*** (.00063)	-.00103* (.00061)	.00254*** (.00064)	-.00093 (.00061)
Natural Log of income			.06012*** (.01830)	-.01184 (.03259)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
Ischaemic(Heart) Diesease				
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00787*** (.00207)	.00045 (.00109)	.00638*** (.00197)	.00056 (.00111)
Natural Log of income			-.41710*** (.06997)	-.14213 (.08768)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
Influenza and Pneumonia				
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00472 (.00521)	.00399 (.00433)	.005609 .0053509	.00414 (.00435)
Natural Log of income			.28742* (.17043)	-.76543*** (.27690)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
Chronic Liver Diseases and Cirrhosis				
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00669 (.00428)	-.00363* (.00203)	-.00565 (.00432)	-.00331* (.00198)
Natural Log of income			.10681 (.09425)	-.2212** (.09728)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 571 for models excluding income and 596 for models including income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

Neonatal Mortality				
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00815*** (.00297)	.00019 (.00325)	-.00750** (.00299)	.00036 (.00323)
Natural Log of income			.06972 (.08678)	-.24343* (.13227)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 571 for specification (a) & (b) and 596 for (c) & (d).

Estimated macroeconomic effects on cause-specific mortality

	Motor Vehicle Accidents			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.01024*** (.00247)	-.01061*** (.00192)	-.00919*** (.00245)	-.010868*** (.00185)
Natural Log of income			.18696** (.07848)	.02989 (.08911)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Other Accidents			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00159 (.00486)	.00595 (.00464)	.00254 (.00490)	.00659 (.00467)
Natural Log of income			.16265 (.13738)	-.73733** (.30223)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Intentional Self-harm			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.01812*** (.00293)	.01016*** (.00203)	.01819*** (.00299)	.01039*** (.00204)
Natural Log of income			-.10736 (.06868)	-.15266*** (.12053)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Assault			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.01893*** (.00474)	.01565** (.00638)	.01972*** (.00491)	.01642*** (.00630)
Natural Log of income			.28053* (.14906)	.76861** (.31695)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Infant Mortality			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00696*** (.00245)	-.00121 (.00252)	-.00594** (.00243)	-.000879 .0024727
Natural Log of income			.10942 (.07306)	-.26192** (.10706)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 571 for models excluding income and 596 for models including income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.3 Gender-specific mortality

Regression estimations indicate that 1% change in the unemployment rate causes 0.33-0.37% change in mortality for female. In case of the male, a 1% decrease in unemployment results with 0.12-0.15% increase in mortality. The income control is not statistically significant for the male. But, it is significant for female. Female estimations also exist at higher confidence levels as being 99% confidence interval than estimations for the male they are at as 95% or 90% confidence interval level.

Table 5

Estimated macroeconomic effects on gender-specific total mortality rates

	All Causes Female			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00331*** (.00087)	-.00372*** (.00080)	-.00318*** (.00087)	-.00358*** (.00081)
Natural Log of income			.08760*** (.02341)	-.09442** (.04606)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	All Causes Male			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00122* (.00067)	-.00155** (.00063)	-.00123* (.00068)	-.00142** (.00062)
Natural Log of income			.02404 (.01998)	-.05218 (.03335)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 601 for models including income and 598 for models excluding income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.4 Gender and cause-specific mortality

In this section, cause-specific mortality rates are examined by subgroups as gender since the mortality rates show variation between the two sexes.

3.4.1 Malignant Neoplasm

The estimated result implies that the coefficient of the unemployment rate is negative when country-specific time trends are included in the model for female and it is statistically significant. On the other hand, the same specification (b) for male, is not statistically significant. However, both have negative coefficients. Income variable is significant only if within country time trends are excluded. In that case, coefficients of income are positive. Moreover, when time trends are excluded, and income is not a control variable, the coefficients are positive. This situation is statistically significant only for male mortality.

Table 6

Estimated macroeconomic effects on gender and cause specific mortality rates

	Malignant Neoplasm (Cancer) Female			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00022 (.00059)	-.00190*** (.00064)	.00026 (.00059)	-.00180*** (.00064)
Natural Log of income			.07235*** (.01970)	-.01204 (.03342)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Malignant Neoplasm (Cancer) Male			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00433*** (.00085)	-.00027 (.00072)	.00432*** (.00086)	-.00017 (.00072)
Natural Log of income			.05547** (.02520)	-.01475 (.03755)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 601 for models including income and 598 for models excluding income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.4.2 Ischaemic Disease

An increase of 1% in unemployment increases female ischaemic disease mortality by 0.81%, indicates that this cause is procyclical. Moreover, a 1% rise in unemployment leads to a 0.74% hike in ischaemic disease mortality for the male. The results are statistically significant when time trends do not take place in the regression model. Coefficients of income are all positive and statistically significant. The relatively great difference between specification (a) and (b) are remarkable.

Table 7

Estimated macroeconomic effects on gender and cause specific mortality rates

	Ischaemic (Heart) Disease Female			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00816*** (.00223)	.00006 (.00125)	.00665** (.00213)	.00016 (.00127)
Natural Log of income			-.40240*** (.07465)	-.15877* (.09497)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Ischaemic (Heart) Disease Male			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00746*** (.00205)	.00061 (.00111)	.00599*** (.00195)	.00074 (.00113)
Natural Log of income			-.42097*** (.07020)	-.10928 (.08654)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 601 for models including income and 598 for models excluding income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.4.3 Influenza and Pneumonia

Results indicate that a 1% hike in income decreases male influenza and pneumonia by 96% while the change is 54% for female.

Table 8

Estimated macroeconomic effects on gender and cause specific mortality rates

	Influenza and Pneumonia Female			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00527 (.00517)	.00381 (.00440)	.00618 (.00532)	.00389 (.00444)
Natural Log of income			.28920* (.17309)	-.54859** (.27477)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Influenza and Pneumonia Male			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00643 (.00549)	.0060 (.00444)	.0073 (.00562)	.00611 (.00443)
Natural Log of income			.27161 (.17927)	-.96749*** (.29310)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 579 for models including income and 576 for models excluding income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.4.4 Liver disease and cirrhosis

A 1% increase in unemployment of women diminishes liver disease mortality 0.83%. While specification (a) demonstrates the impact on women stronger caused by unemployment, specification (b) shows the reflection on men stronger. A 0.36% decrease in this mortality is expected as a result of a 1% increase in male unemployment. In contrast

Table 9

Estimated macroeconomic effects on gender and cause specific mortality rates

	Chronic Liver Diseases and Cirrhosis Female			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.0083* (.00466)	-.00257 (.00262)	-.00728 (.00473)	-.00232 (.00255)
Natural Log of income			.12126 (.10274)	-.3939*** (.14095)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Chronic Liver Diseases and Cirrhosis Male			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00613 (.00440)	-.00360* (.00216)	-.00500 (.00442)	-.00320 (.00213)
Natural Log of income			.11661 (.09860)	-.15198 (.10121)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 601 for models including income and 598 for models excluding income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.4.5 Motor Vehicle accidents

The coefficient of income is estimated as positive for both genders. According to estimations, 1% increment of unemployment reduces vehicle mortality in men by 1.08%. In comparison with the previous results, it is weaker. However, considering recent researches suggesting that procyclical characteristics of mortality cause become weaker, it is not an unexpected result. In fact, Ruhm indicates that while 1% rise in the unemployment rate predicts 2.6% decrease in 1976-1995, the reduction is estimated as being 0.9% in 1991-2010 in his research (2015).

Table 10

Estimated macroeconomic effects on gender and cause specific mortality rates

	Motor Vehicle Accidents Female			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00954*** (.00271)	-.00848*** (.00290)	-.00823*** (.00271)	-.00885*** (.00276)
Natural Log of income			.22191** (.11213)	.11411 (.13270)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Motor Vehicle Accidents Male			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00986*** (.00257)	-.01080*** (.00192)	-.00884*** (.00256)	-.01097*** (.00191)
Natural Log of income			.18471** (.07292)	-.03372 (.09958)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 599 for models including income and 596 for models excluding income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicaterobust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.4.6 Other accidents

Estimations for men excluding country time trends have negative coefficients. With country time trends, coefficients for the female is greater, However, results are not statistically significant. Moreover, income control is statistically significant at 95% confidence level for both genders. 1% increase in unemployment results with a %10.1 decrease in other accidents which is a quiet high effect. The same effect regarding men is approximately half of it as being 5.3%.

Table 11

Estimated macroeconomic effects on gender and cause specific mortality rates

	Other Accidents Female			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.00350 (.00622)	.00809 (.00606)	.00445 (.00624)	.00882 (.00604)
Natural Log of income			.00863 (.16612)	-1.01519** (.3977
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Other Accidents Male			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00194 (.00428)	.00574 (.00419)	-.00084 (.00434)	.00638 (.00424)
Natural Log of income			.26213** (.12674)	-.53562** (.26798
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 599 for models including income and 596 for models excluding income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.4.7 Intentional self-harm

All estimations show statistical significance at the 99% confidence interval. Results suggest that when there is 1% increase in unemployment rate, the number of deaths by female suicide increase 1.4 -2.2 %. Results for men, on the other hand, demonstrate that a 1% rise in unemployment rate results with 0.9-1.7% increase in the number of intentional self-harm caused deaths.

Table 12

Estimated macroeconomic effects on gender and cause specific mortality rates

	Intentional Self-harm Female			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.02297*** (.00386)	.01455*** (.00340)	.02269*** (.00386)	.01473*** (.00337)
Natural Log of income			-.34681*** (.08400)	-.46039*** (.16392)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Intentional Self-harm Male			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.01725*** (.00299)	.00981*** (.00210)	.01751*** (.00306)	.01011*** (.00212)
Natural Log of income			-.00155 (.07190)	-.04808 (.12954)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 601 for models including income and 598 for models excluding income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

3.4.8 Assault

Estimations for both genders are statistically significant at a 99% confidence interval. A one per cent increase of unemployment inclines 1.8% rise in the number of assaults for female and 1.5-1.9% addition for the male. Income control variable is also statistically significant for male-assault mortality, however, results are not significant for female. Coefficients for female is greater than it is in for male.

Table 13

Estimated macroeconomic effects on gender-specific total mortality rates

	Assault Female			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.01834*** (.00580)	.01878*** (.00761)	.0183*** (.00606)	.01891** (.00768)
Natural Log of income			.06507 (.19124)	.38424 (.40290)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes
	Assault Male			
Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	.01980*** (.00470)	.01504** (.00595)	.02088*** (.00480)	.01601*** (.00588)
Natural Log of income			.25958* (.14943)	.80051** (.32034)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	Yes	No	Yes

Note: Number of observations is 596 for models including income and 593 for models excluding income. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

Section IV Sensitivity Analysis

In this section, a sensitivity analysis applied to examine if the dataset gives rise to a change in the case of coefficients sign and magnitude. The time period is narrowed to 1996-2012 and 15 OECD countries, namely Belgium, Canada, Denmark, Finland, France, Germany, Hungary, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, United States, are informed to the regressions. The number of observations is 251 and the dataset is strongly balanced. Table14 below demonstrates the result of strongly balanced data.

Table 14

Estimated macroeconomic effects on total mortality rates

Regressor	All		Female		Male	
	(a)	(b)	(a)	(b)	(a)	(b)
Unemployment rate	-.00311*** (.00094)	'-.002641*** (.00091)	-.00312*** (.00111)	-.00245** (.00104)	'-.00322*** (.00085)	-.00294*** (.00085)
Natural Log of income		-.12176*** (.04375)		-.17022*** (.05469)		-.07168* (.03905)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Number of observations is 251. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

In comparison with results indicated in *Table 3* and *Table 5* (page 5 & 13), estimated coefficients of total mortality and standard errors are slightly enhanced for both specifications. There is not a change regarding sign, indicates that results still claim that mortality is procyclical. In addition, there are also slight changes in coefficients and standard errors for gender-specific estimations. The significance level of the male case is enhanced to a 99% confidence interval. This analysis supports that the unbalanced data set does not cause an important problem in estimations have done in this study.

In the case of income, there is a significant enhancement in coefficients. However, standard errors are worse. For the male, it becomes statistically significant. Signs of the coefficients are the same as previous ones.

On the other hand, the comparison of the estimations of different genders clarifies that inconsistency, females are more sensitive to unemployment, occurs due to the unbalanced dataset.

In addition, following analyses are conducted to examine unemployment as a macroeconomic proxy in comparison with alternative proxies.

Table 15

Estimated macroeconomic effects on total mortality rates

Regressor	Specification			
	(a)	(b)	(c)	(d)
Unemployment rate	-.00311*** (.00094)			-.00298*** (.00094)
Natural Log of income		-.14360*** (.04521)		-.12579*** (.04319)
GDP growth			'-.00075 (.00093)	-.00155 (.00095)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	Yes	Yes	Yes	Yes
	(a)	(b)	(c)	(d)
Unemployment rate	-.00264*** (.00091)	-.00345*** (.00097)	-.14872*** (.04528)	-.00074 (.00090)
Natural Log of income	-.12176*** (.04375)			
GDP growth		-.00150 (.00095)	-.00094 (.00093)	.00220* (.00120)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	Yes	Yes	Yes	No
	(a)	(b)	(c)	(d)
Unemployment rate	-.00087 (.00089)			-.00083 (.00088)
Natural Log of income		.05620** (.02600)		.04735* (.02520)
GDP growth			.00239** (.00113)	.00202* (.00116)
Control variables	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Country-specific time trends	No	No	No	No

Note: Number of observations is 251, 251, 249. The dependent variable is natural logarithm of the total mortality rate. All observations are weighted by the country population's square root. Parantheses indicate robust standard errors (*p<0.1, **p<0.05, ***p<0.01)

Section V. Discussion

5.1 Total and cause-specific mortality

The estimations for total mortality, shown in *Table.3*, may be relatively seen as a reflection of the discussion in the literature showing that a regression model controlling fixed-effects are able to change the condition of aggregated macroeconomic proxy's position regarding mortality. Mortality demonstrates a countercyclical association with unemployment without fixed-effects. Results of regressions including year and control variables supports criticisms for Brenners' analyses regarding that estimations are biased due to selection of country and time period, and frequent correlation between unemployment and better health by Gravaelle et al. (1981), Stern (1983), Wagstaff (1985), and Cook and Zarkin (1986) as mentioned Ruhm (2000). He also underlines that the difference of countries' economic development levels leads a variation in case of health level. For instance, the technological opportunities may vary between different countries. This situation explains how estimation results with showing procyclical relationship when fixed-effects are handled by the equation. Specification (a) on the top section of *Table.3* simply indicates that mortality is countercyclical implying that unemployment rise causes an increase in mortality rate since explanatory variable has a positive coefficient and it is statistically significant. Adding control variables causes a decreasing change in confidence level but does not affect the sign of the coefficient (specification (b)). However, the coefficient of the joblessness becomes negative indicating that a rise in unemployment rate results with a decrease in mortality when country effects are added while year effects and fixed-effects have been kept in the model. Addition of time trends slightly reduces standard error and enhances the model (specification (d)). Specifications in this table also highlight that the results are sensitive to the fixed-effects and time trends of

countries. The income coefficient in the specification (d) is negative and statistically significant, which is in accord with Gerdtham and Ruhm's estimation by implying mortality is procyclical (2006). However, the coefficients for both unemployment and income in this study is less than they found under the same model by their dataset.

5.2 Gender-specific mortality

In the case of gender-specific age-standardized mortality results, both genders indicate that unemployment has a positive impact on the mortality rate by decreasing it, which is consistent with Ruhm's argument (2000). However, in contrast to the literature findings, female mortality indicates that the relationship with unemployment is stronger than the relationship of men, which does not fit in findings in the literature (Grigoriev et al. 2012). The result seems inconsistent by considering male population takes more place on business life since men are found more fragile to macroeconomic effects as generally being employed in private sector in which unemployment is doomed to be more unstable (Riva et al, 2011). The sensitivity analysis, which takes place after the results part, indicates that a problem may exist due to the unbalanced data set. Results in sensitivity analysis alter this finding, and it is consistent with results in the previous studies. Thus, this is almost a warning to be aware of that unbalanced dataset may cause misleading results.

The income control shows that an increase in income causes an increase in mortality for female while country-specific time trend is also included in the model with all other controls and fixed effects. The coefficient of income also shows that mortality is countercyclical for men.

5.3 Cause and gender-specific mortality

For male, results for causes regarding male; malignant neoplasm, ischaemic disease, motor vehicle accidents, and intentional self-harm are statistically significant when the model excludes country-specific time trends, and chronic liver disease and cirrhosis, motor vehicle accidents, suicide, and assault are statistically significant when country time trend is included in the model. For the female, ischaemic heart disease, liver disease and cirrhosis, motor vehicle accident, intentional self-harm, and assault mortality rates are statistically significant for the model without country time trends. The model with time trends indicates that there is statistical significance for the estimation results of causes of malignant neoplasm, motor vehicle accidents, intentional self-harm, and assault. Ischaemic heart disease demonstrates statistical meaning only without the country-specific time trend for both genders. Moreover, estimations do not show any significant impact of the macroeconomic situation on influenza and pneumonia, and other accidents caused deaths.

Discussion regarding gender-specific results as sub-grouped by causes is at the following.

5.3.1 Malignant neoplasm (Cancer)

The effect of unemployment on malignant neoplasm deaths stronger for men than it is for women. Model controlling for fixed effects, year effect, country effects and country time trends, indicates that malignant neoplasm mortality increases in good economic condition. Without country time trends, coefficients demonstrate an opposite impact on this mortality. However, as mortality of cancer relatively linked to having cancer, Chawińska et al (2013) reports that poor economic conditions cause an increase in the number of cancer diseases in men and there are not statistically significant findings for women in the society. On the other

hand, Dr Mahiben Maruthappu (2016) draws attention to that in the past, rises in unemployment was linked to increased cancer mortality but the situation is different nowadays due to universal health coverage indicating that mortality is always not the result of cancer diseases (2016). It may be relatively possible to comment on the fact that malignant neoplasm mortality of female is significant with country-time specific trends due to the fact that health care projects in countries may differ by time, for instance, breast cancer rates are decreased by time thanks to researches and developments such as screening mammography and improved treatment protocols in this field (Narod et al, 2015). Moreover, the income controls also show a stronger effect on male-specific malignant neoplasm mortality, but results are not significant including a time trend within country control.

5.3.2 Ischaemic disease (Heart disease)

The only significant results belong to the models which do not include a country time trend control in case of the ischaemic heart disease mortality. Ischaemic disease mortality is countercyclical, which is not parallel to the results in the literature (Gerdtham and Ruhm, 2006). On the other hand, estimations support Brenner's argument that unemployment is an important factor on both genders and its behaviour is symmetric to economics condition in which increased unemployment rate results with increased ischaemic disease mortality (2016). Gender difference in ischaemic disease is ambiguous and sensitive to taking country-specific time trends into account. Model excluding time trends indicates that female shows a stronger relationship with unemployment.

5.3.3 Influenza and Pneumonia

The analyses do not indicate that there is a statistically significant relationship between Influenza and Pneumonia by gender subgroups. For both genders, estimations suggest mortality caused by influenza and pneumonia is countercyclical. Income controls also demonstrate that better macroeconomic conditions lead to decrease in influenza and pneumonia caused mortality rate. There is a high difference in the case of income of the different genders; demonstrating that men are more affected by income.

5.3.4 Liver disease and cirrhosis

Only statistically significant estimation for female liver disease exist in the model without time trends and indicates disease mortality is procyclical. Neumayer's finding, indicating there are no significant results for both genders and positive coefficients of estimations demonstrate countercyclical behaviour, this study claims that the behaviour of this cause is procyclical supporting a more recent research in case of total cause-specific mortality results (Neumayer, 2004; Gerdtham and Ruhm,2006).

5.3.5. Motor vehicle accidents

In case of being procyclical, there is not a gender disparity in motor vehicle mortality. Estimations all indicate that it is procyclical in accord with the literature (Neumayer, 2004; Gertham and Ruhm, 2006; French and Gumus, 2014). The effect of unemployment on motor vehicle accidents caused death is stronger for male than it is for female as performing a contradictory behaviour against Neumayer's study, on the other hand, it is parallel with Gerdtham and Ruhm' results. results are consistent with literature since short-term

macroeconomic growth keeps its strong symmetric association with motor vehicle mortalities (He, 2016).

5.3.6 Other accidents

Since estimations of fatal non-transport accidents started to show insignificantly positive coefficients after 1987, results of both gender estimations are consistent with previous studies (Ruhm, 2015).

5.3.7 Intentional self-harm

Results regarding sex-specific intentional self-harm are in accord with the previous researches by indicating that both genders show a countercyclical pattern (Gerdtham and Ruhm, 2016). However, in case of differences between genders, there is a contradictory situation in comparison with the previous studies. Many researchers declared opposite way results by saying that men are more sensitive to unemployment than women and/or existence of a causal relationship regarding women does not exist or it is weaker than it is in case of men (Wu and Cheng, 2010). These results bring us with the question whether there is a change regarding sex-specific intentional self-harm deaths lately. Considering women prefer to take place in business life, and previous researches generally examined older period than it is used in this study, it may be possible that there is a change in case of suicide. Adding income control to the estimation also supports that good economic condition helps to reduce the number of suicides. However, income control does not have statistical significance for the case of the male.

5.3.8 Assault

In accord with results with intentional self-harm, in the assault case, female shows more sensitivity to unemployment for assault-cause deaths. However, depending on the sensitivity analysis, it is possible that there may be a misleading result due to the unbalanced dataset.

Conclusion

Estimations used to go through the association between business cycles and mortality are seriously influenced by method choice. One of the main contributions of this study that the organization of model specifications stress how this relationship is fragile regarding controls in regression by indicating coefficient sign changes depending on specification. Moreover, mortality as total, gender-specific, cause-specific, and cause and gender-specific, is examined to understand whether their behaviour is symmetric or asymmetric regarding business cycles. Estimations support that total mortality is procyclical. Suicide, on the other hand, still shows a strong countercyclical aspect in accord with all researches. The study also supports recent claims that procyclical relation becomes weaker for some causes of mortality since the magnitude of coefficients is smaller in comparison with previous researches.

References

Barik D., Deasi S.,Vanneman R., 2017. World Development 103 (2018) 176–187

Brenner, M. (1971). Economic changes and heart disease mortality. *Am J Public Health*, 61(3), pp.606-611.

Brenner, M. H., 1976. 'Estimating the social costs of national economic policy: implications for mental and physical health, and criminal aggression', Joint Economic Committee of Congress Paper No. 5. Washington, DC: US Government Printing Office.

Brenner, M. H., 1980. 'Industrialization and economic growth: estimates of their effects on the health of populations', in M. H. Brenner, A. Mooney and T. J. Nagy (eds), Assessing the Contributions of the Social Sciences to Health. Boulder, CO: Westview Press/AAAS, 65–115.

Bunn, A. R., 1980. 'I[schemic]H[eart]D[isease] mortality and the business cycle in Australia [letter]', American Journal of Public Health 70(4), 410–414.

Brenner, M. Harvey (1987). Economic change, alcohol consumption and heart disease mortality in nine industrialized countries. *Social Science & Medicine*, 25(2), pp.119-132.

Brenner, M. H., 1993. 'Health and the national economy', Research in Human Capital and Development 7, 369–391.

Brenner, M. H., 1995. 'Political economy and health', in B. C. Amick, S. Levine, A. R. Tarlov and D. C. Walsh (eds), Society and Health. New York: Oxford University Press, 211–246.

Brock A., Griffiths, C. and Rooney, C. (2004). The effect of the introduction of ICD-10 on cancer mortality trends in England and Wales. *Health Statistics Quarterly,* 23, pp. 7–

Bunn, A. R., 1979. 'Ischaemic heart disease mortality and the business cycle in Australia', American Journal of Public Health 69, 772–781.

Catalano, R., Goldman-Mellor, S., Saxton, K., Margerison-Zilko, C., Subbaraman, M., LeWinn, K., Anderson, E., 2011. The health effects of economic decline. Annu. Rev. Public Health 32 (1), 431e450.

Cook, Philip J. and Zarkin, Gary A. (1985). Crime and the Business Cycle. *Journal of Legal Studies*, 14(1), pp. 115-128

Cook, P. and Zarkin, G. (1986). Homicide and economic conditions: A replication and critique of M. Harvey Brenner's new report to the U.S. Congress. *Journal of Quantitative Criminology*, 2(1), pp.69-80.

Economou, A., Nikolaou, A. and Theodossiou, I. (2008). Are recessions harmful to health after all?. *Journal of Economic Studies*, 35(5), pp.368-384.

European health for all database (HFA-DB) World Health Organization Regional Office for Europe. http://data.euro.who.int/hfadb/

Freeman, D. G., 1999. 'A note on [Ruhm's] 'Economic conditions and alcohol problems', Journal of Health Economics 18, 661–670.

French, M., Gumus, G., 2014. Macroeconomic Fluctuations and Motorcycle Fatalities in the U.S. Social Science & Medicine, vol. 104, pp. 187e193.

Gerdtham, U. and Johannesson, M. (2005). Business cycles and mortality: results from Swedish microdata. *Social Science & Medicine*, 60(1), pp.205-218.

Gerdtham, U. and Ruhm, C. (2006). Deaths rise in good economic times: Evidence from the OECD. *Economics & Human Biology*, 4(3), pp.298-316.

Gravelle, H., Hutchinson, G. and Stern, J. (1981). Mortality and Unemployment: A Critique of Brenner's Time-series Analysis. *The Lancet*, 318(8248), pp.675-679.

Griffiths, C., Brock, A. and Rooney, C. (2004) The impact of introducing ICD-10 on trends in mortality from circulatory diseases in England and Wales. *Health Statistics Quarterly* 22, pp. 14–20.

Grigoriev, P., Doblhammer-Reiter, G., Shkolnikov, V. (2012). Trends, patterns, and determinants of regional mortality in Belarus, 1990-2007. Population Studies, 2013 Vol. 67, No. 1, 61-81.

He, Monica M.(2016) Driving through the Great Recession: Why does motor vehicle fatality decrease when the economy slows down? University of Pennsylvania, Population Studies Center, USA

Hernández-Murillo R., Martinek C. J., (2010) Mortality Rates and the Business Cycle. Economic SYNOPSES short essays and reports on the economic issues of the day 35.

Hexter, M. B., 1925. Social Consequences of Business Cycles. Hougton Mifflin, Boston, MA.

Joyce, T., Mocan, N., 1993. "Unemployment and Infant Health: Time-Series Evidence from the State of Tennessee," Journal of Human Resources, University of Wisconsin Press, vol. 28(1), pages 185-203.

Marihappu, M., 2016 . Unemployment and austerity 'increases cancer mortality, The Guardian, retrived from https://www.theguardian.com/society/2016/may/25/cancer-mortality-unemployment-austerity

McAvinchey, I. D., 1984. 'Economic factors and mortality: some aspects of the Scottish case 1950–1978', Scottish Journal of Political Economy 31, 1–27.

Neumayer, E. (2004). Recessions lower (some) mortality rates: evidence from Germany. *Social Science & Medicine*, 58(6), pp.1037-1047.

Narod, S. A., Iqbal, J., Miller, A. B., (2015). Why have breast cancer mortality rates declined? Journal of Cancer Policy 5 (2015) 8–17

OECD, Main Economic Indicators – Sources and definitions. http://stats.oecd.org/mei/default.asp?lang=e&subject=10 Accessed 28.05.2015

OECD Health Statistics 2018 June 2018. http://www.oecd.org/health/healthdata.

Ogburn W. F.,Thomas D. S., (1922). The Influence of the Business Cycle on Certain Social Conditions . Journal of the American Statistical Association, Vol. 18, No. 139 pp. 324-340

Riva, M., Bambra, C., Easton, S. and Curtis, S. (2010). Hard times or good times? Inequalities in the health effects of economic change. *International Journal of Public Health*, 56(1), pp.3-5.

Ruhm, C.J., 1995. Economic conditions and alcohol problems. Journal of Health Eco- nomics 14 (5), 583–603.

Ruhm, C. (2000). Are Recessions Good for Your Health?. *The Quarterly Journal of Economics*, 115(2), pp.617-650.

Ruhm, C. and Black, W. (2002). Does drinking really decrease in bad times?. *Journal of Health Economics*, 21(4), pp.659-678.

Ruhm, C. (2003). Good times make you sick. *Journal of Health Economics*, 22(4), pp.637-658.

Ruhm , C. (2004). Macroeconomic Conditions, Health and Mortality. National Bureau of Economic Research Working Paper Series, Dec. 2004, No. 11007. Made available courtesy of National Bureau of Economic Research: http://www.nber.org/

Ruhm, C. (2005). Healthy living in hard times. *Journal of Health Economics*, 24(2), pp.341-363.

Ruhm, C. (2006). Macroeconomic Conditions, Health and Government Policy. National Poverty Center Working Paper Series. #06-26. July, 2006, pp. 1-31.

Ruhm, C. (2007). A healthy economy can break your heart. *Demography*, 44(4), pp.829-848.
Ruhm, C. (2015). Recessions, healthy no more?. *Journal of Health Economics*, 42, pp.17-28.

Ruhm, C.J., 2008. Macroeconomic conditions, health and government policy. In: Schoeni, R., House, J., Kaplan, G., Pollack, H. (Eds.), Making Americans Healthier: Social and Economic Policy as Health Policy. Russell Sage, New York.

Ruhm, C.J., 2015. Recessions, healthy no more?. Journal of Health Economics 42 17-28

Stern, J., 1983. The relationship between Unemployment, Morbidity, and Mortality in Britain, Population Studies, XXXVII, 61-74

Stock, J. and Watson, M. (1998). Business Cycle Fluctuations in U.S. Macroeconomic Time Series. National Bureau of Economic Research Working Paper Series, April 1998, No. 6538.

Tekin, Erdal, McClellan, Chandler, Jean Minyard, Karen, 2013. Health and health behaviors during the worst of times: evidence from the great recession. In: NBER Working Paper No. 19234.

Tapia- Granados, J. (2005). Recessions and Mortality in Spain, 1980–1997. *Eur J Population*, 21(4), pp.393-422.

Wagenaar, A. (1984). Effects of macroeconomic conditions on the incidence of motor vehicle accidents. *Accident Analysis & Prevention*, 16(3), pp.191-205.

Wagstaff, A. (1985). Time series analysis of the relationship between unemployment and mortality: A survey of econometric critiques and replications of Brenner's studies. *Social Science & Medicine*, 21(9), pp.985-996.

Watkins, S., 1985. 'Recession and health: a literature review', in G. Wescott, P.-G. Svensson and H. F. K. Zo¨lner (eds), Health Policy Implications of Unemployment. Copenhagen: World Health Organization Regional Office for Europe.

Wu, W., Cheng H. (2010). Symmetric mortality and asymmetric suicide cycles. Social Science & Medicine 70 (2010) 1974e1981