

Relationship between mortality and financial crisis. The case of Greece

Dimitrios DAPONTAS
University of Peloponnese, Greece
dapontas@uop.gr

Abstract. *This manuscript is presenting the facts of crisis in Greece and especially the mortality raises. Using a set of seven variables proposed by earlier authors (Alcohol and tobacco consumption, crisis(lagged) and unemployment(lagged), Number of heart attacks and suicide attempts and health expenditure per capita) respectively. Under an exact statistic method (Robust Least Squares) for a 38-year period (1979-2016). The results show that six variables had positive relation to mortality but the effect of the two lagged variables needed one year to show. Health expenditure per capita cuts had the expected negative effect.*

Keywords: crisis, health expenditure, mortality, unemployment.

JEL Classification: I18, G41, F34.

Introduction

The present work is presenting the rapport between the financial crisis and mortality in Greece. How the turbulence conditions affected Greek habitant's well-being? Has mortality been elevated because of the crisis? Health spending per capita decrease has been important factor and why? And finally has the tobacco and alcohol consumption rise had affect due to economic crunch and mortality? When possible crisis and unemployment consequences affect mortality and how? The paper is stated as follows: On the first part research questions and a brief introduction is placed. Second part present the established literature on the field and its extensions. Methodology is presented on the third sector. The results are presented on the fourth share. Finally, the last part presents research conclusions as long as further quest proposals.

Past works

The country that concentrated the most interest during the decades of 80's and 90's on the field of financial crises was Mexico having a rich and fascinating history of turbulences. Thus, the link between crises and public health became clear under the proposed framework Cutler, Knaul, Lozano et al. (2002), where vulnerable ages (children and elderly) were recognized as the main victims of the country's mortality increase, along with the considered factor of women rising share to the labor force. The more working women lead to less caring and higher loss of life. Child health has been focused also on a latter work Paxon and Schady (2005) for the same period. They concluded that the collapse in the public sector finance has increased infant mortality in a set of countries under examination.

Asian crisis has also been under consideration on social policy and possible financial crisis. In any under examination country the expenditure cut was as expected a negative factor but on the same way or without possible lags due to dynamic character of these policies Holiday (2005) for the case of Indonesia and Waters, Saddah and Pradhan (2003), where devaluation of national currency was extremely high, both healthcare incidents and reports were reduced in contrast to the compared Thailand. Thus, there is no clear evidence on this major question out of Asian crisis facts.

On the global credit crunch of 2008 and its aftermath rich and recent reference findings are presented. In an early bird work Stuckler and Basu (2009) are presenting the economic crisis mainly as an unemployment effect and its mortality side along to the government intervention. They concluded that percentage change to unemployment had greater effect to the suicides while labor increase policies didn't have the expected positive remedy level. In a proximate work Stuckler and Basu, Suhrcke et al. (2011) have returned engaging more detailed analysis consider major lag between crisis and its effects to unemployment and public health. Eastern European response to 2008 crisis compared to the established facts of the earlier rubble crisis (1997) has been presented on Arinaminpathy and Dye (2010) where possible upturn to raised tuberculosis mortality has been noticed for both periods. The case of Spain is presented on a latter work Gili, Roca, Basu et al. (2012) present the rise in major depression, anxiety, somatoform and alcohol dependence was really high. The case of Greece has raised interest when the crisis was spread. For the case of Greece an

early research Kentikelenis, Karanikolos, Papanikolas et al. (2011) name the Greek situation as concerning. The budget cuts make inhabitants to lose the access to care and preventive services and mortality raised. Simou and Koutsogeorgou (2013), present the effects of the economic crises to the healthcare. The Greek government had practiced successive cut expenditures for health from 2009 to 2013 they set as alarming issue the number of suicides, the mortality has been stable due to reduce of traffic accidents mortality rate.

Sample, methodology, variables and results

We have deployed the mortality (rate of deaths out of 1,000) for Greece in an annual frequency for a 38 years period (1979-2016) as given by Greek Statistic Authority (EL. STAT.). Possible vectors are delivered of the past literature suggestions as presented on the previous part.

Alcohol: Variable refers to alcohol consumption per capita both recorded and unrecorded as given by WHO (World Health Organization) statistics. As expected a larger alcohol consumption leads to higher mortality and vice versa.

Tobacco: Variable refers to cigarette or other forms of tobacco consumption per capita under the Tobacco Atlas and WHO framework. Tobacco dependence and consumption have been increased both in the case of Greece as Dapontas (2016) states. A possible raise to tobacco consumption is expected to lead to increased mortality.

Crisis: Rich literature has been deployed over the definition of “crisis” for a country. Under recent research by Dapontas (2014) it’s a possible national currency decline against an international currency (USD for this case) of 10% over a month or 25% over a quarter period. Alternatively, under a free floating or a possible bonding scheme, the criterion is a 25% deployment to the country’s international reserves or an interest rate raise over than 25% for month’s period as defined by Dapontas (2012). The authors used a binary nominal model which gets the value (0) when there is no crisis and (1) for periods of turbulence. Mortality is expected to raise during crises.

Health expenditure as percentage of GDP: Is the final consumption under the OECD definition where both spending on health and pharmaceutical sources is presented. For the calculation of the GDP possible deflators are used based on national methodologies. OECD and National Statistical Office are the sources for this series. We expect a negative link between mortality and the variable because higher financing would lead to deadliness decrease.

Heart: The variable refers to number of reported cardiovascular and ischemic and stroke per year provided by European Heart Network and Hellenic society of cardiology. The higher number of these incidents, even though there are not only fatal, leads to higher mortality in the short or long term. Thus, we expect positive relationship.

Suicides: number of suicide attempts recorded is a mental health rate for a country. In our case data provided by WHO and national statistical office for number of attempts over 100,000 habitants. We expect positive intercourse between mortality and suicide attempts.

Unemployment: Is the percentage of people of working age who actively seek employment and they cannot find one. Data given by ILO and Employment organization of Greece. Unemployment has major negative effect on sacked person's mental and physical health. We expect positive relation between unemployment and mortality.

We used EVIEWS™ statistical package for the data process. Under the framework of the given literature we assume that the effect of both crisis and unemployment is dynamic. A VAR model have to be used to explain the optimal lag between discharge, crisis and the mortality. Through VAR we could explain the endogenous character of each variable and its role as lagged variable. Model lays as follows:

$$y_t = A_1 y_{t-1} + \dots + A_n y_t + B_1 X_1 + e_t$$

Where y_t is a k vector of dependent variable, x_i is a d vector of independent variables, A and B are matrices of coefficients to be estimated and e_t is an innovative vector remained uncorrected for both all values. We will have to determine the maximum lags. Due to data annual frequency we choose to let a small number of lags (2) as suggested by Gutierrez, Souza, Texeira (2007). The number of lags is given by a set of possible criteria:

- Sequential modified LR testing (LR).
- Final Prediction Error (FPE).
- Akaike Information Criterion (AIC).
- Schwartz Information Criterion (SC).
- Hannan- Quinn information Criterion (HQ).

The lags are determined by the maximum number of criteria implemented. The full lag length analysis is given in the appendix. For both variables under all criteria, the optimal lag was one year before the mortality raise.

The data nature leads to possible unconventional regression modes because established methods cannot lead to a clear relationship among the variables. An exact method is suitable to get more than parametric or non-parametric methods. Robust least squares (RLS) is one of them which is less sensitive to datasets outliers. This method is also adjustable and flexible under a variety of regression methods. A variety of methods can be described as robust. Among them we select the classic M – estimation introduced by Huber (1973). The method has to do with regressors' differing significantly from the model pattern.

Every least squares (LS) method aims to minimize possible residuals sum:

$$\hat{\beta}_{LS} = \underset{\beta}{\operatorname{argmin}} \sum_{t=1} r_t(\beta)^2$$

Residual function is given by:

$$r_t(\beta) = r_i - X_i' \beta$$

M function aims to minimize the weight of possible residuals function ρ :

$$\widehat{\beta}_M = \operatorname{argmin}_{\beta} \sum_{i=1}^N \rho_c \left(\frac{r_i(\beta)}{\sigma w_i} \right)$$

Where σ is the residuals scale, c is a tuning constant determined by chosen function and w_i refer to weights and its minimized to 1. The ρ function is set to Cauchy distribution which is similar to normal distribution but with heavier tails. Provided that data sensitivity gets higher and possible findings are robustized this distribution is selected. Its constant is $c = 2.385$.

$$\left(\frac{c^2}{2} \right) \log \left(1 + \left(\frac{X}{c} \right)^2 \right)$$

With the scale σ known k first non- linear equations can be found in order to achieve $\widehat{\beta}_M$ standardization.

$$\sum_{i=1}^N \psi_c \left(\frac{r_i(\beta)}{\sigma w_i} \right) \frac{x_{ij}}{w_i} = 0 \quad j = 1, \dots, k$$

Where $\psi_c(.) = \rho_c(.)$ The derivative of the ρ_c function and the value of j regression x_{ij} . The initially unknown σ can be found under the Huber method that escalated the old estimation to a new scale estimator of $\widehat{\beta}_M^{(s-1)}$ to an updated scale $\widehat{\sigma}^{(2)}$:

$$\widehat{\sigma}^{(s)} = \sqrt{\frac{1}{hN} (\widehat{\sigma}^{(j-1)})^2 \sum_{i=1}^N N \xi \left(\frac{r_i^{(s-1)}}{\widehat{\sigma}^{(s-1)}} \right)}$$

Where $\xi(v) = \min \left(\frac{v^2}{2}, \frac{2.5^2}{2} \right)$ $h=0.48878$ N

R squared can be found:

$$R^2 = \frac{\sum_{i=1}^N \rho_c \left(\frac{y_i - \tilde{\mu}}{\widehat{\sigma} w_i} \right) - \sum_{i=1}^N \rho_c \left(\frac{\hat{r}_i}{\widehat{\sigma} w_i} \right)}{\sum_{i=1}^N \rho_c \left(\frac{y_i - \tilde{\mu}}{\widehat{\sigma} w_i} \right)}$$

Where $\tilde{\mu}$ is the M estimate from the constant only specification.

The results are shown on the table below where important variables are highlighted and their coefficient is presented to the right column:

Table 1. Robust least squares results

Variable	Coefficient
Constant	78.328
Alcohol	3.2587
Crisis	-0.0049
Crisis (-1)	3.4805
Health Expend.	-7.222
Heart	0.0004

<i>Variable</i>	<i>Coefficient</i>
Suicides	2.3485
Tobacco	0.0006
Unemp.	-0.4312
Unemp. (-1)	0.1645
R-squared	0.8811

Results show that seven variables are important and with the expected sign. Alcohol and tobacco consumption raise are connected to fatality increase. Suicides attempts and heart attack incidents increase have also positive effect. The most important effect has to do with crisis and unemployment. One period lagged crisis is important and positive which means that crisis effects are delayed for one year seem to have significant effect on mortality. On the other hand, both variables on present time have negative sign but they are not significant. A very large determination is noted (0.8811) showing a strong relationship between mortality and proposed variables. The present situation of unemployment and crisis seem to be unimportant in terms of mortality. This is explained on uncertainty

Conclusions and further research proposals

In the present work we considered the mortality during economic crisis under the examination of a set of proposed by earlier works variables for the case of Greece. The fact that the crisis and unemployment effect is shown a year latter result that possible analysis of the negative consequences of the crisis needs time and correlation to further variables more related to health such as number of heart attacks which had also positive effect to mortality and suicides attempts who can be named as the expression of mental illness raise during turbulences. The tobacco and alcohol consumption have been increased during crisis and its raise boosted also mortality. The most interesting fact even though it had been noticed earlier was the health expenditure decrease due to government and private finance cuts. The large effect of them can be a policy lesson for all governments where the remedy of the possible crisis victims is critical for them, instead of guiding them to less health care providing.

A researcher could investigate the possible effect of the expansive policies as a remedy in the long term to mortality for example in 5-10 years for the same country and he could compare possible results. Also, doubtful can be the implication of the austerity measures to tobacco and alcohol consumption long term effect at the end of crisis. The possible successful policies which guide to redress can and should always be a lesson for policy makers and economic and academic scholars. The discussion on the aftermath of a possible crisis could last until the next occurs or stable and fast policies are deployed.

References

- Arinaminpathy, N. and Dye, C., 2010. Health in financial crises: economic recession and tuberculosis in Central and Eastern Europe, The Royal Society on line, pp. 1-9.
- Cutler, D., Knaul, F., Lozano, R., Mendez O. and Zurita B., 2002. Financial crisis, health outcomes and aging: Mexico in the 1980s and 1990s, *Journal of Public Economics*, Vol. 84, Issue 2, May, pp. 279-303.
- Dapontas, D., 2012. Were the crises in Eurozone countries predictable? "Ovidius" university Annals Economic Sciences Series. Vol. XII issue 2/2012. pp. 43-49
- Dapontas, D., 2014. The Argentinian peso crisis. *Stiințe Economice*, University of Iasi Romania. 61 (2), 2014, 149-159 DOI 10.2478/aicue-2, pp. 014-0011.
- Dapontas, D., 2016. Smoking dependence during economic crisis the case of Greece, *International Journal of Advances in Management and Economics (IJAME)*. July-August 2016, Vol. 5, Issue 4, pp. 18-21.
- Gili, M., Roca, M., Basu, S. et al., 2012. The mental health risks of economic crisis in Spain: evidence from primary care centers, 2006 and 2010. *European Journal of Public Health*, Vol. 23, Issue 1, pp. 103-108.
- Gutierrez, C.E.C., Souza, R.C., Texeira, O. et al., 2007. Selection of Optimal Lag Length in Cointegrated VAR Models with Weak Form of Common Cyclical Features, Working Papers Series 139, Central Bank of Brazil, Research Department.
- Holliday, I., 2005. East Asian social policy in the wake of the financial crisis: farewell to productivism? *Policy & Politics*, vol. 33, no. 1, pp. 145-162.
- Huber, P., 1973. Robust regression, asymptotics, conjectures and Monte Carlo, *The annals of statistics*. Vol. 1, no. 5, pp. 799-821.
- Kentikelenis, A., Karanikolos, M., Papanikolas, E. et al., 2011. Health effects of financial crisis: omens of a Greek tragedy, *The Lancet*, DOI:10.1016/S0140-6736(11)61556-0, pp.1457-1458.
- Kontaxakis, V., Papaslanis, T., Tsouvelas, G. et al., 2013. Suicide in Greece: 2001-2011, *Psychiatriki*, 24, pp. 170-174.
- Paxon, C. and Schady, R., 2005. Child Health and Economic Crisis in Peru, *The World Bank Economic Review*, Vol. 19, Issue 2, January, pp. 203-223.
- Simou, E. and Koutsogeorgou, E., 2013. Effects of the economic crisis on health and healthcare in Greece in the literature from 2009 to 2013: A systematic review. *Health link policy*, 1, pp. 111-119.
- Stuckler, D. and Basu, S., 2009. The International Monetary Fund's effects on global health: before and after the 2008 financial crisis, *Lancet*. July 25, 374(9686), pp. 315-323.
- Stuckler, D., Basu, S., Suhrcke, M. et al., 2011. Effects of the 2008 recession on health: a first look at European data, e1001020. DOI: <https://doi.org/10.1371/journal.pmed.1001020>.
- Waters, H., Saddah, F. and Pradhan, M., 2003. The impact of the 1997-98 East Asian economic crisis on health and health care in Indonesia, *Health policy and planning*, 18 (2), pp. 172-181.

Appendix. Variables optimal lags**Variable 1: Crisis**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-25.21690	NA	0.251235	1.456495	1.500481	1.471847
1	-12.83772	23.38291*	0.133528*	0.824318*	0.912291*	0.855023*
2	-12.30146	0.983140	0.137050	0.850081	0.982041	0.896139

Variable 2: Unemployment

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-120.0725	NA	48.83194	6.726247	6.770234	6.741600
1	-94.00497	49.23859*	12.13200*	5.333609*	5.421583*	5.364314*
2	-93.96187	0.079004	12.79790	5.386771	5.518731	5.432828