DISCUSSION PAPER SERIES

DP13131

THE HUMAN SIDE OF AUSTERITY: HEALTH SPENDING AND OUTCOMES DURING THE GREEK CRISIS

Roberto Perotti

MACROECONOMICS AND GROWTH and PUBLIC ECONOMICS

ISSN 0265-8003

THE HUMAN SIDE OF AUSTERITY: HEALTH SPENDING AND OUTCOMES DURING THE GREEK CRISIS

Roberto Perotti

Discussion Paper DP13131
Published 21 August 2018
Submitted 21 August 2018

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

THE HUMAN SIDE OF AUSTERITY: HEALTH SPENDING AND OUTCOMES DURING THE GREEK CRISIS

Abstract

The Greek crisis was the most severe in postwar Europe; its budget cuts were the deepest. Among the components of the budget, health spending was hit particularly hard, declining by more than one third in just five years. This paper has two goals: establish the facts about health inputs, outputs and outcomes during the Greek crisis, and explore the connection between budget cuts and health outcomes. Health spending and inputs were very high in Greece before the crisis: in several dimensions, even after the budget cuts were implemented health spending and inputs were still at or near the top of the European countries; in other cases they merely went back to the European average. Nevertheless, budget cuts so deep and so sudden are unlikely to merely cut into inefficiencies and overcapacities. I highlight several areas in which a comparative quantitative analysis suggests that budget cuts might have had an appreciable effects on the health of the population.

JEL Classification: E62, H51, I18

Keywords: Fiscal austerity, Greek crisis, Health crisis

Roberto Perotti - roberto.perotti@unibocconi.it
Bocconi University, CEPR and NBER and CEPR

Acknowledgements
Department of Economics, Bocconi University, CEPR and NBER. Email: roberto.perotti@unibocconi.it. Website: rp.rperotti.com. I thank Luca Gagliardone for excellent research assistance and Jerome Adda, Paolo de Santis, and seminar participants at Oxford University for comments.

The human side of austerity: health spending and outcomes during the Greek crisis

Roberto Perotti*

This version: August 1, 2018

First version: November 5, 2017

Abstract

The Greek crisis was the most severe in postwar Europe; its budget cuts were the deepest. Among the components of the budget, health spending was hit particularly hard, declining by more than one third in just five years. This paper has two goals: establish the facts about health inputs, outputs and outcomes during the Greek crisis, and explore the connection between budget cuts and health outcomes. Health spending and inputs were very high in Greece before the crisis: in several dimensions, even after the budget cuts were implemented health spending and inputs were still at or near the top of the European countries; in other cases they merely went back to the European average. Nevertheless, budget cuts so deep and so sudden are unlikely to merely cut into inefficiencies and overcapacities. I highlight several areas in which a comparative quantitative analysis suggests that budget cuts might have had an appreciable effects on the health of the population.

JEL codes: E62, H51, I18.
Keywords: "Fiscal austerity", "Greek crisis", "Health crisis".

---

* Department of Economics, Bocconi University, CEPR and NBER. Email: roberto.perotti@unibocconi.it. Website: rp.rperotti.com. I thank Luca Gagliardone for excellent research assistance and Jerome Adda, Paolo de Santis, and seminar participants at Oxford University for comments.

1 INTRODUCTION

The economic crisis of the last decade in Greece has been the deepest of post-war Europe. The recession started in 2008, followed by a major fiscal retrenchment that started in 2010 and led, by 2014, to an increase in the cyclically adjusted primary surplus of almost 20 percentage points of GDP. While the large academic literature on "fiscal austerity" has focused on a variety of macroeconomic variables, during the Greek crisis scores of articles in newspapers, periodicals, and internet blogs have focused on developments in several socio-economic dimensions, foremost among them the health system and outcomes. There is a reason: by 2014 real health spending per capita in Greece had fallen by 44 percent relative to 2010, a decline that has no comparison with any episode of fiscal austerity in post-war Europe: the next largest decline was in Portugal in 2011-13, by 16 percent.

Understandably given the depth of the crisis and of the budget cuts, the debate on health in Greece has often assumed strongly partisan dimensions. In fact, in the context of this diverse literature on the Greek crisis, it is not uncommon to encounter expressions like "tragedy", "collapse", "humanitarian crisis", "meltdown" when referring to the health system and health outcomes[1]. The first goal of this paper is to ascertain the basic facts on health policy and outcomes during the Greek crisis and the associated episode of fiscal austerity.

Systematic investigations on this issue are few and far between.[2] While informative, they also suffer from several drawbacks. They are often selective in the indicators and in the time frame they use, typically pointing out the deterioration of *some* conditions or cause of mortality over *some* periods of time. They rely on partial, unofficial or journalistic figures when trying to reconstruct the budget of the health system, often drawing attention to the reduction in outlays for *some* specific functions. They virtually never try to put the events in Greece in a comparative perspective, the only method to gather an idea of the depth of the crisis and its effects on health. When they do, they often cite the low *levels* of some health policy or outcome indicator relative to other countries as an illustration of the effects of budget cuts.

A quantitative, comparative approach is also the only method to make some progress on the issue of causality: if indeed there was a deterioration in health outcomes, were the budget cuts responsible for this or was it the result of the deep recession? Of course, recession and budget cuts are not necessarily unrelated: a large literature makes the point that the latter *caused* the former. While with the available macro data it is difficult to disentangle convincingly the role of the two factors, a comparative approach, coupled with fact that the recession started two to three years before the budget cuts, can offer some tentative conclusions on at least some issues. This is the second goal of this paper.

I first show that, on many dimensions, before the crisis health spending and inputs were very high in Greece relative to the rest of Europe. At the outset of the crisis Greece had the highest spending on pharmaceuticals per capita of all European countries (and by far the highest rate of antimicrobial resistance), the highest density of hospital and of specialist doctors, and the highest number of surgical

[1] "Tragedy": Kentikelenis et al. (2011), Bonovas and Nikolopoulos (2012), title of chapter 5 in Stuckler and Basu (2014); "Collapse": Mason (2012); "Humanitarian crisis", "Meltdown": Chrisafis (2015).

[2] I am not aware of any contribution in the economics literature. Among the contributions that come closest to a systematic investigation, chapter 5 of the book by Stuckler and Basu (2014) and two papers in the medical literature, Kentikelenis et al. (2011) and Kondilie et al. (2013). The latter are very short by the standard of the academic articles in econoimics, two and eight pages respectively. One should also cite the meta-analysis of Simou and Koutsogeorgou (2014), to which I will come back in section 10..

procedure in about half the procedures tracked; it had a density of medical equipment and of examinations with imaging techniques (CT and MRI scans) that was well above the European average, in some cases by a multiple of three; and it had above average rates of vaccinations against tetanus, measles, diphtheria, Hepatitis B, and of many surgical procedures.

In many cases the budget cuts merely brought spending back to the levels at the beginning of the century, and often Greece remained above the European average or even close to the top. Pharmaceutical spending declined by about one third, back to the level of the beginning of the century and still at the European average. This however was due to a substantial increase in private spending, as public spending per capita became the third lowest in Europe. The density of hospital doctors also reversed to the level of 2000, and to the European average. The density of specialist doctors kept increasing, and remained well at the top of all European countries. The density of medical equipment remained mostly above the European average, and in some cases it increased further. The number of surgical procedures declined slightly but remained at the top in about half of the cases, and was slightly below average in just two. The coverage of vaccination remained above the European average and increased. Screenings (breast examination and cervical smear tests) also increased, and more than in Europe.

This summary would seem to indicate that there is little evidence of a dramatic decline in inputs that suddenly brought Greece below the European average, with two possible exceptions: the large decline in government spending on pharmaceuticals, which conceivably could have affected the poorest individuals; and the 15 percent decline in hospital employment. On might reply that for most inputs including pharmaceuticals and hospital employment the starting point was the highest or among the highest in Europe. Still, even though the initial condition probably included considerable waste and inefficiencies, one might expect that such deep and sudden budget cuts affected the health of the population.

Starting with self-perceived health, I show that among the poorest two quintiles of the population it displayed a surprising improvement during the crisis and the austerity years. This was only in part the consequence of a change in composition of these quintiles, away from retirees and towards younger, healthier unemployed and low-paid employed: self-perceived health improved even within each age class, and among the unemployed and the retirees. A more objective measure of health outcomes, the standardized mortality rate, declined significantly during the crisis, and although the rate of decline slowed relative to the pre-crisis period, it slowed even more in the rest of Europe. Similarly, amenable deaths, i.e. those deaths that "in the light of medical and technology [….] could be avoided through good quality healthcare", also declined in Greece but less than in Europe; in contrast to standardized deaths, the rates of decline slowed down in Greece more than in the other countries.

I then move to an analysis of four outbreaks of transmissible diseases that have been identified by a meta-analysis of the literature and have been widely discussed in relation to the Greek crisis: HIV, malaria, influenza and West Nile virus. The HIV outbreak was, in percentage terms, the fifth largest in Europe, although starting from one of the lowest infection rates in Europe. It was the only such outbreak to have ended after three years. There were very limited budget cuts in HIV prevention and treatment policy; they occurred after the beginning of the outbreak, and were revered very quickly. 76 locally acquired cases of malaria were reported in Greece between 2009 and 2013; little evidence exists that they were due to budget cuts limiting the spraying of areas at risk I estimate that the 2010 A(N1H1) influenza outbreak was responsible for 141 deaths according to the lab test method, the fourth highest

mortality rate in Europe; finally, the West Nile virus outbreak was probably responsible for about 90 deaths, by far the highest toll in European Union countries.

Two objective indicators do point to a worsening of health conditions. First, low-weight births and infant mortality rates, already the highest in the European Union, increase. Second, the year 2012 displays an increase in the standardized death rate by 12 deaths per 100,000 population, the only year in the century together with 2016 to display a rise in the rate. This might be in part the consequence of the policies implemented by the 2011 Memorandum of Understanding, which restricted access to health insurance and to free examinations and pharmaceuticals. On the other hand, there is no evidence of a decline in the utilization of hospital resources in 2011 or 2012, either at the extensive or the intensive margin; and in 2012 the standardized death rate *fell* by 60 deaths per 100,000 population, and by 4 percentage points relative to Europe. Finally, the suicide rate in Greece before the crisis was the lowest in Europe after Cyprus; like in all recessions, it rose during the crisis and the austerity period. Whether it increased more than predicted by the large decline in GDP depends on the method to estimate the relation between GDP and suicides.

Particularly in an area like health and in a rapidly changing environment like the Greek crisis, it is however difficult to capture all aspects of the phenomena with the available macro data. Therefore, the contribution of the present paper is no substitute for the knowledge and experience accumulated by those who operated in the midst of the Greek health system, or that were its clients. In particular, one should certainly not discount anecdotal accounts by practitioners, of which the following are but two examples among many: "*As the head of Greece's largest oncology department, Dr. Kostas Syrigos thought he had seen everything. But nothing prepared him for Elena, an unemployed woman whose breast cancer had been diagnosed a year before she came to him. By that time, her cancer had grown to the size of an orange and broken through the skin, leaving a wound that she was draining with paper napkins. 'When we saw her we were speechless,' said Dr. Syrigos, the chief of oncology at Sotiria General Hospital in central Athens. 'Everyone was crying. Things like that are described in textbooks, but you never see them because until now, anybody who got sick in this country could always get help.'"* (Alderman 2012).

"Konstantinos Syrigos, the head of the oncology wing at Sotiria [hospital] and the man responsible for the volunteer initiative, became aware at the beginning of 2012 of the growing number of cancer patients who had no access to care, either in the form of exams, treatment or necessary medicine. 'People started coming to us saying "I am sick, please do what you can, I have no insurance", and my hands were tied […] We also had patients who had started treatment and that would then disappear. When we called them they told us that their insurance booklets were no longer valid.' Most among the fifty or so cancer patients benefiting from the initiative at 'Sotiria' […] were men and women who fifty years ago had belonged squarely to the middle class. "(Palaiologos 2012, p. 56)

Rather, this paper should be interpreted as offering a complementary perspective, focusing on a quantitative evaluation of the inputs and outputs of the health system in its entirety and on a comparative approach.

The plan of the paper is as follows. Chapter 2 discusses briefly the methodology of the comparative analysis. Chapter 3 gives a short presentation of the institutional features of the Greek health system and its recent developments. Chapters 4 to 6 discuss inputs to the health system: chapters 4 and 5 study the evolution of health spending and pharmaceutical spending, while chapter 6 discusses the supply and usage of resources, like hospital capacity and employment, exams, screenings, and surgical procedures. The following chapters study outcomes, starting with some surprising results on measures of self-reported health in chapter 7. Chapter 8 deals with measures of mortality, including a measure

that is particularly interesting from the perspective of the present paper: "amenable mortality", i.e. mortality that would be preventable with existing medical knowledge and technology and given "good quality healthcare". The chapter also relates mortality to indicators of health resources, namely bed-days per capita and the average health of stay. Two important real time indicators of deteriorating health conditions, low weight births and infant mortality, are discussed in chapter 9. Chapter 10 discusses specific issues selected by a meta-analysis of the literature, namely four outbreaks of transmissible conditions: HIV, malaria, influenza, and West-Nile virus. Chapter 11 presents the evidence on a frequently noted rise in suicides during the crisis, and places it in a comparative perspective. Chapter 12 concludes.

2 METHODOLOGY

The Greek crisis was not a natural experiment. Changes in health outcomes depend on policy inputs, particularly the health budget and access to healthcare, but also on medical technology and practices, and on culture, health habits, genes, and external factors like pollution. For all these reasons, changes over time in resource allocation and utilization and in health outcomes are more informative when compared to the same movements in a reference group. Under the joint assumptions that medical technology and practices spread rapidly, that some behavioral patterns affecting incidence and prevalence (like smoking) have common trends across countries, and that the confounding factors are little influenced in the short run by changes in budget resources and allocations, this difference-in-difference approach partials out at least some of the confounding factors. The cut-off date for this comparison is 2010, the year when the cyclically adjusted deficit, total government spending, and health government spending, all started to decline in Greece. In this paper, I will call the years 2010 to 2016 the "austerity period" for short. [3]

In certain cases, I will make use of the equivalent of a diff-in-diff-in diff approach: I will subtract the change in a certain policy or outcome in Greece during the austerity period from the change during the pre-austerity period 2000 - 2009, and will compare that to the same difference of differences in the comparison group. Because policies and outcomes might have country specific trends, this approach sheds light on how to interpret a given change in outcomes during the austerity period.

I will use two comparison groups: a set of 27 European Union countries, for which most of the variables I will display are available at least from the year 2000;[4] and the CIIPS countries (Cyprus, Ireland, Italy, Portugal, and Spain), that are often grouped together as they were all hit severely during the post-2008 crisis. Also, with the possible exception of Ireland they are probably closer to Greece than most other European countries in terms of institutional arrangements, culture, and politics. In most cases, results using the CIIPS countries as comparison group are very similar to those that use the larger set of European countries; hence, for brevity I will only display the latter, unless otherwise useful.

[3] In 2015 health spending increased very slightly relative to 2014, to fall back to approximately the 2014 level in 2016.

[4] Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Hungary, Luxembourg, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, United Kingdom.

3 BACKGROUND: INSTITUTIONS AND ACCESS TO HEALTHCARE

This section provides the essentials on the key aspects of the Greek health system. Until 2011, hence well into the period of the budget cuts, the Greek health system had three key features: coverage was universal; exams, prescriptions and treatments were basically free; and there was no gatekeeping system, whereby primary care physicians operate a referral system to secondary care physicians. In fact, Greece was one of only six European countries where any individual could go directly to a specialist doctor.[5]

The Memoranda of Understanding signed in the course of the two major bailouts, and their many updates, contained many detailed prescriptions on the health system, although not all were fully implemented. For the sake of brevity, I will focus on the main changes, all of them introduced in 2011. First, the four main government insurance funds, covering about 90 percent of the insured population, were merged into a single large fund, the EOPYY. As a result, theoretically all the insured individuals of the four pre-existing funds had equal access to the best hospitals of the best insurance fund, regardless of their past contributions to their original fund. However, EOPYY was plagued by severe administrative problems.[6] Second, a list of exams that were no longer free was introduced. Third, the copayment on many healthcare services was raised from 3 to 5 euros.

Fourth, from 2011 coverage was no longer universal: the long-term unemployed lost access to free healthcare. Specifically, after the first year of unemployment individuals older than 55 would be insured provided they could show they had contributed for at least 3000 daily wages; individuals between 29 and 55 were covered for two years provided they could prove contributions for at least 600 daily wages; and individuals younger than 29 could get an additional six months of coverage if they had been unemployed for at least six months. After this, the only way for an unemployed to obtain coverage was to obtain a certificate of indigent status (a "poverty booklet", introduced in 2006), that guarantees free access to hospitals and medicines. Those self-employed that were in arrears with their contributions to their insurance funds, or workers in the informal sector, or the unemployed that had any property to their name (including the house they lived in) could not get a certificate of indigent status. [7] No official estimate of the number of uninsured individuals exists, although in September 2013 the head of EOPYY put the number at 3 millions.[8] In June 2014 the "Atlas plan" was introduced, that essentially reinstated coverage for hospital expenses and medicines for the unemployed and their families. [9]

[5] The other countries were Austria, Cyprus, the Czech Republic, Germany, and Luxembourg. See OECD (2016) p. 39.

[6] Palaiologos (2014), p.66 cites a report by the Inspector General for Public Administration on a regional EOPPY office that, as of the summer 2013, "had no way of directly knowing if an individual insured by one of the funds merged into it was up to date on his contributions".

[7] See Palaiologos (2014) p. 56.

[8] See Palaiologos (2014) p. 60, footnote 5.

[9] Another program, the "health vouchers" introduced in September 2013, had a limited take-up.

4 HEALTH SPENDING

Table 1 displays several indicators of fiscal policy outcomes in Greece since 2006. All point to the same result: government spending (whether in nominal or volume terms, whether cyclically adjusted or not, whether in absolute terms or as a share of GDP) increased until 2009, then declined until 2014, when it stabilized. The cyclically adjusted primary surplus as a share of potential GDP (last row) also turned around in 2010, and kept increasing until 2016: the change between the two years, more than 20 percentage points of GDP, is truly dramatic, and unprecedented in post-war Europe.

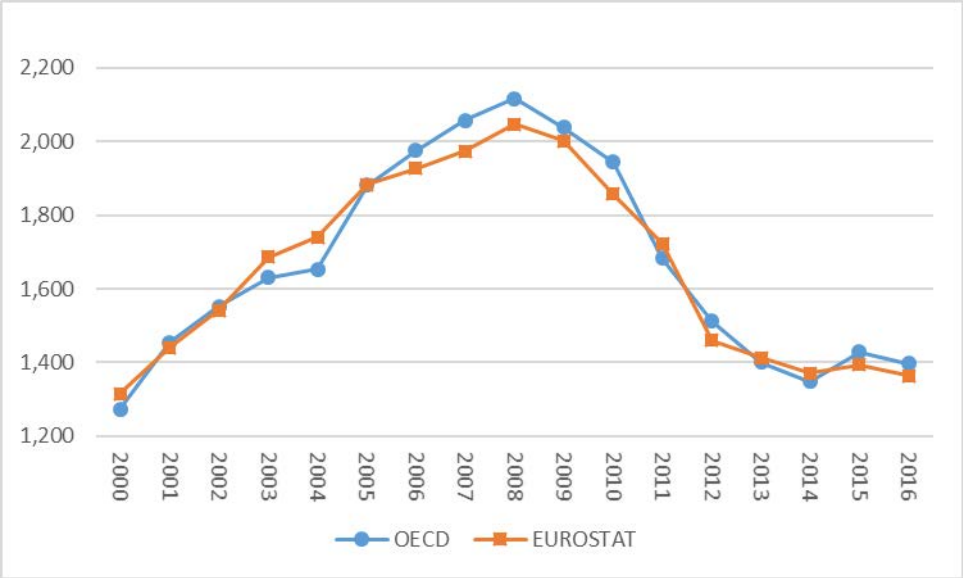
Table 1: Fiscal policy indicators in Greece, 2006-2016

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Government final consumption expenditure, volume	49.85	52.53	51.33	52.42	50.21	46.68	43.34	40.96	40.47	40.93	40.37
General government primary spending	94.15	103.93	114.76	120.77	110.24	101.11	95.46	90.36	88.28	88.93	86.45
General government primary spending, volume	104.85	111.79	118.63	121.52	109.94	100.15	94.92	92.22	91.88	93.48	91.73
Cyclically adjusted general government primary spending, volume	105.05	112.07	118.89	121.64	109.91	99.89	94.51	91.80	91.50	93.12	91.37
Cyclically adjusted general government primary spending as a share of potential GDP	46.57	49.11	51.71	52.92	48.17	44.36	42.68	42.14	42.53	43.67	43.08
Cyclically adjusted general government primary balance as a share of potential GDP	-4.57	-6.25	-9.30	-12.26	-5.22	0.63	2.84	-0.90	6.38	4.14	9.65

Source: OECD *Economic Outlook* database

Figure 1 displays health spending per capita in Greece since 2000, in constant 2010 prices. Two series are available: from the OECD and from EUROSTAT. They differ slightly in the levels, but also in the timing of the decline during the crisis. Both peak in 2008 (one year earlier than total government spending), but the EUROSTAT series shows a larger decline in 2010, while the OECD series declines quite dramatically in 2011 by 13 percent. In both series, by 2014 real health spending per capita had fallen by about one third of its 2008 value, and was back to its level at the beginning of the century.

Figure 1: Real spending on health per capita in Greece, 2000-2016



Sources: OECD *Health expenditure and financing* dataset and EUROSTAT *Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates* dataset.

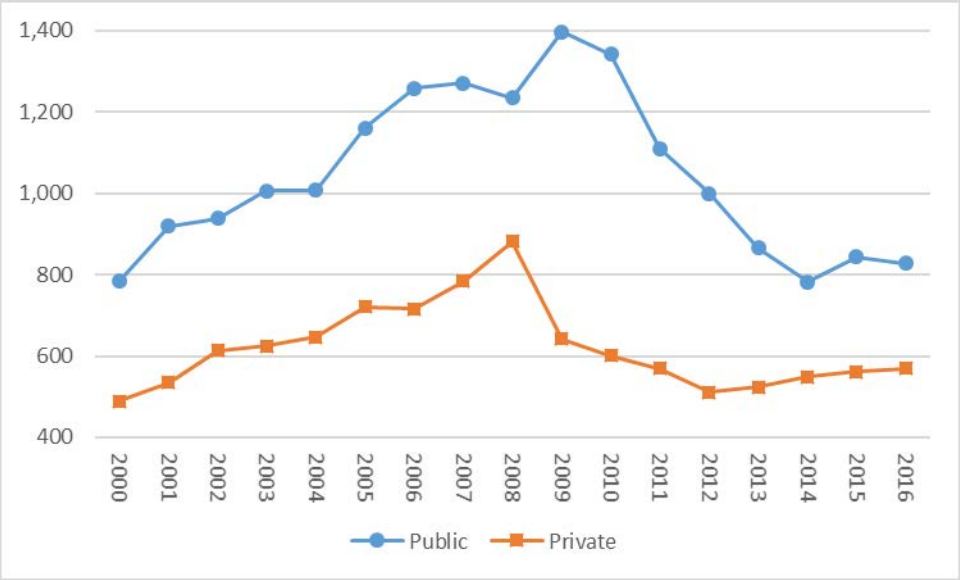
Notes: Base year is 2010. Only the OECD dataset provides the deflator for health spending. Hence, the Eurostat series on nominal health spending is converted to real values using the OECD health deflator. The average of the absolute value of the percentage difference between the nominal OECD and Eurostat figures is 2.6 percent. Starting in 2009, the OECD figures are identical to the System of Health Account figures from EUROSTAT used here and in several tables of the rest of this paper. The EUROSTAT data for Greece from the System of Health Accounts start in 2009; data from a previous version of the System of Health Accounts are used by the OECD for the pre-2009 period.

Figure 2 shows the decomposition into public and private spending.[10] Of the latter, about 90 percent was out-of-pocket expenditure, the rest spending by private insurance schemes.[11] The initial decline in 2009 was driven entirely by a collapse of private spending: public spending continued to increase, and declined only slightly even in 2010. The decline in public spending started in earnest in 2011, following the signing of the Memorandum of Understanding outlined in the previous section. By 2014, both private and public spending had declined by the same proportion, more than one third.

[10] This decomposition is available only for the OECD series.

[11] Although for obvious reasons no hard data are available, it is widely believed that informal payments were a considerable part of out-of-pocket expenditure: "informal payments, represent a significant part of out-of-pocket payments (approximately 30%) [….] In a previous study it was shown that more than 36% of people who were treated in a public hospital reported at least one informal payment to a doctor mostly in order to have access or faster access to public inpatient health care services." (see Economou et al. 2014, p. 103).

Figure 2: Real spending on health per capita in Greece, public and private, 2000-2016



Sources: OECD *Health expenditure and financing* dataset.
Note: Base year is 2010.

Figure 3 displays health spending per capita in Greece relative to the average of the 27 European Union countries. All figures are expressed in purchasing power euros for health[12], with the European Union countries as reference group for the construction of the purchasing power parity (as it is well known, PPP spending is the appropriate measure for comparisons between countries at a point in time, while is less well suited for comparisons over time). The figure also shows the first and third quartile of the distribution of spending per capita in each year. Until 2009 Greece's per capita spending on health in PPP euros was about 20 percent higher than the European average and at or above the third quartile. At the peak in 2008 it was 15 percent higher than in Ireland, 20 percent higher than in Italy, 25 percent higher than in Spain, and 30 percent higher than in Portugal; it was also above health spending per capita in Finland and Sweden. By 2014, it had fallen to 60 percent of the European average, and well below the first quartile; only Cyprus and Latvia had lower health spending.[13]

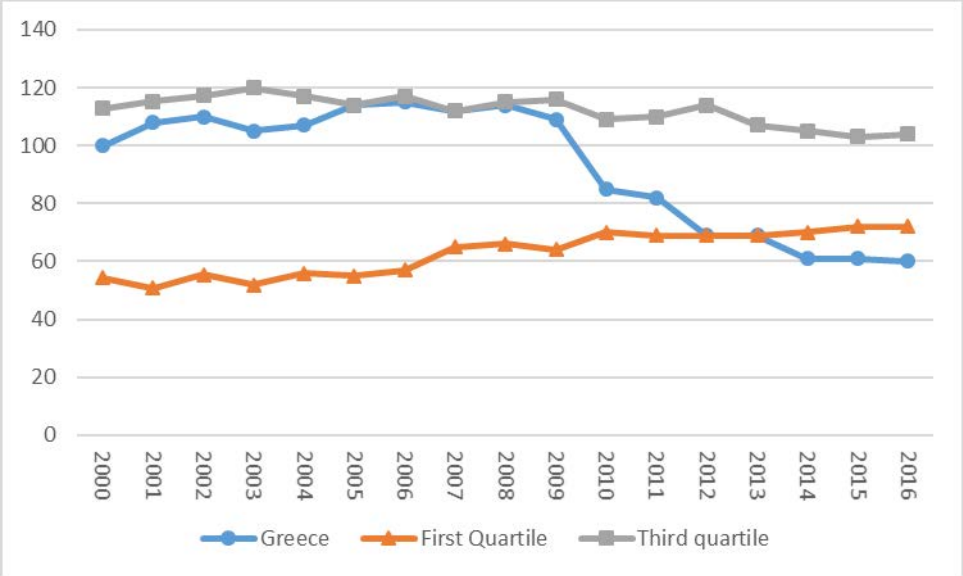
The decline in the Greek government spending on health after 2009 is extraordinary by any standard. Table 2 displays the changes in government health spending per capita during the large fiscal consolidations in European countries over the period 1975-2015. "Large" consolidations are defined as increases in the cyclically adjusted primary surplus as a share of potential GDP by at least 4 percentage points over four years, or more than that over longer periods of time. The precise definition is in Appendix 1.

[12] One PPP health euro in Greece buys the same bundle of health services, at Greek prices, as one euro does in the weighted average of the reference group of 28 EU countries in the sample. Thus, countries with lower health prices than the reference group will display an aggregate health spending in PPP health euros that is higher than their spending in euros.

[13] As a reference, in 2009 Greece's GDP per capita in PPP euros was 95 percent of the GDP per capita of the EU.

The 44 percent decline in real health spending during the 2010-2014 Greek consolidation was by far the largest decline recorded in the sample; the second largest decline was in Portugal 2011-2013, by 16 percent. If one regressed the change in health spending on the change in the primary surplus in the sample of large fiscal consolidations of the table (except the last Greek consolidation of 2010-14), the predicted decline in health spending during the Greek consolidation of 2010-14 would be 4.7 percent, against an actual decline of 44 percent (see the last row of Table 2).

Figure 3: Expenditure on health per capita in current PPP euros, relative to EU27 average, 2000-2016



Source: EUROSTAT *Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates* dataset.
Notes: Units are percentages of the European average, all in PPP health euros. The aggregate "Health spending" in this figure includes private and public spending. The list of items included in this aggregate in this figure is in the *"Eurostat-OECD Methodological Manual on Purchasing Power Parities"*, at pp. 346-49. The total for Greece does not coincide exactly with the total expenditure on health from the System of Health Accounts, utilized below. The difference in 2009 was about 7 percent: 22,053 million euros in this table against 23,553 million euros in the System of Health Accounts.

A similar exercise can be performed on the sample of large recessions, defined similarly to large consolidations (again see Appendix 1 for a precise definition), and displayed in Table 3. Again, the Greek recession of 2008-13, with a cumulative loss of 25 percent of GDP, was the largest in the sample; during that recession, health spending declined by 38.5 percent. The next largest recessions, in Estonia 2008-9 (18.1 percent GDP loss) and Latvia 2008-2010 (16.6 percent GDP loss), were associated with an increase in health spending by 8.5 percent and a decline by 8 percent, respectively. An OLS regression would predict a decline in health spending in Greece by 2.3 percent, against 38.5 percent in actuality (see last row of Table 3). Of all the cases in the sample, the Greek recession was the only one in which the percentage change in health spending was smaller, in algebraic terms, than the percentage change in GDP. Thus, there is no doubt that, within an already unprecedented fiscal consolidation, the health sector was hit particularly hard.

Table 2: Large consolidations and health expenditure

		Change in cyclically adjusted primary surplus	% change in real health expenditure per capita
	(1)	(2)	(3)
Czech Republic	2010-13	5.4	8.7
Denmark	1983-86	12.0	0.9
Estonia	2009-10	10.4	-4.4
Finland	1994-00	9.7	12.0
Germany	1980-83	4.8	5.5
	1996-00	9.5	10.4
Greece	1990-94	12.9	21.0
Hungary	2008-10	9.6	-3.2
	2013-14	4.1	4.2
Ireland	1981-89	12.9	-8.4
	2011-13	26.9	-10.2
Italy	1991-97	8.6	-1.0
Netherlands	1990-93	3.3	25.5
Norway	1994-00	7.7	40.4
Portugal	1984-86	8.0	31.6
	2011-13	11.2	-16.4
Slovenia	2014-15	10.9	3.7
Spain	1994-97	4.3	4.0
	2010-13	11.3	-11.1
Sweden	1981-87	8.1	3.7
	1993-98	10.4	8.6
United Kingdom	1995-98	5.7	-2.3
Average		9.4	5.4
Greece, actual	2010-14	18.8	-44.0
Greece, predicted			-4.7

Sources: OECD *Health expenditure indicators* and OECD *Economic Outlook* datasets

Notes: Base year is 2010.. Column 2 displays the percentage change in per capita GDP between the first and last year of the consolidation, shown in column 1. Column 3 displays the change in the cyclically adjusted primary surplus as a share of potential GDP, between the first and last year of the consolidation. See Appendix 1 for the definition of large consolidation. The last row, "Greece, predicted change in health spending", displays the change in real health spending in Greece predicted by a OLS regression of column 3 on column 2, excluding Greece. The sample includes Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom.

Table 3: Recessions and health expenditure

		% change in real GDP per capita	% change in real health expenditure per capita
	(1)	(2)	(3)
Denmark	2008-09	-6.5	8.0
Estonia	2008-09	-18.1	8.0
Finland	1990-94	-8.3	-5.8
Ireland	2008-13	-11.9	4.8
Italy	2008-09	-7.8	2.8
	2011-13	-5.5	-8.4
Latvia	2008-10	-16.6	-8.5
Norway	2008-11	-4.6	12.1
Portugal	2009-13	-7.0	-11.6
Slovenia	2009-13	-11.2	-4.4
Spain	2008-13	-10.6	0.5
Sweden	1990-93	-6.1	-0.5
	2008-09	-7.3	2.9
United Kingdom	2008-09	-6.4	10.0
Average		-9.1	0.7
Greece, actual	2008-13	-25.9	-38.5
Greece, predicted			-2.3

Sources: see Table 2.

Notes: see Table 2. See Appendix 1 for the definition of recession.

5 PHARMACEUTICAL SPENDING

Until 2012 every Greek citizen had access to virtually free medicines without co-payments or with minimal ones. That year, a list of non-reimbursable medicines was introduced, under the terms of the Memorandum of Understanding. In 2013 the government introduced a 10 percent copayment on medicines for some conditions, and raised it from 10 percent to 25 percent for other conditions.[14] As a result, between February 2010 and February 2013 the average co-payment rate rose from 13.3% to 18% (see Economou (2014) p. 106). On the other hand, a cap on drug prices was introduced. In this section, I show that before the crisis pharmaceutical spending in Greece was much higher than in the rest of Europe, and was still high even after the spending cuts were enacted.

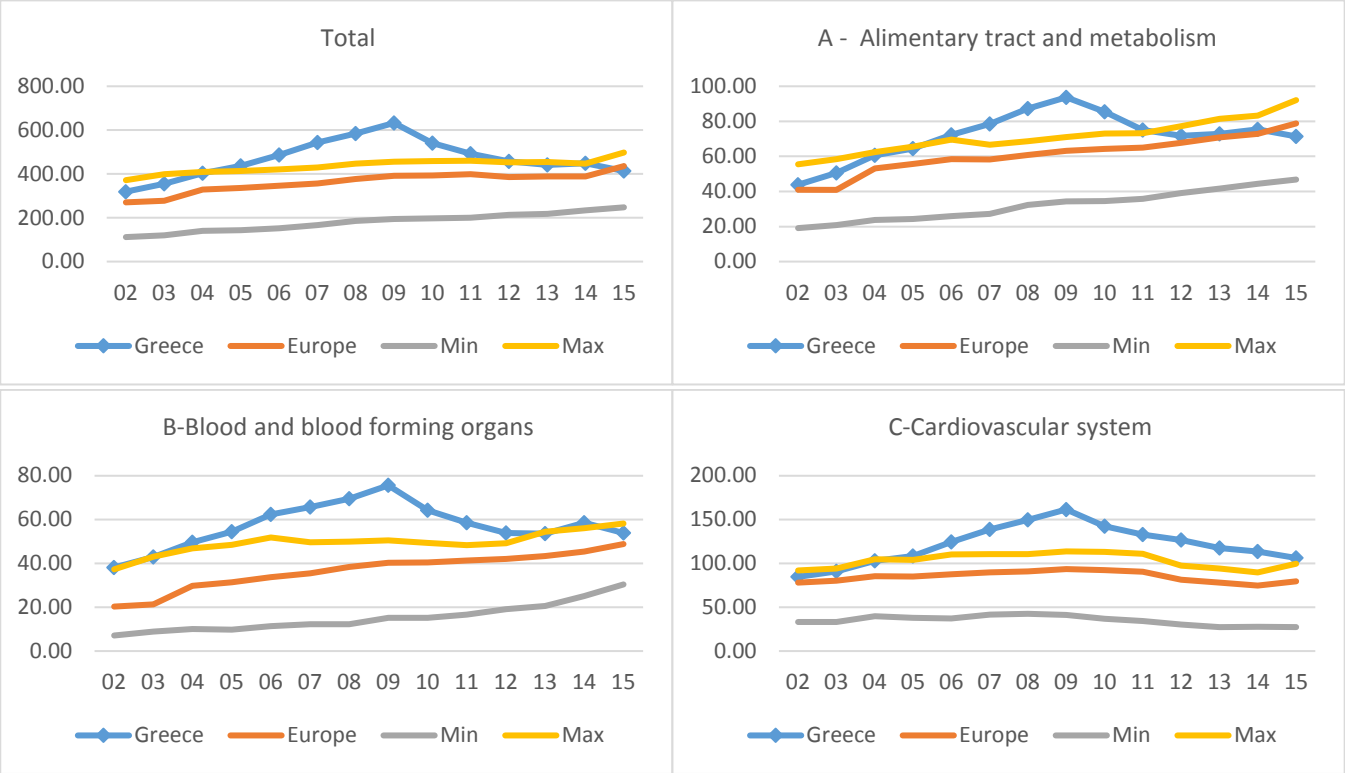
In 2007 (the last year for which figures for *total* sales were available) total pharmaceutical sales per capita in Greece were 65 percent higher than the European average in PPP terms. Expressed in euros, the difference was about 230 euros: in other words, pharmaceutical spending explained all of the the

[14] A copayment was introduced for Alzheimer, Dementia, Epilepsy, Diabetes II; it was increased for Coronary Heart Disease, Hyperlipidemia, Rheumatoid Arthritis and Psoriatic Arthritis, Chronic Obstructive Pulmonary Disease, Osteoporosis and Paget, Crohn Disease and Liver Cirrhosis.

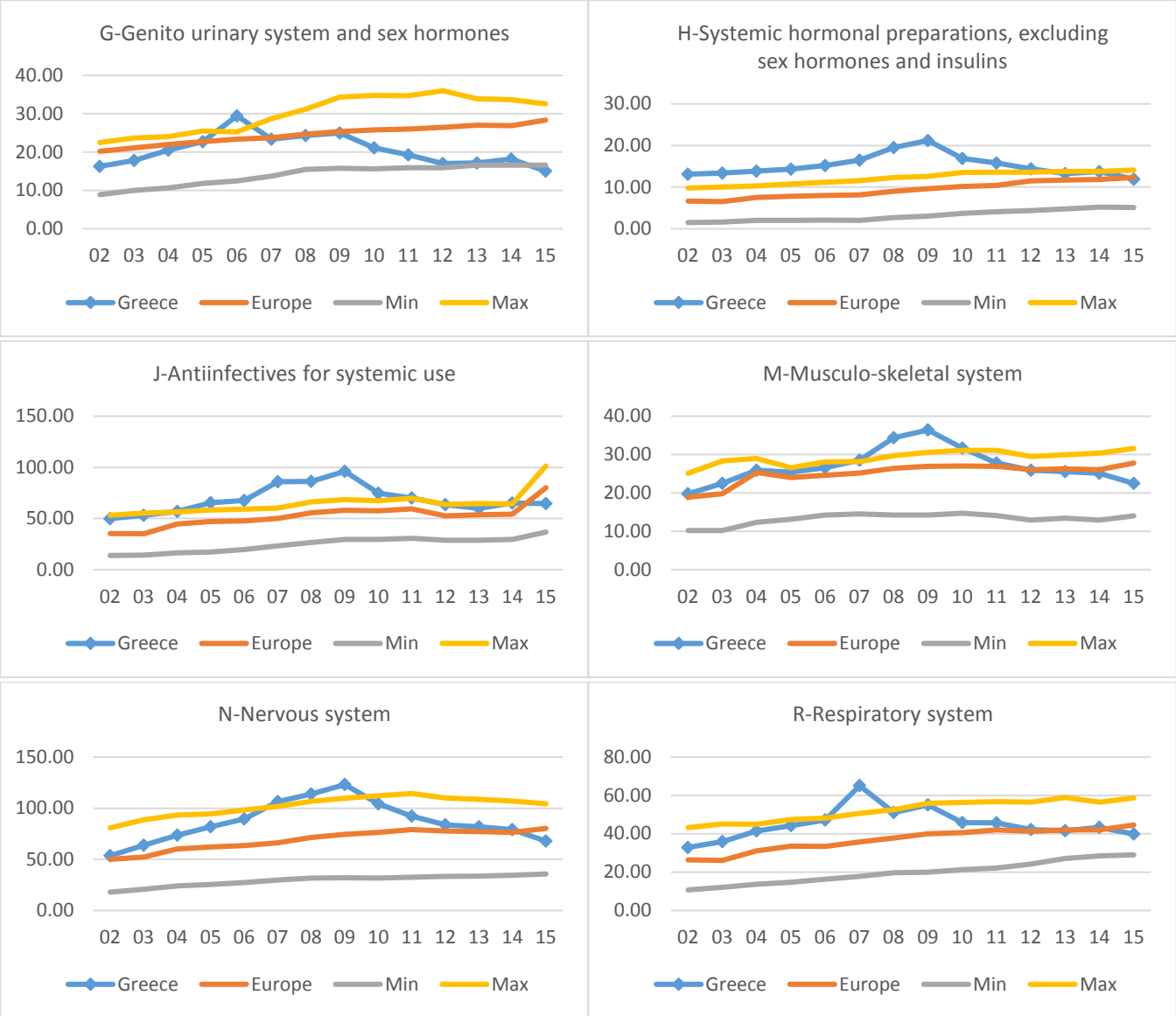
difference in health expenditure between Greece and the other European countries.[15] After 2007, only disaggregated data on sales for nine Anatomic Therapeutic Chemical (ATC) groups are available for Greece. Figure 4 displays these data, together with their sum (in 2007, the sum of these nine ATCs in Greece was about two thirds of the overall total). I also reduce conservatively the Greek figures by 20 percent to take into account parallel exports. [16]

Even after this arbitrary reduction, the first panel of Figure 4 shows that in 2009 pharmaceutical sales per capita in Greece were 60 percent higher than the European average. The other panels show that Greece was the top spender in eight of the nine ATC groups. By 2014, Greece's pharmaceutical spending had declines by exactly one third. However, Greece was still the third spender in the sample after Belgium and Italy.[17]

Figure 4: Pharmaceutical sales, Greece and Europe, 2000-2015



[15] In 2007, PPP spending per capita on health in the European Union was 2000 euros, in Greece it was 2240 euros.
[16] Because drug prices tended to be lower in Greece throughout this period, there was an incentive to re-export medicines, particularly to the UK and to Germany. Scheuermann (2006) p. 22 estimates the size of parallel exports in Greece in 2002 at about 20 percent of the total Greek market. As relative prices grew, this share probably fell over time, to increase anew when the government imposed rigid price ceilings on pharmacies, to reduce the expenditure for reimbursements of pharmaceuticals. In February 2013, the Greek health ministry estimated that over 25 percent of the drugs imported into Greece were then re-exported (see "'Medical stocks are down by 90 percent': Greece accuses pharma giants of slashing imports", RT, February 23 2013). A ban on the re-export of certain medicines was imposed in 2013.
[17] It was still the top spender before the across the board 20 percent reduction of its figures.



Source: OECD *Pharmaceutical market* database.

Notes: 1. Data in PPP dollars. Because these are OECD and not EUROSTAT data, the reference group of countries is made of the OECD countries, instead of the 28 EU countries. However, by agreement between the OECD and EUROSTAT, the relative PPPs between EU countries are the same in the OECD and in the EUROSTAT datasets (see EUROSTAT – OECD (2012), p. 241).

2. The Greek figures on pharmaceutical sales include (i) drugs dispended in hospitals, (ii) non-reimbursed drugs, and (iii) over-the-counter drugs. Only eleven other European countries include all these three items. These countries are: Belgium, Czech Republic, Denmark, Estonia, Finland, Italy, Slovak Republic, and Sweden (France and the United Kingdom have too many missing data to be useful). Therefore, the sample in this figure includes these countries only.

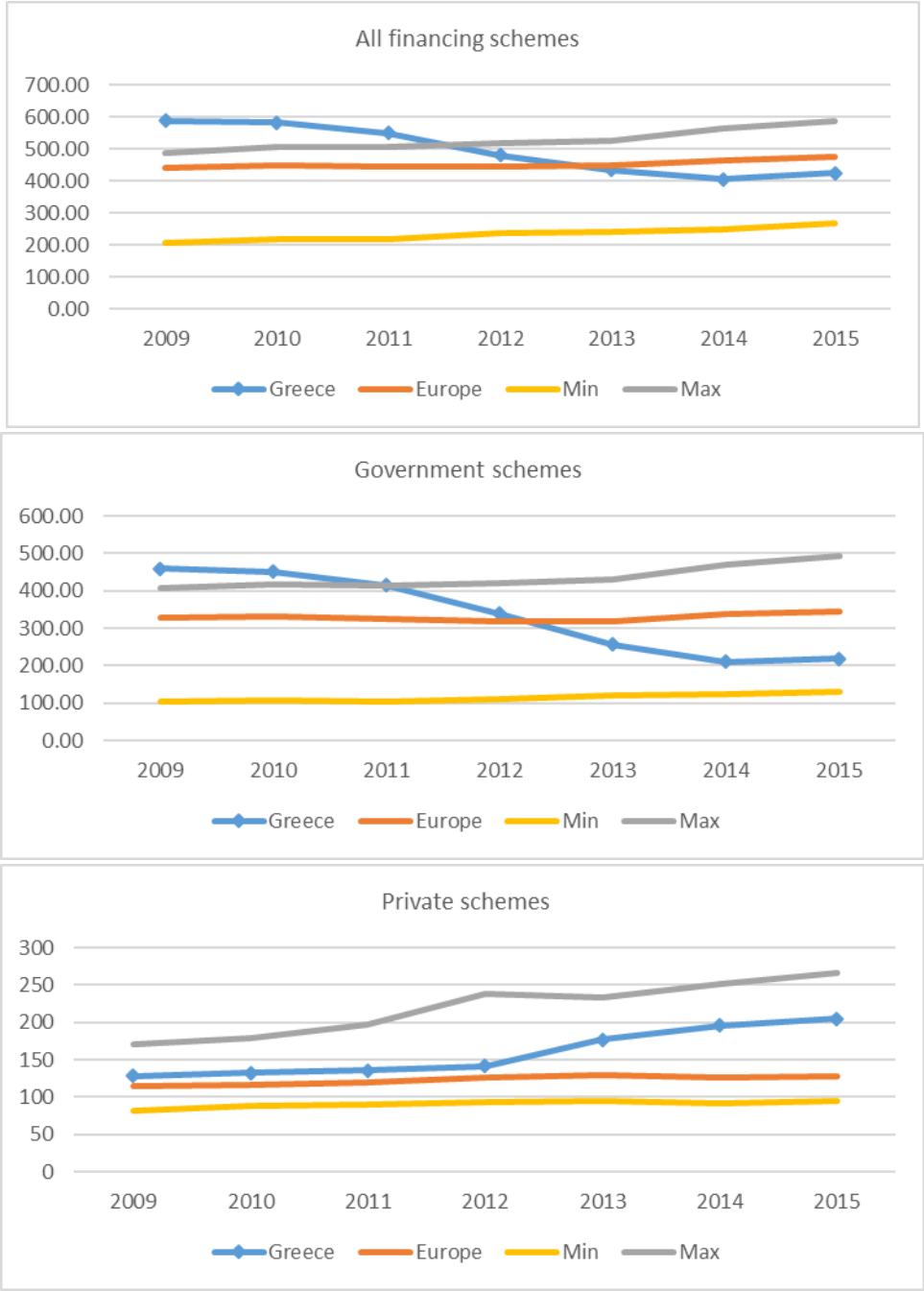
3. The first panel, on "Total", displays the sum of the seven pharmaceuticals displayed in the other panels. It does not include all pharmaceuticals, because the figure for actual overall total pharmaceutical sales in Greece in the original dataset stops in 2007. In that year, in Greece the overall total was about 50 percent higher than the sum of the seven pharmaceuticals of this figure, displayed in the first panel.

4. The original Greek figures are reduced by 20 percent to take into account re-exports of pharmaceuticals from Greece (see text)

A similar picture emerges from data based on the National System of Health Accounts, displayed in Figure 5. This data starts in 2009; on the other hand, total spending on pharmaceuticals can now be broken down into public and private spending (the latter includes out-of-pocket expenditure, about nine tenth of the total, and private insurance). Total pharmaceutical spending in Greece starts 40 percent higher than in Europe in 2009, and 20 percent higher than the next highest spender, but ends 10 percent lower in 2014, with the bulk of the decline occurring in 2012 and 2013. In particular, the decline of public

spending on pharmaceuticals is dramatic: from 150 percent of the European average to 65 percent. This is partly made up by private spending that increased by 50 percent in absolute terms.

Figure 5: Pharmaceutical spending per capita in PPP euros, public and private, 2009 – 2015



Source: EUROSTAT, *System of Health Accounts* database

Notes: Unit of measurement: PPP euros. The sample includes: Belgium, Estonia, Finland, France, Germany, Lithuania, the Netherlands, Portugal, Spain, Sweden.

An alternative approach consists of studying pharmaceutical consumption rather than sales.[18] For Greece, this data stops in 2004 to start anew in 2014. Table 4 shows that in 2004 Greece already had a higher consumption per capita than the average country of the comparison group in all the nine ATC groups; it had the highest level of consumption in four groups, and the second level in the remaining five. By 2014, Greece was below the European average in all but two groups, and was not among the top three consumers in any of the groups, except two. This suggests a stronger decline than in Figure 4, which was based on sales rather than consumption.

Table 4: Pharmaceutical consumption per capita, 2004 and 2014

	Europe	Greece	Top cons.	Second highest cons.	Third highest cons.	Europe	Greece	Top cons.	Second highest cons.	Third highest cons.
	2004					2014				
A Alimentary tract and metabolism	174	236	261	165	139	225	175	271	248	231
B Blood and blood forming organs	73	215	103	82	63	101	177	134	133	83
C Cardiovascular system	398	456	519	419	349	504	411	719	683	433
G Genito urinary system and sex horm.	47	59	61	50	48	42	29	61	50	42
H Systemic hormonal preparations	30	55	61	21	19	40	16	85	35	33
J Antiinfectives for systemic use	17	39	23	22	13	16	20	23	17	15
M Musculo-skeletal system	60	74	70	67	59	59	38	71	70	61
N Nervous system	138	174	186	167	115	150	121	255	134	130
R Respiratory system	81	155	95	85	79	71	70	107	80	71

Source. OECD P*harmaceutical market* database.

Notes: 1. Units of measurement: defined daily doses per 100,000 inhabitants

2. The Greek figures on pharmaceutical consumption do not include (i) drugs dispended in hospitals, (ii) non-reimbursed drugs, and (iii) over-the-counter drugs. Only five other European countries present data without these three items: Austria, Germany, Hungary, Netherlands, and Spain; the data for Austria, however, start only in 2010; hence the European group includes only the last four countries.

The Memoranda of Understanding also made several provisions for expanding the use of generics (until then, there was no incentive in Greece to use generics). Table 5 presents data on the use of generics in the reimbursed pharmaceutical market. This data starts in 2012, hence no comparison is possible with the pre-crisis period. In value terms, Greece is 25 percent below the European average. However while in the rest of Europe the share of generics in volume terms is more than double the share in value terms, in Greece the two shares are nearly identical. This suggests that, unlike in the other countries, the price of generics in Greece is nearly identical to the price of branded pharmaceuticals.

[18] In this case, the Greek data do not include any of the three items listed in note 2 of Figure 4: the comparison group of European countries with this type of data is therefore in a sense the complement of the previous one, and includes only four countries. These countries are: Germany, Hungary, Netherlands, and Spain.

Table 5: Share of generics in reimbursed pharmaceutical market

		2012	2013	2014
Value	Greece	18.6	18.5	19.0
	Europe	22.7	24.2	22.0
Volume	Greece	18.5	18.2	20.1
	Europe	50.3	53.1	48.8

Source: OECD *Pharmaceutical market* database

Note: The sample includes: Austria, Belgium, Denmark, France, Germany, Ireland, Italy, Netherlands, Portugal, Slovak Republic, Spain, United Kingdom

Perhaps not surprisingly given the high level of spending on pharmaceuticals, by 2009 Greece was by far the European country with the most serious problem of antimicrobial resistance. For the seven microorganisms of major public health importance tracked by the European Centre for Disease Prevention and Control, in 2009 or the first available year after 2009, Greece had an above average resistance in all cases, and only in 4 cases out of a total of 96 possible cases was there a country with a higher resistance.

Table 6: Antimicrobial resistance

Klebsiella pneumoniae, Combined resistance (third-generation cephalosporin, fluoroquinolones and aminoglycoside)	2009	Greece	52.5	0/18
		Europe	11.6	
Acinetobacter spp.,Combined resistance (fluoroquinolones, aminoglycosides and carbapenems)	2012	Greece	74.5	1/10
		Europe	28.8	
Escherichia coli, Combined resistance (third-generation cephalosporin, fluoroquinolones and aminoglycoside)	2009	Greece	6.4	3/18
		Europe	4.0	
Pseudomonas aeruginosa, Combined resistance (at least three of piperac. and tazob., fluoroq., ceftaz., aminogl. and carbapenems)	2009	Greece	40.2	0/18
		Europe	13.0	
Enterococcus faecium, High-level gentamicin	2009	Greece	63.1	0/16
		Europe	51.7	
Enterococcus faecalis, High-level gentamicin	2009	Greece	61.2	0/16
		Europe	36.7	

Source: European Centre for Disease Prevention and Control

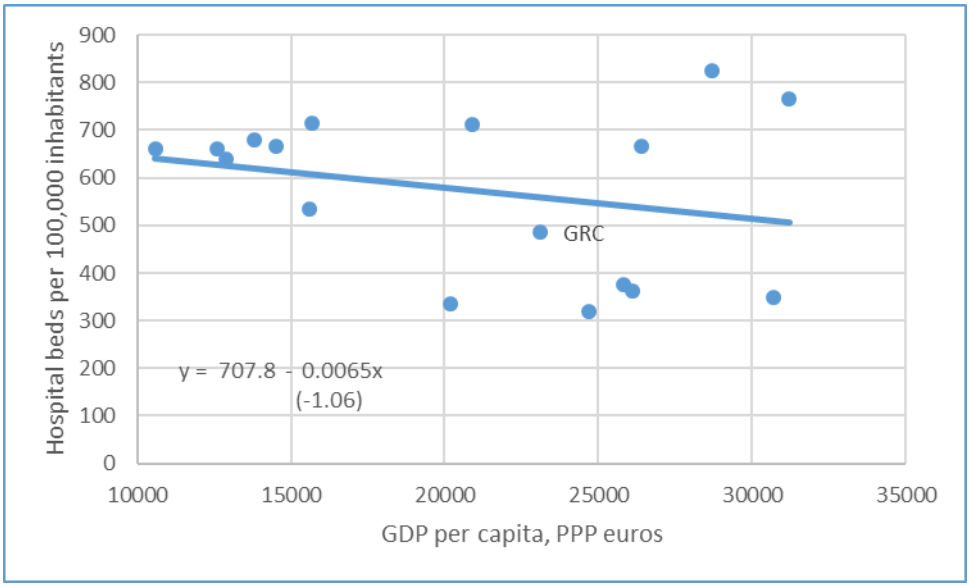
Note: Proportion of resistant isolates. The last column displays the number of countries with higher proportion of resistant isolates than Greece, and the total number of countries in the sample. " "Isolates" are bacteria isolated from a specimen (e.g., stool, blood, food). "Antimicrobial resistance" is the ability of a microbe (germ) to resist the effects of a drug. Antimicrobial-resistant germs are not killed by the drugs that are typically used against them and may continue to multiply. Antimicrobial resistance includes antibacterial, antifungal, and antiviral resistance." (From: European Center for Disease Control and Prevention)

6 HEALTH RESOURCES

6.1 HOSPITAL CAPACITY

Despite the high level of spending on health before the crisis, there was no *prima facie* evidence of an excess capacity of health institutions. In a regression of hospital beds per capita on PPP GDP per capita in 2009, Greece was below the OLS line of the European sample, as shown in Figure 6 (the result for public hospitals only, not shown, is similar).

Figure 6: Hospital beds per 100,000 population, 2009



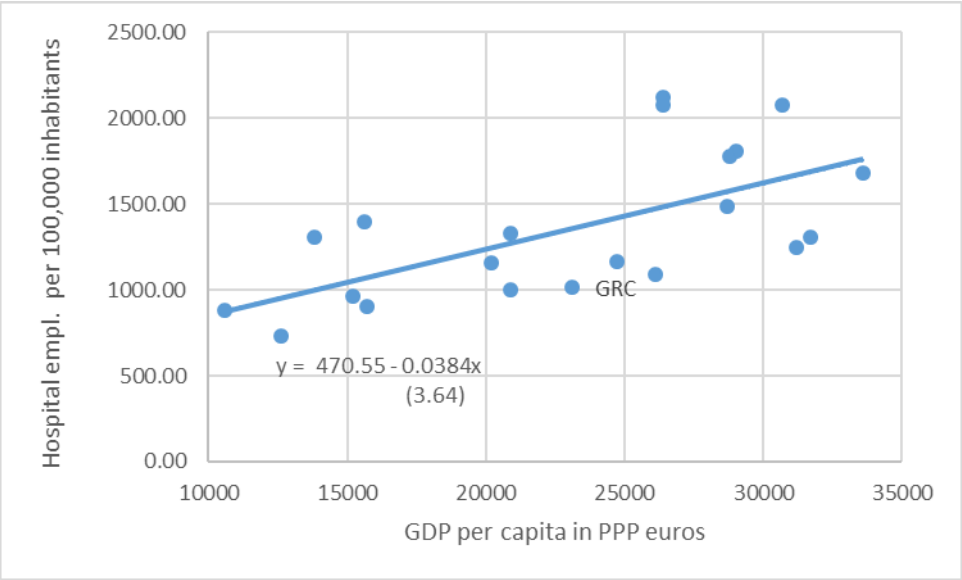
Source: Eurostat *Healthcare* database.

Note: The sample includes Bulgaria, Czech Republic, Denmark, Germany, Estonia, Spain, France, Italy, Cyprus, Latvia, Lithuania, Hungary, Austria, Poland, Portugal, Romania

Since 2009 the number of hospital beds per capita in Greece declined by about 12 percent, but this is a common trend in all countries; as a result, in relative terms the decline was limited, from 83 percent of the European average in 2009 to 77 percent in 2015. Neither does hospital employment provide *prima facie* evidence of any obvious excess capacity of the Greek system. Total hospital employment in Greece in 2009 was about 30 percent lower than in the average European country, and well below the OLS line (see Figure 7). [19]

[19] Hospital employment for Greece is not available for public and private hospitals separately. In 2009 there were 142 public hospital with 38115 beds, 5 private hospitals with 1465 beds, and 166 private clinics with 15124 beds (see the Hellenic Statistical Authority.) Although the EUROSTAT and OECD manuals do not state whether the Greek data on hospital employment refer to public or all institutions, the ELSTAT (Hellenic Statistical Institute) reference manual of the Single Integrated Metadata Structure (SIMS) states that "The purpose of the census is to

Figure 7: Hospital employment per 100,000 population



Source: EUROSTAT *Healthcare* database
Sample: Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Spain, France, Croatia, Italy, Lithuania, Hungary, Netherlands, Austria, Portugal, Romania, Slovenia, United Kingdom

6.2 EMPLOYMENT AND DOCTORS

By 2015, the absolute number of hospital employment had declined by 16,800 units, or 15 percent, well below the level at the beginning of the century. Relative to the EU average it had declined from 71 to 62 percent (see Table 7). [20] Note that these numbers contrast with widely circulating statements at the time, like the following: *"[.....] the government's austerity budget cut the jobs of 35,000 clinicians, doctors and public health workers." (*Stuckler and Basu 2014, p.85).

Table 7: Hospital employment, Greece

	2000	2008	2009	2010	2011	2012	2013	2014	2015
Hospital employment	101,935	111,414	114,471	111,672	111,337	106,282	100,985	96,909	94,659
Greece/Eu	0.68	0.71	0.71	0.68	0.69	0.67	0.64	0.62	0.62

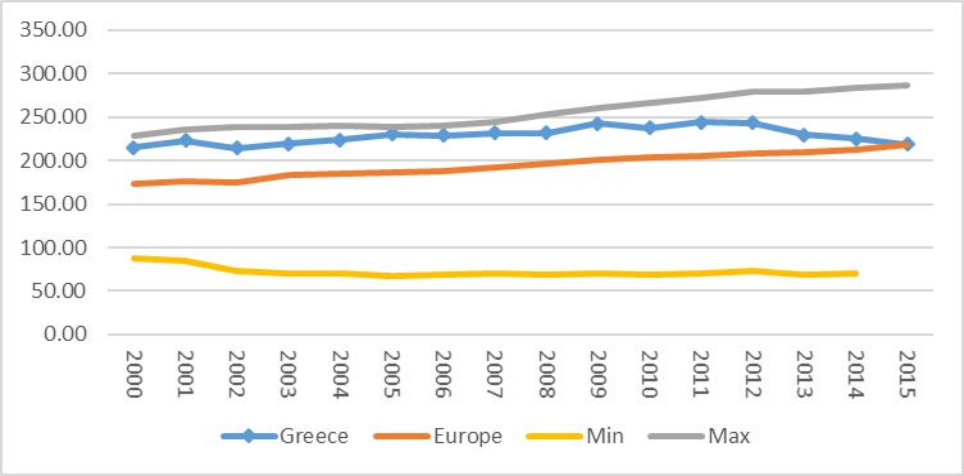
Source: EUROSTAT *Health care* database

collect non – financial data that refer to all Hospitals of the country (Legal Entities of Public Law, Legal Entities of Private Law and private clinics)." See also here.

[20] In 2011, the Greek government imposed a near-freeze on new hirings of medical personnel in hospitals: only one out of five retiring doctors would be replaced. The freeze, however, was not enforced rigidly, and there were numerous slippages.

However, these averages mask a remarkable difference in the shares of different types of workers. At the beginning of the crisis, Greece had a much larger density of hospital doctors per capita: about 30 percent more than the average European country (see Figure 8). Looking at doctors in general, including those outside hospitals, further highlights the distinguishing features of the Greek system. In 2009 Greece had a large density of doctors licensed to practice[21], 20 percent more than the average European country (see Figure 9, first panel). In fact, this number hides an even more fundamental difference with European countries. As we have seen, Greece does not have an effective primary care system acting as a gatekeeper to secondary care specialists. In essence, an individual covered by the national health system (virtually any individual, as the coverage ratio was 100 percent until 2011) could go directly to the specialist of their choice for free. The consequence of this institutional arrangement is clear from the data. In 2009 Greece had only 23 percent of the density of generalist doctors of the average European country, with the lowest density of all (Figure 9, second panel); but almost 80 percent more specialist doctors (Figure 9, third panel), with by far the highest density of all. Its ratio of specialists to generalists was more than 5 times that of the average European country. With the crisis the density of hospital doctors declined to the European average (see Figure 8); but the density of specialist doctors licensed to practice increased further, both in absolute terms (by more than 25 percent) and relative to the European average (see Figure 9).

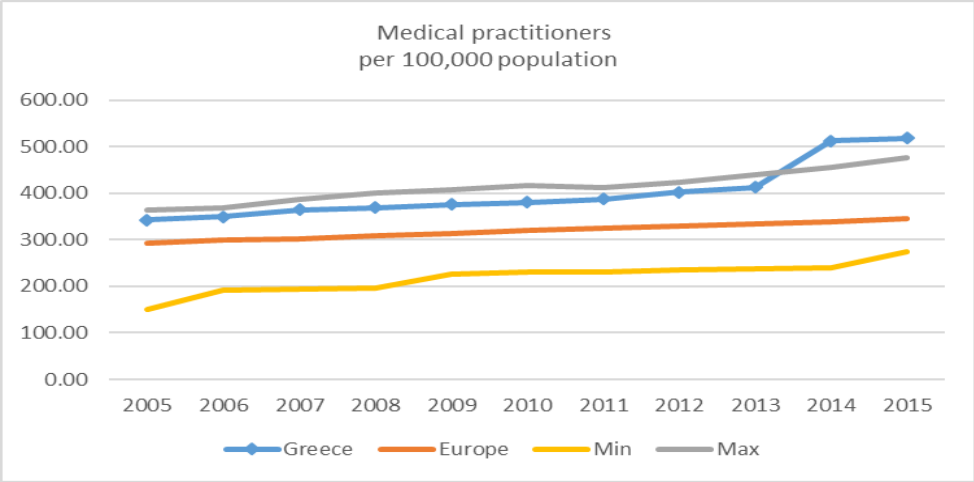
Figure 8: Hospital doctors per 100,000 population

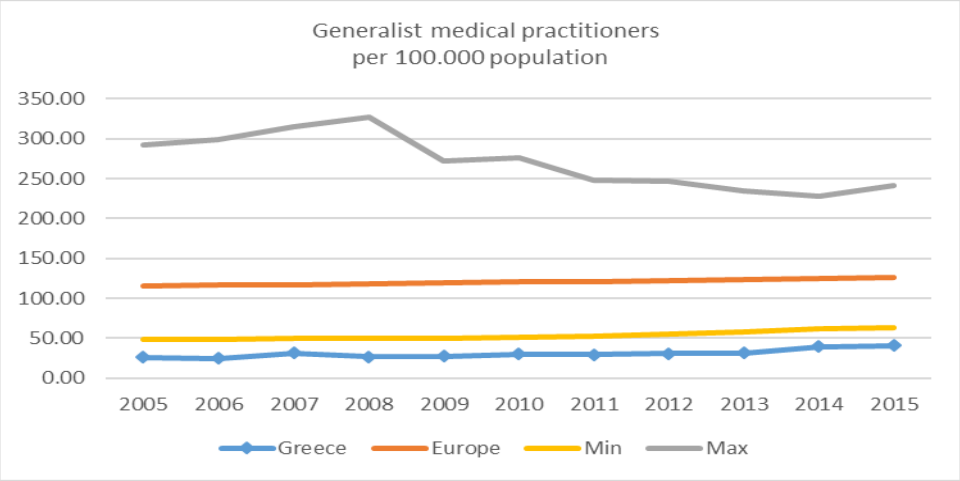


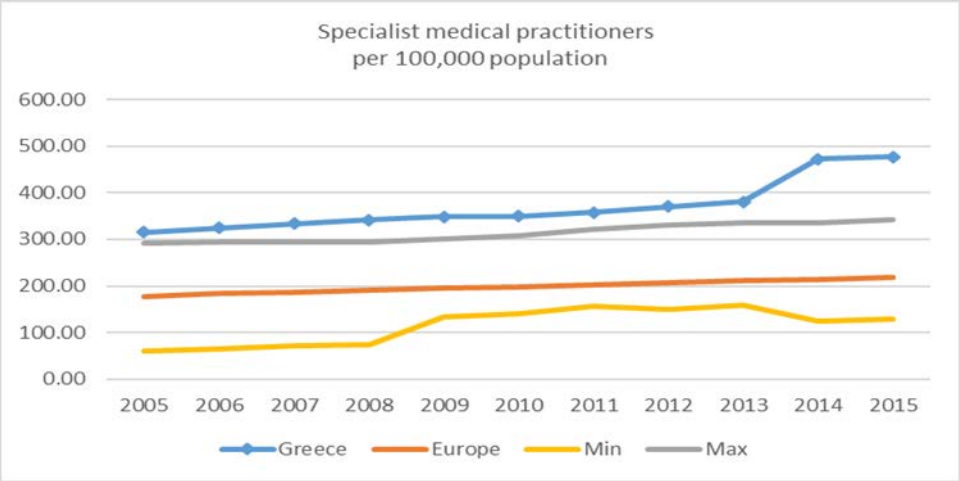
Source: EUROSTAT *Healthcare* database
Sample: Belgium, Denmark, Germany, Ireland, Spain, France, Italy, Lithuania, Netherlands, Austria, Portugal, Romania, Slovenia, Finland

[21] Greece does not have data on practicing doctors, hence for comparability across countries the density of doctors licensed to practice is used for all countries.

Figure 9: Generalist and specialist medical practitioners







Source: EUROSTAT *Healthcare* database

Sample: Belgium, Bulgaria, Denmark, Germany, Estonia, Ireland, Spain, France, Croatia, Latvia,Lithuania, Netherlands, Austria, Portugal, Romania, Slovenia, Finland, Sweden, United Kingdom

Note: The data for Greece starts in 2005. Data for Finland and Sweden in 2015 are missing.

6.3 MEDICAL EQUIPMENT

The large number of specialists was naturally associated with a high density of medical equipment. Out of the eight types of equipment tracked, in 2009 Greece had an above-European average density in five cases (Table 8), with ratios to the European average ranging from 111 percent in Angiography units to 246 percent in Mammographs. [22] It was below the average in the two types of equipment used for treatment as opposed to diagnosis: Radiation therapy equipment and Lithotriptors, and in one imaging instrument, PET scanners. With the crisis, the relative density of medical technology equipment initially declined only slightly, and in fact it rose in two cases, Gamma cameras and Mammographs: by 2016 it was higher in four technologies out of six with available data, and in the case of Mammographs it had risen to almost 5 times the European average..

Table 8: Medical equipment, 2005, 2008, 2013 and 2016

	2005	2009	2013	2016	2005	2009	2013	2016
	Computed Tomography Scanners				**Magnetic Resonance Imaging Units**			
Greece	2.52	3.08	3.37	3.67	1.32	2.17	2.21	2.66
Europe	1.86	2.05	2.33	2.29	1.06	1.35	1.64	1.80
Gr/Eu	1.35	1.51	1.44	1.60	1.24	1.61	1.35	1.48
	Gamma cameras				**Angiography units**			
Greece	0.86	1.34	1.44	1.41	0.90	0.96	1.09	
Europe	0.75	0.75	0.71	0.67	0.51	0.86	1.02	1.25
Gr/Eu	1.14	1.79	2.03	2.12	1.76	1.11	1.07	
	Lithotriptors				**Pet scanners**			
Greece	0.14	0.19	0.18		0.01	0.04	0.05	0.11
Europe	0.28	0.31	0.36	0.10	0.07	0.14	0.19	0.21
Gr/Eu	0.50	0.62	0.50		0.13	0.29	0.26	0.53
	Radiation therapy equipment				**Mammographs**			
Greece	0.53	0.57	0.60	0.64	3.65	4.84	5.59	6.22
Europe	0.50	0.64	0.68	0.79	1.57	1.97	2.07	1.31
Gr/Eu	1.05	0.89	0.88	0.81	2.33	2.46	2.70	4.75

Source: EUROSTAT *Healthcare* database.
Notes: Data for Greece area available from 2005. The sample varies for each technology. The criterion for inclusion for ach country is: not more than three missing years in a row, and not more than four missing years in total over the period 2005-2016.

6.4 EXAMS AND SCREENINGS

What changed during the crisis was the utilization of this equipment. For Greece, data are available for two types of exams, and in 2008 and 2012 only. In 2008 Greece had 3.4 times the number of CT exams per capita than the average European country, and 1.9 times the number of MRI exams; [23] by 2012 these ratios had fallen to 1.4 and 0.9, respectively (see Table 9).

[22] Gamma cameras were developed in the 1950s to detect tumours. PET scanners were developed in the 1960s, medical MRI equipment and CT scanners in the 1970s. Two types of equipment recorded here are used for treatment as opposed to diagnosis: radiation therapy equipment (also used for diagnosis), and lithotriptors. The latter were developed in the 1980s and use acoustic shocks to break up kidney stones and gallstones.
[23] Comparative data are available also for PET scans, but not for Greece.

Table 9: Examination by imaging techniques

		2008	2012
CT scans	Greece	32037	18030
	Europe	10262	13088
	Gr/Eu	3.12	1.38
MRI exams	Greece	9789	6761
	Europe	5581	7851
	Gr/Eu	1.75	0.86

Source: EUROSTAT *Healthcare* database
Notes: Exams per 100,000 inhabitants

There has been a large echo on the sharp worsening of indicators of self-reported "unmet needs for medical examination". Figure 10 presents the data. As we have seen, in 2011 several measures restricting access to healthcare were introduced; that year, the percentage of Greeks who declared unmet needs of medical examinations due to economic reasons (by far the most important motive for unmet needs)[24] rose sharply, from 4 to 6 percent, and it kept rising to 12 percent in 2016. This translated into a sharp increase also relative to the European average. The first quintile exhibited a dramatic increase, from 8 percent in 2009 to 35 percent in 2016; after a blip in 2011, the fifth quintile returned to its pre-crisis level, which is equal to the European average.

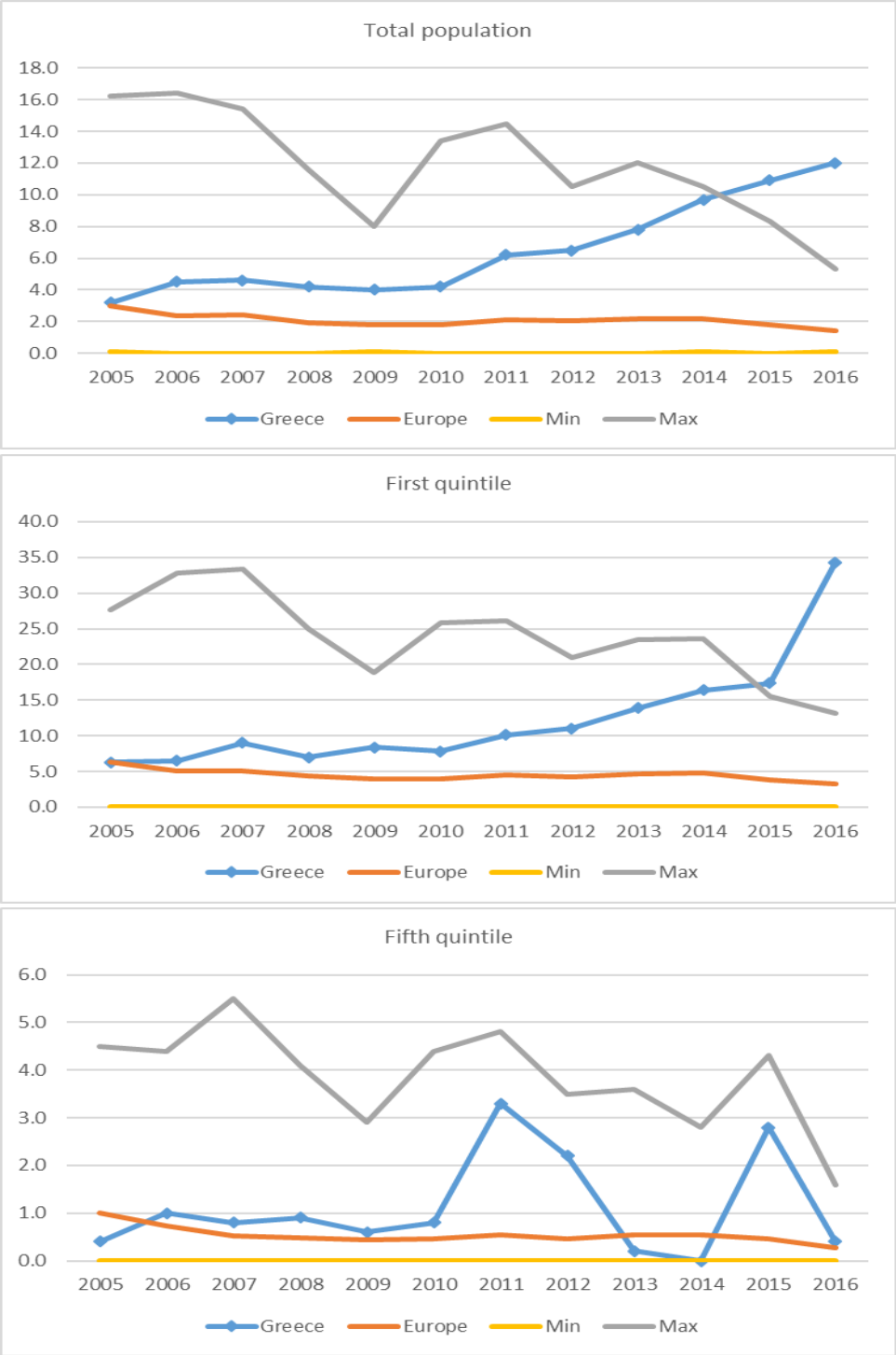
It is not clear how to interpret a self-assessment that an individual has unmet needs for medical examinations; in addition, the reference point for this assessment might be influenced by the fact that until the onset of the crisis and beyond, Greek citizens had virtually universal and free access to specialists. During the crisis there was a widespread perception of a retrenchment in screening efforts for early detection of certain types of cancer. For instance, Tsounis, A., P. Sarafis and E. Alexopoulos (2014), p. 2010 write: "[t]he population in Greece receiving screening services compared with that recommended by the European Union is already low [….] In countries with organised screening programmes, participation rates in Pap testing are up to 80% (eg, Sweden, Finland, and the UK), whereas in Greece, participation is less than 60%."[25] This perception is not supported by the data. Table 10 shows that between 2008 and 2014 (the latest two years in which the survey was taken) the coverage of the two types of screening tracked by official data, for breast and cervical cancer, increased both in absolute terms and relative to the European average.[26]

[24] Waiting times as a cause of unmet needs have always played a very marginal role in Greece, due to the institutional structure that we have seen

[25] It should be noted that these numbers for Greece, in an article published in 2014, are in turn based on an article published in 2009 (Dimitrakaki et al. 2009), and referring to a survey taken in 2006.

[26] Note that in August 2014 an upper limit was set to the number of exams for uterus, breast, and prostate cancers that each doctor can prescribe, and to the expenditure by doctor on such exams.

Figure 10: Unmet needs for medical examination because "too expensive"



Source: EUROSTAT *Healthcare* database

Sample: Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, United Kingdom

Table 10: Screenings

			2008	2014
Breast examination	Less than 2 years	Greece	50.1	59.6
		Europe	64.9	69.4
		Gr/Eu	0.77	0.86
	2 years or more	Greece	21.0	26.9
		Europe	14.1	17.4
		Gr/Eu	1.49	1.55
	Never	Greece	29.0	13.5
		Europe	18.1	13.2
		Gr/Eu	1.60	1.02
Cervical smear test	Less than 3 year	Greece	70.1	75.5
		Europe	69.3	73.4
		Gr/Eu	1.01	1.03
	3 years or more	Greece	9.8	12.7
		Europe	10.7	12.5
		Gr/Eu	0.91	1.02
	Never	Greece	20.1	11.8
		Europe	20.0	14.2
		Gr/Eu	1.00	0.83

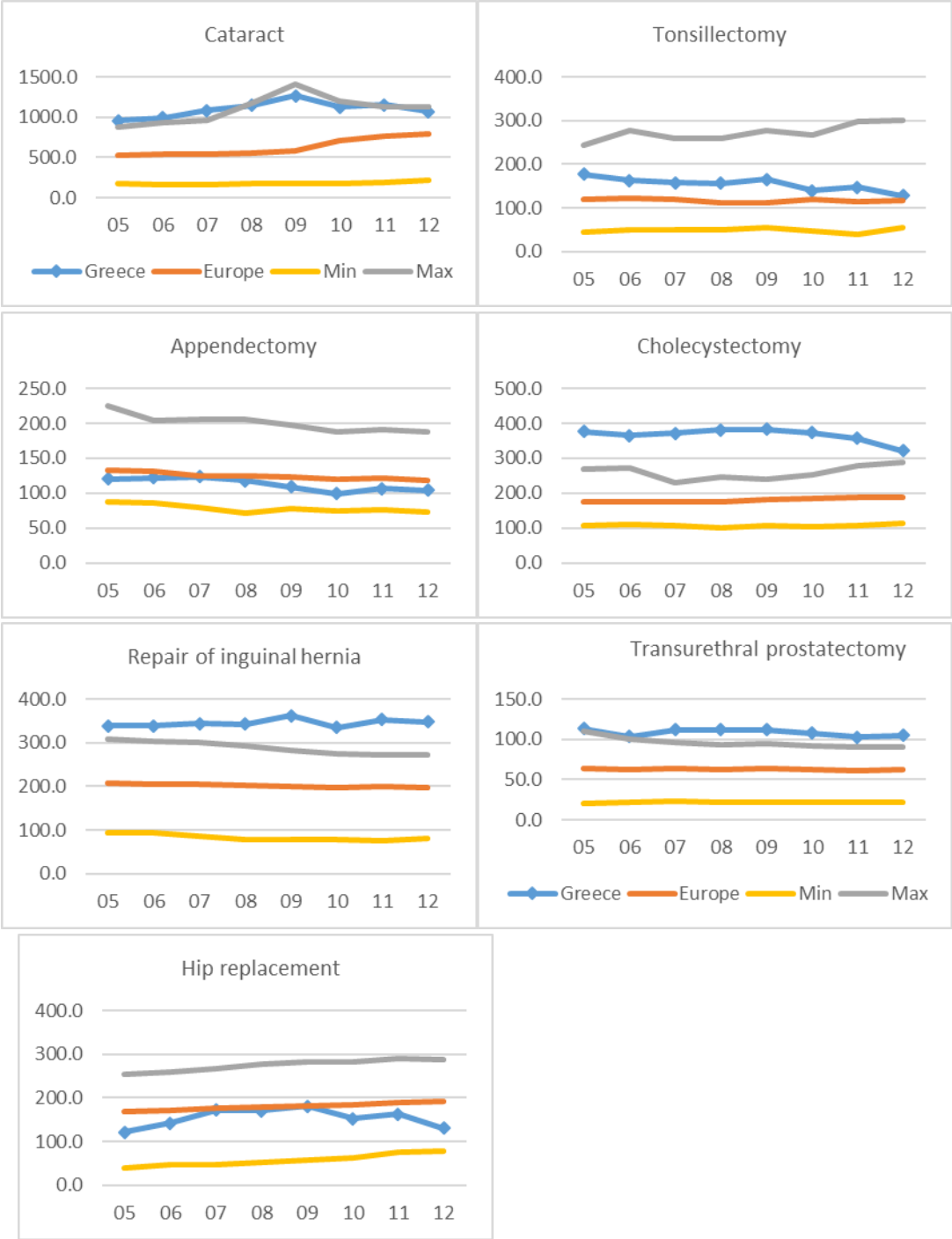
Source: EUROSTAT *Healthcare* database
Sample: Belgium, Bulgaria, Czech Republic, Germany, Estonia, Spain, France, Cyprus, Latvia, Hungary, Malta, Austria, Poland, Romania, Slovenia, Slovakia.
Notes: Mammographs: women aged 50-69; Cervical cancer test: women aged 20-69.

6.5 SURGICAL PROCEDURES AND IMMUNIZATIONS

As Figure 11 shows, of the seven surgical procedures tracked by EUROSTAT in 2008 Greece had an above average density in five and the highest density in four (with a density close to or higher than twice the European average); the remaining two were just below the average.[27] Greece stopped collecting this type of data (or at least providing them to EUROSTAT and the OECD) in 2012; by that year, the density of operations had declined relative to 2009 in all cases except one, but Greece still had an above average density in five procedures out of seven, and the highest density in three.

[27] I do not report data on kidney transplants because for Greece they stop in 2010. In that year Greece was well below the European average. This procedure is heavily influenced by cultural factors, namely the availability of donors.

Figure 11: Surgical procedures



Source: EUROSTAT *Healthcare* database.

Notes: procedures per 100,000 inhabitants. Sample: Belgium, Bulgaria, Czech, Republic, Denmark, Germany, Estonia, Ireland, Spain, France, Italy, Lithuania, Hungary, Netherlands, Austria, Poland, Portugal, Slovenia, Finland, Sweden, United, Kingdom,

Immunization rates against diphteria, tetanus, and pertussis have remained at 99 percent throughout the crisis (see Table 11); that against measles has declined slightly, from 99 to 97 percent, but it is still among the highest in the sample. A similar decline by 2-3 percentage points is not uncommon over the same period, and has been experienced also by Italy and Spain – perhaps as a result of immigration.[28]

More indicative of the utilization of health resources are less routine types of immunizations. That against Hepatitis B increased from 95 percent in 2009 to 98 percent in 2012 and 2013, during the largest spending cuts, to fall back to 96 percent in 2015; all these numbers are higher than the European average. Data on influenza vaccination in Greece are available only for 2009 and 2014: the coverage increased from 42 percent to 49 percent, while it fell in the average European country. As a result, the coverage rate in Greece increased from 72 percent of the European average in 2009 to 1.03 percent in 2014.

Table 11: Vaccination

		2000	2008	2009	2010	2011	2012	2013	2014	2015
Diphtheria, Tetanus, Pertussis	Greece		99	99	99	99	99	99	99	99
	Europe		96.5	96.3	96.6	96.7	97.0	96.8	96.7	96.4
	Gr/Eu		1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.03
Measles	Greece		99	99	99	99	99	99	97	97
	Europe		92.8	92.8	93.2	93.4	94.2	94.1	93.9	93.9
	Gr/Eu		1.07	1.07	1.06	1.06	1.05	1.05	1.03	1.03
Hepatitis B	Greece	89	95	95	95	95	98	98	96	96
	Europe	55.8	80.0	80.9	83.9	85.5	85.8	86.7	90.3	90.6
	Gr/Eu	1.59	1.19	1.17	1.13	1.11	1.14	1.13	1.06	1.06
Influenza	Greece			41.6					48.9	
	Europe			57.4					47.8	
	Gr/Eu			0.72					1.02	

Source: OECD *Healthcare utilization* dataset.

Samples:

Diphtheria: Tetanus, Pertussis: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Lithuania.

Measles: Austria, Belgium, Czech Republic, Estonia, France, Germany, Ireland, Italy, Latvia, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Lithuania.

Hepatitis B: Austria, Belgium, Czech Republic, Estonia, France, Germany, Ireland, Italy, Latvia, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Lithuania.

Influenza: Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Lithuania.

[28] It is indicative that the immunization rate against measles declined below 99 percent only in 2014, after the large inflow of refugees in Greece of 2013.

7 SELF-PERCEIVED HEALTH

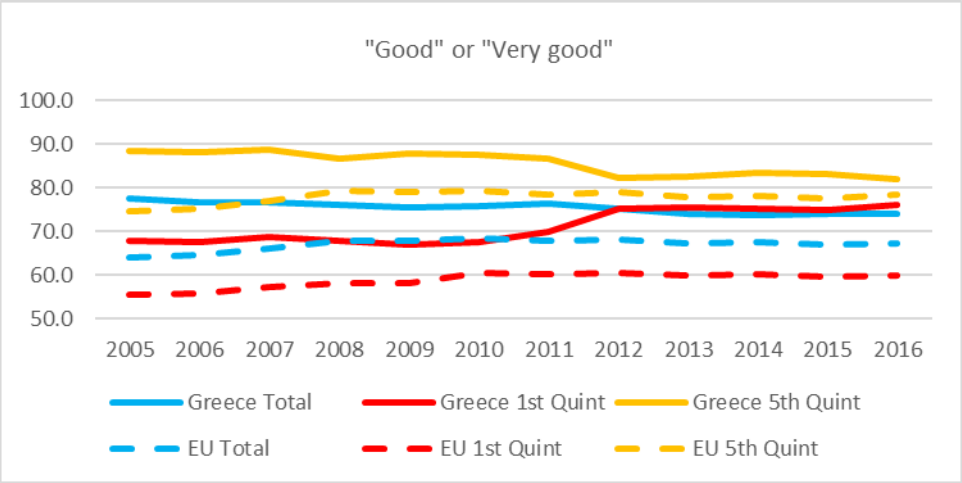
Ultimately, what matters is health outcomes. I start from indicators of self-perceived health, with the obvious *caveat* that differences over time and especially across countries in self-perceived health are difficult to interpret, as cultural and psychological factors play a large and poorly understood role.

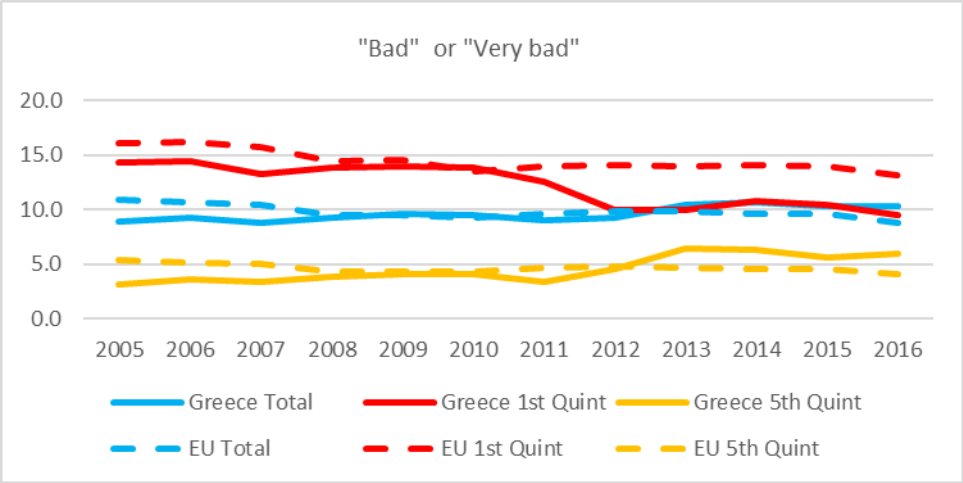
As shown in Figure 12, Greece has always had a higher percentage of individuals who report "Good or very good health" than the average European country. This share declined by just over one percentage point during the austerity years, from 75.5 percent in 2009 to 74.0 percent in 2016, about the same proportional decline as in the rest of Europe. However, Figure 12 also shows clearly that, while in Greece the decline between 2009 and 2016 continues a pre-existing trend decline, in Europe the 2009-16 decline interrupts a marked improvement in health over the previous period. Slightly more marked is the change in the share of the Greek population who report "Bad or very bad health": the second panel of Figure 12 shows that it increased from 9.6 percent in 2009 to a peak of 10.7 percent in 2014, a more than 20 percent increase, and a change from 101 percent to 111 percent of the European average.

If this change were due to a worsening of the actual health or of the effectiveness of the health system, one would expect self-perceived health to decline more markedly for poorer individuals. In fact, the opposite is the case. The share of the Greek population in the first (poorest) quintile that report "Good or very good health" increased dramatically over the austerity years, from 67 to 75 percent, which once again represents a striking improvement in the trend relative to the previous period. In Europe the opposite is true: the share of the first quintile reporting "Good or very good health" declined after 2008, also an inversion of the trend over the previous period. The picture for the "Bad or very bad health" responses (second panel of Figure 12) is symmetrical to that of "Good or very bad health" responses.

Roughly the same pattern, with smaller changes, can be detected in the second quintile. Starting with the third quintile, the pattern reverses itself: the share of "Good or very good" responses declines during the austerity years, and the share of "Bad or very bad" responses increases.

Figure 12: Self perceived health by quintiles, Greece and average of EU countries





Source: EUROSTAT *Health status and determinants* database
Sample: Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, United Kingdom

The improvement in the self-reported health of the first quintile may be due to a composition effect. As shown in Figure 13, retirees have a much worse health than the employed and the unemployed, simply because they are older on average; during the crisis, the income of the retirees was much better protected than that of the unemployed and of the less paid of the employed. Table 12 displays the percentage change, relative to 2010, of the median income of individuals, by labor market status and by age. The median income of retirees suffered a smaller loss than that of any other category; and within each category the median income of individuals over 65 held better than that of individuals up to 65 years of age. Hence, the composition of the first quintile shifted from retirees to unemployed and low-paid employed.

Table 12: Income by labor market status. 2011-2016, relative to 2010

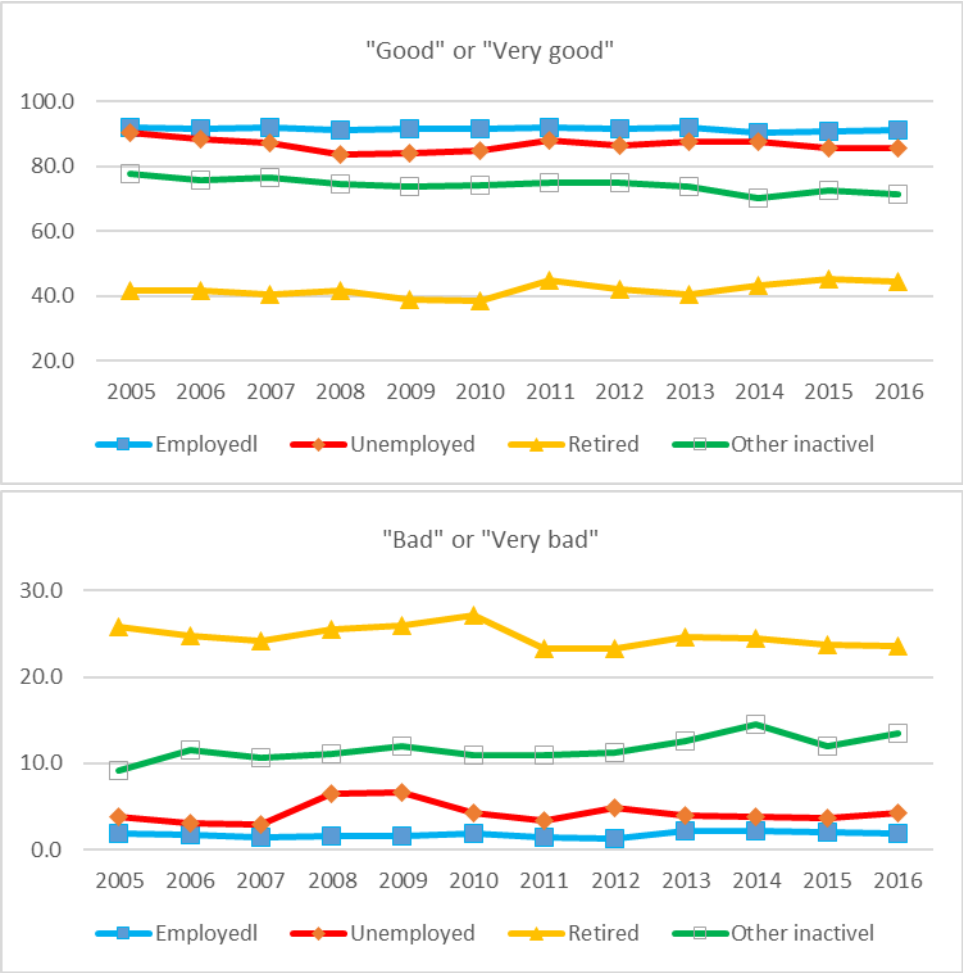
		2011	2012	2013	2014	2015	2016
All	18 to 64	-10.0	-26.1	-33.6	-38.7	-40.5	-40.6
	65+	-12.1	-9.9	-18.6	-27.3	-26.7	-25.9
Employed	18 to 64	-6.8	-22.4	-29.0	-33.9	-35.6	-36.5
	65+	17.0	20.2	-11.4	-48.9	-49.7	-43.3
Unemployed	18 to 64	-10.8	-25.3	-34.8	-39.6	-40.0	-42.0
	65+						
Retired	18 to 64	-9.8	-21.4	-31.9	-33.7	-34.4	-32.0
	65+	-11.1	-10.1	-17.7	-25.5	-25.2	-24.3
Other inactive	18 to 64	-13.7	-30.5	-37.7	-38.8	-38.8	-37.4
	65+	-16.0	-14.3	-25.5	-31.9	-29.8	-31.8

Source: EUROSTAT *SILC* database.
Notes: percentage change in median income of the labor market category in the first column, in current euros, relative to 2010.

However, although a composition effect may explain some of the improvement in the self-perceived health of the first quintile, this is unlikely to be the whole explanation. Figure 13 shows that

starting in 2011 there is indeed a genuine improvement in self-reported health even *within* the categories of the retirees and the unemployed; interestingly, in both categories this improvement represents a reversal of a decline up to 2010; in contrast, self-reported health appears stable among the employed, and worsening among the "other inactive". [29]

Figure 13: Self-reported health by labor market status, Greece



Source: EUROSTAT *Health status and determinants* database.

To further appreciate this point, Table 13 displays the share of "good or very good" responses broken down by income quintile and by age. For the first quintile, in all three age classes (16-64, 65-74, and 75+) there is a decline until 2010, especially among the 75+; in 2011 self-perceived health starts improving, both absolutely and relative to Europe, although for the oldest cohort there is a relapse in 2012 and 2013. In all cases, however, by 2014 self-perceived health was better in 2014 than in 2009. The fifth quintile presents a different pattern: self-perceived health keeps worsening even after 2009 for the first two age classes, and improves only for the oldest one.

[29] In 2011, the composition of the Greek population according to the SILC database classification was as follows (in parentheses the 2010 percentage): employed, 44.6 percent (49.5); unemployed: 10 percent (5.9); retired, 24.5 percent (22.1); other inactive, 20.7 percent (22.1).

Table 13: Self-perceived health by income quintile and by age

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	First quintile												
16-64	Greece	84.5	83.0	83.2	81.1	80.5	82.5	83.0	85.2	84.5	84.4	82.9	83.7
	Europe	65.1	65.7	66.5	68.4	67.7	69.0	68.2	68.2	67.2	67.3	66.6	67.0
	Gr/Eu	1.30	1.26	1.25	1.19	1.19	1.20	1.22	1.25	1.26	1.25	1.24	1.25
65-74	Greece	37.3	32.2	29.9	34.9	34.5	29.0	43.8	48.0	44.4	37.0	44.3	40.8
	Europe	29.1	30.2	31.1	32.3	32.2	33.6	33.8	34.2	35.2	36.0	36.9	37.8
	Gr/Eu	1.28	1.06	0.96	1.08	1.07	0.86	1.29	1.40	1.26	1.03	1.20	1.08
75+	Greece	21.0	21.8	22.7	20.7	15.8	14.4	21.1	12.5	10.7	15.9	17.1	18.1
	Europe	22.1	22.0	23.0	22.7	23.8	23.8	23.9	23.0	24.2	24.0	24.4	25.4
	Gr/Eu	0.95	0.99	0.99	0.91	0.66	0.61	0.88	0.54	0.44	0.66	0.70	0.71
	Fifth quintile												
16-64	Greece	92.7	92.0	93.7	92.2	93.3	92.5	91.7	89.7	90.6	90.8	90.3	89.9
	Europe	79.3	80.0	81.3	83.3	83.5	83.8	83.0	84.1	83.3	83.6	83.0	83.6
	Gr/Eu	1.17	1.15	1.15	1.11	1.12	1.10	1.10	1.07	1.09	1.09	1.09	1.07
65-74	Greece	69.2	68.6	67.2	65.3	65.3	69.3	68.4	63.9	59.0	61.5	62.2	60.7
	Europe	47.8	48.1	51.7	54.6	54.7	56.7	57.0	57.9	58.8	59.3	58.8	60.4
	Gr/Eu	1.45	1.43	1.30	1.20	1.19	1.22	1.20	1.10	1.00	1.04	1.06	1.00
75+	Greece	53.6	40.4	33.6	37.7	33.4	30.8	40.5	36.1	29.5	34.4	38.4	35.8
	Europe	30.3	30.6	33.7	35.9	37.1	36.7	36.5	35.0	38.4	37.0	39.3	41.2
	Gr/Eu	1.77	1.32	1.00	1.05	0.90	0.84	1.11	1.03	0.77	0.93	0.98	0.87

Source: EUROSTAT Health status and determinants care database

A similar pattern is displayed by the share of individuals who report a long standing illness or health problem (not shown). On average it increased slightly during the crisis, roughly in line with the European average,[30] but it declined significantly in the first quintile, against a stable European average; it was stable in the second quintile; and it increased in the top three quintiles, more than in the European average.

8 MORTALITY

8.1 CRUDE AND STANDARDIZED MORTALITY RATES

Mortality is an immediate, objective indicator of the health status of the population, and perhaps the most easily measurable. Table 14 presents the data. The first three columns of the first panel display the average crude death rates in the 2000-2009 and 2010-2015 periods, and their percentage change, for Greece and Europe. The average crude death rate during the austerity years increased by 7.2 percent in Greece relative to the pre-austerity period, while it remained constant in Europe. The last three columns display the rates of change of the crude death rates in the two periods, and their difference. The rate of

[30] The increase in Greece, however, started well before 2007.

change of the crude death rate increased substantially in the second period in Greece, and more than in the rest of Europe. These results seem to indicate a considerable increases in mortality in Greece, and of its rate of change, during the austerity period.

The next two panels however show that the crude death rate in Greece declined both in the age group below and above 65 years. This suggests that the increase in the overall crude death rate in Greece is purely the result of a composition effect: the Greek population was getting older at a fast pace during this period, and of course the crude overall death rate is highly influenced by the oldest cohorts, which exhibit by far the highest death rates.

A compact way to isolate the effects of aging on mortality is to calculate standardized death rates, i.e. the death rates that would have prevailed in Greece and in Europe if the age structure of the population had remained constant, and equal to that of a benchmark group of countries in a given year. I use the European Union countries and 2009 as benchmarks.[31] The fourth panel of Table 14 presents the results. Now the average death rate in the austerity period declines by as much as 11 percent relative to the previous period, slightly less than in the average European country.

Laliotis, AIoannidis, and Stavropoulou (2016) argue that, even though it is true that the standardized death rate fell in Greece during the crisis, the rate of decline was lower than before the crisis. This depends on how the two periods are broken down: the last three columns of the fourth panel of Table 14 show that indeed rate of decline of the standardized death rate slowed by 2.6 percentage points in the austerity period 2010-2015, relative to the previous period; however, it accelerated by 2.2 percentage points in the crisis period 2008-2015 (not shown). In any case, regardless of the breakdown the rate of decline of the standardized death rate slowed in Europe more than in Greece (see the last columns of the fourth panel of Table 14).

The same pattern emerges if one looks at disaggregated causes of mortality. The World Health Organisation (WHO) classifies diseases and mortality in the International Statistical Classification of Diseases and Related Health Problems (ICD), which is currently in its tenth version (ICD10). EUROSTAT groups the ICD10's causes of death into 86 categories (see the "European shortlist 2012"), which in turn are grouped into 15 main categories. Of these main categories, four – "Diseases of the circulatory system", "Neoplasms", "Diseases of the respiratory system", and "Symptoms, abnormal clinical and laboratory findings" - accounted for about 75 percent of total standardized deaths (37 percent, 22 percent, 9 percent, and 8 percent, respectively) in Greece in 2009.

The last four panels of Table 14 display the standardized mortality rates for these four conditions. With one exception ("Diseases of the respiratory system") the average standardized death rate in Greece was lower in the austerity period than in the previous period,[32] although proportionally it declined more in Europe than in Greece. However, in all four cases the rate of change declined, sometimes substantially, in Greece in the second period relative to the first, while with exception (where it remained stable) it increased in Europe.

[31] The construction of the standardized mortality rate displayed here is slightly different from that applied by EUROSTAT. The latter uses a "European standard population" based on projections for 2011-2030, I use the actual population in 2009.

[32] A decline in mortality during to cardiovascular factors is a standard result in the literature on health and the business cycle: see e.g. Ruhm (2000) and (2012).

Table 14: Mortality

	avg. 00-09	avg. 10-15	% diff.	% change 00-09	% change 09-15	diff.
	(1)	(2)	(3)	(4)	(5)	(6)
	Crude death rates, all					
Greece	965.3	1034.6	7.2	1.6	10.6	9.0
Europe	988.7	987.6	-0.1	-2.9	2.3	5.2
Greece/Europe*	97.6	104.8	7.1	4.4	8.3	3.9
	Crude death rates, 0-64					
Greece	194.2	192.0	-1.1	-4.2	-1.1	3.1
Europe	245.7	220.8	-10.2	-9.3	-8.3	1.1
Greece/Europe*	79.0	87.0	7.9	5.1	7.2	2.1
	Crude death rates, 65+					
Greece	4453.4	4425.2	-0.6	-3.5	2.5	5.9
Europe	4796.9	4467.7	-6.9	-9.4	-3.2	6.2
Greece/Europe*	92.8	99.0	6.2	6.0	5.7	-0.3
	Standardized death rates					
Greece	1008.6	896.0	-11.2	-10.8	-8.2	2.6
Europe	1083.8	923.8	-14.8	-14.8	-8.9	5.9
Greece/Europe*	93.1	97.0	3.9	4.0	0.8	-3.2
	Standardized death rates, diseases of the circulatory system					
Greece	490.9	367.5	-25.1	-20.6	-23.0	-2.3
Europe	461.4	345.1	-25.2	-25.7	-16.6	9.2
Greece/Europe*	106.4	106.5	0.1	5.1	-6.4	-11.5
	Standardized death rates, neoplasms					
Greece	236.9	229.4	-3.2	-0.1	-1.8	-1.8
Europe	272.5	252.0	-7.5	-7.6	-5.4	2.2
Greece/Europe*	86.9	91.0	4.1	7.6	3.5	-4.0
	Standardized death rates, diseases of the respiratory system					
Greece	82.6	89.8	8.8	17.8	5.6	-12.2
Europe	85.2	72.1	-15.3	-15.2	-8.1	7.0
Greece/Europe*	97.0	124.6	27.6	32.9	13.7	-19.3
	Symptoms, abnormal clinical and laboratory findings					
Greece	79.2	79.6	0.5	-16.4	-25.7	-9.3
Europe	35.3	31.5	-10.8	-9.5	-5.1	4.3
Greece/Europe*	224.3	252.5	28.2	-7.0	-20.6	-13.6

Source: EUROSTAT *Mortality* database

Notes: *: columns 1 and 2: 100 x Greece / Europe; column 3 = column 2 – column 1; columns 4 and 5; Greece – Europe; column 6 = column 5 – column 4.

"% change 00-09": percentage difference between the average of 2008 and 2009 and the average of 2000 and 2001; "% change 00-09": percentage difference between the average of 2014 and 2015 and the average of 2008 and 2009.

8.2 AMENABLE MORTALITY

A better indicator for the purpose of comparing the performance of health systems is that of amenable deaths, first developed by Nolte and M. McKee M (2004). According to the definition used by the Office for National Statistics (2011), and adopted also by EUROSTAT (2017), a "death is amenable if, in the light of medical and technology at the time of death, all or most deaths from that cause could be avoided through good quality healthcare."[33] The complete list of amenable causes of deaths included in the definition was prepared by a task force of experts set up by EUROSTAT and is reproduced in Appendix 2. Note that with three exceptions, the age limit considered in the construction of the indicator of amenable deaths is 74 years.

I have computed standardized amenable death rates using the procedure outlined above. In some cases the correspondence between the International Statistical Classification of Diseases and Related Health Problems (ICD) of the diseases in the original definition of amenable death and the classification of n the EUROSTAT database used here is not perfect. Appendix 2 lists also the ICD conditions included in my definition of amenable deaths. The results are in

Table 15, which has the same structure of the previous table and includes also the CIIPS countries. The amenable death rate declined substantially in Greece, Europe, and the CIIPS countries, but proportionally more in the latter two groups.

The next three columns display the trends of the two periods and their differences. In both periods there was a trend decline in amenable deaths; the rate of decline slowed down by similar percentage points in Greece and Europe. The slowdown was much less marked in the CIIPS countries. Overall, amenable deaths do paint a clear pattern: the levels declined in Greece but less than in Europe and in CIIPS countries; the rates of decline slowed down in Greece more than in the other countries. Thus, like standardized death rates, standardized amenable death rates declined in the austerity period, and also relative to the rest of Europe, both in levels and in rates of change. In contrast, standardized death rates worsen relative to the rest of Europe only in rates of change.

Table 15: Amenable mortality

	avg. 00-09	avg. 10-15	% diff.	% change 00-09	% change 09-15	diff.
	(1)	(2)	(3)	(4)	(5)	(6)
Greece	152.3	127.2	-16.5	-17.5	-5.8	11.7
Europe	185.4	139.0	-25.0	-26.7	-16.4	10.2
Greece/Europe*	0.82	0.92	0.07	9.2	10.6	1.4
CIIPS	138.1	107.4	-22.2	-21.3	-15.9	5.4
Greece/CIIPS*	0.74	0.82	0.08	3.8	10.1	6.3

Source: EUROSTAT *Mortality* database

Notes: *: columns 1 and 2: 100 x Greece / Europe (CIIPS); column 3 = column 2 – column 1; columns 4 and 5; Greece – Europe (CIIPS); column 6 = column 5 – column 4.

"% change 00-09": percentage difference between the average of 2008 and 2009 and the average of 2000 and 2001; "% change 00-09": percentage difference between the average of 2014 and 2015 and the average of 2008 and 2009.

[33] Note that, as stated by EUROSTAT (2017): "The concept of preventable deaths is broader and includes deaths which could have been avoided by public health interventions focusing on wider determinants of public health, such as behaviour and lifestyle factors, socioeconomic status and environmental factors."

8.3 MORTALITY AND RESOURCES

In 2000, the Greek standardized mortality rate was 92 percent of the European average; in 2015, it was 97 percent (see Table 16). This was the result of two jumps: before the crisis, in 2006 and 2007, by a total of 7 percentage points relative to Europe; and in 2012, the only year of the crisis period when standardized mortality increased, by 1 percentage points relative to Europe and by 12 deaths per 100,000 inhabitants.

Vlachadis (2014) p. 691 writes that *"[t]he 2011–12 increased mortality in people older than 55 years (about 2200 excess deaths) probably constitutes the first evident short term consequence of austerity on mortality in Greece."* Although he does not specify how he defines "excess deaths" nor how he gets this number, in 2012 the crude death rate of individuals aged 55 or more in Greece increased by 130 deaths per 100,000 inhabitants, against an average increase of 58 in Europe. In 2012 the Greek population 55 years or older was about 3.5 millions. (130-58) times 35 (where 35 is 3.5 millions divided by 100,000) gives 2,500 extra deaths (relative to the European average) per 100,000 individuals.

Might the temporary spike in mortality in 2012 be attributed to the budget cuts? We have seen that 2011 was the year when government spending on health started to decline in earnest. In addition, in that year curbs on the free availability of medicines were introduced, and the unemployed were no longer insured. Thus, on a purely temporal basis, there are reasons to attribute the 2012 spike in mortality to the austerity policies. This conclusion is difficult to reconcile with the fact that the 2012 increase in mortality was followed by a dramatic decline in 2013, by 60 standardized deaths per 100,000 inhabitants and 4 percentage points relative to Europe, which brought the mortality rate to a new historical minimum for Greece (see Table 16).

Still, it is interesting to look at two variables that are good indicators of the effort of the health system: total hospital bed-days per 100,000 population, and the average length of hospital stays, as shown in the next panels of Table 16 (the data are available only from 2007 to 2012). Because obviously a change in hospital resources could have a delayed effect on mortality, I ask a simple question: is there evidence that one or both of these variables declined in 2011 or in 2012?

Total bed-days per capita in Greece increased both in 2011 and especially 2102, by a cumulative 4 percentage points; in contrast, they decreased substantially in Europe, so that relative to the latter, in Greece they increased by more than 4 percentage points each year, from 100 percent in 2010 to 109 percent in 2012. This could suggest that contemporaneous budget cuts were not the reason for the increase in mortality in 2012. However, and quite obviously, bed-days are endogenous, and negatively correlated with health conditions *ceteris paribus*. Still, if the budget cuts were binding one would also expect at the same time a decline in the average length of stay, to save resources at the intensive margin. The next panel of Table 16 shows that the average length of stay too *increased* substantially in Greece in 2011 and 2012, while it again *declined* in Europe.

The same exercise can be carried out for the individual causes of the death (not shown). The 12 point increase in the standardized death rate and the 53 point increase in the crude death rate in 2012 can be explained entirely by three of the four causes of death, "Diseases of the respiratory system" (+5 percentage points), "Neoplasms" (+ 3 pps), and ""Symptoms, abnormal clinical and laboratory findings" (+3 pps). In the first two cases, total bed days per capita increased in 2011, both in absolute terms and relative to Europe; they kept increasing in 2012 in the case of "Neoplasms", while remaining stable in the case of "Diseases of the respiratory system". The average length of stay follows the same pattern. Only

in the case of "Symptoms, abnormal clinical and laboratory findings" do both bed-days and average length of stay fall, both in absolute and in relative terms.

Table 16: Death rates, bed-days, and average length of stay, 2000-2015

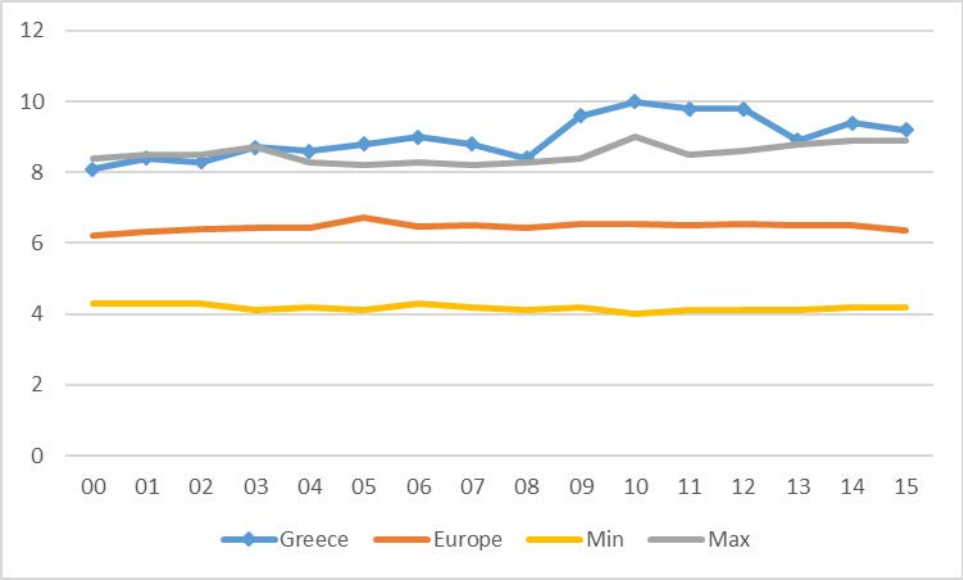
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Crude death rate															
976	946	954	967	959	953	954	991	976	976	981	999	1052	1016	1041	1119
1018	994	1003	1018	974	987	967	973	978	976	975	969	994	989	975	1025
0.96	0.95	0.95	0.95	0.99	0.97	0.99	1.02	1.00	1.00	1.01	1.03	1.06	1.03	1.07	1.09
Standardized death rate															
1093	1037	1035	1038	1019	994	977	992	960	940	923	914	926	867	857	888
1186	1134	1131	1141	1108	1108	1035	1018	1000	977	956	932	938	916	887	914
0.92	0.91	0.92	0.91	0.92	0.90	0.94	0.97	0.96	0.96	0.97	0.98	0.99	0.95	0.97	0.97
Standardized amenable death rate															
165.0	161.5	164.1	160.4	160.4	148.0	147.3	146.9	136.4	133.1	129.3	126.9	129.8	123.2	125.5	128.5
225.1	204.4	199.5	194.5	191.4	186.3	171.4	166.0	160.6	154.4	149.1	143.8	141.0	136.9	131.7	131.6
0.73	0.79	0.82	0.82	0.84	0.79	0.86	0.89	0.85	0.86	0.87	0.88	0.92	0.90	0.95	0.98
Bed-days per capita															
							1366	1333	1380	1315	1341	1379			
							1330	1329	1325	1313	1283	1262			
							1.03	1.00	1.04	1.00	1.04	1.09			
Average length of stay															
							6.9	6.6	6.7	6.6	6.8	7.0			
							8.2	8.1	8.0	8.0	7.8	7.8			
							0.84	0.82	0.83	0.83	0.87	0.91			

Source: EUROSTAT *Healthcare* database and *Mortality* database.

9 LOW-WEIGHT BIRTHS AND INFANT MORTALITY

Low weight births typically track closely sudden and marked deteriorations in health conditions.
Figure 14 shows that in 2000 Greece already had one of the highest low-weight birth rates in Europe; in 2008 it increased suddenly and substantially, from 8.4 percent to 10 percent in 2010, and remained above the pre-2008 level during all the austerity years; as a result, between 2008 and 2013 it was well above the next highest in Europe.

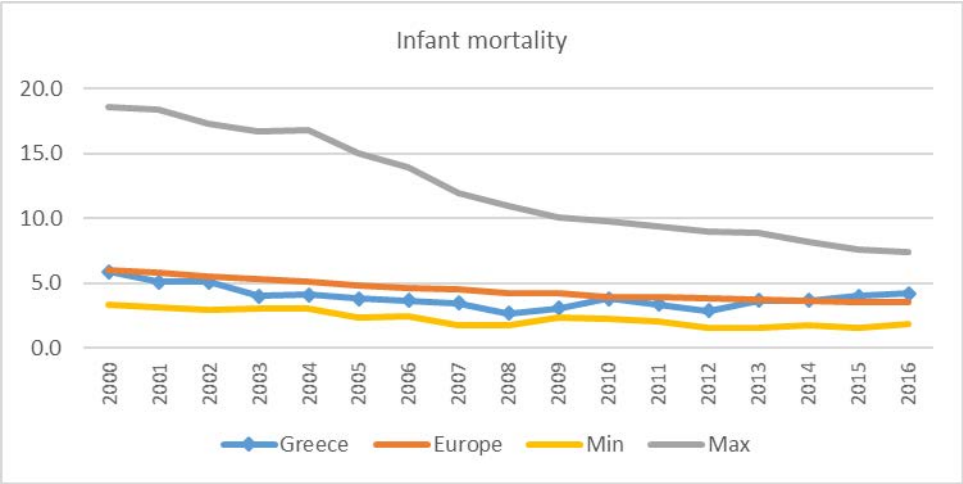
Figure 14: Low weight births

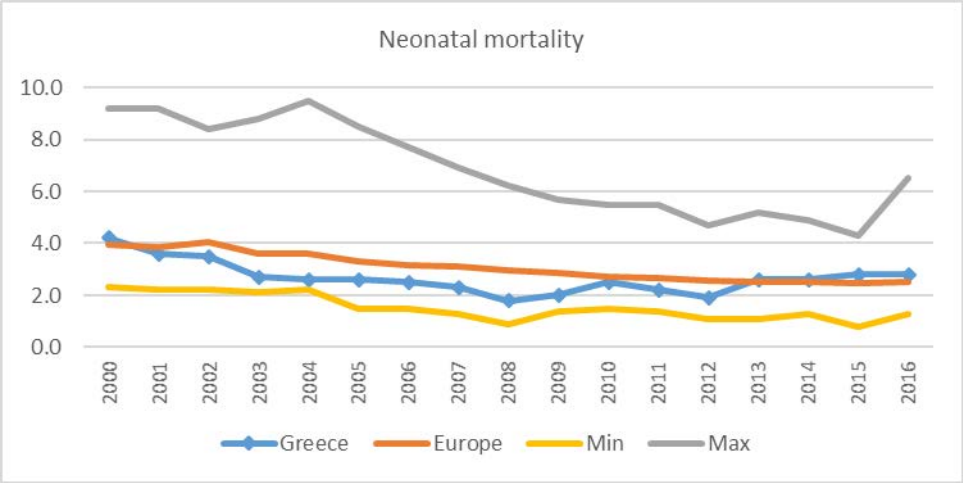


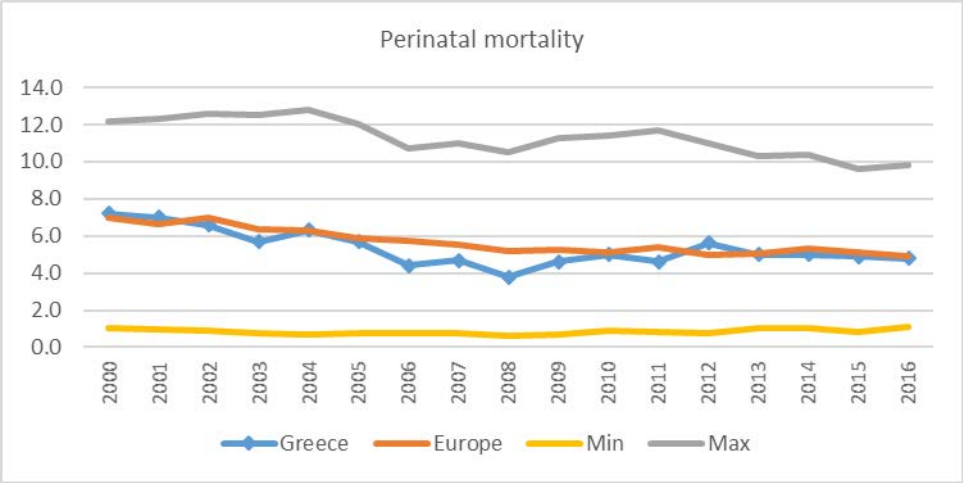
Source: OECD *Health status* dataset.
Notes: Percentage of live births. The sample includes: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom.

Infant mortality also shows a clear deterioration. As shown in Figure 15, after a steady decline between 2000 and 2009, all three measures – infant mortality, neonatal mortality, and perinatal mortality – show an increase in rates starting in 2009, also relative to the other countries. As a result, while all three measures started below the European average, by 2016 they were at or slightly above the average.

Figure 15: Infant, neonatal, and perinatal mortality







Source: EUROSTAT *Healthcare* database.
Notes: all figures are deaths per 1000 live births.
Infant mortality rate: the ratio of the number of deaths of children under one year of age during the year to the number of live births in that year.
Neonatal mortality rate: the ratio of the number of deaths of children under 28 days during the year to the number of live births in that year.
Perinatal mortality rate: the ratio of the number of deaths of children under one week and the stillbirths during the year, to the number of births in that year (including still births).

10 META-ANALYSIS

Simou and Koutsogeorgou (2014) performed a review of the peer-reviewed literature in English published from January 2009 to March 2013, searching for the following terms and keywords in the title and the abstract: “financial”, “economic”, “crisis”, “troika”, “IMF”, “debt”, “bailout”, “austerity”, “measures”,“Greece”, “Greek”, “health”, and “healthcare”.[34] The goal was to identify the effects of the crisis on health and healthcare. I have already dealt extensively with the latter; thus, in what follows I

[34] The search was based on the following databases: PubMed,Scopus, EBSCOhost, and Thomson Reuters (formerly ISI)Web of Knowledge.

will concentrate on the effects on health. Five types of effects are identified in the paper: Epidemics, Suicides, Self-rated health, Mental health, Otorhinolaryngologic disorders.

I will focus on the first two. I have already dealt with self-rated health. Evidence on deterioration of mental health in Greece during this period is based on telephone interviews, and there are no comparative data across Europe. An increase in the diagnoses of vertigo and tinnitus was reported by one publication, which tentatively related it to the stress caused by the economic crisis.

Reports on epidemics have been much more widespread, and have frequently been the object of the larger debate on the crisis. Four types of epidemics have been discussed: HIV infection among injecting drug users in 2011; Autochthonous Plasmodium Vivax malaria in 2009–2011; Pandemic influenza A (H1N1) in 2009; and West Nile Virus (WNV) infections in 2010 and 2011. In this section, I will deal with each of these in turn.

10.1 HIV

" [….] an HIV outbreak— the only one to occur in Europe in decades— emerged in the center of Athens." (Stuckler and Basu 2014, p. 86). Starting in late 2010 or the beginning of 2011, there was a large surge in new HIV diagnoses in Greece; by 2012, these had increased by almost 80 percent relative to 2010 (see Table 17). In the literature on the Greek crisis, it is frequent to attribute the increase in HIV infections to the budget cuts (see e.g. Paraskevis et al. 2013 and Scaturro 2013).

Table 17: New HIV infections in Greece, 2006-2015

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	505	559	614	612	642	958	1147	871	761	691

Source: European Centre for Disease Prevention and Control/WHO Regional Office for Europe. HIV/AIDS surveillance in Europe 2015. Stockholm: ECDC; 2016

There is no official definition of an "HIV outbreak". Table 18 lists all the country-years in the EU-EEA countries (with more than 50 HIV infections) in which new HIV infections increased by at least 50 percent with respect to the average of the previous two years, starting in 2006. The outbreak so defined lasts until new infections fall back to the value of the year before the outbreak, plus at most 25 percent. Greece was not unique during this period. Between 2007 and 2015, there were 6 such outbreaks according to this definition; the Greek one was the second smallest in terms of percentage increase, and the only one to have ended by 2015, when new HIV diagnoses had fallen dramatically relative to the 2012 peak, and had returned to just above the level of 2008.

Table 18: HIV outbreaks in Europe, 2007-2015

	begins	% increase	ends
	(1)	(2)	(3)
Lithuania	2009	79.1	
Slovakia	2013	67.7	
Poland	2010	67.3	
Italy	2009	63.4	
Greece	2011	52.8	2013
Spain	2008	51.3	

Source: European Centre for Disease Prevention and Control/WHO Regional Office for Europe. HIV/AIDS surveillance in Europe 2015. Stockholm: ECDC; 2016

Notes: The sample includes all country years of all EU and EEA countries, with at least 50 new diagnoses. The sample starts in 2006. Column 1: year t, i.e. when new HIV infections increased by at least 50 percent relative to the average of the previous two years. 1. Column 2: percentage increase in year t relative to average of previous two years. Column 3: year when new HIV infections return to the level of 125 percent of year t-1 or less.

To gather evidence on the causal effects of budget cuts in HIV programs, it is important to establish first the modes of transmission of the Greek HIV outbreak. Table 19 shows that virtually all of the increase in new HIV diagnoses in Greece between 2009 and 2012 can be accounted for by drug injection as probable source of transmission.

Table 19: New HIV infections, by mode of infection

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	505	559	614	612	642	958	1147	871	761	691
Drug use	14	13	9	15	25	311	519	261	112	70
Sex between men	250	300	327	337	378	344	333	344	368	351
Heterosexual contact	152	132	160	123	119	148	149	115	135	106
Mother to child	3	3	1	0	3	4	0	0	1	0
Unknow	86	111	117	137	117	151	146	151	145	164

Source: European Centre for Disease Prevention and Control/WHO Regional Office for Europe. HIV/AIDS surveillance in Europe 2015. Stockholm: ECDC; 2016

Note. "Unknown" includes transmission via transfusion and nosocomial infections.

Over the 2010-15 period, on average infections by injection were about 15 times higher than in 2009: Table 20 shows that only Romania experienced anything comparable. However, the starting point in Greece was extremely small, 25 new infections.

Table 20: New HIV infections with drug injection as probable cause of transmission, average 2010-2015, as percentage of 2009

	% change
Greece	1442.2
Romania	1009.3
Czech Republic	166.7
Latvia	108.8
Germany	106.2
Estonia	101.4
Austria	96.4
Average EU-EEA	91.4

Source: European Centre for Disease Prevention and Control/WHO Regional Office for Europe. HIV/AIDS surveillance in Europe 2015. Stockholm: ECDC; 2016

Notes: the table displays the percentage change og the 2010-2015 average relative to 2009. Only countries with percentage change above the unweighted average of the EU and EEA countries are displayed.

Research by molecular epidemiologists also confirms that the origin of the HIV outbreak in Greece was injecting behavior. HIV-1 sequences taken from samples of injecting drug users were genetically similar, "suggesting the recent nature of the HIV-1 epidemic among them" (see Paraskevis et al. 2013 p. 8). In addition, there was a change in the role of clustered transmission: it was rare in the 2009 samples, with less than 5 percent of IDU infections being clustered; in the 2011 and 2012 samples about 95 percent of IDU infections were clustered.[35] Clustered transmission is important because it suggests prevalence of transmission via needle sharing as opposed to sexual transmission.[36]

The key question for the purposes of the present paper is: can this change in behavior be attributed to the budget cuts in health services? I address this question in two steps: first, I look at evidence on the timing of the causes of the transmission of HIV via drug use; second, I reconstruct the accounts of the drug treatment services to establish the timing of cuts in their budgets, if any.

The Greek authorities estimate each year the number of "Problem drug users" ("PDUs", now called "High-risk drug users") using heroin as their primary substance. These are the individuals most likely to transmit an HIV infection via drug use.[37] These estimates are based on the "capture-recapture" method, which in turn is based on drug users applying for treatment with KETHEA, 18 ANO and other treatment services. The method is meant to account also for the "hidden population" of problem drug users, i.e. those that do not transit through the services collecting the information. For obvious reasons, these estimates are subject to substantial uncertainty.

[35] See Paraskevis et al. 2013, Table 2, p.5 and Fotiou et al. 2012, Table 5 p. 47.

[36] The two largest identified clusters (sub-outbreaks) of HIV-1 in the 2011-12 sample, with 75 percent of all IDUs in the sample, originated in Western Europe outside Greece and in Iran-Afghanistan, respectively. The nationality of the potential founder was Bulgaria and Iran, respectively (see Paraskevis et al. 2013, Table 3 p.5). This suggests a potential disproportionate role for recent immigrants in the HIV outbreak.

[37] "Problem drug use is defined by the EMCDDA as 'injecting drug use or long duration or regular use of opioids, cocaine and/or amphetamines'. This definition specifically includes regular or long-term use of prescribed opioids such as methadone but does not include their rare or irregular use nor the use of ecstasy or cannabis. Existing estimates of problem drug use are often limited to opioid and poly-drug use." (see the EMCDDA website).

Row 1 of Table 21 displays the central estimates of the number of PDUs. This number peaked in 2009 and then declined in 2010 (hence one year before the start of the outbreak) and 2011. Current injectors, i.e. those PDUs that used injection of the substance in the last 30 days, also peaked in 2009. The estimated share of PDUs currently sharing needles also peaked in 2009 and then dropped off sharply (see row 3) to levels well below that recorded in 2004. Thus, the change in behavior of drug users towards injection and needle sharing occurred in 2009.

Table 21: PDUs, injecting PDUs, and needle sharing

	2004	2005	2006	2007	2008	2009	2010	2011	2012
PDUs	19601	19151	20146	N/A	20181	24097	22515	20473	20429
Injecting last month	8959	9416	9729	N/A	8148	10658	9439	7847	7651
Currently sharing	3230	2988	2816	N/A	2179	2800	2405	2023	1808

Source: 2013 NATIONAL REPORT (2012 data) TO THE EMCDDA by the Reitox National Focal Point.

Early detection of an increased risk of infection via drug injection can be obtained by looking at the prevalence of the Hepatitis C virus.[38] Table 22 displays prevalence of HCV antibody (the data come mostly from Attica, where the HIV outbreak of 2011 among IDUs was concentrated). There is a dramatic increase between 2008 and 2010, especially among recent IDUs (i.e. IDUs who started injecting in the last two years). Among the latter, in Athens there is a further big jump in 2011, although not outside Athens.

Table 22: HCV prevalence

	2008	2009	2010	2011	2012
ALL PWID	55.5	64.3	69.3	69.3	73.4
All PWID, Athens	60	68.3	74.6	76.5	79.1
PWID with injecting history less than 2 years	29.3	39	55.5	52.4	63.6
PWID with injecting history less than 2 years, Athens	33.9	44.7	59.4	76.5	72.9
PWID less than 25 years old	40.3	38.8	52.4	52.5	62.3
PWID less than 25 years old, Athens	42.6	49.9	61.2	52.2	73.3

Source: 2014 NATIONAL REPORT (2013 data) TO THE EMCDDA by the Reitox National Focal Point, Table 6.1 p. 64
PWID: "People Who Inject Drugs".

Having established that the change in behavior occurred by 2010 at the latest, I now look at the yearly evolution of the budget of the health programs for drug users. There is a widespread belief that budget cuts in health programs were among the causes of the 2011 HIV outbreak. *"A significant increase in HIV infections occurred in late 2010 [….] Budget cuts in 2009 and 2010 have resulted in the loss of a*

[38] "[D]ata on prevalence of hepatitis C infection can form a valuable indicator of injecting risk in populations where HIV has not yet expanded, especially among young or new injectors " (EMCDDA and ECDC 2012, p. 3). See also Vickerman et al. (2010) and Reintjes et al. (2007).

third of the country's street-work programmes; one survey of 275 drug users in Athens in October, 2010, found that 85% were not on a drug-rehabilitation programme." (Kentikelenis et al. 2011, p. 1458).

The two most important types of drug treatment providers in Greece are "drug free programmes " and "opium substitution centers (OST)".[39] The former provide inpatient and outpatient services also to inmates and to adolescents; the latter only outpatient services. There are four main officially recognized providers of drug treatment: OKANA (mostly OST), KETHEA (mostly drug free treatment), 18 ANO (Attica Psychiatric Hospital), and the Thessaloniki Psychiatric Hospital.

Table 23 displays the expenditure of the four programs between 2004 and 2013, the last year for which the data is publicly available. Total spending increased continuously up to 2010, by almost 80 percent relative to 2004. Then it started falling, and in 2013 it was about 30 percent below its 2010 peak, at about the 2006 level.

Table 23: Expenditure of drug treatment programs

	18 ANO	Tessaloniki Psychiatric Hospital	OKANA	KETHEA	Total	% change relative to 2009 total	%change relative to 2009 OKANA + KETHEA
2004	5209	1652	25156	20946	52963		
2005	5612	1924	28636	21336	57508		
2006	8798		27800	23001	59599		
2007							
2008	12249	3234	39185	28672	83340		
2009	11987	3638	46934	30318	92877		
2010	11870	4352	51064	26549	93835	1.0	0.5
2011	10524	3597	43458	23626	81205	-12.6	-13.2
2012	8526	2578	40076	20208	71388	-23.1	-22.0
2013			33713	18463			-32.5

Thousands of euros

Source: EMCDDA: *National Report to the EMCDDA by the Reitox National Focal Point*, various years.

The majority of clients of treatment programs was in OST programs. Table 24, row 1, shows that in 2010 one OST center was added, and in 2013 17 more. The capacity of OST programs increased steadily, including in 2009, with a bigger jump in 2011 and then again in 2012 due to the opening of several programs. The total staff of OST programs increased steadily up to 2009, declined in 2010 by just 4 percent, and then increased further in 2011 by 25 percent. The number of individuals treated also increased steadily.

[39] "The main objectives of drug-free treatment programs include total abstinence from drug use, improvement of personal and social skills, health condition and family and social relations, decrease in deviant behavior, vocational training. The therapeutic process may be multi-phased (counselling, main treatment, social reintegration) and may be developed in a single or a network of affiliated units. The main goal of the OST programme is to achieve reduction in drug use and drug-related social and health problems, as well as to protect public health from the spread of infectious diseases." (EMCDDA 2012 p. 57)

Table 24: Statistics on treatment centers

		2002	2003	2004	2005	2006	2008	2009	2010	2011	2012
OST centers	Number of centers	5	11	15	17	17	24	24	25	42	53
	Capacity	1310	2155	2804	3060	3250	4804	4800	5300	6789	8691
	Staff	142	198	302	362	358	463	475	458	575	702
	In treatment	1616	2293	3336	3596	3950	5045	5360	6264	6783	9878
Drug free centers	Number of centers	26	32	34	39	40	45	49	52	50	50
	Capacity	846	1024	1099	1186	1228	927	1238	1310	1064	1114
	Staff	370	347	361	411	502	587	611	580	538	559
	In treatment	2129	1967	1799	2099	2175	2115	2187	2032	2264	2156

Source: EMCDDA (2013)

Thus, spending on HIV programs kept increasing until 2010 included, well after the increase in problem drug users, in current injectors, and in users currently sharing needles. The number of centers, their capacity, and the number of treated individuals kept increasing throughout this period, both before and after the HIV outbreak. The number of applicants on waiting list for OST treatment in Athens was stable between 2009 and 2011, and declined sharply after that.[40]

Cuts in the budget for free needle distribution have also been mentioned as a possible concurring factor in the HIV outbreak. Table 25 displays the number of syringes distributed yearly, and the number per PDU. The coverage remained stable at a very low level, about 6 per PDU (the lowest among European countries) until 2009, then increased to 15 in 2011 and 81 in 2013. These are still low numbers, but given that these programs are concentrated in Athens, the coverage of syringe distribution in Athens in 2013 was estimated to be 216 per PDU.[41] As a reference, in 2007 in the twelve European countries for which data were available, Wiessing et al. (2009) estimate an average number of syringes distributes through needle exchange programs of 50 per injecting drug user, with a maximum of 325 in Norway (see European Monitoring Center for Drugs and Drug Addictions 2010).

Table 25: Syringe distribution

	2005	2006	2007	2008	2009	2010	2011	2012
Syringes distributed	29782	34809	64958	55109	68579	61516	119397	406898
Coverage	3.2	3.6	6.6	6.8	6.4	6.5	15.2	53.2

Coverage is the ratio of syringes distributed to injecting drug users

Source: 2013 NATIONAL REPORT (2012 data) TO THE EMCDDA by the Reitox National Focal Point

Overall the evidence does not seem to be consistent with the view that the budget cuts in drug treatment services caused the HIV outbreak among drug users. The budget cuts were limited, they did not seem to have affected the capacity of treatment centers and the numbers of clients they treated, and

[40] The benefits of being on a waiting list are debatable, however. Reported waiting time for entry in an OST center in Athens in 2011 was 88 months.

[41] See EMCDDA (2014) p. 74.

occurred after the increase in drug use and in the frequency of injectors and needle sharers. In addition, the cuts in drug treatment services were small, and were more than reversed in 2011 in response to the outbreak.

10.2 MALARIA

Locally acquired malaria is not unknown in Europe, but it is extremely rare. In recent years, there were two probable cases in Italy, in 2009 and 2011 respectively, and one Spain in 2010. In 1974, Greece was declared malaria-free. A few cases of locally acquired malaria were reported in 1975, 1999 and 2000. [42] In 2009, seven cases were reported, followed by 4 in 2010 and 42 in 2011, 20 in 2012, and 3 in 2013. After this, no more cases of malaria have been reported.

75 percent of the cases reported in Greece occurred in or in the vicinity of Evrotas, in the Prefecture of Laconia, in the Peloponnese region in Southern Greece, an area which is mainly farm land covered with citrus trees and with a strong presence of immigrants from countries with endemic malaria.[43] The association has been made between the increase in malaria cases and less intense spraying in areas at risk, due to the local government budget cuts (see e.g. the individuals cited or interviewed in Scaturro 2013), although no evidence has been put forward.

Table 26: Malaria in Greece, 2009-2014

Year of symptom onset	Imported cases	Locally-acquired cases	Of which: immigrants	Of which: Evrotas	Total
2009	44	7		6	51
2010	40	4		1	44
2011	54	42	8	36	96
2012	73	20	6	10	93
2013	22	3	0	0	25
2014	38	0	0	0	38
Total	271	76	14	53	347

Source:
Hellenic Center for Disease Control and Prevention. Epidemiological surveillance report, malaria in Greece, 2015, up to 16/10/2015
Hellenic Centre for Disease Control and Prevention (KEELPNO): http://www.keelpno.gr/Portals/0/%CE%91%CF%81%CF%87%CE%B5%CE%AF%CE%B1/%CE%95%CE%BB%CE%BF%CE%BD%CE%BF%CF%83%CE%AF%CE%B1/2015/Malaria_report_ENG_16_10_2015_final-2.pdf
Hellenic Centre for Disease Control and Prevention (KEELPNO): Malaria in Greece: Epidemiological data and KEELNO action

[42] Locally-acquired malaria is defined as malaria in individuals that are not migrants from areas were malaria is endemic nor individuals who have travelled to an area were malaria is endemic in the last five years.
[43] European Center for Disease Prevention and Control: Rapid risk assessment: Update on autochthonous Plasmodium vivax malaria in Greece – 11 October 2011, p. 2 writes: "The vast majority of farm workers are migrants from malaria-endemic areas of Asia and the Indian subcontinent, especially during the cropping season. It is reported that approximately 2 000–4 000 migrants currently live and work in the area of Skala, Lakonia and that there is a rapid turnover in their population."

10.3 INFLUENZA

It has been widely claimed that Greece suffered disproportionately from the A(N1H1) influenza pandemic of 2009 (the first cases in Europe were reported in May 2009). Several commentators have attributed the high mortality rate in Greece to the debilitating effects of the recession and to the budget cuts of the health system (see e.g. Bonovas and Nikolopoulos 2012).

Gathering comparable cross-country data on mortality attributable to influenza is difficult. There are essentially two methods by which countries estimate influenza mortality. The first is statistical: various models of "normal" mortality are fitted, and deviations from this are attributed to the pandemic. This method is highly country-specific, and I am not aware of comparable data that have been collected based on it

The second method is death certificates and laboratory tests. Organic samples of individuals who are suspected of having dies of influenza are sent to a lab; if tested positive for the virus, the death is attributed to influenza. This method provides the lower bound to the true influenza mortality: since influenza manifests itself through various symptoms, not always a lab test is requested and carried out. For this reason, underestimation is likely to be particularly severe in older people. On the other hand, at the peak of the pandemic, a lab test might be considered unnecessary.

The European Center for Disease Prevention and Control has collected data from national sources on laboratory confirmed death from A(N1H1). The results are in Table 27, which displays the absolute number of deaths and the number of deaths per million population as of April 2010 (the pandemic was over by that time). Mortality in Greece was the fourth highest in Europe, and similar to that of countries like Hungary and Portugal.

Table 27: Mortality attributed to influenza A(N1H1) in Europe, 2010 season

Country	Number of deaths	Deaths per 1,000,000 population	Country	Number of deaths	Deaths per 1,000,000 population
Latvia	34	16.0	**Luxembourg**	3	6.0
Estonia	21	15.8	**Denmark**	33	6.0
Hungary	134	13.4	**Spain**	271	5.8
Greece	141	12.7	**Ireland**	26	5.7
Portugal	122	11.5	**Bulgaria**	40	5.4
Slovakia	56	10.4	**France**	344	5.3
Cyprus	8	9.8	**Austria**	40	4.8
Czech Republic	102	9.7	**Poland**	181	4.8
Slovenia	19	9.3	**Italy**	244	4.1
Finland	44	8.2	**Netherlands**	62	3.7
United Kingdom	474	7.6	**Germany**	254	3.1
Lithuania	23	7.3	**Sweden**	29	3.1
Romania	122	6.0	**Belgium**	19	1.8
Europe	2846	5.7			

Source: European Centre for Disease Prevention and Control: Questions and answers on the pandemic (H1N1) 2009

Influenza mortality is highly age-specific: it tends to be higher in the very young and in the elderly. Data on influenza A(N1H1) mortality by age are sparse: for the four countries I was able to find data, Table

28 shows that mortality in Greece mortality was below that of the Netherlands and the UK up to age 45, and then increased dramatically: for individuals over 65 it was eight times that of Germany, four times that of the Netherlands, and three times that of the UK.

Table 28: Influenza mortality by age, deaths per million population

	Greece	Germany	Netherlands	UK
0-4	3.0	2.9	5.3	6.9
5-14	3.0	2.5	5.6	5.5
15-24	5.0	2.2	1.5	4.6
24-44	5.0		2.2	6.2
45-64	10.0	4.2	5.5	8.1
65+	19.7	2.4	4.7	6.0

Sources: Greece: Athanasiou, M. et al. (2010): Fatal cases associated with pandemic influenza A (H1N1) reported in Greece, *PLOS Currents: Influenza*, November 9, 2010; Netherlands: van Gageldonk-Lafeber, Rianne et al. (2011): Case-based reported mortality associated with laboratory-confirmed influenza A(H1N1) 2009 virus infection in the Netherlands: the 2009-2010 pandemic season versus the 2010-2011 influenza season, *BMC Public Health* 2011, 11:758; UK: Peabody, Richatrd et al. (2010): Pandemic Influenza A (H1N1) 2009 and mortality in the United Kingdom: risk factors for death, April 2009 to March 2010, *Euro Surveillance*. 2010;15(20):pii=19571; Germany: Wilking H., et al: 2010): Buda S, von der Lippe E, Altmann D, Krause G, Eckmanns T, Haas W. Mortality of 2009 pandemic influenza A(H1N1) in Germany, *Euro Surveillance* 2010;15(49):pii=19741

Notes: Deaths per million population. For Germany, the age groups are: 0-4, 5-14,15-34,35-59, and 60+.

10.4 West Nile virus

West Nile virus (WNV) is a mosquito-borne virus. It is spread by mosquitoes and wild and captive birds. "Most humans infected with WNV remain asymptomatic. Approximately 20–40% of infected humans develop symptoms, the vast majority of which range from a mild flu-like syndrome, West Nile fever (WNF), to severe West Nile encephalitic disease (WNED). This severe condition involves less than 1% of the infected patients. The neurological disease usually encompasses three different syndromes: meningitis, encephalitis, and acute flaccid paralysis." (see Sambri et al. 2013).

Up to the mid-1990s, there were only sporadic cases in Europe. The first outbreak occurred in 1996 in Romania, with about 400 cases (see Calistri et al. 2010), followed by several outbreaks in three regions of Russia until 2010. In 2010, there were autochthonous human cases of West Nile virus infection in Romania, Hungary, Italy, Spain, and Greece among EU countries (see European Center for Disease Prevention and Control 2012), in addition to Croatia, the Former Yugoslav Republic of Macedonia, Kosovo, Montenegro, and Serbia (see Sambri et al. 2013). Only in Greece, however, did this characterize as an "outbreak" according to the European Center for Disease Prevention and Control (2012). The cases recorded in Greece in 2010 were the first ever reported in the country.

The European Center for Disease Prevention and Control started collecting data in 2011. Table 29 displays the number of cases recorded in the European Union countries that ever recorded more than 5 cases in at least 1 year (in parentheses the incidence per 100,000 population, where the denominator is the sum of the population of the provinces where cases were detected).[44] The source does not

[44] I have added data for 2010 for Greece from Danis et al. (2011) and European Center for Disease Control (2012).

distinguish between individuals that developed WNED and those that did not. However, most individuals discover to be affected by WNV by being hospitalized after developing these symptoms: for instance, of the 262 individuals reported in Greece in 2010, 197 had WNED (see Danis et al. 2011).

In the years from 2010 to 2013, Greece did indeed have by far the highest incidence recorded in this dataset in European Union countries. Part of the difference can be explained by the age structure of the Greek population: the incidence of neurological disorders caused by WNV increases dramatically with age (see Table 30).

Table 29: WNV cases and incidence

	Greece	Hungary	Italy	Romania	Bulgaria	Croatia
2010	262					
2011	100	3	14	11		
	(1.37)	(0.13)	(0.50)	(0.25)		
2012	161	17	50	14	2	5
	(2.13)	(0.25)	(1.02)	(0.35)	(0.47)	(0.72)
2013	65	31	69	24		16
	(1.04)	(0.46)	(0.71)	(0.34)		(1.30)
2014	15	11	24	23		
	(0.33)	(0.21)	(0.37)	(0.27)		
2015		18	61	32	15	
		(0.43)	(0.58)	(0.38)	(0.97)	
2016		44	76	93	2	
		(0.53)	(0.71)	(0.82)	(0.15)	
Total	603	124	294	197	19	21
Estimated total with WNED	453	92	221	148	14	16
Estimated deaths	90	19	44	30	3	3

Sources: West Nile data by year (since 2011): https://ecdc.europa.eu/en/west-nile-fever/surveillance-and-disease-data/historical.

For Greece 2010: Danis, K. et al. (2011): "Outbreak of West Nile infection in Greece", *Emerging Infectious Diseases Journal*, Volume 17 Number 10-October 2011.

European Center for Disease Control (2012): "Epidemiological situation of West Nile virus infection in the European Union", Risk Assessment Update, 13 July 2012.

Notes: for each country year, the table reports the number of cases, and in parentheses the number of cases per 100,000 population of the provinces where the cases were reported. Second to last row: third to last row, multiplied by 197/262, the proportion of individuals with WNV that presented WNED in Greece in 2010-2011 according to Danis et al. (2012). Last row: second to last row multiplied by .15, the fatality rate in Greece 2010-2011 among individuals with WNED according to Papa (2013).

Table 30: WNV incidence by age, Greece 2010

Age group	No. of patients	Incidence per 100,000 population
<20	4	0.18
20–29	3	0.2
30–39	6	0.34
40–49	9	0.55
50–59	18	1.27
60–69	29	2.44
70–79	85	8.01
80+	43	9.63

Source: Danis, K. et al. (2011): "Outbreak of West Nile infection in Greece", *Emerging Infectious Diseases Journal*, Volume 17 Number 10-October 2011, Table 1. Characteristics of 197 patients with West Nile neuroinvasive disease. Greece, July–October 2010.

The second to last row of Table 29 displays the estimated number of individuals who developed WNED, using the proportion 197/262 discussed above. Fatality rates (number of deaths over number of cases) are available only in few cases. The fatality rate among individuals with neurological disorders from WNV in the Greek 2010 and 2011 outbreak was 15 percent (see Papa 2013), against a 16 percent fatality rate for the same category of individuals between 2008 and 2011 in Italy (see Rizzo et al. 2012). Applying a factor of .15 to the second to last row of Table 29, the last row displays the estimated total number of deaths from WNV. The estimated number fo deaths due to the WNV outbreak in Greece was 90, over the period 2010-2014.

11 SUICIDES AND TRANSPORTATION ACCIDENTS

Since at least Ruhm (2000) suicides have been found to be countercyclical, although more recent evidence questions the strength of this relationship (see e.g. Ruhm 2012). In 2007, the year before the start of the recession, the standardized suicide rate in Greece was 2.9, the lowest in Europe after Cyprus. In 2013, the last year of the recession as defined in this paper, it was 4.8, an increase by 64 percent; over the same period the European average had remained stable. During the austerity period 2010-2014, the suicide rate in Greece increased from 3.3 percent to 5 percent, while it declined in Europe from 11.8 to 11.2 percent. At least one academic paper, Antonakakis and Collins (2014), explicitly speaks of a causal relationship between budget cuts and the increase in suicides, attributing an extra 275 male suicides per year solely to the budget cuts.

Was Greece exceptional in the response of suicides? Rows 1 and 2 of Table 31 displays actual and predicted average yearly number of suicides during the Greek recession (columns 1 and 2) and during the Greek consolidation (columns 3 and 4), where the predicted number is obtained from a OLS regression of the change in suicides on the change in GDP per capita or the change in the cyclically adjusted surplus,

respectively, in both cases using two different definitions of the regressor.[45] The OLS regressions themselves give insignificant coefficients, hence the results have to be interpreted with care.

Using the first definition of the regressor, the predicted average yearly suicide rate for the 2008-13 recession in Greece is 387 against an actual yearly average during the same period of 443, implying an excess suicide rate of about 56 per year during in the Greek recession. However, the same exercise but with the alternative definition of the regressor gives an estimated negative excess deaths by suicide during the Greek recession of -91.

The same exercise, performed on the sample of consolidations, give a similar results: a negative excess death toll by suicides during the Greek consolidation of 2010-2014 using the first definition and a positive one using the second definition.

A standard result for developed countries is that recessions are typically associated with a lower mortality rate, in part because of lower transportation accidents due to less intense traffic (see again Ruhm 2000 and the survey of the intervening literature in Ruhm 2012). Using the same methods as in the previous table, Table 32 shows that Greece had an excess deaths from transportation accidents of between 800 and 900 during the recession and about half that during the consolidation. The reason is intuitive from a look at Table 2 and Table 3: the Greek recession was about triple the average recession of the sample, and the Greek consolidation was about double the average. It is implausible to expect such a large drop in traffic intensity so as to compensate for these enormous differences in the change in GDP and in the cyclically adjusted budget surplus.

Table 31: Suicides in Greece compared to other major recessions and consolidations

		2008-13 Recession		**2010-14 Consolidation**	
		(1)	(2)	(3)	(4)
(1)	Predicted yearly number of suicides	387	534	548	418
(2)	Actual average yearly number of suicides	443	443	492	492
(3)	Excess yearly number of suicides	56	-91	-56	74

Source: EUROSTAT *Mortality* database from 2000 on. Before 2000: see online appendix

Notes: Column 1 is based on a OLS recession of the total percentage change in GDP per capita during the recessions listed in Table 3 on the percentage change in the absolute number of suicides (average during the recession relative to the average of the two years before the start of the recession). Column 2 is based on a OLS recession of the total percentage change in GDP per capita during the recessions listed in Table 3 on the difference in the standardized suicide rate per 100,000 inhabitants (average during the recession less average of the two years before the start of the recession). Columns 3 and 4 have the same structure as columns 1 and 2, respectively, but the sample is the major consolidations listed in Table 2.

Row 1 displays the yearly number of suicides predicted by multiplying the OLS slope coefficient by the change in GDP per capita during the 2008-2013 Greek recession (columns 1 and 2) or by the change in the cyclically adjusted primary surplus in the 2010-2014 Greek consolidation (columns 3 and 4), and adding the estimated constant.

[45] In the first definition (columns 1 and 3), the regressor is the percentage change in the absolute number of suicides (average during the recession relative to the average of the two years before the start of the recession). In the second definition (columns 2 and 4), the regressor is the difference in the standardized suicide rate per 100,000 inhabitants (average during the recession less average of the two years before the start of the recession).

Table 32: Deaths from transportation accidents in Greece compared to other major recessions and consolidations

		2008-13 Recession		2010-14 Consolidation	
		(1)	(2)	(3)	(4)
(1)	Predicted yearly number of deaths from transportation accidents	607	501	880	774
(2)	Actual average yearly number of deaths from transportation accidents	1404	1404	1216	1216
(3)	Excess yearly number of deaths from transportation accidents	797	903	336	443

Source: EUROSTAT *Mortality* database from 2000 on. Before 2000: see online appendix
Notes: For the structure of this table, see notes to Table 31.

12 CONCLUSIONS

The Greek crisis was the most severe in postwar Europe; its budget cuts were the deepest. Among the components of the budget, health spending was hit particularly hard, declining by more than one third in just five years. On the other hand, health spending was high in Greece before the crisis: in several dimensions, even after the budget cuts both spending and inputs in Greece were still at or near the top of the European countries, and in some cases continued to increase; in other cases the budget cuts merely brought spending and inputs back to the levels of the beginning of the century, and close to the European average. However, budget cuts so deep and so sudden are unlikely to merely cut into inefficiencies and overcapacities; most likely they do bite at some levels. Rather than replicating the main results of the paper, in these conclusions I summarize the areas where some evidence exists of a substantial impact on the inputs and outputs of the health system, and on the health of the population.

First, the dramatic decline in government spending on pharmaceuticals (the highest in Europe before the crisis), although compensated by a large increase in private spending, was presumably not neutral for the different income classes. At the moment, I am not aware of data that could shed light on this issue.

Second, standardized mortality increased in 2012. This has been attributed by some to the measures implemented by the 2011 Memorandum of Understanding, restricting access to health insurance and to free examinations and pharmaceuticals. On the other hand, there is no evidence of a decline in the utilization of hospital resources in 2011 or 2012, either at the extensive or the intensive margin; in addition, in 2012 the standardized death rate *fell* by five times its increase in 2011, and by 4 percentage points relative to Europe.

Third, amenable deaths kept decreasing, but at a lower rate than before the austerity period. This in itself is not surprising, because they had fallen very fast before the crisis; but the slowdown was more marked than in the rest of Europe.

Fourth, at least two outbreaks of transmissible diseases during the crisis, West Nile fever and are A(NiH1) influenza, are exceptional by contemporaneous European standards and are responsible for at least 230 deaths.

Fifth, low-weight births and infant mortality rose significantly.

Sixth, there was a large decline in medical examinations (CT scans and MRI), although the former remained well above the European average.

Finally, the suicide rate increased significantly during the crisis, albeit from the lowest level in Europe after Cyprus. Whether it increased more than predicted by the large decline in GDP depends on the method to estimate the relation between GDP and suicides.

13 REFERENCES

Alderman, L. (2012): "Amid Cutbacks, Greek Doctors Offer Message to Poor: You Are Not Alone", *New York Times*, October 24, 2012. https://www.theguardian.com/world/2015/jul/09/greek-debt-crisis-damage-healthcare-hospital-austerity

Bonovas, S. and G. Nikolopoulos (2012). "High-burden epidemics in Greece in the era of economic crisis. Early signs of a public health tragedy", Journal of Preventive Medicine and Hygiene, 53(3):169-71 · September 2012. https://www.researchgate.net/publication/235383877_High-burden_epidemics_in_Greece_in_the_era_of_economic_crisis_Early_signs_of_a_public_health_tragedy

Calistri, P. et al. (2010): "Epidemiology of West Nile in Europe and in the Mediterranean Basin", *The Open Virology Journal*, 2010, 4: 29–37. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2878979/

Chrisafis, A. (2015): "Greek debt crisis: 'Of all the damage, healthcare has been hit the worst'", *The Guardian,* July 9, 2015. https://www.theguardian.com/world/2015/jul/09/greek-debt-crisis-damage-healthcare-hospital-austerity

Danis, K. et al. (2011): "Outbreak of West Nile infection in Greece", *Emerging Infectious Diseases Journal*, Volume 17 Number 10-October 2011. https://wwwnc.cdc.gov/eid/article/17/10/11-0525_article

Dimitrakaki, C., D. Boulamatsis, A. Mariolis, N. Kontodimopoulos, D. Niakas, Y. Tountas (2009): "Use of cancer screening services in Greece and associated social factors: results from the nation-wide Hellas Health I survey", *European Journal of Cancer Prevention.* https://www.semanticscholar.org/paper/Use-of-cancer-screening-services-in-Greece-and-ass-Dimitrakaki-Boulamatsis/04964e2130afd995f1cfa0978e85612789d403cd

Economou, C. et al. (2014): "Impacts of the economic crisis on access to healthcare services in Greece with a focus on the vulnerable groups of the population", Social Cohesion and Development 2014 9 (2), 99-115, http://www.epeksa.gr/assets/variousFiles/file_1.Economou-Kaitelidou.pdf

European Center for Disease Prevention and Control (2012): "Epidemiological situation of West Nile virus infection in the European Union", Risk Assessment Update, 13 July 2012. https://ecdc.europa.eu/en/publications-data/risk-assessment-epidemiological-situation-west-nile-virus-infection-european

European Center for Disease Prevention and Control (2011). "West Nile virus infection outbreak in humans in Central Macedonia, Greece", Mission Report, July – August 2010. https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/1001_MIR_West_Nile_virus_infection_outbreak_humans_Central_Macedonia_Greece.pdf

European Center for Disease Prevention and Control (various years:) West Nile data by year (since 2011). https://ecdc.europa.eu/en/west-nile-fever/surveillance-and-disease-data/historical

EMCDDA (2012): National Report (2011 data) to the EMCDDA by the Reitox National Focal Point

EMCDDA (2013): National Report (2012 data) to the EMCDDA by the Reitox National Focal Point

EMCDDA (2014): National Report (2013 data) to the EMCDDA by the Reitox National Focal Point

EMCDDA and ECDPC (2012): "HIV in injecting drug users in the EU/EEA, following a reported increase of cases in Greece and Romania". http://www.emcdda.europa.eu/publications/joint-publications/hiv-in-injecting-drug-users-2011_en

European Monitoring Center for Drugs and Drug Addiction (2010): "Trends in Injecting Drug Use in Europe". http://www.emcdda.europa.eu/attachements.cfm/att_108590_EN_EMCDDA_SI10_injecting.pdf

EUROSTAT-OECD (2012): *Methodological Manual on Purchasing Power Parities*, p. 241. https://www.oecd.org/std/prices-ppp/PPP%20manual%20revised%202012.pdf

EUROSTAT (2017): "Amenable and preventable death statistics". http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Amenable_and_preventable_deaths_statistics#Data_sources_and_availability

Fotiou, A., K. Micha, D. Paraskevis , M. Terzidou, M. Malliori, A. Hatzakis. (2012): "HIV outbreak among injecting drug users in Greece An updated report for the EMCDDA on the recent outbreak of HIV infections among drug injectors in Greece", 31 October 2012. http://www.emcdda.europa.eu/attachements.cfm/att_191984_EN_HIV_update_Greece_2012.pdf

Kentikelenis, A., M. Karanikolos, I. Papanicolas, S. Basu, M.n McKee, D. Stuckler (2011): "Health effects of financial crisis: omens of a Greek tragedy", *Lancet*, Vol 378, October 22, pp. 1457-58. http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(11)61556-0.pdf

Kondilie, E. et al. (2013): "Economic Crisis, Restrictive Policies, and the Population's Health and Health Care: The Greek Case", *American Journal of Public Health*, June 2013, Vol 103, No. 6, pp. 973-80. https://www.researchgate.net/publication/236226575_Economic_Crisis_Restrictive_Policies_and_the_Population%27s_Health_and_Health_Care_The_Greek_Case?enrichId=rgreq-1f3f26c0f4d1e9b44eaaf43d3021c6f1-XXX&enrichSource=Y292ZXJQYWdlOzIzNjIyNjU3NTtBUzoyNDM4NDgzMDM2MDc4MTJAMTQzNTE0OTM3NTAxNw%3D%3D&el=1_x_3&_esc=publicationCoverPdf

Laliotis, I., J. P. Aloannidis, C. Stavropoulou (2016): "Total and cause-specific mortality before and after the onset of the Greek economic crisis: an interrupted time-series analysis", Lancet Public Health, The Lancet Public Health Volume 1, Issue 2, December 2016, pp. e56-e65. https://ac.els-cdn.com/S2468266716300184/1-s2.0-S2468266716300184-main.pdf?_tid=edf3579e-bc00-11e7-8170-00000aab0f27&acdnat=1509209963_324f0335c2c4e87647cc7aacc0bbd295

Mason, P. (2012): "Struggling Greeks losing belied in the state", *BBC News*, February 17, 2012. https://www.bbc.com/news/business-17067104

Nolte E., and M. McKee M (2004): *Does health care save lives? Avoidable mortality revisited,* Nuffield Trust, London

OECD (2016): *Health at a Glance: Europe 2016 – State of Health in the EU Cycle*, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264265592-en

Office for National Statistics (2011): Definition of avoidable mortality. http://www.ons.gov.uk/ons/about-ons/get-involved/consultations/archived-consultations/2011/definitions-of-avoidable-mortality/definition-of-avoidable-mortality.pdf

Palaiologos, Y. (2014): *The 13th labour of Hercules: Inside the Greek crisis*, Portobello books, Lon don, UK

Papa, A. (2013) "West Nile virus infections in Greece: an update", *Expert Review of Anti-infective Therapy*, 10 (2012), pp. 743-750. https://www.tandfonline.com/doi/full/10.1586/eri.12.59?scroll=top&needAccess=true

Paraskevis. D. et al (2013): "Economic Recession and Emergence of an HIV-1 Outbreak among Drug Injectors in Athens Metropolitan Area: A Longitudinal Study", PLOS ONE, 10 November 2013, Volume 8, Issue 11. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0078941

Reintjes R, and I. Wiessing (2007): "L. 2nd-generation HIV surveillance and injecting drug use: uncovering the epidemiological ice-berg". *International Journal of Public Health,* 2007;52(3), pp. 166–72.

Rizzo, C. et al. (2012): "Epidemiological surveillance of West Nile neuroinvasive diseases in Italy, 2008 to 2011", *Euro Surveillance*, 17 (2012). https://link.springer.com/article/10.1007/s10096-003-1085-1

Ruhm, C. (2000): 'Are recessions good for your health?', *Quarterly Journal of Economics*, 115 (2),617–50.

Ruhm, C. (2012): "Understanding the relationship between macroeconomic conditions and health", *The Elgar companion to health economics*, second edition, chapter 1, pp. 1-14, Edward Elgar publishing.

Sambri, V. et al. (2013): "West Nile virus in Europe: emergence, epidemiology, diagnosis, treatment, and prevention", Clinical Microbiology and Infection, Volume 19, Issue 8, August 2013, pp. 699-704. https://www.sciencedirect.com/science/article/pii/S1198743X14614154

Scaturro, M. (2013); "Malaria and HIV Spike as Greece Cuts Healthcare Spending. The Nasty Downside of Austerity", The Atlantic, May 15 2013. https://www.theatlantic.com/international/archive/2013/05/malaria-and-hiv-spike-as-greece-cuts-healthcare-spending/275836/

Scheurmann, A. (2006): "Parallel Import of Pharmaceuticals in the EU", MA Dissertation, Lund University. http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=1340157&fileOId=2434528

Simou, E. and E. Koutsogeorgou (2014): "Effects of the economic crisis on health and healthcare in Greece in the literature from 2009 to 2013: A systematic review", *Health Policy*, 115, pp. 111–119. http://www.sciencedirect.com/science/article/pii/S0168851014000475

Stuckler, D. and S. Basu (2014): *The Body Economic: Eight experiments in economic recovery, from Iceland to Greece*. Penguin Books Ltd. Kindle Edition.

Stuckler, D., S. Basu and M. McKee (2014): "How government spending cuts put lives at risk", Nature, Vol 465, 20 May 2010, p. 289. https://www.nature.com/nature/journal/v465/n7296/full/465289a.html

Tsounis, A., P. Sarafis and E. Alexopoulos (2014): "Austerity and its consequences on cancer screening in Greece", *Lancet*, Vol. 384, December 13, 2014, p. 2110. http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(14)62373-4.pdf

Vickerman P., M. Hickman, M. May, M. Kretzschmar, L. Wiessing (2010): "Can hepatitis C virus prevalence be used as a measure of injection-related human immunodeficiency virus risk in populations of injecting drug users? An ecological analysis". *Addiction*. 2010, Feb., 105(2), pp. :311–8.

Vlachadis, N., N. Vrachnis, E. Ktenas, M. Vlachadi, E. Kornarou (2014): "Mortality and the economic crisis in Greece", *Lancet*, Vol 383, February 22, p.691. http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(14)60250-6.pdf

Wiessing, L., G. Likatavičius, D. Klempová, et al. (2009): “Associations between availability and coverage of HIV-prevention measures and subsequent incidence of diagnosed HIV infection among injection drug users”, *American Journal of Public Health* 99, pp. 1049–52.

14 APPENDIX 1

A large fiscal consolidation is defined as follows: Define CAS(t) as the cyclical adjusted surplus at time t, and ΔCAS(t) = CAS(t)-CAS(t-1). A period of large fiscal consolidation occurs if the following conditions occur:

1. The primary surplus increases by at least 4 percent of potential output as follows
   ΔCAS(t) + ΔCAS(t-1) > 0.04 (consolidation from t-1 to t), or
   ΔCAS(t) + ΔCAS(t-1) + ΔCAS(t-2)> 0.04 (consolidation from t-2 to t), or
   ΔCAS(t) + ΔCAS(t-1) + ΔCAS(t-2) + ΔCAS(t-3) > 0.04 (consolidation from t-3 to t), or ΔCAS(t) + ΔCAS(t-1) + ΔCAS(t-2) + ΔCAS(t-3) + ΔCAS(t-4) > 0.05, or
   ΔCAS(t) + ΔCAS(t-1) + ΔCAS(t-2) + ΔCAS(t-3) + ΔCAS(t-4) + ΔCAS(t-5) > 0.06, or
   ΔCAS(t) + ΔCAS(t-1) + ΔCAS(t-2) + ΔCAS(t-3) + ΔCAS(t-4) + ΔCAS(t-5) + ΔCAS(t-6) > 0.07, or
   ΔCAS(t) + ΔCAS(t-1) + ΔCAS(t-2) + ΔCAS(t-3) + ΔCAS(t-4) + ΔCAS(t-5) + ΔCAS(t-6) + ΔCAS(t-7) > 0.08.
   Define t_{min} and t_{max} as the first and the last years of the intervals thus defined.
2. All ΔCAS(t), $t_{min} \leq t \leq t_{max}$, are positive except two, and neither of these two is smaller than -0.005; or except one, which is not smaller than -.01.
3. ΔCAS(t_{min}) > 0.005, ΔCAS(t_{max})> 0.005 (the first and last years of the consolidation the primary surplus increases by at least 0.5 percent of potential output).
4. CAS(t_{max}) > CAS(t), $t \neq t_{max}$ (the last year of the consolidation has the highest primary surplus of the consolidation period).
5. If a longer consolidation period as defined above contains all the years of a shorter one, obviously only the longer period is considered.
6. If two consolidation periods as defined above overlap for some years, they are joined in one consolidation period (this never occurs in the sample used in this paper).

A recession is defined the same way, with Y(t) replacing CAS(t), where Y is the log of real per capita GDP in year t, and all the inequality signs are reversed, and all the thresholds become negative. Hence, a large recession occurs if the following conditions occur:

1. Real per capita GDP falls by at least 4 percent as follows
   ΔY(t) + ΔY(t-1) < -0.04 (recession from t-1 to t), or
   ΔY(t) + ΔY(t-1) + ΔY(t-2) < -0.04 (recession from t-2 to t), or
   ΔY(t) + ΔY(t-1) + ΔY(t-2) + ΔY(t-3) < -0.04 (recession from t-3 to t),
   or ΔY(t) + ΔY(t-1) + ΔY(t-2) + ΔY(t-3) + ΔY(t-4) < -0.05, or
   ΔY(t) + ΔY(t-1) + ΔY(t-2) + ΔY(t-3) + ΔY(t-4) + ΔY(t-5) < -0.06, or
   ΔY(t) + ΔY(t-1) + ΔY(t-2) + ΔY(t-3) + ΔY(t-4) + ΔY(t-5) + ΔY(t-6) < -0.07, or
   ΔY(t) + ΔY(t-1) + ΔY(t-2) + ΔY(t-3) + ΔY(t-4) + ΔY(t-5) + ΔY(t-6) + ΔY(t-7) < -0.08.
   Define t_{min} and t_{max} as the first and the last years of the intervals thus defined.
2. All ΔY(t), $t_{min} \leq t \leq t_{max}$, are negative except two, and neither of these two is larger than 0.005; or except one, which is not larger than .01.
3. ΔY(t_{min}) < -0.005, ΔY(t_{max}) < -0.005 (the first and last years of the recession real per capita GDP increases by at least 0.5 percent).

4. $Y(t_{max}) < Y(t)$, $t \neq t_{max}$ (the last year of the recession has the lowest real GDP per capita of the recession period).
5. If a longer recession period as defined above contains all the years of a shorter one, obviously only the longer period is considered.
6. If two recession periods as defined above overlap for some years, they are joined in one recession period.

15 APPENDIX 2: AMENABLE DEATHS

Group of causes included in total amenable deaths in original definition	IC-10 Codes in original definition	Group of causes included in total amenable deaths in my definition	IC-10 Codes in my definition	Age to be used for calculation
Tuberculosis	A15-A19, B90	Tuberculosis	A15-A19_B90	0-74
Selected invasive bacterial and protozoal infections	A38-A41, A46, A481, B50- B54, G00, G03, J02, L03			0-74
Hepatitis C	B171, B182	Viral hepatitis and sequelae of viral hepatitis	B15-B19_B942	0-74
HIV/AIDS	B20-B24	Human immunodeficiency virus [HIV] disease	B20-B24	TOTAL
Malignant neoplasm of colon and rectum	C18-C21	Malignant neoplasm of colon, rectosigmoid junction, rectum, anus and anal canal	C18-C21	0-74
Malignant melanoma of skin	C43	Malignant melanoma of skin	C43	0-74
Malignant neoplasm of breast	C50	Malignant neoplasm of breast	C50	0-74
Malignant neoplasm of cervix uteri	C53	Malignant neoplasm of cervix uteri	C53	0-74
Malignant neoplasm of bladder	C67	Malignant neoplasm of bladder	C67	0-74
Malignant neoplasm of thyroid gland	C73	Malignant neoplasm of thyroid gland	C73	0-74
Hodgkin's disease	C81	Hodgkin's disease	C81-C86	0-74
Leukaemia	C91, C920	Leukaemia	C91-C95	0-44
Benign neoplasms	D10-D36	Non-malignant neoplasms benign and uncertain	D00-D48	0-74
Diabetes mellitus	E10-E14	Diabetes mellitus	E10-E14	0-49
Epilepsy and status epilepticus	G40-G41			0-74
Rheumatic and other valvular heart disease	I01-I09			0-74
Hypertensive diseases	I10-I15			0-74
Ischaemic heart disease	I20-I25	Ischaemic heart disease	I20-I25	0-74
Cerebrovascular diseases	I60-I69	Cerebrovascular diseases	I60-I69	0-74
Influenza including swine flu	J09-J11			0-74
Pneumonia	J12-J18	Pneumonia	J12-J18	0-74
Asthma	J45-J46	Asthma and status asthmaticus	J45-J46	0-74

Gastric and duodenal ulcer	K25-K28	Ulcer of stomach, duodenum and jejunum	K25-K28	0-74
Acute abdomen, appendicitis, intestinal obstruction, cholecystitis/lithiasis, pancreatitis, hernia	K35-K38, K40- K46, K80, K83, K85, K861- K869, K915			0-74
Nephritis and nephrosis	N00-N07, N17-N19, N25- N27	Diseases of the genitourinary system	N00-N99	
Obstructive uropathy and prostatic hyperplasia	N13, N20-N21, N35, N40, N991			0-74
Complications of perinatal period	P00-P96, A33	Certain conditions originating in the perinatal period	P00-P96	TOTAL
Congenital malformations, deformations and chromosomal anomalies	Q00-Q99	Congenital malformations, deformations and chromosomal abnormalities	Q00-Q99	0-74
Misadventures to patients during surgical and medical care	Y60-Y69, Y83- Y84			TOTAL

Source: here. For the ICD classification system: see here