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Social Spending and Health Care Outcomes:
Some International Evidence

Ernesto Raul Ferreira

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Orientador: Prof. Doutor José Ramos Pires Manso

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To my wife, Conceição, for all her love and understanding, and my sons, Dinis and Duarte, for all their help and encouragement.

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Resumo

A doença afecta todos os indivíduos, independentemente da faixa etária, e é definidora do nosso papel na sociedade. Contudo, os cuidados de saúde salvam e/ou prolongam vidas. Assim, porque parecem ter algum poder para inverter (ou retardar) o ritmo de envelhecimento (i.e., ritmo de desgaste individual da dotação inicial de saúde e bem-estar), estes são sobejamente valorizada. Neste sentido, em 2015, os países membros da Organização para a Cooperação e Desenvolvimento Economico (OCDE) despenderam aproximadamente 9.0 por cento do seu rendimento (medido em PIB per capita) em cuidados de saúde—um valor substancialmente acima dos 8.3 por cento gastos em 2008.

Sendo que os governos nacionais têm vindo a assumir uma parte cada vez maior destes custos, o controle deste tipo de despesa é um problema que todas as sociedades modernas enfrentam e com o qual todos os países vão forçosamente ter de lidar. Visto estas considerações, esta tese começa por centra-se nas respostas ás perguntas seguintes: quais os factores capazes de fazer aumentar os gastos em saúde? Para além disso, em que sentido os gastos públicos na área da saúde afectam os custos e gastos nestes cuidados? Em caso afirmativo, como?

Assim, para informar sobre um assunto que, em ultima analise, consta da esfera política, neste trabalho procura-se identificar as determinantes das despesas de cuidados de saúde em Portugal e num conjunto de países-membros da Organização para a Cooperação e Desenvolvimento Economico (OCDE), tendo em conta o rendimento (PIB) per capita, a quota-parte do financiamento publico de cuidados de saúde, o envelhecimento da população, bem como os custos associados ao recurso a mais (e melhor) tecnologia.

Para além de sugerir a irrelevância da variável publica na determinação da despesa e custos de cuidados de saúde, os resultados que se depreendem da primeira parte deste trabalho (Capítulos 2 e 3) sugerem que a actual tendência de aumento destes tem como raiz um conjunto de factores diferenciados. Para Portugal (Capitulo 2), valores mais elevados de rendimento levam a um aumento de despesas e custos de saúde. Mais ainda, a magnitude estimada da elasticidade-rendimento em relação a estas despesas e custos força alguma preocupação sobre a sustentabilidade a longo prazo das tendências actuais destes gastos. No entanto, a elasticidade-rendimento em relação a estas despesas e custos não só depende do pormenor de analise sobre o qual olhamos cada país, mas também o respectivo nível de rendimento e grau de desenvolvimento económico.

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Por exemplo, no Capitulo 3, que analisa as determinantes do crescimento dos custos e despesas de saúde para um grupo de países membros da Organização para a Cooperação e Desenvolvimento Economico (OCDE), determina-se uma elasticidade-rendimento em relação a estes cuidados inferior a um, sugerido assim uma certa insensibilidade da procura de bens e serviços de saúde face a aumentos de rendimento. Este resultado não só indica que a procura de cuidados de saúde é determinada de acordo com as necessidades—em vez das capacidades de resposta a alterações de rendimento—mas também apela a um maior envolvimento público na prestação e financiamento destes cuidados de saúde. Além disso, os resultados são também indicativos de que o crescimento do número de idosos e o recurso a mais (e melhor) tecnologia são factores determinantes do actual crescimento das despesas de saúde e estas dificilmente poderão ser comprimidas, a não ser através do seu racionamento.

Para além de informar sobre os factores capazes de influenciar o aumento de crescimento dos custos e despesas de saúde, esta tese também analisa os factores capazes de influenciar a saúde e bem-estar, particularmente como e em que sentido o investimento publico em programas de protecção social e cuidados de saúde afecta indivíduos e populações. Embora estes últimos pareçam ter pouco impacto sobre as mortes por "todas-as-causas" e as mortes por "causas-especificas" (tal como, por exemplo, suicídios), os resultados desta investigação indicam que outros factores (tais como, por exemplo, aumentos de rendimento e gastos públicos com medidas de protecção social, bem como o recurso a técnicas médicas mais avançadas) são factores potenciadores de saúde e bem-estar. Assim, a evidência que emerge dos Capitulos 4, 5 e 6, nos quais se analisa o efeito da actual crise económica (2008-2012) sobre a saúde das populações da União Europeia, indica que o investimento publico em programas de protecção social é tão relevante, se não mais, que os gastos públicos com a saúde, como forma de moderar os efeitos da crise económica sobre indivíduos e populações, especialmente entre os mais jovens, e os pobres e seus filhos, e devem ser assim incluídos em trabalhos futuros de investigação sobre os factores determinantes da saúde e bem-estar social.

Palavras-chave

Despesas publicas e privados de cuidados de saúde, sustentabilidade, elasticidade-rendimento, gastos públicos em programas de protecção social, cuidados de saúde e bem-estar social.

Abstract

From the very young to the very old, disease defines our roles in society and affects everyone. But medical care saves or extends lives. Because it (seems) to have some power over disease and retards or slows the rate of depreciation of an individual´s initial endowment of health, it is perceived very positively. Thus, as of 2015, individuals and populations in the Organization for Economic Cooperation and Development (OECD) area-countries spent approximately 9.0 percent of their incomes (as measured by GDP per capita) on health care—up from 8.3 percent in 2008. With national governments assuming an increasing share of these costs and pressures to spend more likely to continue, controlling this type of spending is a problem that all modern societies face and one which every country must grapple with. Therefore, this thesis begins with the questions: what factors are behind this push for more spending? And does government involvement in health care affect health care costs and spending? If so, how?

Thus, to inform on what is ultimately a political decision, we looked at the determinants of health care expenditure growth in Portugal and a set of countries in the OECD area, taking into account the role of income, the share of publicly funded health care, ageing population, as well as technological progress. Although governments seem unable to control health care costs and spending, the results from Part One of our research (Chapters 2 and 3) suggest that the current trend of increasing health care expenditure is rooted in a set of differentiated factors. In Chapter 2, higher Portuguese income levels lead to higher health care expenditure, and the magnitude of the estimated elasticity poses some concern about long-term sustainability of current trends of spending. However, the income elasticity of health care expenditure not only depends on the level of analysis but also the range of income and economic development. For example, characteristics of a non-luxury good for health care have been found in Chapter 3, in the study examining the determinants of expenditure growth in a sample of OECD countries. This indicates that the delivery of health is determined according to needs, rather than responsiveness to income changes, and thus warrants greater public involvement in the provision and financing of health care. In addition, our main results confirm that the growth in numbers of the elderly and the development of new medical technologies are determining factors of current health expenditure growth, and these may not be easily compressed if not through rationing.

Besides informing on the factors that are behind the push for health care expenditure growth, this thesis also looks at the socio-economic determinants of health, particularly how government involvement in health care and social protection programs may lead to better health care outcomes. Although publicly funded health care spending seems to have very little impact on all-cause and cause-specific mortality rates, the results of our investigation

indicate that other factors (such as, for example, higher levels of income and publicly funded welfare spending, as well as advances in new medical technologies, do significantly influence the overall health status and well-being of a country´s population. Thus, while using data from the European Union for a period that leads up to, and coincided with the ongoing recession (2008-2013), the evidence emerging from Part Two (Chapters 4, 5 and 6) of our research suggests that when it comes to protecting population health, the results are that social welfare spending is as relevant, if not more so, than public health spending in moderating increased vulnerabilities to adverse economic shocks, especially among younger males and females, the poor and their children, and should be accounted for in future inquiry into the determinants of aggregate population health.

Keywords

Public and private health care expenditure, sustainability, income elasticity, social welfare spending, health care outcomes.

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List of Acronyms

DALE: Disability Adjusted Life Expectancy

EEC: European Economic Community

EU: European Union

EU15: EU Member States before May 2004

EU25: EU Member States before January 2007

EU27: EU Member States after January 2007

FE: Fixed Effects

GDP: Gross Domestic Product

GST: Government Social Transfers

HE: Health Expenditure

HCE: Health Care Expenditure

LE: Life Expectancy

LEB: LE at birth

NHS: National Health Srervice

OECD: Organisation for Economic Co-operation and Development

OLS: Ordinary Least Squares

OOP: Out-of-pocket (payments)

PIB: Produto Interno Bruto

PPP$: Purchasing Power Parity

PYLL: Potential Years of Life Lost

RE: Random Effects

WB: World Bank

WHO: World Health Organization

Chapter 1

1. General introduction

1.1. The economics of health

Over the years health has been recognized has a state of complete physical, mental and social well-being (WHO, 1948). This multi-dimensional process that transcends the mere absence of illness involves subjective and objective elements (i.e., bodily, mental and social qualities of life of people), and is determined in particular by environmental, psychological, societal, cultural and policy dimensions (Frankish et al., 1996). Although the mechanisms by which social and psychological factors influence health are complex and variable, this (not so) contemporary view holds that both factors are implicated in all diseases, and that health and illness are social, as well as medical, issues.

Given that an individual´s experience of health is related to his or her state of well-being, what exactly is "well-being" and how is it achieved and quantified? Described by The Oxford Dictionary as "the state of being confortable, healthy, or happy", well-being is very difficult to measure as the term embodies much more of the human experience and describes a person´s ability to respond or to take control over every day needs and challenges (The Oxford Dictionary, 2007). Still—in spite of the considerable controversies surrounding the choices of specific indicators, the reliability of the data used, and how the various indicators should be weighted—a number of international organizations (e.g. The World Health Organization, and the Organization for Economic Cooperation and Development) have taken the lead in collecting and publishing data on the overall health status and well-being of a country´s (region´s) population. Among the most commonly used measures are life expectancy (LE), particularly life expectancy at birth (LEB), infant mortality rates (IM), and potential years of life lost (PYLL). The use of these indicators allows assessing whether systems are achieving the efficient provision of accessible, good-quality, and financially sustainable health care (Evans et al., 2001).

In 2014, life expectancy at birth (LEB) across the Organization for Economic Cooperation and Development (OECD) countries reached 80.6 years, an increase of more than 10 years since 1970 (OECD Health Statistics, 2016). Increases ranged from 23.8 years in Turkey to 6.7 years in Hungary. In spite of these gains, there remain large gaps between male and female life expectancy in all OECD countries. For example, on average across this set of countries, life expectancy at birth for women reached 83.3 years in 2014, compared with 77.9 years for

men, a gap of 5.4 years. This gap has narrowed during the past two and half decades, reflecting higher gains in life expectancy among males than among females. Although this health status indicator continues to increase on average by 3 to 4 months each year in OECD countries, with no sign of slowing down, this steady rise is not as apparent when one considers life expectancy from age 20, from age 40, or from any other age (OECD Health at a Glance, 2015). For example, at age 65, life expectancy averaged 3.5 years longer for women than for men. Much of this improvement in life expectancy at birth is due to reductions in mortality during infancy, especially during the neonate period. Thus, as of 2014, the infant mortality rate (IM) across OECD countries—which largely reflects quality and access to medical care, maternal health, public health practices and socioeconomic status—was 4.0 infant deaths per 1 000 live births. These infant mortality figures for the OECD countries are somewhat misleading, however, since they obscure the persistent wide disparities between individual member countries. In 2014, as the OECD Health Statistics (2016) indicate, the rate at which babies and children of less than one year of age died in Mexico (12.5), Turkey (11.1), and Chile (7.0) is considerably higher than that of Slovenia (1.8), Japan (2.1), and Iceland (2.1), although the rate has fallen sharply over the past few decades in the lower-income countries. In the case of potential years of life lost (PYLL), which measures the years of life lost before age seventy due to preventable conditions, lower-income countries performed relatively poorly (I.e., PYLL above the OECD average for women and men). This suggests that a greater focus on infant and child mortality as well as amenable mortality—deaths that are avoidable with timely and effective health care—in these OECD countries is warranted (OECD Health Statistics, 2016).

While gains in quality-of-life indicators are convincing intuitively, there is in fact very little hard evidence on the cost of providing them. Although the indirect costs resulting from the ill health and premature deaths of individuals and populations in OECD countries exceed the direct costs of medical care, it is the latter which are at the center of public attention, and society as a whole is assuming an increasing share of these costs. As of 2015, these countries spent 9.0 percent of their GDP on health care (OECD Health Statistics, 2016). The proportion spent in the highest spending country (the United States, 16.9 percent) was nearly double the OECD average and over 46 percent more than the country spending the second largest share of GDP (Switzerland, 11.5 percent). Between 2005 and 2015, per capita health care spending across this economic region grew at an annual adjusted rate of 2.0 percent and outstripped growth in the economy by 0.4 percent. Although this trend has long been recognized as a significant challenge, these growth rates are likely to create the potential of an unsustainable (unfunded) future liability—and the recent fiscal and economic crisis has suddenly brought it closer (OECD Health Statistics, 2016; OECD Health at a Glance, 2015). Between 2005 and 2009, average annual health expenditure growth across the region was 3.4 percent, in contrast to the 0.6 percent in the period between 2009 and 2013. After grounding to a halt in 2009 in the wake of the global financial and economic crisis, per capita spending on health

across this set of countries edged upward in 2013 continuing a trend of recent years. Although the health benefits of additional spending may be judged not sufficient to justify spending more on health care, pressures to spend more will continue—even at the relatively high current levels of spending.

While the gains in the health of individuals and populations throughout the last two centuries have been greatly influenced by improved living and working conditions in most of the western world, it is not directly observable how much of this can be properly attributed to the expansion in health care, as the empirical evidence on the determining capacity of health services on population health is inconclusive. However, the extension of life and improvements in its quality over the past 50 years is so great that, even if medical intervention were responsible for only a small part of the total observed improvements in life expectancy, in all likelihood this would be *prima facie* evidence to justify the contribution of health care to health (Litchenberg, 2004; Bunker, 2001, Szreter, 2000; McKeown, 1979). In fact, in spite of the problems associated with measuring the overall health benefits of health spending, a number of studies have demonstrated, with some varying degrees of reliability, that health services can, if appropriately organized and delivered, prevent disease and help promote and maintain health. For example, Cutler and Kadiyala (1999) estimate that better acute care and better medicines accounted for over two-thirds of the reductions in deaths from cardiovascular diseases. Gains in the performance of activities of daily living have also been observed for conditions that are not self-limiting if left untreated, such as cataract removal and hip replacement surgical interventions (see, among others, Bunker, 2001; Albert et al., 1996). Yet, Nolte and McKee (2004) suggest that, while still positive, the contribution of health care to health (and life expectancy) is diminishing. For example, in the case of infant mortality, which is used as a health outcome to examine the effect of medical and non-medical determinants of health, more health spending is not necessarily required to achieve better results, as countries with high levels of spending do not always exhibit low levels of infant mortality (Retzlaff-Roberts et al. 2004). Probably most fundamentally, in their research on health system efficiency performance in 191 countries, Evans et al. (2001) noticed that countries with the best levels of health do not always achieve optimal use of available resources and that efficiency is related to expenditure on health per capita, especially at low expenditure levels. Thus, implicit in the rise in spending noted earlier is the notion that extra spending will not be deemed worthwhile, as returns on the additional investment in health might be declining at the margin, or might even be negative. On this reading, for example, there is evidence that the value of medical drugs now coming on to the market is declining and that levels of spending on pharmaceuticals in (some) developed countries are such that the benefits from increasing their consumption are non-significant (Litchenberg, 2003; Miller and Frech, 2000; Taylor, 2003). But reasons abound why this evidence may be misleading as a guide for future levels of spending, as increases in the future value of marginal benefits—advances in medical technology, changing preferences, or other

sources of benefits and so on—may explain or justify future increases in spending on health care.

Should a limit be set for spending on health? For medical goods and services provided through the market place this question would not arise, as these are evaluated by the consumers on a "willingness to pay" basis. Consumers are free to choose the combination and quantity of goods and services they buy and this interaction, in essence, is an unavoidable rationing decision performed in private markets. But the unique nature of health care has resulted in major differences between health care markets and the so-called free markets, as demand is driven principally by the incidence of disease, not price levels. As a result, attempting to understand health care markets with basic economics can lead only to false conclusions as these differ from most other markets in a number of important ways. First, these markets exist only in response to the initial medical need for the relief provided by a medical product or service. Second, these are prescribed by an individual not involved in the financial transaction of the actual sale. And, third, they are consumed by another individual (the patient) who, all things considered, may or may not have a direct role in the actual purchase of the heath care product or service (Kolassa, 2009).

But while still maintaining many of the characteristics of marketed goods and services, in most developed countries these are mostly funded by the government and (sometimes) also provided by the public sector. In as much as 80 percent of all health spending in Denmark, Sweden and the United Kingdom is financed from public (state) sources, in the Czech Republic, France, Luxembourg, Japan and Germany, social health insurance finances approximately 70 percent of all health expenditure (OECD Health at a Glance, 2015). In marked contrast, in Chile and the United States, a disproportionate amount of this spending is financed either directly by households (Chile) or by private insurance (United States). In general, across OECD countries, approximately 73 percent of health care spending in 2015 was publicly financed while 27 percent was private (OECD Health Statistics, 2016). A possible cause for concern is that private out-of-pocket spending through co-payments and cost sharing accounts for over one fifth of the total, and the WHO has proposed a rate of 15 percent or lower as being most effective in protecting against catastrophic household health care expenditure (Xu K. et al., 2005). For example, in 12 of the OECD34 countries, this disproportionately high share of out-of-pocket spending limits the affordability of health care and places an undue burden on poorer households (OECD Health Statistics, 2016). Consequently, a high proportion of the population across OECD countries reports some unmet needs due to cost, travelling distance and waiting lists in 2013—facts that lead us to question whether this public-private approach to the provision and financing of health care is the only way to intervene or even the best (OECD Health at a Glance, 2015).

In managing this sustained growth in health care expenditure, health systems must define which sets of services each sector can handle most effectively, and ensure that the two

sectors work in such a manner that they complement each other. Most importantly, given current budget constraints, health systems must create more value by delivering more and better health services with the same or fewer resources.

1.2. Objectives and research questions

Before examining the economic justifications for this arrangement, it is useful to reflect (first) on the structural factors that are driving greater demand for health care, and (second) on the relationship between increases in social (health and non-health) spending and health gains with particular attention on how the most recent financial and economic crisis has affected mortality rates and how governments might reduce adverse effects. Several questions are relevant here, namely:

1 Can a limit on spending be defined? If not so, what factors are behind any push for more health care spending?

Given that evidence from higher spending countries suggest that the gains from additional spending may be diminishing, any decision on setting a limit or threshold for spending must rely on an informed view on the possible benefits that further spending on health care will achieve. But the lack of definite data on many key areas prevent us from reaching clear-cut conclusions on whether health systems are generating positive, declining or negative returns on the current additional investment on health. To inform further on what is ultimately a political decision, we investigate the determinants of health expenditure growth in (some) OECD countries over an extended period of time, explicitly taking into account the role of public and private health expenditure, income, ageing population, as well as technological progress. To take into account the various factors influencing health care outcomes, we examine the relation between various facets of health and public social welfare and health spending, as well as socio-economic, demographic, and life-style control variables.

Although health systems have little influence over the structural factors that are behind the increasing demand for health care, such as ageing, life style and income growth, more addressable may be the incentives underlying supply-side inefficiencies which, from the point of view of health care costs, tend to add to the pressures to increase spending and discourage value-conscious behavior. Only based on this knowledge can health systems and its key stakeholders define the scale on what has to be done to maximize both quality and cost-effectiveness of health care. If, for example, the growth in numbers of the elderly is largely responsible for adding to the demand for medical care, then it would be hard to argue that growth should be resisted—otherwise average standards of care would actually fall. If, on the other hand, growth was largely accounted for by the cost-enhancing effect of advances in therapeutic interventions, or initiatives to increase patient choice and access to health care services, then the question would be what rate of improvement or level of care accessibility

is society prepared to finance? However, only if economic, clinical and humanistic dimensions of outcomes are measured and considered can the true value of health care interventions, programs and policies be assessed.

2   Can governments add to the demand for health care?

It is generally assumed that governments may be in a position to control the health care purse strings as the majority of the spending in health care sectors (72.9 percent) is publicly funded in most OECD countries. Although this is an appropriate assumption to make in most cases, it is rather difficult to effectively determine an appropriate size for government involvement in health-related matters without measuring on a systematic basis the actual "opportunity costs" of the inputs to health care. This study further contributes to an understanding of this issue by extending the typical statistical models of the determinants of health care expenditure to account for the financial effort made by governments in providing for the medical care needs of national populations.

3   Does direct government involvement in the provision and financing of health care add to improvements in health care outcomes? If not so, are there any other roles for government in the health care sector?

In recent decades in OECD countries, measures of population health status show an improvement in longevity. This raises an obvious question—how much, if any, of the observed improvement in the quantity of life (not in the quality of life) can be attributed to the publicly financed health care? The answer, as discussed before, is not obvious, since apart from health care, there is a wide range of factors that influence outcomes. Yet, strong arguments can be made for either a beneficial or adverse relationship between government involvement in health care and measures of population health. It may be the case, however, that the appropriate mix of public and private provision and financing of health care will vary for different categories of health services and, as noted by Self and Grabowski (2003), across countries. The authors extend Thornton´s (2002) analysis on the repercussions of health spending on U.S. longevity to a cross-section of 191 countries and conclude that publicly financed health care is effective in improving health in developing countries whereas it is not significant in developed countries. But even in countries where health care policies seem to have no impact on health outcomes, government may indirectly affect the health status of individuals and populations by introducing social protection programs that aim at improving the financial conditions of people in disadvantaged circumstances (i.e., direct income support, housing support, and unemployment benefits) (Modrek et al., 2013).   We re-introduce this issue in our analysis by examining how government involvement in health care and other social protection initiatives has affected selective measures of population health across OECD countries. In particular, we focus on a set of homogeneous European Union (E.U.)

countries that have been greatly affected by the most recent economic crisis. The empirical analysis will determine which of these effects (beneficial or adverse) prevails in the data.

4   Can the economic crisis have an impact on measures of population health?

While previous studies that focused on the relatively milder recessions of the late 20th century show that economic deterioration significantly improves health outcomes and behaviors, it is not clear whether one can extrapolate the conclusions from these studies to make predictions for the effect of the most recent recession on the health of individuals and populations for at least two reasons. First, the recent global recession that officially started in 2007, differs significantly from any other recession since the 1940s and closely resembles the Great Depression, both in terms of length and depth (Tekin et al., 2013). Economic historians that have assessed the impact of recessions then, and now, point to similarities in the disproportionate number of individuals that have exhausted their financial options to cope with unemployment and have fallen into the ranks of poverty (Currie and Tekin, 2012). Second, each of these problems has been found to trigger unhealthy behaviors, which in turn are likely to press the demand for health care (Portela and Thomas, 2013). Additionally, many of the newly-unemployed entered into public assistance programs at precisely the moment when such programs received less funding, due in large part to declines in income and tax-based financial revenues (Boyd, 2003). Ultimately, a decrease in social welfare and health budgets and a subsequent fall in the supply of both forms of public assistance may have increased recession-related morbidity or mortality, especially among individuals that are at the highest risk for suicide and alcohol abuse. In this setting, we used data from the 2007 financial and economic crisis to shed light as to whether there is something fundamentally anomalous about this recession that might have affected the counter-cyclical pattern of health documented during previous recessions.

1.3. Methodology

While some attention has been placed on the relationship between spending on health and health outcomes (i.e., population health status) in Portugal, the rising costs of its health care system and its sustainability has been an ongoing topic of discussion. This is expected, since along with the need to evaluate its effectiveness, comes the need to identify what determines current health care expenditure. As a proportion of GDP, total health spending increased from 2.3 percent to 8.9 percent between 1970 and 2015, which implies that per capita total health spending in fact increased faster than per capita income during this period (OECD Health Statistics, 2016). Yet, if everything else is held constant and if health care is a normal good, it is theoretically expectable that an increase in per capita income will lead to increased demand for health care. Nonetheless, despite a healthier Portuguese population as

compared to 1970, real per capita total health expenditure during the period increased substantially more than life expectancy and very few studies have explained this trend.

With these concerns in mind, the first study examines the relationship between total, public and private health expenditure and a set of economic, socio-demographic and institutional variables for Portugal over the period 1970-2011 (the latest year for which complete data were available). This disaggregation of health spending is justified by the fact that its public and private components respond to different motivations. While public spending on health is a political choice, private expenditure reflects the way individuals distribute their available income depending on personal preferences. As for the set of explanatory variables, it includes public expenditure on health as a percentage of total health expenditure (used as an estimator in total health expenditure regressions), real per capita GDP, life expectancy at age 65, population aged 0 to 14 as a percentage of total population, and private consumption as a percentage of total consumption. In order to capture possible deterministic trends in the data, time variables are also accounted for in the analysis. As a matter of form, this study attempts to explore the dynamic relationship between these explanatory variables and total, public and private health expenditures, using time series data for Portugal. As suggested by Lichtenberg (2004), this dynamic modeling approach is justified by the fact that health care expenditure may respond to a regressor(s) with a time lag, and the need to ensure that there is no reverse causation from expenditures to—for example--income and health status.

We analyzed the relationship between the time series for total, public, and private health expenditure and the chosen set of explanatory variables using Ordinary Least Squares (OLS) estimators. We must note, however, that the classical properties of this standard regression technique depend on the assumption that the series are stationary stochastic processes. In view of this statistical concern, we jointly considered the KPSS test for stationarity of the variables, where the null hypothesis is that the series are level/trend stationary, and the (augmented) Dickey-Fuller (DF) and Phillips-Peron (PP) tests where the null hypothesis is that the series exhibit a unit root. Finally, because it could be argued that the relatively high current levels of health care spending were influenced by different factors other than those that came into play in the 1970s and early 1980s—an era characterized by a transitional period to democracy and decolonization, and full membership to the European Economic Community (EEC)—we examined the stability of our models between two sub-periods 1970-1990 and 1990-2011 using the Chow tests for predictive failure and stability of the regression coefficients (Chow, 1960).

But health care expenditure has been growing much more rapidly than national incomes in all OECD countries. Whatever the mechanism, it is clear that controlling health care spending is a problem that all developed countries face. Thus, in the second study, we extend the analysis on the determinants of Portuguese health care expenditure to a cross-section of 18 OECD countries using data for the period 1995-2013. Thus, we retained in our dataset only the

observational units for which we had full data on all variables of interest—although health care expenditure data for Ireland were available up to 2012. In the analysis that followed, real per capita total health care spending was modeled conditioned on the share of public and out-of-pocket health expenditure to the total health care expenditure, the real per capita income, the share of the population aged 65 and over to the total population, and life expectancy at birth. As in the first study, all variables were expressed as natural logarithms and included on the right-hand side of the specification in one-period lagged form.

Before proceeding with the estimation process, we tested whether or not the underlying stochastic process that generated the series could be assumed to be invariant with respect to time. Although a wide variety of procedures have been developed with an emphasis on the attempt to combine information from the time-series dimension with that obtained from the cross-sectional dimension, the widely-used Hadri (2000) test tends to over-reject the null hypothesis of no unit root in any of the series in the panel and yield results that directly contradict those obtained using alternative test statistics For these reasons we have also considered the Levin, Lin and Chu (2002) test to test whether the series were non-stationary against the alternative that were stationary.

With regard to the estimation technique, it should be noted that in the literature we can find various types of models focusing on the type of data under consideration. Therefore, we first presented the data based on the fixed effects estimation and then the random effects estimation, followed by a comparison of the two models. Although the coefficients of the two models looked quite similar, the Hausman test showed that the fixed effect estimator was more appropriate. Thus, fixed effects seemed the natural estimation method for handling the transformation of the data through which the country-level time-invariant unobserved heterogeneity effects could be eliminated. At this point, however, it was important to note that even though fixed effects estimators appeared to be preferable to the random effects estimators, we had to check for the absence of heteroscedasticity and serial correlation in the error term, as consistency of the data depended on it. Thus, based on the Bartlett, Levene, and Brown-Forsythe tests for equality of variances of residuals, the null hypothesis of homoscedasticity was not rejected at the 5 percent level of significance (Judge, et al., 1985; Brown and Forsythe, 1974; and Levene, 1960). Still, we must note that these tests are not statistically powerful, in the sense that one may often fail to reject the null hypothesis of normality even when the error distribution is non-normal (Pindyck and Rubinfeld, 1998). In the same way, when we considered a test of the null hypothesis that no linear relationship existed between two or more of the independent variables, the low DW statistic of .655 strongly suggested the presence of positive first order serial correlation, and thus the usual OLS estimators were no longer efficient relative to other linear and unbiased estimators. Set against these problems, adjustments were made to guarantee that no linear relationship existed between two or more of the independent variables and that the errors were

independently distributed from a normal population with 0 expected value and constant variance. Thus, we re-estimated the original model using an iterative procedure for correcting for serial correlation, and the White´s cross-section method for obtaining heteroscedasticity-corrected regression results. In this way, the coefficient estimates of the transformed regression can be interpreted to be efficient and robustly statistically significant. Finally, to further assess the sensitivity of our results to misspecifications, linear and second order polynomial functions of time were specified in order to capture possible deterministic trends in the data. For instance, the share of public and out-of-pocket health expenditures may increase over time with advances in knowledge and technology, with some curvature for the latter periods. This has the added advantage of reducing the risk of omitted variables bias as many of the variables other than the ones considered in the analysis may also influence health care.

The third study deals with the need to assess whether the rise in spending noted earlier is generating less in terms of direct health benefits as conventionally measured by, for example, increases in life expectancy. Thus, using data for the euro-group countries for the period 1980-2009 and a standard panel data approach, this study extends the typical model of the determinants of life expectancy at birth to account for the financial effort made by national governments in providing for the financial support of those that are at risk for poverty and social exclusion. We assessed the contribution of real per capita public health expenditure and real per capita public welfare expenditure to explain life expectancy at birth while accounting for the effect of other economic factors (e.g., real per capita income and real per capita private health expenditure). Each of the models used in the estimation process were estimated twice, with and without time trend.

While the discussion in the previous study has focused on the existing evidence that population health is not only determined by health care expenditure but by many factors outside the health system, the fourth and fifth studies extend this analysis and highlight how health outcomes might be affected by economic crises. In particular, how public social welfare spending might significantly reduce mortality from diseases related to social circumstances (such as alcohol-related deaths and suicides). Though the economy´s performance continues to be disappointing, both studies use fixed effects estimators to analyze data from total, and age-specific male and female deaths in European Union countries over a period that leads up to, and coincides with the 2008 Great Recession. While the fourth study uses mortality from all causes where there would not plausibly be a short-term relation between the age-standardized mortality rate and social welfare spending, the fifth study uses data from diseases where we would expect to see changes with spending, such as the age-standardized suicide mortality rate. Equally important for testing whether both mortality functions shifted over time because of the 2008-2011 recessionary period (the

last years for which complete data were available), time dummies, one for each year of the crisis, were introduced in each one of the studies.

1.4. Research results and contributions to the literature

Although much work has been done on the determinant factors of health spending and health outcomes, less is known about the impact of economic crises on health systems and other forms of social protection, and how these changes might adversely affect population health. Thus, this thesis contributes to the literature by extending the typical statistical models of the determinants of expenditures and the performance of the health care sector to account for changes in mortality risk related to recessions or fiscal austerity, and the responses of public health systems under fiscal constraints. In the following paragraphs we broadly discuss the results and major contributions of this thesis.

The first study begins with an introduction to a problem that all developed countries face and one which Portugal will, after a long period of relatively underfunding, also have to grapple with—controlling health care spending. Portuguese investments in health care have increased significantly over the past few decades, and currently surpass EU average. As a result, growth in health expenditure exceeds growth in the economy, and poses a national sustainability concern. Using a multivariate regression and national health data for the years 1971-2011, this study examines the association between changes in a set of explanatory variables and health expenditure growth, and how these associations vary depending on the different types of government expenditure. The findings fail to support Himmelstein´s and Woolhandler´s basic hypothesis that greater government involvement in health care financing results in lower levels of health care spending. According to the estimation results, greater public and private participation in health care, as well as increases in the lagged value of income per capita and the growth in numbers of the elderly adds to the demand for medical care, and are the likely promoters of higher levels of spending.

Our results make clear, however, that cross-sector synergies work together to determine the amount of health care spending and, hence, must be included in an analysis of policy options that could help in developing a rational, socially acceptable and evidence-informed process for arriving at sensible limits to spending growth. Without a doubt, there is strong evidence that income (personal or national) is positively associated with higher health care spending. Income elasticity corresponding to the estimated coefficient of lagged GDP provides evidence of total health care expenditure being a luxury good, suggesting that as people (and the country) become wealthier, they are willing to consume more (and pay more) for a given improvement in health status. Higher income also increases the capacity of public and private players to supply more and better health care. If, for example, an increase in GDP leads to a more than proportionate increase in health spending, then it would be hard to support the

argument that economic growth should be sought as a means for resisting further budgetary controls in the health sector, for confirmation of the "luxury good" hypothesis points directly to the core of the sustainability problem. However, this apparent relationship should not be taken lightly, since the estimated elasticity for the two health-related sub-components is below unity. This suggests that public and private health care services are necessary goods and underscores the importance of economic growth as a means of resisting further increases in health care spending.

But spending decisions concerning health are not solely affected by the share of publicly funded health care and income level but also by other factors that must work together to determine the amount of health care spending. The variable describing longevity (LE65), for example, is negative in all regressions and statistically significant in one of them. The more plausible explanation for this finding is that as the senior population as a whole is living longer, but at the same time the onset of disability occurs later in life, the associated costs of dying may have been postponed. Hence, improvements in longevity may dampen rather than accelerate the growth in health care spending. As a result, more long-term care resources will be required in the future, as people age.   Although the accuracy of these estimates is hard to evaluate, the case for resisting further expenditure growth rests in part on whether or not this ageing factor is behind the push for more spending. If, in fact, the growth in numbers of the elderly adds to the demand for medical care, setting limits to spending should be resisted—unless the reduction in both the quantity and quality of care can be offset by gains in efficiency in care provision. If, on the other hand, pressures to spend more on health care are largely accounted for by new (and generally costlier) ways of improving the quality and effectiveness of the care available, then a question must be asked concerning the rate of improvements that it is worthwhile financing.

The second study therefore asks the question: can a limit on spending be defined? If not so, what factors are behind any push for more spending? To inform on what is ultimately a political decision, this study investigates the determinants of health expenditure growth in (some) OECD countries over the period 1995-2013, explicitly taking into account the role of public and private health expenditure, income, ageing population, as well as technological progress. The results hold up to a series of specification tests and confirm that the current trend of current health expenditure growth is driven by structural factors (e.g. the growth in numbers of the elderly and the costs of medical care) that cannot be easily compressed if not through rationing.

Furthermore, the results show an inverse but statistically significant relationship between the portion of the OECD health system financed through out-of-pocket spending and total health care expenditure. Thus, this disproportionate reliance on private sources in financing the recent increases may place an additional burden on disadvantaged households and potentially limit future access to care. The results indicate, however, that the share of publicly funded

health care expenditure has no net impact on overall health care spending—although a case can still be made for other forms of government involvement in the health care sector.

The results also show that total health care spending is also positively related to the share of senior population. If this is correct, and society is not (yet) prepared to put up with a significant degree of inequality in access to health care (and health), then OECD health systems (and their key stakeholders) must carry on increased spending at current rates while improving efficiency and productivity in the health care sector. This measure is likely to be viable only for the most immediate planning periods, but it will buy some extra time before new pressures for more spending force governments to confront the inevitable decision to contain costs. The findings also imply that the inclusion of linear and quadratic time trends for statistical reasons and to capture possible changes in medical technology are of importance since the results provide evidence that new technology has been the main driver for more spending. Fortunately, its impact appears to be declining, at least for this sample of countries and over the period 1995-2013.

The third study begins with an introduction to the economics of health spending (i.e., the relationship between costs and benefits), and assesses the contribution of a novel variable—social welfare spending—which is likely to have a discernible impact on health outcomes. In this way, this study examines the determinant factors of life expectancy at birth (LEB) in the euro-group countries. Among these factors it includes GDP growth rate, public and private health expenditure, government social transfers and technical progress. Using statistical data for 12 OECD countries and a standard panel data approach over the period 1980-2009, the results confirm that GDP growth rate, public and private health expenditures and technical progress have a positive influence on life expectancy at birth, while government social transfers have a negative influence.

In this study we tested the soundness of government involvement in two critical areas – health care and social security. Although public sector outputs are often indivisible and difficult to quantify, when measured in terms of life expectancy, there is no systematic link from more government spending to higher efficiency. Indeed, as the results show, public spending is more effective in promoting good health care than basic social assistance for the poor. Even though a proper consideration of both types of spending would require a more disaggregated look at inputs and outputs for a range of outcomes, a suggestive interpretation shows that this difference in performance may be directly related to the nature of the services rendered. Aside from the fact that public and private expenditures are to some degree substitutes, not all social sectors react favorably to both types of intervention. Health care, for example, can be delivered or purchased by the public sector and concerns about efficiency start to matter only after expenditures on health per capita reach an unwarranted level. Highly dependent on infrastructures and equipment, the level of efficiency in health care is prone to improvements and more can still be done with less. As for government social

transfers, highly dependent on direct cash transfers, the results are mixed and suggest a negative effect on longevity. It is possible, however, that this counterproductive effect of government social transfers on life expectancy has weakened, or even reversed, when the analysis period is extended to recent years. This is shown by the results of the fourth and fifth studies, as both studies highlight how investments in a variety of social policies benefit health.

The fourth study therefore asks the question: can socioeconomic fluctuations explain variations in European Union mortality? To answer such important question we investigate the effect of socioeconomic and demographic factors on age-specific, male and female all-cause mortality rates using panel data for 15 European Union (EU) countries plus Iceland over the time period 1990-2011. Although the findings are robust across different estimation methodologies, when a fixed-effects technique is used to control for unobserved time-invariant characteristics within countries, the results show that public health and welfare expenditures are strong predictors of all-cause mortality. Besides yielding literature-consistent, statistically significant and economically meaningful coefficients, the findings show that without social transfers, the current financial and economic crisis would have produced poorer health, especially among women, the poor and their children, and should be accounted for in future inquiry into the determinants of aggregate population health. This finding is consistent with empirical evidence from earlier studies and hints at the buffering effects on health of some social protection programs (for more details see, for example, Stuckler et al., 2009). Such programs are those that are designed to deal with unemployment and underemployment, on the one hand, and, on the other hand, those that are designed to provide assistance to those who should not work—such as children, single parents, the aged, the physically and mentally disabled, etc.

In fact, the empirical results show that social welfare programs had a more significant impact on all-cause mortality than did public health care programs. The coefficient estimates on the public health expenditure term is negative and statistically significant only among males of all ages. This statistical significance disappears in regressions using female and age-specific all-cause mortality rates as a dependent variable. This finding does not imply that medical care is not (potentially) effective. It suggests, however, that the impact of public financing of health care is much more complex than the effectiveness of the medical services purchased. Still, with the optimal composition of total consumer spending shifting towards health, governments—unable to influence all-cause mortality or control total spending on health—can act on both micro and macro levels to influence many of the proximal non-medical determinants of population health (e.g. income, demography, institutions and technological/behavioral changes). While adapting, governments must also develop new patterns of activity likely to improve certain public health performance attributes, especially

those that are likely to close the gap between the actual performance of the health care sector and the apparent potential of public spending in improving health status.

To further isolate the effects of social welfare spending on public health, the fifth and last study examines the relation between social welfare and health expenditures in the European Union and mortality from diseases where we would expect to see changes with spending, such as deaths from suicides and self-inflicted injuries. As noted above, this study models the behavior of age-specific male and female suicide rates over the period 1990-2012 using the unemployment rate and social welfare and health spending as key explanatory variables. We find that our specifications explain male suicide rates better than female suicide rates and rates in the 0-64 age group better than those in the 65 and older age group. The findings suggest that unemployment and divorce rates are significant influences on total, male and female suicide rates but evidence on the former´s significance among older females is lacking. Also, while average income does not seem to have a discernible impact on suicide, higher alcohol consumption is significantly associated with higher suicide rates but only among younger females. Most importantly, when it comes to protecting population mental health, the results suggest that social welfare spending is as relevant, if not more so, than public health spending in moderating increased vulnerabilities to adverse economic shocks, especially among younger males. The estimated coefficient on the public health term is negative but robustly insignificant in all specifications and for all dependent variables.

It is thus suggested that the suicide rate would have climbed higher in the current recession had it not been for the substantial buffering effects of social protection programs on mental health, especially among working-age males and their children. Moreover, given that most of the explanatory variables are not generally significantly associated with female suicide rates, as opposed to male suicide rates, we conclude that male suicide behavior better reflects this group´s greater involvement in market employment and increased vulnerability to adverse economic fluctuations. Our proposed model specifications, however, are of only limited use in predicting female suicide behavior and hints at the possibility of future research into the determinants of female suicide mortality.

1.5. Structure of the thesis

This thesis is divided into two parts, each concentrating on key factors influencing health care performance and outcomes. Thus, Chapters 2 and 3 attempt to untangle the effects of government financing and production on the performance of the health care sector. Chapters 4, 5 and 6 set out to examine whether there is an historical association between levels of health and non-health social spending and population health outcomes. Given the difficulty of isolating the effects of social welfare and health spending on health, these chapters compare mortality from all-causes, where there would not plausibly be a short term relation between

social spending and health, with mortality from diseases where we would expect to see changes with spending, such as suicides and self-inflicted injuries.

Chapter 1 begins with an introduction to the purpose and content of this research, the research questions which the thesis attempts to answer, the observational units and the research methods used, the principal conclusions, and the importance and relevance of the thesis to the field of study.

Chapter 2, under the title of: "Can Government add to the demand for Health Care? Evidence from Portuguese Health Data, 1970 – 2011", uses Portuguese health data for the years 1971-2011 to introduce us to some leading issues in the economics of health care spending, particularly the relationship between government involvement in health care and the growth in health care spending. It also provides a critical review of the contributions other writers have made in the field, the overall approach to the research process and the choice of econometric approach, the findings that were established, and the significance and shortcomings of the results. Finally, it concludes with a discussion of the main points of the study and proceeds to place these within the broader context showing how these findings lead to the possibility of further research in the field of health economics.

Chapter 3 is titled "Health Expenditures and Government Intervention in Health: Evidence from OECD Health Data". Except for the discussion of the research methods involved in accumulating the necessary evidence to systematically answer the questions presented in Section 1.2, which now describes the various types of models focusing on cross-sectional variations over time, this study follows the structure used in Chapter 2 to further investigate the determinants of health expenditure growth in (some) OECD countries over the period 1995-2013. While providing a thoughtful ending to what has been written in the first part of this thesis (Chapters 2 and 3), the conclusions presented here help define the point where a limit to spending can be set.

The second part of this thesis, comprising Chapters 4, 5, and 6, introduces in the analysis of the key determinants of health and disease a novel variable—social welfare spending—which it is posited to have an impact on the overall health status and well-being of a country´s population. While Chapter 4, titled "Living Longer: An Assessment of Euro-Zone Life Expectancy Trends Using a Panel-Data Approach", examines the determinant factors of life expectancy at birth (LEB) in the euro-group countries, Chapter 5, titled "Crisis revisited: the 2008 economic recession and age-specific, male and female mortality in the European Union", develops this analysis for age-specific, male and female all-cause mortality rates using panel data for 15 EU countries plus Iceland over the time period 1990-2011. Under the title of "Death by Economic Crisis: Measuring the Effects of Economic Conditions on Suicide and Self-Inflicted Injury in Europe", the last chapter of Part Two of this thesis is devoted entirely to examining the way social protection programs can be modifiers of the recession-

health relation. Specifically, it focuses on how social spending other than health care may affect suicidal deaths during economic recessions.

Finally, Chapter 7 focuses on the main points of the research and then proceeds to place these within the broader context showing how the study leads to the possibility of further research in this area and why this is important in advancing knowledge in this subject.

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Chapter 2

2. Can Government Add to the Demand for Health Care? Evidence from Portuguese Health Data, 1970 – 2011

2.1 Introduction

In most developed countries, the health care sector has become a key part of national economies and its expenditure share in national incomes has been increasing over the years. In 2013, health care expenditure (hence HCE) per capita in OECD countries averaged 3453 USD and the ratio of health expenditures to gross domestic product (GDP) reached 8.9 percent (OECD Health Statistics, 2015). Further, between 2012 and 2013, OECD health expenditures increased 2.0 percent and exceeded the growth in gross domestic product (GDP) per capita of 1.2 percent. However, with rising public demand, advancement and dissemination in (generally more costly) medical technologies, and a senior population that, as a whole, is living longer, pressures on spending are only likely to increase. According to the EU Sustainability Report (2009), for the EU-27 Member States and over the period 1910-2060, of the projected increase in the so-called total age-related public spending, more than half (2.5 percent) are accounted for by both an increase in health care spending and an increase in long-term care spending. As a result, the provision and financing of heath care has become an issue that every society must address as the sustained growth in health care spending is likely to increase the fiscal and financial pressure on governments, households and businesses, and create the potential of an unsustainable future liability (WHO, 2016; Kotlikoff, 2007; Savedoff, 2007).

Designed to promote long and healthy lives, different health care systems pursue this goal in different ways. In principle, a country´s health care can be both provided and financed either entirely publicly, or entirely privately. Irrespective of the private/public mix and the commonality of multiple objectives, key aspects of health systems include the efficiency and quality of services delivered, equity in access to care, and—given the increased importance that societies attach to health—the sustainability of the system (Cutler, 2009; Musgrove, 1996). For a variety of conceptual and practical reasons, health care services in most developed countries are largely funded by the government and sometimes also provided by the public sector. Although this mix will vary depending on a country´s stage of development, there has been a growing recognition that direct government intervention in care provision and financing is not the only way to intervene or even the best and that modifying or using

the market approach may often be more effective. Thus, one crucial question must be placed at this stage, though it applies throughout our discussion. In health care markets, does government involvement raise economic efficiency or lower efficiency? The only overreaching answer that can be offered is: it depends.

Economic theory is clear that government intervention through funding and other mechanisms has the potential to improve efficiency when used to address various sources of market failure and inequity in the distribution of goods and services. Direct government provision may not be desirable, however, if markets are already "perfect", and government intervention can only reduce efficiency. In the case of health care, the market differs substantially from most other markets in a number of important ways. Such differences pose problems about expectations of the magnitude of the price effect and its sign, as services are not evaluated by the consumers on a "willingness to pay" basis, either because of a shared-cost effect or a third-party payer (Dardanoni and Donni, 2012; Gruber and Washington, 2005; Chiappori et al, 1998). Apart from such features, this arrangement is likely to introduce asymmetric information, distortions in the perception of value, and distortions in production and use, as some type of products/services and service providers are favored over others (Kolassa, 2009).

In theory, when this happens, government intervention has the potential to improve efficiency by moving away from the economically inefficient output produced by the market. In reality, however, efficiency-enhancing measures cannot be produced without being accompanied by efficiency-reducing side effects. On the one hand—because of financial barriers to access--some services would be under-produced and under-consumed in the absence of direct government intervention. For example, the prevention and treatment of infectious and non-communicable diseases will be underprovided if left exclusively to the market mechanism and to the behavior of individuals who may be poorly informed about issues concerning their own health. On the other hand, indirect government involvement in health care may come at the cost of excessive regulations. These regulations may lead to reductions in the quantity and quality of care, as providers respond to the market and regulatory incentives to contain costs, or reduce output by diverting resources to non-economic compliance costs. As a result, both direct and indirect government intervention in health care may lead to complications in measurement and, most importantly, non-price rationing of some medical products and/or services—even if at the expense of some unresponsiveness to individual needs. For example, according to Joumard et al. (2010), by reducing all types of inefficiencies in health systems by half in the OECD would increase life expectancy at birth, on average, by more than one year.

Although economic efficiency is easy to define theoretically, discord arises when applied to the actual assessment of the total returns to health care investment, including all sources of benefits and the "opportunity costs" of the inputs (Williamson, 2000). Besides varying from

country to country, depending on national income, disease burden, and the preference of patients, physicians and health care decision makers, standard measures of population health are often crude and unreliable (Anderson and Hussey, 2001). Even in cases where this link has been correctly identified, comparisons are still limited by the lack of a universal definition of what should be classified as health care spending. More importantly, as a result of difficulties in getting comparable data on the number of people caring for others, the frequency of their caring, and the significant variation between countries in informal care provision, comparisons use only data for the formal sector. This approach leaves out value creation on the part of the informal sector and introduces substantial bias on final results (Colombo et al., 2011; Smith and Street, 2007). Yet, only based on this information can policy analysts monitor productivity and cost efficiency over time and compare performance at the international, national, regional, local or institutional level (Di Matteo, 2004, Ibrahim, 2001)). Given the just-mentioned theoretical and empirical concerns, and because there is no single model that delivers the best results across all countries, it seems more appropriate and useful to conduct a country-specific study that aims to analyze how government involvement in health care has affected country-specific performance and expenditures. For the purpose of our study health system indicators for Portugal were analyzed in order to test the null hypothesis that government involvement in health care has no significant effect on health care spending and cost. While this issue has dominated policy discussions at both the national and international level, the testing of this hypothesis builds on the framework developed by Himmelstein and Woolhandler (1986), Baumol (1989) and Santerre et al. (1991), and is consistent with economic theory and most of the empirical analysis that were subsequently undertaken on the economics of health care spending (Bevan et al., 2014; Litchenberg, 2004; Barros and Martinez-Giralt, 2002).

On this reading, the evidence appears not to support a strategy of increasing public spending on health, at least not with some significant caveats relating to the compositional effects of expenditures. From a more narrow, micro-level perspective, it may happen that for the same amount of public expenditure, higher allocations to primary care as opposed to secondary care, may relieve pressure on the hospital sector, reduce spending and, more importantly, improve quality of care. We find, however, that lagged income is strongly related to total, public and private health care expenditure. The results also lend support to the finding that spending has increased over time, perhaps reflecting the evolution of cost-enhancing technologies over the sample period. Finally, other important findings are that lagged health status and ageing factors (i.e., LE65 and POP14) have the expected signs in all regressions and are individually, as well as collectively, statistically significant in total health care expenditure regressions. This finding hints at important differences in the underlying stochastic process describing component-specific health care spending.

This article is organized as follows. Section 2.2 briefly reviews empirical evidence from past studies which may prove useful in future work. Section 2.3 analyzes the evolutionary trajectory and the sustainability issue of public spending on health care in Portugal. A brief account of the underlying factors responsible for the historical growth in health care spending is given in Section 2.4. Section 2.5 describes the methodology and reports the results of our analysis. Section 2.6 concludes, discussing the main policy implications of our work. Graphical representations are included in the Appendix.

2.2. Brief country profile

Like many initiatives that have been put in place to improve public knowledge and understanding of major health issues, in this section we present data from the Organization for Economic Cooperation and Development (OECD) and the World Health Organization (WHO) on the performance of health care systems and focus our cross-national comparisons on three broad subject areas: (i) access to care and health system responsiveness, (ii) health system spending and sustainability, and (iii) health service outcomes.

Access to health services and responsiveness to people´s expectations are defining goals of health systems. In the case of Portugal, its health care system is characterized by a fragmented, multi-tiered system of health care provision: a tax-financed National Health System (NHS), which provides universal health care coverage, irrespective of socio-economic condition; an occupation-based insurance scheme for civil servants and other special groups that provide coverage to about one-quarter of the population; and private voluntary health insurance (VHI), with estimates of coverage that vary from one-tenth to one-fifth of the population (Barros et al., 2011). Though, in theory, the NHS tends to be free at the point of use, in practice, certain services such as diagnostic tests, hospital admissions, specialist visits and prescription drugs are subject to co-payments (Barata et al., 2012(. In addition, certain benefits such as dental care or rehabilitation are mostly provided by the private market. While the share of private funding allocated to different health care service providers, including both voluntary health insurance (VHI) and out-of-pocket (OOP) payments, has remained largely the same over the years, a steady upward trend was observed as of 2011, reflecting a number of budget-balancing measures implemented in the wake of the 2007 financial crisis (OECD Health Statistics, 2015).

To further improve health outcomes, reduce the variation in health status, and be more responsive to the expectations of the Portuguese population while containing costs is challenging. Indeed, although the -0.9 percent total growth in health expenditures per capita during 2005-2013 was below the OECD average of 2.0 percent, total health care expenditure as a share of GDP rose from 5.5 percent in 1990 to 9.1 percent in 2013 (OECD Health Statistics, 2015). Increasingly, however, a disproportionate amount of this growth has come

from private sources. In fact, breaking down the distribution of health care financing in 2014 by source, private out-of-pocket spending through co-payments and cost-sharing accounted for nearly 27.2 percent of the total, while the OECD average was 19.5 percent. With 3.9 percent of household spending going towards medical goods and services, this high proportion of out-of-pocket spending limits the affordability of health care and places an undue burden on poorer households, which are more likely to report unmet needs for medical care for financial and other reasons. Indeed, due to cost, around 3 percent of the population in Portugal reported some unmet needs for medical examinations and 14.3 percent reported some unmet needs for dental care. On the other hand, based on the OECD (2015) analysis on current trends of health care spending, the rate of public spending as a percentage of GDP has decreased to 66.2 percent in 2014—a rate that is below the OECD average of 72.2 percent—after reaching record levels of spending of nearly 70.5 percent in 2009. Thus, on this reading, the proximate challenge lies not in containing public health care spending, which consumes approximately 13 percent of total government spending (lower than the 15 percent OECD34 average), but rather in improving health system performance with limited resources and given constraints on fiscal capacity (OECD, 2015).

So what is health care spending on the National Health System (NHS) helping to achieve right now? This is a question that can only be answered by investigating the actual improvements in the quality of life of the Portuguese population. Among the most commonly used indicators of the general health status and well-being of a country´s population are life expectancy (LE), infant mortality (IM), and potential years of life lost (PYLL). As suggested by Figures 1, 2, and 3, in the Appendix, life expectancy in Portugal at all ages (at birth, at ages 1, 15, 45, and at 65, for example) has been increasing for both males and females, over a sustained period of time, reflecting economic growth and improved access to an expanding health care network (WHO, 2016; Barros et al., 2011). In the period between 1970 and 2013, the WHO figures show that life expectancy at birth has increased from 66.7 to 80.8 years—an increase of 14.1 years. Although these gains were higher in Portugal than in all other EU15 Member States, these increases are not as apparent when one considers life expectancy at age 1, which has increased only 10.66 years (10.45 years for males and 10.93 years for females); from age 15, which has increased 9.41 years (9.13 years for males and 9.75 years for females); from age 45, which has increased 8.1 years (7.46 years for males and 8.72 years for females); or from age 65, which has increased 6.74 years (6.04 years for males and 7.39 years for females). Much of this improvement, however, is due to reductions in mortality during infancy, especially during the neonate period. Thus, as of 2013, the infant mortality rate in Portugal— which largely reflects quality and access to medical care, maternal health, public health practices and socioeconomic status—was 2.9 infant deaths per 1 000 live births, below the OECD´s average of 4.1 infant deaths per 1 000 live births (OECD Health Statistics, 2015). In the case of avoidable mortality (amenable and preventable deaths, respectively), while Portugal had the highest rates for both indicators among the EU15 countries in 2002-2003,

these rates are now better than the EU15 averages (Eurostat, 2016; WHO, 2010). These lower values for amenable and preventable deaths most likely reflect improvements in the most important causes of death, especially causes of death under the age of 65 years—such as cerebrovascular diseases, ischemic heart conditions, malignant neoplasms, injuries, and alcohol relates diseases. Despite improvements in mortality, there are inequalities in health between population groups and among regions. For example, women continue to have a longer life expectancy than men and have lower rates of potential years of life lost (PYLL). Relative to other European Union countries, this indicator, which measures the years of life lost before age seventy due to preventable conditions, was nearly 64 percent above the EU15 median for men and 84 percent for women in 1970, whereas by 2013 it was only 20 percent greater for men and nearly 5 percent lesser for women (OECD Health Statistics, 2015).

However, despite the indication that Portuguese citizens are living longer than ever, the evidence is mixed about how persons age. As of 2013, while Portuguese males had a disability-free life expectancy at age 65 that was .14 years less than the EU15 average, the gap for females was .93 years (OECD, 2015). In addition, more than half of adults aged 65 and over reported limitations, either to some extent or severely, in their usual daily activities because of a health problem in 2013. In the case of perceived health status, which reflects people´s overall perception of their health and is a good predictor of individuals health care use and mortality, only 46 percent of adults in Portugal rate their health as being good (OECD, 2015; DeSalvo et al., 2005). This rate increases to 12 percent among the population aged 65 and over and is the lowest in OECD countries. Last, when viewed from the perspective of limits in access to health services for financial or other reasons, the OECD figures also show that nearly 62 percent of individuals in the highest income quintile report being in good health, compared with 40 percent for individuals in the lowest income group. In the last analysis, although there was an improvement in the overall health status of the Portuguese population, many lives are still lost because inequalities in health exist and seem to be unchanged—either due to cost, travelling distance and/or the existence of explicit rationing at several points in the system—and quality of care is not improving fast enough (Barros et al., 2011; Santana, 2005).

2.3. Factors accounting for the historical growth in health care spending

Although it is the latter which are at the center of public scrutiny, the indirect costs resulting from ill health and premature deaths exceed the direct costs of medical care, and three factors are thought to cause these costs to grow. First, the growth in income, which assumes that, as people and societies become wealthier, they are willing to pay more for a given improvement in health. Second, the growth in numbers of the elderly adds to the demand for

medical care. Third, the costs of medical care, notably those of hospital treatment, have been rising rapidly with the development of new medical technologies.

2.3.1 Income

Since the seminal studies by Kleiman (1974) and Newhouse (1977), the examination of the determinants of health care expenditure has been a matter of extensive debate. In most of these studies per capita income has been accepted as its major explanatory factor (Hosoya, 2014; Mehrara, M. et al., 2010; Smith et al., 2000). As a way to measure this relationship, the income elasticity concept was appropriated and applied to cross-country settings. Although it has been extensively debated, the issue of whether health care is a luxury good (income elasticity above one) or a necessity (income elasticity between zero and one) is largely unresolved, and empirical investigations which rely on different techniques have come to conflicting results. For example, as in Newhouse (1977), one of the first generation of studies using cross-country regression analysis for the member countries of the OECD indicates that the income elasticity of demand for health care spending ranges from about 1.3 to 1.8 (Schieber and Pouillier, 1992).

This shows a more than proportionate response of consumption to income change (the case of a luxury good) and suggests that variations in per capita income explain most of the variance in per capita health expenditure between countries. A new generation of studies that use panel data and new econometric techniques provide further confirmation that per capita income has a positive impact on per capita health expenditure, although of a less magnitude. After correcting for the potential non-stationarity of data and cross-section heterogeneity, most of the recent studies are unanimous in accepting values of 1.0 to 1.4 as reasonable estimates of income elasticity of demand for health care in developed countries (Baltagi and Moscone, 2010; Jewel et. al., 2003; Hsiao, 2003; MacDonald and Hopkins, 2002; Schieber and Pouillier, 1992).

This indicator may vary depending on the level of aggregation of health expenditure data and the level of analysis, with income elasticities at the cross-national level being generally larger than at the national or regional level (Dormont et al., 2007; Di Matteo, 2003). Using these estimates and given that Portuguese real GDP per capita increased by approximately 169 percent between 1970 and 2011, income growth (for a given state of technology, population age-structure, and so on) could only account for nearly a 169 to 236 percent rise in real per capita health expenditure. A considerable amount but inadequate in explaining the 1 053 percent increases in total health spending. Demography and the structure of the Portuguese health sector must account for most of the rest (Seshamani and Gray, 2004; Smith et al., 2000).

2.3.2 Demography

Questions of the relationship between age and spending on health care have been debated over the past decades using many different techniques, but to date, the accuracy of their results are hard to judge (see Chritiansen et al., 2006 for a review). Contemporaneously, studies using aggregate (macro) data have found negative or insignificant estimates for ageing variables (see, among others, Hosoya, 2014; Byongho and Sang-Ho, 2010; Felder et al., 2010; Wang, 2009; Gerdtham and Jõnsson, 2000; Barros, 1998). For example, a study on ageing and health care spending—covering the 1970-2002 period, and both in the U.S. and a subset of OECD countries—attributes to population ageing 0.3 percentage points out of the 4.3 percent real annual growth in health spending in the U.S., and 0.5 percentage points out of the 3.8 percent increase for the subset of OECD countries (Jenson 2007). The low importance attached to demographics runs counter to a number of early studies that emphasize the importance of ageing in explaining the variation in health related expenses (Di Matteo and Di Matteo, 1998; Gerdtham et al., 1998; Hitiris and Posnett, 1992; Grossman, 1972). These findings suggest that the ambiguous relationship may in part be explained by the fact that the senior population as a whole is living longer and the onset of disability occurs later in life—or, as described by Grignon (2003), differences between the "pure" age effect and health status of individuals (Vogel, 2007) .

Clearly, as proposed by Seshamani and Gray (2004), what one observes is that the proximity to death, rather than age, may be the main demographic driver of expenditure on health care. Also, as suggested by other studies, costs tend to be lower the older people are when they die (Payne, 2009; Dixon et al., 2004; Canadian Health Service Research Foundation, 2003). These findings support the view that improvements in life expectancy will dampen rather than accelerate the growth of health spending. On this issue, Cutler (2003) opined, however, that the statistical and economic relevance of ageing factors may be related only to changes in the future health environment. At this point, there is scope for considerable improvement in evaluating health care spending so as to help better inform future decision making.

Like other countries, Portuguese population is ageing. In 2010, 18 percent of the population was aged 65 or over, while 5 percent were aged 80 or older (OECD, 2015). Accordingly, between 2010 and 2050 the share of the population aged 65 or over is projected to increase from 18 to 32 percent, while those 80 or over are projected to increase from 5 to 11 percent. As a result, the old age dependency ratio (i.e., the population aged 65 years and older divided by the working age population) is projected to increase from the current 25 to 54.8 percent by 2060 (Eurostat 2008). Given the underlying uncertainties, the implications for national health care spending are very difficult to establish. If, for example, actual changes in demography are largely responsible for the rapid expenditure growth in health care, then it is hard to argue that growth should be contained since health care utilization seems to

increase with age. Irrespective of the apparent causality, the fact that (all age) national health care spending more than ten folded over the 1970 and 2011 period while population changes occurred gradually, is convincing proof that population ageing is itself a relatively minor factor in the growth of Portuguese health care spending. Other factors, including more innovative and/or service intensive medical procedures, seem to play a much bigger role.

2.3.3 Technological Innovation

Once income and ageing has been taken into account in explaining outlays on health, a residual growth remains that can only be explained by the added demand and rising cost of new medical technologies, notably new physical capital and equipment, new surgical procedures and treatments, as well as new pharmaceuticals (Baltagi et al., 2011; Lichtenberg, 2007 and 2006; Cutler and Huckman, 2003; Okunade and Murphy, 2002; Cutler and McClellan, 2001). Although the accuracy of these estimates is hard to judge, between 1940 and 1990, according to Newhouse (1992), technological change accounted for approximately 65 percent of the increase in U.S. health spending. In a subsequent paper, Cutler (1995), provides a lower, but still significant, estimate of 49 percent. However, some forms of technological progress may reduce or increase costs. For example, a number of empirical studies on the value of pharmaceuticals in enhancing health status suggest that newer pharmaceuticals are more productive in that regard than older vintage drugs, and that these pharmaceuticals are highly cost-effective compared to the other inputs in the health production function (physician and hospital inputs) (Shaw, Horace, and Vogel, 2005; Lichtenberg, 2001). On the other hand, as a result of new or expanded needs for medical intervention, new medical technologies which are cost-effective and cost-reducing at the micro level can lead to an increase in overall aggregate expenditures (DiMasi et al., 2003). Consequently, the net effect of new medical technologies on health care spending tends to be inflationary, at least historically, as suggested by the health economics literature (see Pammolli et al., 2005 for a review).

When Portuguese health expenditures are decomposed into its various parts, hospital spending is the single largest component of the overall expenditure increase—much of which can be attributed to changes in the technology, style or quality of care. If we look at the latest available data attentively we see that hospital discharge rates in 2009 are above 2000 levels (rising from 85.7 to 113.2 per thousand) (OECD, 2015). Aside from age adjustments, higher discharge rates tend to be affected by the increased capacity of hospitals to treat patients. In compensation, the average length of a hospital stay has fallen from 7.3 days in 2000 to 5.9 days in 2009 (the latest available year), which helped to reduce the cost per discharge and shift care from inpatient to less costly out-patient care. However, shorter stays tend to be more service intensive and more costly per day (OECD, 2015). As a result, the expenditure on inpatient care, in PPP$ per capita, rose by nearly 31 percent from 2000 to 2011 (increasing from 395.3 to 518.7 PPP$ per capita) (WHO, 2015). The use of diagnostic

imaging in 2009 was also higher, with more CT and MRI exams performed—more 73.7 and more 16 per 1 000 population, respectively—than in 2000. What this evidence suggests is that the type of care being offered to each individual patient, and not a greater than before number of patients attended, is increasing hospital expenditure. This finding is consistent with the theoretical proposition that the growth in new (and generally more expensive) forms of improving health-related quality and length of life through medical technology accounts for the greater part of the increase in health care costs and, as a result of the effort to maintain or improve the level of care, health spending (Cutler, 1995).

2.4. Modeling the determinants of health care expenditure in Portugal

2.4.1 Model specification

In this study we propose to examine the relationship between the time-series for Portuguese health care expenditures (HCE) and a set of explanatory variables using Ordinary Least Squares (OLS) regression estimators, over the period 1970-2011 (the latest year for which complete data were available). To further inform this debate, different sets of regressions are estimated for total, public and private health care expenditure (THE, PHE and PrHE). Thus, the equation to be estimated (three variants of which we implement) takes the following form:

$lnHE_t = \beta_1 + \beta_2 lnGDP_{t-1} + \beta_3 lnRPHE_t + \beta_4 lnLE65_{t-1} + \beta_5 lnRPOP14_t + \beta_6 lnRPrCON_t + \beta_7 Time + \beta_8 Time^2 + \varepsilon_t$ (1)

This equation relates total, public and private HCE to a set of economic, social and institutional variables. Drawing on the existing literature, the set of explanatory variables includes real income per capita (GDP), life expectancy at age 65 (LE65), the ratio of the population aged 0 to 14 to the total population (RPOP14) and the ratio of private consumption to the total consumption (RPrCON)—four factors known to affect demand for medical services. Given that as life expectancy increases, the average age of the population--and the ratio of the population 65 and over to the total population (RPOP65)--increases, we use LE65 as a means at capturing the effect of age on HCE (Barros et al., 2011; Lichtenberg, 2004). This is justified by the need to avoid working with a non-stationary (RPOP65) series and/or a possible collinearity problem that may arise from including both measures of ageing conditions in the same specification. A known factor that is likely to affect the supply of services, the ratio of public HCE (RPHE) to the total health expenditure (THE) is added as a way to account for the level of effort exerted by the government in providing health services and improving the health status of its population. Time variables are included in Eq. (1) in order to capture possible deterministic trends in the data. For instance, a visual inspection of the time-series for income, expenditures, and key aspects of overall health status, displays

some tendency for variables to move together over the years of the sample period, with some curvature perhaps for the latter years. Thus, the time trend will help in isolating their idiosyncratic effects on the patterns of health expenditures and will act as a proxy for common shocks to the model (such as, for example, technological progress which seems to play an important role in the rising cost of health care) (Mosca, 2007; Crivelli et al., 2006). Finally, the ε is the error term and t denotes that the data are measured at time t, from 1970 to 2011. We must note, however, in regards to the application of least-squares (OLS) techniques to the type of data under consideration, that the results presented here must be treated with caution.

Instead of estimating Eq. (1) using data on the levels of GDP, RPHE, LE65, and RPrCON, equations for total (THE), public (PHE) and private health expenditures (PrHE) were estimated using data on the logarithms of these variables. This convenient transformation achieves two purposes. First, it accounts for the non-linear relationship between HCE and a set of key explanatory variables and over the range of regressions we examine. Second, it allows comparisons with earlier studies as the regression results provide elasticities, which are assumed to be constant. To further improve the results, some of the variables considered in the analysis are introduced in one-period lagged form (namely, GDP and LE65). As suggested by Bilgel and Tran (2011), this is justified by the fact that HCE may respond to a regressor(s) with a time lag, and the need to ensure that there is no reverse causation from expenditures to both income and health status (GDP and LE65). Because of the lag structure, models are based on a time-series of 41 observations, rather than 42, as the year 1970 is dropped for lagging.

2.4.2 Data

For our purpose, data was collected and integrated from the World Health Organization (WHO), The World Bank (WB), the Organization for Economic Cooperation and Development (OECD), and Pordata. Whilst data on real GDP per capita were extracted from the WHO (2015) European Health for All databases (HFA-DB), data on the ratio of the population aged 0 to 14 to the total population (RPOP14) were extracted from the World Bank (2015) World Development Indicators Database, and data on the ratio of private consumption to the total consumption (RPrCON) were taken from the Pordata Databases (2015). Additionally, life expectancy at age 65 (LE65), data on current expenditure on health, as a percentage of GDP (HE), and public expenditure on health, as a percentage of total expenditure on health (RPHE), were taken from the OECD Health Statistics (2015). Bearing in mind that the available OECD Health Statistics data only considers current expenditures, real per capita total health expenditure (THE) was obtained by multiplying its respective share of GDP by (real) per capita GDP. Likewise, real per capita total public health expenditure (PHE) was obtained by multiplying its respective share of current expenditure on health by (real) per capita total

health expenditure. Finally, real per capita private health expenditure (PrHE) is calculated by differencing THE and PHE.

In this way, all health expenditure variables are expressed in constant monetary values. Table 2.1 reports the data sources and summarizes the main descriptive statistics of the variables included in our regressions.

Table 2.1: Variables, notation (and their sources), and descriptive statistics

Variables	Mean	Median	Max.	Min.	S. E.
Dependent variables:					
- THE (log of real total health care expenditure)[2]	6.593	6.623	7.513	5.003	0.708
- PHE (log of real public health care expenditure)[2, 5]	6.062	6.145	7.000	4.432	0.739
- PrHE (log of real private health care expenditure)[2, 5]	5.537	5.697	6.340	4.068	0.646
Independent variables					
- GDP (log of real per capita GDP – lagged)[1]	9.356	9.446	9.752	8.732	0.321
- RPHE (log of the ratio of public health expenditure to the total health expenditure)[3]	4.134	4.168	4.248	3.935	0.091
- LE65 (log of life expectancy at age 65 – lagged)[2]	2.762	2.769	2.933	2.564	0.106
- RPOP14 (log of the ratio of the population aged 0 to 14 to the total population)[3]	3.013	3.004	3.356	2.692	0.235
- RPrCON (log of the ratio of private consumption to the total consumption)[4]	4.384	4.383	4.445	4.321	0.039

Data sources: 1. World Health Organization (2015), "Health for All Database"; 2. OECD Health Statistics (2015); 3. The World Bank, *World Development Indicators,* 2015; 4. Pordata (2015);5. Author´s own calculations.

2.4.3 Preliminary findings

Like in many of the time-series that one encounters in economics, one would suspect that the underlying stochastic process that generated the series on health expenditure and its determining factors is non-stationary. If this is the case, misleading values of test statistics (t-ratios and R^2s) can lead to the conclusion that a meaningful association exist among variables that are in fact unrelated, and this may happen, for example, because of a common trend rather than a true economic relationship (Asteriou and Hall, 2007). To shed light on this issue, the widely-used Augmented Dickey-Fuller (ADF) and Phillips-Peron tests (PP) (Dickey and Fuller, 1979; Phillips and Perron, 1988) jointly test the null hypothesis that the time-series under consideration has a unit root, that is, it is non-stationary, against the alternative that the time-series is stationary. However, the power of both tests is notoriously low, which can lead to the non-rejection of the null (unit root) hypothesis when it is in fact false (Gujarati and Porter, 2009). A solution to this conundrum was to use the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test to test whether the series are stationary against the alternative hypothesis that the series are non-stationary (Walsh and Walsh, 2011; KwiatKowski et al., 1992).

Table 2.2 reports the KPSS test statistic for the stationarity of variables used in this study. While the statistics in Panel A test whether the series are level stationary, those in Panel B test whether these are stationary around a deterministic trend. For most series the hypothesis of level stationarity is rejected in our data, the only exception being the share of current public expenditure on health (PHE). In Panel B, for the TPrHE series, the hypothesis of stationarity around a deterministic trend is rejected at the 5 percent level of significance. However, for the series THE, TPHE, GDP, PHE, LE65, POP14 and PrCON the hypothesis of stationarity around a deterministic trend cannot be rejected at the 5 percent level of significance. Upon these results, given that the key explanatory variables used in equations for total, public and private health care expenditures (HCE) are trend stationary as distinct from level stationary, we include a time trend in all our regressions (Gujarati and Porter, 2009).

Table 2.2: KPSS Stationary Test and Stability Diagnostics

Panel A					
Including an Intercept but not a Trend *Asymptotic Critical Values (5 percent level of significance):* 0.463000 . *42 Observations 1970 – 2011, Bandwidth: 9*					
Dependent Var. *Test Statistic*	*lnTHE* *0.669**	*lnTPHE* *0.664**	*lnTPrHE* *0.653**		
Independent Var. *Test Statistic*	*lnGDP* *0.650**	*lnRPHE* *0.242*	*lnLE* *0.657**	*lnRPOP14* *0.648**	*lnRPrCON* *0.638**
Panel B					
Including an Intercept and a Linear Trend *Asymptotic Critical Values (5 percent level of significance):* 0.146000 *42 Observations 1970 – 2011, Bandwidth: 8*					
Dependent Var. *Test Statistic*	*lnTHE* *0.144*	*lnTPHE* *0.084*	*lnTPrHE* *0.182**		
Independent Var. *Test Statistic*	*lnGD* *0.126*	*lnRPHE* *0.094*	*lnLE65* *0.102*	*lnRPOP14* *0.098*	*lnRPrCON* *0.089*
Panel C					
Stability Diagnostics *Chow Breakpoint Test: 1990 (Equation Sample: 1971 – 2011)*					
F-statistic 1.099 *Prob. F(10,21)* 0.406 *Log likelihood ratio* 17.405 *Prob. Chi-Square(10)* 0.066 *Wald Statistic* 36.567 *Prob. Chi-Square(10)* 0.0001					

*Test statistic > critical value.

Finally, the issue of parameter instability needs to be addressed. As a consequence of the extensive number of reforms that have been undertaken in the health care sector since early 1990s, it could be argued that the relatively high current levels of health care spending were influenced by different factors than those that came into play in the 1970s and early 1980s—an era characterized by a transitional period to democracy and decolonization, and full membership to the European Economic Community (EEC). We therefore examine the stability of our models between two sub-periods 1970-1990 and 1990-2011 using the Chow tests for predictive failure and stability of the regression coefficients (Chow, 1960).

However, as these tests suggest (Table 2.2, Panel C) that there is no parameter instability (i.e., the health expenditure function is the same before and after the 1990s structural reforms of the health care sector) we estimate the basic regression equation (Eq. 1) for the whole sample (1970-2011).

2.5. Empirical findings

The regression results for the whole sample 1970-2011 are reported in Table 2.3, each corresponding to another dependent variable (total, public and private HCE). We have not included the ratio of public health expenditure to total health expenditure (PHE) in the regressions for total public and total private HCE as it relates primarily to the total HCE. To improve the regression results, where the Durbin-Watson statistic indicated the presence of positive first-order serial correlation, an AR(1) error regression model was estimated.

While the results are generally good (significant t values, relatively high R^2s and standard errors of the regressions that are less than 10 percent of the dependent variable means), our model explains total HCE better than public HCE and public HCE better than private HCE. In accordance with the previous findings in the literature, we identify a positive relationship between HCE and lagged GDP. Given the log-log specification of the model, income elasticities corresponding to the estimated coefficients of lagged GDP are higher than one for total HCE and smaller than one for both public and private HCE. More concretely, a 1 percent point rise in lagged GDP leads to total HCE increasing by 1.06 percentage points, and the coefficient is statistically significant at the 1 percent level. Coherent with existing evidence from cross-country studies showing that the income elasticity of demand for medical care is greater than 1.0 (Feldstein, 2005), the estimated elasticity of total HCE provides empirical support for the luxury good hypothesis.

These coefficient magnitudes, however, are smaller for public and private HCE. Our estimates suggest that a 1 percent increase in lagged GDP is associated with a .95 and a .99 percent increase in public and private HCE respectively, suggesting that the impact of economic growth on HCE passes mainly through the private component. In relation to other economic control variables other than GDP, the coefficient estimates for the ratio of private

consumption to total consumption (PrCON) are statistically insignificant in all regressions, including those for private HCE.

Table 2.3: Regression Results, 1970 – 2011
Dependent Variable.: Total, public and Private Health Expenditure (THE, PHE and PrHE)

	MODEL 1	MODEL 2	MODEL 3
Dep. Var.	lnTHE	lnPHE	lnPrHE
Variables	**Coefficient .**	**Coefficient .**	**Coefficient .**
Constant	4.377615	8.066933	-16.37308
$lnGDP_{t-1}$	1.055090*	0.952989**	0.988071***
lnPHE	0.089347		
$lnLE65_{t-1}$	-1.26637***	-0.270968	-0.992063
lnPOP14	1.187741**	0.279417	1.588035
lnPrCON	-2.132031	-2.693106	2.044743
TREND	0.075327*	0.052485**	0.107052*
TREND^2	-0.000505*	-0.000473	-0.000922**
AR(1)	0.369715**	0.738722*	0.452549*
N Obs.	41	41	41
Time bounds	1971-2011	1970-2011	1971-2011
R^2	0.993103	0.989770	0.976310
Adj. R^2	0.991101	0.987213	0.970388
S.E.	0.063242	0.079362	0.105212
F stat.	495.9963*	387.0222*	164.8505*
D.W. stat.	1.813792	1.877256	1.918151

Note: $*p \leq 0.001$; $**p \leq 0.05$; $***p \leq 0.01$.

We now turn to describing our findings for the institutional control variable. The results on the public HCE share (PHE) fail to support the basic hypothesis that greater government involvement in health care leads to a lower level of HCE. The coefficient estimate on the PHE term is positive, rather than negative, but only significant at the 58 percent level. In fact, the estimated coefficient on the PHE term also lend no support for the alternative hypothesis that a greater public HCE share leads to excess health care spending.

The results indicate, however, that the effects of a country´s life expectancy and age structure are central issues in the HCE analysis. Although—as explained earlier—we had to select the one instrument having the highest correlation with the demographic control variable RPOP65, the coefficients on the life expectancy at age 65 (LE65) term are negative but statistically insignificant in all regressions, except the one on total HCE. Namely, as life expectancy increases, but at the same time the onset of disability occurs later in life and at a less rapid rate than the increase in life expectancy at age 65, the cost of maintaining previous levels of health may actually decrease. This situation may lead to less need for and thus less expenditure on health care (Payne et al., 2009). Incidentally, as lagged LE65 rises by 1

percent, total HCE decrease by 1.27 percent. We note, in connection with our inclusion of this variable in the public and private HCE regressions, that the estimated coefficients are negative but not statistically different from zero. In the same way, if RPOP14 falls by 1 percent, total HCE decreases by 1.18 percent. The statistical significance of the result, however, disappears in the models for public and private HCE. Our estimates suggest that the growth in spending linked to birth and childhood illnesses dos not offset the decrease in numbers of the population aged 0 to 14. This finding might reflect the effect of an omitted variable, such as the proportion of population aged 65 and over, which is positively correlated with longevity at age 65 and negatively correlated with the proportion of population aged 0 to 14. Finally, the coefficient of the linear time trend is positive and significant at conventional levels for all three models. As a consequence of the fast growing cost of medical technology, these results suggest that total, public and private HCE grow at an average rate of 7.5, 5.2 and 10 percent respectively after the remaining factors are accounted for. However, this observed increase in HCE associated with possible deterministic trends in the data occurs at diminishing rates. The quadratic time trend is negative in all regressions and statistically significant in total and private HCE estimations.

2.6. Discussion and final consideration

Perhaps the most important measure of a country´s health service performance is the achievement of high life expectancy at birth and, at the same time, low infant mortality. Needless to say, Portuguese "health performance indicators" compare well with other OECD countries. Despite these indicators, Portugal, in line with other developed countries, faces serious challenges posed by new disease patterns, seriously compromising the financial ability of health services to deliver care in the near future. The problems of controlling costs and expanding access to high quality care is forcing health systems to search for alternative strategies for redistributing scarce limited resources at both the macro and the micro levels Aiming at achieving valued social objectives, governments are stepping in and altering the natural workings of the open market in order to achieve some desired goal. Either through the direct funding and ownership of the means of care delivery, or through the regulatory process, governments are interjecting their political goals and values into a sector where the market mechanism does a poor job in the allocation and employment of existing resources. No longer overseen by the self-adjusting or natural regulating laws of the open market, this type of intervention is a matter of public policy and, by extension, a political choice.

Sandwiched between contrasting theories of policy evaluation and program performance, defining success for government participation in health care has become a major permanent concern. If, on the one hand, Ahlbrandt (1973) and Baumol (1989) were of the opinion that public expenditure would increase when government controlled a greater share of spending, Himmelstein and Woolhandler (1986), on the other hand, counter proposed that greater government involvement in health care financing would reduce total health care costs and,

thus, spending. In line with both propositions, this study set out to use Portuguese health data to test the validity of both arguments. For this specific case the results fail to support Himmelstein´s and Woolhandler`s basic hypothesis that greater public involvement in health care financing results in lower levels of health care spending. In fact, the coefficient estimate on the government variable is positive, but not statistically different from zero. Despite its statistical insignificance, the result suggests that greater government participation in health care leads to growth in the levels of spending.

By having (some) net impact on the overall level of spending, government has shifted part of the decision-making process from the economic market to the political market   Although the sustainability of future health expenditure is difficult to predict and needs future statistical analysis, health care in Portugal is likely to remain in large part publicly funded in the foreseeable future. At the same time that financing pressures are going to force gradual changes in the way in which services are provided and paid for, legislatively mandated medical decisions are going to reign on every day medical acts like, for example, distributing health care regardless of age or lifestyle, the performance of certain medical procedures, or the choice of specific standards of care, Perhaps not surprising, and since future growth of health spending can only come from private funding, a switch to increased reliance on co-payments, a more widespread use of voluntary health insurance and social insurance, or a combination of all of the above, is likely to occur. Most importantly, future policy makers must reassess what can be included in "an adequate level of care" and who should make this determination—health care professionals, insurance companies, the public, or government officials.

Our results make clear, however, that cross-sector synergies work together to determine the amount of health care expenditure (HCE) and, hence, must be included in an analysis of policy options that could help in developing a rational, socially acceptable and evidence-informed process for arriving at sensible limits to health care spending. Without a doubt, there is strong evidence that income (personal or national) is positively associated with higher health care spending. Income elasticity corresponding to the estimated coefficient of lagged GDP provides evidence of total HCE being a luxury good, suggesting that as people (and the country) become wealthier, they are willing to consume more (and pay more) for a given improvement in health status. Higher income also increases the capacity of public and private players to supply more and better health care. If, for example, an increase in GDP leads to a more than proportionate increase in HCE, then it would be hard to support the argument that economic growth should be sought as a means for resisting further budgetary controls in the health sector, for confirmation of the "luxury good" hypothesis points directly to the core of the sustainability problem. However, this apparent relationship should not be taken lightly, since the estimated elasticity for the two sub-components of HCE is below unity. This suggests that public and private health care services are necessary goods and underscores the

importance of economic growth as a means of resisting further increases in health care spending.

But spending decisions concerning health are not solely affected by the share of public HCE and income level but also by other factors that must work together to determine the amount of health care spending. The variable describing longevity (LE65), for example, is negative in all regressions and statistically significant in one of them. The more plausible explanation for this finding is that as the senior population as a whole is living longer, but at the same time the onset of disability occurs later in life, the associated costs of dying may have been postponed. Hence, improvements in longevity may dampen rather than accelerate the growth in HCE. As a result, more long-term care resources will be required in the future, as people age.

Although the accuracy of these estimates is hard to evaluate, the case for resisting further expenditure growth rests in part on whether or not this ageing factor is behind the push for more spending. If, in fact, the growth in numbers of the elderly adds to the demand for medical care, setting limits to spending should be resisted—unless the reduction in both the quantity and quality of care can be offset by gains in efficiency in care provision. If, on the other hand, pressures to spend more on health care are largely accounted for by new (and generally more costly) ways of improving the quality and effectiveness of the care available, then a question must be asked concerning the rate of improvements that it is worthwhile financing.

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Appendix

FIGURE 1: HEALTH EXPENDITURE AND LIFE EXPECTANCY AT BIRTH

lnTHE — lnLEB

FIGURE 2: HEALTH EXPENDITURE AND GROSS DOMESTIC PRODUCT (GDP)

lnTHE — lnGDP

FIGURE 3: PUBLIC AND PRIVATE HEALTH EXPENDITURE

lnTPHE — lnTPrHE
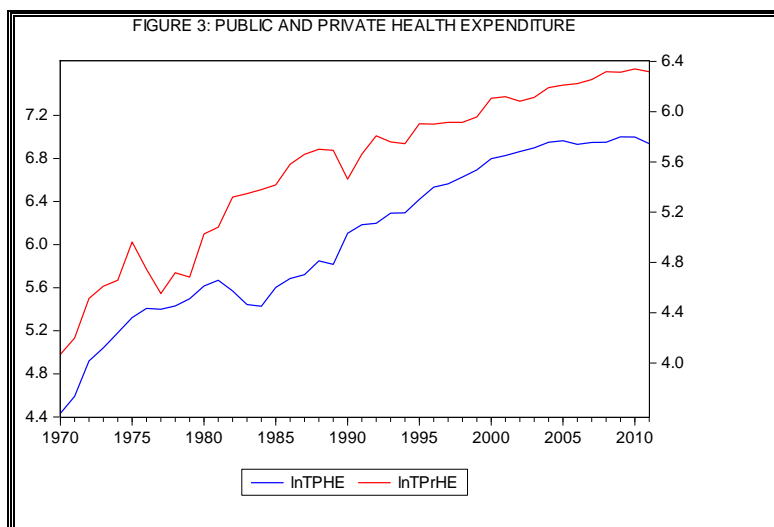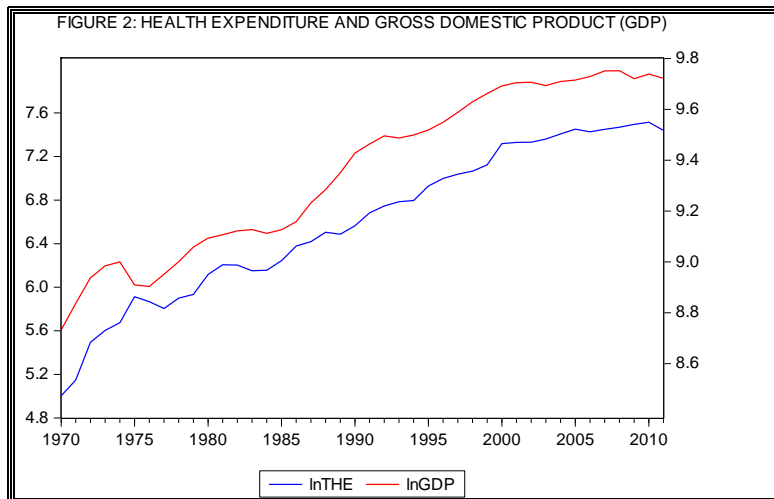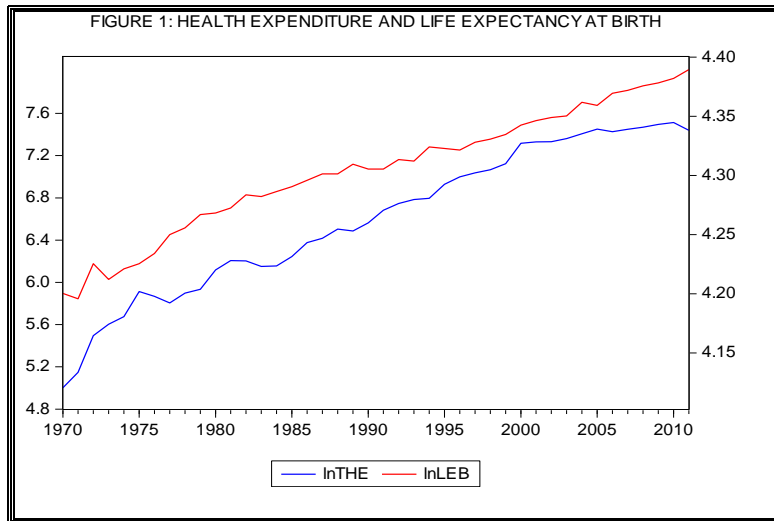
Chapter 3

3. Health expenditure and government Intervention in health: Evidence from OECD health data

3.1. Introduction

In 2015, the cost of medical care accounted for 9.0 percent of GDP across Organization for Economic Cooperation and Development (OECD) countries, and thus public policy for reducing the suffering and both the direct and indirect costs of ill health is a major and increasingly urgent public concern in most developed countries (OECD Health Statistics, 2016). The indirect costs resulting from ill health and premature deaths of members of our society exceed the direct costs of medical care, but it is the latter which are at the center of public attention, and society as a whole is assuming an increasing share of these costs. A number of factors are causing direct costs to grow. Along with income and the growth in numbers of the elderly, other important factors such as public expectations about the health-related quality of new medical technologies and, most importantly, the political importance that government´s attach to health are causing direct costs and—consequently—expenditures to grow (Bilgel and Tran, 2013; Lichtenberg, 2007; White, 2007; Di Matteo, 2004). How much is enough, however, is a question that can only be answered by developing a rational, acceptable, and evidence-informed approach for measuring the costs and consequences of additional spending and its impact on individuals, health care systems, and society.

With pressures to spend more likely to continue, this study uses OECD health data and standard analytical methods to further investigate the factors that are causing health costs and spending to grow. As in previous studies on the determinants of health care expenditure (hence HCE) that use the age structure of a country´s population, along with income and technological factors, we also put forth the hypothesis that government intervention in health affects the levels of health care spending (Getzen, 1992; Santerre et al., 1991; OECD, 1996; Gerdtham and Jōnsson (2000; Norton, 2000). Given that the share of publicly funded health care represent 72.9 percent of current expenditures on health in OECD countries, this rate of involvement in this sector reflects a political judgment about the kind and quality of medical services OECD populations should have (OECD Health Statistics, 2016). So as to better inform on this issue, this study extends the typical statistical model of the determinants of total HCE to account for the relationship between government involvement in health care and the levels of spending.

We find that the private out-of-pocket expenditure on health as a percentage of total health care expenditure (HCE), real per capita income, the numbers of the elderly as a percentage of total population, and new medical technologies are strong predictors of overall levels of health care spending. The coefficient estimates are statistically significant and their magnitudes are economically meaningful. However, some of the explanatory variables of interest which have been identified in the literature as important (e.g. the share of spending that is funded from public sources and life expectancy at birth) do not have a statistically discernible impact on total levels of spending. The broad conclusions from our study are threefold. First, in view of the fact that changes in demography are found to be largely responsible for the rapid expenditure growth in health care, increased spending at current rates should be continued—otherwise average standards of care would actually fall. Second, given that the share of spending that is funded from public (state) sources has decreased over the years, our findings highlight the rising importance of individual (and household) responsibility in providing for their own health care needs. Third, although higher income leads to higher expenditures on health care, the magnitude of the estimated elasticity poses no serious concern to the sustainability of current trends of health care consumption.

This study is organized as follows. The next section describes the variables that are included in the baseline specification. Country profiles, summary statistics, correlation matrices, diagnostic tests, and model specification are presented in Section 3.3. Section 3.4 presents empirical findings and discussion of estimation results and conclusions are drawn on Section 3.5.

3.2. Variables and discussion

Numerous studies, including Di Matteo (2005); Sen (2005); Gerdtham and Lothgran (2000); Barros (1998), have used income as a factor when examining health care expenditure (HCE) and most have documented a significant relation between rising income and rising health care spending. The extent of this relation determines whether health care behaves more like a "luxury" good (income elasticity greater than one) or as a necessity (income elasticity below one). Although most of the empirical work on this issue indicate that the income elasticity of demand for health care spending ranges from about 1.3 to 1.8, the accuracy of these estimates is hard to judge (Getzen, 2000; Schieber and Pouillier, 1992). Indeed, unlike some of these early studies at macro and national levels claiming income elasticities greater than unity (i.e., luxury good), characteristics of a normal good for health care have been proposed in the literature, including the relatively recent contributions of Hosoya (2014), Mosca (2007), and others. From the perspective of an economic evaluation, the search for a firm conclusion remains, as the answer has relevant policy implications for expenditure growth and public finances sustainability (see Hall and Jones, 2007).

Spending decisions concerning health are not solely affected by the income level (personal or national) but also by the age structure of a country´s population (White, 2007; White and Cutler, 2004; Seshamani and Gray, 2002). Longer life expectancies and declining fertility rates mean that the average age of the population across OECD countries will continue to rise. According to the OECD (2015), if the projected increase in numbers of the older population becomes a reality, the proportion of the population aged over 65 years in OECD countries is expected to nearly double in the next three and a half decades to reach 17 percent in 2050. By using economic theory and the results of previous empirical studies, it is expected that the inflationary effect of an increasing share of the older population on health spending is set to increase, as the population ages (Bilgel and Tran, 2013; Vogel, 2007). Strong arguments have been made, however, suggesting that existing empirical research considerably exaggerated the impact of demographic change on the health care costs of an ageing population. One line of research suggests, for example, that approaching death, rather than age, may be the main demographic driver of HCE (Seshamani and Gray, 2004; Stearns and Norton, 2004; Miller, 2001). Other research support the view that health care costs do not rise with increasing age, and may in fact be lower the older people are when they die (although more long-term care resources will be needed, as people age) (Dixon et al, 2004; Canadian Health Services Research Foundation, 2003). Other influences, such as the extension in the number of years of healthy life, may actually dampen rather than accelerate the growth of health care spending (Payne, 2009; Miller, 2001).

Interwoven with income, demography and institutions, technology has also been identified as a determining factor of rising health care costs and thus its effect cannot be clearly predicted by standard economic theory. Although there is some measure of dispersion between care categories, technological progress—new surgical techniques, new pharmaceuticals, and so on—can reduce the price of individual treatments, improve cost effectiveness and, most importantly, contribute to the important progress being made in the health status of individuals and populations (Schnittker and Karandinos, 2010; Ford et al., 2007; Lichtenberg, 2007). For example, according to Lichtenberg (2001), effective drug therapy helps to partially explain why the mean length of in-patient hospital stays has decreased over the years. However, as a result of increases in utilization rather than price, medical innovations— advances in science that bring to market new products, changes in treatment protocols and clinical practice standards—which are cost reducing at the micro level can ultimately lead to increases in overall aggregate expenditures)Pammolli et al., 2005; Berndt, 2001).

Over the years, a number of quantitative studies have examined the actual behavior of key actors in health care systems and how these tend to add to the pressures to increase spending (Pritchard, 2004; Pauly, 2003; Freemantle and Hill, 2002; Moynihan et al., 2002). With OECD governments controlling nearly 73 percent of current expenditures on health, decisions on setting a limit or threshold for funding for the provision of health care is ultimately a political

matter (OECD Health Statistics, 2016). In this setting, many argue that more government involvement is very likely to have an adverse, rather than a beneficial, impact on the performance of the health care sector. On the one hand—as a result of limitations in affordability or the pitfalls and challenges associated with converting all of the benefits to monetary terms—greater government involvement or financing of health care may provide poorer households and individuals who are unable to pay greater access to health care (Bunker, 2001; Buck et al., 1999; Santerre et al., 1991). On the other hand—as a result of excessive intervention and regulation—greater government involvement in health care may adversely affect the total output (quantity and quality) of health care providers (Harrison and Appleby, 2005; Appleby and Devlin, 2004; Santerre et al., 1991). For example—although controversy swirls around pricing of some pharmaceuticals that have emerged from R&D efforts—price controls and other forms of regulation may also lead to the introduction of fewer new, and potentially life-saving, medicines (Golec and Vernon, 2006; Giaccotto et al., 2005; DiMasi, Hansen and Grabowski, 2003). Indeed, since the early works on the theory of economic regulation (Stigler, 1971), the theory of government enterprise (Ahlbrandt, 1973), and the theory of public choice (Brennan and Buchanan, 1980), most of the empirical analysis that were subsequently undertaken suggest that more government involvement is very likely to have an adverse, rather than a beneficial, impact on the performance of the health care sector.

3.3. Modeling OECD health expenditure data

Although specifications of health care expenditures (HCE) are mostly ad hoc (Roberts, 1999), most of the standard analysis have largely been carried out along the lines of a demand side framework. Thus, personal (or national) income, the age structure of a country´s population and relative prices of health care are generally the driving force. Assuming that health care is not a Giffen good, the higher health prices experienced in most OECD countries should come at the cost of a decreasing demand for health care. However, if stationarity of these prices is assumed, the rising shares of expenditures in national incomes are quite difficult to explain in these models. To further improve the HCE estimation process, supply side variables should be considered as well. For example, advances in knowledge and technology may actually be behind rising health care costs and, thus, the increase in health care spending. However, assessing the impact of advances in medical technology is difficult, as data are often incomplete. On this account, numerous studies have included health status in their analysis as a proxy for new pharmaceuticals, new surgical techniques and so on (see, among others, Lchtenberg, 2004; Starfield and Shi, 2002; Filmer and Pritchett, 1999). For example, life expectancy (LE) and infant mortality (IM) are supposed to be affected by medical progress, among other factors, and thus, theoretically, advances in medical knowledge and technology should lead to increases in the former and decreases in the latter. In addition, it is expected that the extent to which HCE is financed by the government has a relationship with levels of

total health spending (Hitiris and Posnett, 1992). Nonetheless, missing data on government taxing and spending across OECD countries prevent us to include public budget variables in the analysis. For these reasons, in the analysis that follows, real per capita total health care expenditures (THE) are modeled conditioned on the share of public and out-of-pocket health expenditure to the total health care expenditure (PHE and OOP), the real per capita income (GDP), the share of the population aged 65 and over to the total population (POP65), and the average length of life for an infant born today, given current death rates (LEB). Thus, we propose to analyze this relationship using a standard panel regression approach, which is a familiar one in the modeling of HCE (Hosoya, 2014). Our baseline, most parsimonious model takes the following form:

$$lnTHE_{it} = \beta_i + \beta_1 lnPHE_{it-1} + \beta_2 lnOOP_{it-1} + \beta_3 lnGDP_{it-1} + \beta_4 lnLEB_{it-1} + \beta_5 lnPOP65_{it-1} + \varepsilon_{it} \quad (1)$$

where the subscripts i = 1...,18 and t = 1995,....,2013 denotes countries and time periods, respectively, ßi are the country-specific unobserved heterogeneity effects, and εit is the observation-specific error term and is expected to be serially correlated within and between panels. In the same way, the subscript t-1 denotes that one-period lagged explanatory variables have been included explicitly in the model specification. This form of lag structure is appropriate in our case for the following reasons: (i) it allows for the time that usually lapses between the movement of the lagged independent variables and the response of the dependent (THE) term, and (ii) ensures that causality between these regressors and the controlled variable does not run in both directions (Litchenberg, 2004). Hence our baseline model specification is based on a time-series of 18 observations, rather than 19, as the year 1995 is dropped for lagging. Finally, because all variables in Equation 1 are expressed as natural logarithms, all coefficients in the model can be interpreted as elasticities.

With regard to the choice of econometric technique, it should be noted that in the econometric literature we can find different methods of estimation focusing on cross-sectional variations over time (Gujarati and Porter, 2008). The most widely used approaches are the Fixed-Effects (FE) model and Random-Effects (RE) model. However, given the (long) panel structure of our data, a natural econometric technique for handling Equation 1 requires a Fixed-Effects (or within) transformation of the data to control for time-invariant country characteristics which are not (or cannot) be observed (Asteriou and Hall, 2007). This choice of econometric technique is further reinforced by the Hausman test, which gives the results shown in Table 3.4.

For the purpose of this study, for the period 1995-2013, data was collected and integrated from the Organization for Economic Cooperation and Development (OECD) and The World Bank (WB) for the 18 OECD countries for which comparative data are available (Austria, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Korea, Netherlands, Norway, Poland, Portugal, Spain, United Kingdom, United States). Thus, we

retain in our dataset only the observational units for which we have full data on all variables of interest—although HCE data for Ireland were available up to 2012. This data selection process resulted in a sample of 288 observations. Whilst data on the ratio of the population aged 65 and over to the total population (POP65), and life expectancy at birth (LEB) were extracted from the World Bank (2015) World Development Indicators Database, data on current expenditure on health, as a percentage of GDP (HE), public expenditure on health, as a percentage of total expenditure on health (PHE), and out-of-pocket expenditure on health, as a percentage of total expenditure on health (OOP) were taken from the OECD Health Statistics (2016). Data on real per capita income (GDP) were extracted from the OECD GDP Statistics (2015). Bearing in mind that the available OECD Health Statistics data only considers current expenditures, real per capita total health expenditure (THE) was obtained by multiplying its respective share of GDP by the real per capital income (GDP).

Table 3.1. Public and Current Expenditure on Health, and Life Expectancy at Birth, 2015

Country	Public Expenditure on Health as Percentage of Total Health Expenditure	Current Expenditure on Health as Percentage of Gross Domestic Product	Life Expectancy at Birth, Total Population
Austria	76.2	10.3	81.6
Canada	70.8	10.2	81.5
Denmark	84.2	10.6	80.8
Finland	75.5	9.6	81.3
France	78.6	11.0	82.8
Germany	85.0	11.1	81.2
Greece	60.6	8.2	81.5
Ireland	69.5	9.4	81.4
Israel	62.5	7.4	82.2
Italy	75.5	9.1	83.2
Korea	55.6	7.2	82.2
Netherlands	80.7	10.8	81.8
Norway	85.2	9.9	82.2
Portugal	66.0	8.9	81.2
Spain	69.6	9.0	83.3
United kingdom	79.0	9.8	81.4
United States	49.4	16.9	78.8
OECD Average	**72.9**	**9.0**	**80.6**

Source: OECD Health Statistics, 2016

In Table 3.1, we have listed the share of total health care expenditure that is publicly funded, current expenditure on health as a percentage of GDP, and life expectancy at birth for each OECD country in our sample in 2015. OECD averages for those variables are shown at the bottom of the table. Although the United States has one of the lowest life expectancies among OECD countries, according to OECD Health Statistics (2016) and the indicators shown in Table 3.1, it has by far the most expensive health care system in OECD countries, based on health expenditure per capita, and on total expenditure as a percentage of GDP. Based on this information, the Unites States spent 9 451 USD per capita on health care in 2015, more than twice the OECD average, and far more than its closest competitor, Switzerland (6 935

USD). The United States health spending as a percentage of GDP, 16.9 percent in 2015, also outdistanced the next most expensive health systems, Switzerland (11.5 percent) and Japan (11.2 percent). That is despite the fact that its government is responsible for the lowest expenditure share of all OECD countries. Tables 3.2 and 3.3 summarize the main descriptive statistics and the raw correlations between the variables used in the analysis. Except for the sign of the coefficient of the share of public health care expenditure to total HCE, positive correlations are observed between the dependent variable and lagged income, the age structure of a country´s population, and life expectancy, and negative correlations are observed between the dependent variable and the share of out-of-pocket health expenditure to the total HCE. These results could have been inferred from economic theory and the results of previous empirical studies and are suggestive of the substantive correlations which were subsequently endorsed by our regression analysis.

Table 3.2. Variables, notation (and their sources) and descriptive statistics

Variables	Mean	Median	Max.	Min.	S. E.
Dependent variable:					
- THE (log of real total health care expenditure)[2]	7.985064	8.010393	9.007575	6.334522	0.435018
Independent variables					
- PHE (log of the ratio of public health expenditure to the total health expenditure – lagged)	4.254730	4.297965	4.472781	3.668677	0.165092
- OPHE (log of the ratio of out-of-pocket health expenditure to the total health expenditure – lagged)	2.815781	2.774984	3.972730	1.653801	0.477189
- GDP (log of real per capita GDP – lagged)[1]	10.46816	10.48856	11.02620	9.715948	0.248622
- POP65 (log of the ratio of the population aged 65 and over to the total population)[3]	2.683829	2.743493	3.072138	1.776724	0.229205
- LEB (log of life expectancy at birth)[2]	4.368954	4.368938	4.419781	4.295848	0.022639

Data sources: 1. World Health Organization (2014), "Health for All Database"; 2. OECD (2014); The World Bank, World Development Indicators, 2014.

Table 3.3: Correlation matrix of dependent and independent variables

	lnTHE	lnPHE	lnOPHE	lnGDP	lnPOP65	lnLEB
lnTHE	1.000000					
lnPHE	0.216807	1.000000				
lnOPHE	-0.614509	-0.483869	1.000000			
lnGDP	0.887425	0.352185	-0.584337	1.000000		
lnPOP65	0.441567	0.527297	-0.261523	0.268871	1.000000	
lnLEB	0.349830	0.312347	-0.130106	0.309719	0.40018	1.000000

Finally, we test whether the underlying stochastic process that generated the series can be assumed to be invariant with respect to time. Although a wide variety of procedures have been developed with an emphasis on the attempt to combine information from the time-series dimension with that obtained from the cross-sectional dimension, the widely-used Hadri (2000) test tends to over-reject the null hypothesis of no unit root in any of the series in the panel and yield results that directly contradict those obtained using alternative test

statistics For these reasons we have also considered the Levin, Lin and Chu (2002) test to test whether the series are non-stationary against the alternative that they are stationary. The results are reported in Table 3.4. Given the contradictory results of both test regarding the unit root problem, it is argued that pushes for more health care spending can be best characterized as temporary rather than permanent.

Table 3.4. Levin, Lin, and Chu (LLC) and Hadri Stationarity Tests

	LLC (Levels) test statistic *p-value*		LLC (First Diff.) test statistic *p- value*		Hadri (Levels) test statistic *p-value*		Hadry (First Diff.) test statistic *p-value*	
lnTHE	-6.71699	0.0000	-4.45631	0 .0000	10.7331	0.0000	5.61320	0.0000
lnPHE	-2.82302	0.0024	-8.81234	0.0000	7.90933	0.0000	5.01062	0.0000
lnOPHE	-1.80259	0.0357	-10.5207	0.0000	9.44959	0.0000	2.50391	0.0061
lnGDP	-8.55591	0.0000	-6.07855	0.0000	9.44095	0.0000	8.32327	0.0000
lnPOP65	-1.85112	0.0321	-1.16953	0.0000	11.2815	0.0000	7.21999	0.0000
lnLEB	-1.56656	0.0586	-5.33256	0.0000	11.6051	0.0000	0.70991	0.2389

3.4. Empirical findings and discussion

Estimation results from variations of Equation 1 are presented in Table 3.5. Models (1)-(3) report three different methods for estimating standard linear panel estimations: with a common constant (pooled OLS), allowing for fixed effects (FE), and allowing for random effects (RE). From these results (Models 1-3), we notice that the value of the slope coefficients are different and that all the different intercept coefficients are individually highly statistically significant, suggesting that perhaps the 18 cross-sectional units are heterogeneous and, therefore, the pooled regression results presented in Table 5 may be suspect. In addition, if we compare the results of the FE and RE regressions, we note that there are substantial differences between the two. To assist in making a choice between the FE and RE approaches, we use the Hausman test, which gives the results shown at the bottom of Table 3.5. Since the estimated chi-square value (24.76) is highly statistically significant, we can reject the RE model in favor of the FE model, so we start with a detailed exploration of the results in Model 2 (Table 3.5).

Assuming all the assumptions of the classical linear regression model hold true, the results are generally good (an R2 of .988, a standard error of the regression that is .6 percent of the dependent variable mean, and five variables that are individually, as well as collectively, statistically significant and economically meaningful). In addition, based on the Bartlett, Levene, and Brown-Forsythe tests for equality of variances of residuals, the null hypothesis of homoscedasticity cannot be rejected at the 5 percent level of significance (Judge, et al., 1985; Brown and Forsythe, 1974; and Levene, 1960). Still, we must note that these tests are not statistically powerful, in the sense that one may often fail to reject the null hypothesis of normality even when the error distribution is non-normal (Pindyck and Rubinfeld, 1998). In

the same way, when we consider a test of the null hypothesis that no linear relationship exists between two or more of the independent variables, the low Durbin-Watson (DW) statistic of .655 strongly suggests the presence of positive first order serial correlation, and thus the usual OLS estimators are no longer efficient relative to other linear and unbiased estimators. Under these conditions, the t, F and Chi-square distributions may not be valid.

Table 3.5. Regression Results, 1995– 2013
Dependent Variables: Total Health Expenditure (THE)

Dep. Variable Methods:	Model 1 lnTHE Pooled OLS Panel LS	Model 2 lnTHE Fixed-Effects Panel LS	Model 3 lnTSM Random-Effects Panel EGLS	Model 4 lnTHE Fixed-Effects Panel LS
Indep. Variables				
C	-5.808287*	-13.71883*	-12.63035*	1.759153
lnPHE(-1)	-0.954553*	-0.029812	-0.145501***	-0.118036
lnOPHE(-1)	-0.225597*	-0.268630*	-0.283975*	-0.099376***
lnGDP(-1)	1.344453*	1.125987*	1.141668*	0.527662*
lnLEB(-1)	0.644513*	2.329175*	2.131689*	-0.356010
lnPOP65	0.604011*	0.242084*	0.295994*	0.815807**
TREND				0.112601*
$TREND^2$				-0.003563*
AR(1)				0.845474*
R^2	0.927956	0.988052	0.934885	0.994885
Adjusted R^2	0.926751	0.987165	0.933796	0.994418
S.E. of regression	0.115367	0.048292	0.049859	0.031256
DW Statistic	0.137320	0.655244	0.574860	1.926071
F statatistic	770.2494*	1114.430*	858.5691*	2131.409*
Type of Panel	Unbalanced	Unbalanced	Unbalanced	Unbalanced
N. of observations	305	305	305	288
N. of cross-sections	17	17	17	17
Period	1995-2013	1995-2013	1995-2013	1995-2013
Specification Tests				
F Test Fixed-Effects Hausman test		88.964593* 24.760730 *		

*, **, *** - significant at 1%, 5%, 10%, respectively.

With the above analysis in mind, we next re-assess the sensitivity of the coefficient magnitudes and statistical significance for the economic and demographic control variables to alternative specifications (involving other control variables and the necessary adjustments which must be made to OLS to guarantee unbiased, consistent, and efficient estimators). In particular, we wish to further address the effect of technological advances on HCE. Indeed,

as described by Pammolli et al. (2005), available empirical evidence consistently shows that new medical technologies are major determinants of the significant increases in HCE, and this effect may not be fully captured by the estimated coefficient for the LEB term (Model 2, Table 3.5). Therefore, linear and second order polynomial functions of time are specified in order to capture possible deterministic trends in the data. For instance, the share of public and out-of-pocket HCE in total HCE may increase over time with advances in knowledge and technology, with some curvature for the latter periods. This has the added advantage of reducing the risk of omitted variables bias as many of the variables other than PHE, OOP, GDP, POP65, and LEB that might be proposed as influences on health care spending growth are trended. Turning to the adjustments that must be made to OLS to guarantee that no linear relationship exists between two or more of the independent variables and that the errors are independently distributed from a normal population with 0 expected value and constant variance, we re-estimate Model 2 (Table 3.5) using an iterative procedure for correcting for serial correlation, and the White´s (1980) method for obtaining heteroscedasticity-corrected regression results. In this way, the coefficient estimates of Models 4 (Tables 3.5) can now be interpreted to be efficient and robustly statistically significant.

Compared with the results shown in Model 2 (Table 3.5), the results reported in Model 4 are considerable different. Although we find that this richer model appears to provide a superior fit of the data, the standard errors have changed. As a result, a number of variables that have thus far been significant, are now un-correlated with THE. For example, in Model 2, the estimated coefficients for the intercept and the life expectancy at birth (LEB) terms are negative/positive and highly statistically significant, whereas the transformed equation (Model 4), suggest that these coefficients are positive/negative and statistically insignificant even at the 10 percent level.

However, the estimated coefficients for fundamental variables such as PHE, OOP, GDP, and POP65 remain much the same way as before. As reported in Models 2 and 4 (Table 3.5), their coefficient estimates are similar in magnitude but are (often) slightly lower in terms of statistical significance. In the original and transformed specifications, the estimated coefficient on the PHE term fail to support the hypothesis that health expenditure will be higher when government controls a greater share of health care spending. In fact, the coefficient estimate on the government term is negative, rather than positive, although not statistically different from zero. Apparently, the need to curb expenditures, in order to pursue long-term sustainability of public finances, more than offsets the ever-increasing pressure for higher public spending on health care. The empirical findings also imply that recent past (last year´s) out-of-pocket health care expenditures (OOP) are expected to negatively affect current total HCE. The one-period lagged OOP term is statistically significant (at the 10 percent level) and inversely related to THE. Specifically, a 1 percent

increase in OOP in the present time causes THE to decline by .09 percent in the following year, all other things being constant. The more plausible explanation for this finding is that a shift in financial responsibility from a third-party payer (i.e., a public or private payer) to the patient tends to heighten the awareness of health care costs and, consequently, affect future care consumption (Kolassa, 2009).

However, other factors do significantly influence total HCE. In particular, a 1 percent increase in lagged real per capita GDP leads to a .53 percent increase in one-period ahead real per capita total HCE. This result for the statistically significant (at the 1 percent level) GDP term provides empirical support to the necessary good hypothesis, and suggests that need (an epidemiological concept), rather than demand (an economic concept), determines the use and allocation of health care resources—a finding which is consistent to that of Hosoya (2014), Mosca (2007), Gerdtham et al. (1998), and a number of other studies that have analyzed the income elasticity characteristics for health care goods and services. However, because of non-optimal consumption of medical care that results from co-pay sensitivity, rather than price-sensitivity, it is difficult to come to a firm conclusion whether health care exhibits an elasticity that is below, equal to, or higher than one. For example, from some early studies at the macro and national levels, we do know that the income elasticity of demand for health care has been determined to be somewhere in the range of 1.3 to 1.5 (Feldstein, 2005). This is suggestive that, as people (and nations) become richer, they are willing to spend an increasing share of their newly acquired income for a given improvement in health. The question of which of these interpretations can best describe the true response of quantity purchased of medical care to changes in income may in part be explained by the empirical evidence and trends in health care consumption and income growth in the last decade(s). Presumably, at some point in time, the income elasticity of demand for health care spending in OECD countries has dropped below 1.0, for the known reasons. Thus, given the possibility that spending on these will not increase as fast as the growth in national incomes, this result points to the opportunities for expanding spending on health care—even as a share of GDP—without the need for sacrificing other forms of public and private spending as long as economies grow in real terms.

A country´s age structure also significantly accounts for the growth in OECD health spending, as expected. Specifically, if the share of the senior population (POP65) rises by 1 percent, total health care spending increases by .82 percent. The positive relation between these two variables confirms that as the average age of the population in most countries has been rising, health spending rises with age. This result—if confirmed by other studies—has important policy implications for total HCE growth and public finances sustainability. For, given current policy initiatives to align (public) health spending growth to general, long-term growth in the economy, average standards of care may actually have to fall unless offsetting gains in efficiency are to be achieved. In the meantime, depending in part on how

governments formulate appropriate actions and policies for reducing the scale of health care needs, determines how these two factors balance out.

From Model 4 (Table 3.5), it may actually be technological change—new medicines, new surgical techniques, new treatment protocols and so on—that is responsible for the considerable growth in health spending. The results suggest that when time or the technological change is captured by a linear time trend, 11 percent of the increase in real per capita health expenditure in OECD countries is attributable to technological innovation or time and the estimated coefficient is statistically significant at the 1 percent level. However, this level of importance attached to new medical technology is significantly lower than its estimated contribution from some earlier studies (Newhouse, 1992; Cutler, 1995). Although the accuracy of these estimates are hard to judge, it is possible that as a result of technological change in the medical care and pharmaceutical sectors, OECD health care systems have begun to transform gradually from high-cost to moderate-cost structures. Indeed, when we allow for possible non-linearity between both variables, the observed increase in real per capita total HCE associated with technological change occurs at diminishing rates. The estimated coefficient on the quadratic trend variable is negative and highly significant (at the 1 percent level). If this is correct, and an account is made of the medical benefits associated with medical technology improvements. then the (not so) recent increases in health care spending that resulted from the net impact of technological development on the cost of health care might be regarded as a temporary phenomenon, as these technologies may have already begun to reduce costs. As a result, it may increasingly be hard to argue that growth in spending must be resisted, as more net benefits are likely to be produced at every level of spending.

3.5. Implications and conclusion

In 2000, the OECD countries spent 7.2 percent of their national incomes on health care. By 2005, health spending had increased to 8.05 percent of GDP, and by 2015, it had increased to 9.0 percent (OECD Health Statistics, 2016). Will health spending consume 20.0 percent of national incomes, or more, in the year 2050? The answer to this question is difficult to predict. We do know, however, from cross-country studies that as people (and nations) become richer, they are willing to spend more for a given improvement in health, at least historically (Hartwig, 2008; Hall and Jones, 2004; Smith et al., 2000). And yet, as Vogel (2007) notes, unless nations are prepared to risk reaching the point where their entire incomes are consumed by health care spending, there has to be some upper limit on this per capita spending as a percentage of GDP. It is not surprising, therefore, that at some point in time the income elasticity of demand for health care may have dropped below 1.0. In our study, the results suggest that, while still positive, the contribution of the growth in income to increases in health care spending is diminishing. Income elasticity corresponding to the

estimated coefficient of GDP is smaller than unity, suggesting that for this particular sample of OECD countries the delivery of health care is dominated by the needs rather than the ability to pay. This finding provides further support to the claims for more economic growth as means to smooth or reduce present and future budgetary controls in the health sector. We warn, however, that care has to be exercised in interpreting these results, as choices on health care consumption are strongly affected by the universality of access and the limits that are imposed by all health care funders through the setting of budgets or maximum spending limits.

Besides GDP, the results show an inverse but statistically significant relationship between the portion of the OECD health system financed through out-of-pocket spending (OOP) and total health care expenditure (THE). Thus, this disproportionate reliance on private sources in financing the recent increases in total HCE may place an additional burden on disadvantaged households and potentially limit future access to care. The results indicate, however, that the share of publicly funded (PHE) health care expenditure has no net impact on overall health care spending—although a case can still be made for other forms of government involvement in the health care sector. For example—without abandoning the core equity values that embrace modern national health systems—governments can still indirectly improve the performance of the health care sector by creating an environment which, from the point of view of health care spending, tends to subtract to the pressures to increase spending. Given the limited resources available for improving health system´s performance, this may involve the reallocation of existing resources in order to achieve health gains for the population as a whole and for subgroups.

As shown in Model 4 (Table 3.5), total HCE is also found to be positively related to the share of senior population. In line with conventional wisdom and most of the empirical work on the economics of health care spending, our findings support the view that growth in numbers of the elderly adds to the demand for medical care. If this is correct, and society is not (yet) prepared to put up with a significant degree of inequality in access to health care (and health), then OECD health systems (and their key stakeholders) must carry on increased spending at current rates while improving efficiency and productivity in the health care sector. This measure is likely to be viable only for the most immediate planning periods, but it will buy some extra time before new pressures for more spending force governments to confront the inevitable decision to contain costs.

The findings also imply that the inclusion of linear and quadratic time trends for statistical reasons and capture possible changes in medical technology are of importance since the results provide evidence that new technology has been the main driver for more spending. Fortunately, its impact appears to be declining, at least for this sample of countries and over the period 1995-2013. For example, the substitution of pharmaceutical based therapy for other forms of therapy (particularly some forms of hospital treatment) is cost reducing and

increases the social benefits of medications. Thus, not only new medical advances show great promise with respect to the improvement in health status and well-being of individuals and populations, these may also help to reduce costs and improve future health system sustainability.

In the end, with OECD economic growth prospects still uncertain and a significant fraction of its health care being tax funded, governments may ultimately be forced to reduce cost by, for example, setting budgets or spending limits, and/or imposing restrictions as to how those funds can be spent. However, before these policy initiatives are effectively trialed, governments must design and promote fiscally sustainable pluralistic systems of health care delivery and financing, without abandoning the core equity values of modern-day health care systems. Ultimately, governments may be forced to put the health care budget to the vote and ask tax payers to decide on what rate of health improvements is it worthwhile financing.

All in all, this study is preliminary in nature and the analysis here presented contributes to our understanding of the key driving forces of health care spending in OECD countries over the period 1995-2013. Using a standard panel data approach, we take into account the following (aggregate) economic, institutional, and socio-demographic determinants of health spending: real per capita GDP, public and private out-of-pocket health spending, the share of senior population, life expectancy at birth, and new technologies. However, limitations on data availability and concerns over the statistical limitations in the application of a standard panel data technique to the type of data under considerations warns that care has to be exercised in interpreting these results. Nevertheless, the analysis presented here has a number of implications for what should be done to help define the point where a limit to spending can be set.

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Chapter 4

4. Living Longer: An Assessment of Euro-Zone Life Expectancy Trends Using a Panel-Data Approach

4.1. Introduction

During the second half of the 20th century life expectancy at birth for a representative world citizen increased by approximately 21.1 years. According to the United Nations, this quantity of life indicator increased from 46.5 years in 1950-1955 to 67.6 years in 2005-2010. By reducing the probability of dying, life expectancy at birth moved upward 7.8 years from 1975-1980 to 2005-2010, with further expected increases up to 76 years in 2045-2050. In addition, the gap between the more and the less developed regions of the world is expected to narrow between 2005 and 2050 (82.8 years versus 74.3) (UN World Population Prospects 2010).

Among developed regions, life expectancy is generally higher than in most other areas of the world. According to Bongaarts and Feeney (2002), life expectancy has increased in developed countries from 45.7 years in 1850 to 80.7 years in 2000. Their research supports the view that nearly half of these gains are attributed to the substantial reductions in infant and child mortality. This phenomenon is also documented in observations for the 27 member countries of the European Union (EU-27). Based on these observations, a new born in 2008 is expected to live, on average, to 79.4 years of age—an increase of approximately 1.7 years over the last six years for which data at an aggregate level are available. Life expectancy for the EU-27 stands at 76.07 years for men and 82.21 years for women, ranging from 80 years in Iceland and Lichtenstein to 66.3 years in Lithuania (a gap of 13.7 years) (Eurostat 2011).

Considering the unprecedented political, economic and social changes that took place within Europe over the past 30 years, this study seeks to provide an analysis of a broad range of health and social issues that affect human life expectancy at birth (LEB) across European countries. A special emphasis is placed on the relationship between LEB and the factors that are usually taken to be the determinants of its long-term trajectory--namely, gross domestic product (GDP), public and private health expenditures (PHE and PRHE), government social transfers (GST), and a proxy for technological progress (t). Although health expectancies were developed more than 30 years ago, unanswered questions remain regarding the (positive) association between these factors and longevity. Does our analysis confirm this association, or the importance of these variables to the euro zone countries? If so, what is the impact of each one of these factors on LEB? More importantly, is this relationship truly causal? If so, can life expectancy be further extended by more generous social policies? To try answering these

questions, this study explores available data on income and health expenditures to explain life expectancy in euro zone countries for the period 1980 to 2009. In the absence of consistent observations, and particularly of chronological series on government social transfers (GST), an unbalanced panel of twelve European Union (EU) countries was selected—namely, Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.

4.2. Determinants of life expectancy – a brief literature review

Many of the important questions related to health either focus on the individual-level socio-economic factors that contribute to increase longevity, or the institutional arrangements that govern its financing. In thinking about these questions, the underlying issue has always been the fact that increases in longevity are as important to social welfare as increases in non-health consumption (Nordhaus, 2003; Becker, Philipson, and Soares, 2005, Murphy and Topel, 2006). This puts health at par with other superior good (Hall and Jones, 2007). In this context, it is expected that as people grow wealthier they will spend more on health care (Jewel et al., 2003; Baltagi and Moscone, 2010). This apparent bond between health and wealth has been consistently documented by major studies that point to a clear link between socio-economic background and health (Marmot, et al., 1984; Townsend, et al., 1986; Acheson, 1998). Wilkinson and Pickett (2009) show conclusive evidence pointing out that people experiencing greater levels of income inequality fared worse on a range of social indicators. Marmot (2010) puts the more financially disadvantaged English urban dwellers experiencing more ill health and living seven years less than their most affluent counterparts. In another tone, Marmot and Shipley (1996) describe health inequality as not being an issue just of poverty, but a phenomenon that is related to overall economic inequality, and Lynch et al. (2004) conclude that socioeconomic disadvantage generally precedes ill health. In sum, most of the recent research has been supportive of the hypothesis that population health and mortality are substantially influenced by income distribution (De Vogli et al., 2005; Dorling et al., 2007; Babones, 2008; Karlsson et al., 2009; Biggs et al., 2010; Idrovo et al., 2010; Pritchett and Viarengo, 2010).

Aside from the avoidable health inequalities that stem from the unequal distribution of the social determinants of health, technological progress (on the form of new medical drugs, medical devices, and surgical and diagnostic procedures) has changed inequality in both consumption and health itself. Not only it reduced the costs of some treatments, but it also allowed for new cures to take place (see, for example, Cutler and Huckman, 2002). Santerre (2011) puts the U.S. short-run savings from new medical drug use at 0.06% of overall medical care spending. According to Cutler (2004), and for cardiovascular disease alone, improved medical knowledge contributed to approximately two-thirds of the reduction in disease-related mortality, with declines well over 50% since 1960. A number of other important

studies have provided convincing evidence pointing in the direction of specific medical innovations used in treating heart conditions, namely beta-blockers, as a key factor in promoting recent declines in cardiovascular disease mortality (Conrad, 2007; Ford et al., 2007, Kunitz, 2007). Lichtenberg (2010) attributes to the combined effects of cancer imaging and cancer drug innovation the three month increase in United States life expectancy at birth that took place between 1996 and 2006 - a $500 billion value on each percentage reduction in cancer mortality (Murphy and Topel, 2006). Further theoretical and empirical cases regarding this dependency are also provided by Potts and Schwartz (2004) and Akkoyunlu, et al. (2009). Yet, when measured in terms of life expectancy, the benefits of medical technology cannot be overstated. New evidence shows that this relationship has declined overtime and suggests the presence of diminishing marginal returns on the innovation now entering the market (Schoder and Zweifel, 2009). It is important to note, however, that the diffusion and local adoption of medical technology makes possible for increasing improvements in long-run average life expectancy in "non-frontier" countries (Deaton, 2004; Papageorgiou et al., 2007).

The share of GDP devoted to health care has risen in virtually every country, despite wide variations in systems for allocating health care (Jones, 2002). A possible explanation for such an impressive effort is that increasingly people tend to value life and demand higher quality of health care (Costa and Kahn, 2004; Skinner et al., 2005). According to Hammitt, Liu and Liu (2000), this value is growing twice as fast as income. Does higher health spending correspond to improved health outcomes? Although the evidence is inconclusive, most of the empirical studies point to the high levels and growth rates of health spending as being economically justified by the incremental health care benefits that patients receive (Cutler and McClellan, 2001; Cutler et al., 2004; Shaw et al., 2005; Baltagi et al., 2011). Crémieux et al., (2005), in their study of the relationship between health expenditure and health outcomes in Canadian provinces, point to lower spending as being statistically associated with increases in infant mortality and a decrease in life expectancy. Since three quarters of that spending are publicly financed, a number of studies emphasize the positive role of public health services on life expectancy levels (Lichtenberg, 2004; Akkoyunlu et al., 2009); Schnittker and karandinos, 2010).

4.3. Data and empirical specification

Our study specifies and estimates a multivariate regression that explains country level health outcomes with socioeconomic characteristics and public and private expenditures on health. From an aggregate "health production function", we adopt the following empirical specification:

$$lnLEB_{it} = \alpha_i + \beta_{2i}lnGDP_{it} + \beta_{3i}lnPHE_{it} + \beta_{3i}lnPRHE_{it} + \beta_{4i}lnGST_{it} + \beta_{5i}t_{it} + u_{it}$$

This equation relates the (natural) log of life expectancy at birth LEB, to the log of per capita income (GDP), the log of per capita public health expenditures (PHE), the log of per capita private health expenditures (PRHE), the log of per capita government social transfers (GST), and a time trend t which stands as a proxy for technical progress. As a matter of convention, the subscript i stands for countries (i = Austria, . . . , Spain) and t for years (t = 1980, . . . , 2009). For many countries, however, data on the key variables of interest are either not available or available for a very short time period. This limits the scope of our study to 12 of the 17 euro zone countries. In addition, as we can observe from the number of observations on Table 4.1, our data set is highly unbalanced; in particular the sample size drops considerably when government social transfers (GST) are added to the regression. When available, data was collected by country for the period 1980 to 2009 from the Organization for Economic Cooperation and Development (OECD) National Accounts and the World Health Organization (WHO) Health for All databases. Both income and expenditures have been adjusted for inflation (i.e., all monetary variables are expressed in constant 2006 Euros). In this manner, real per capita private health expenditure (PRHE) is calculated by differencing THE and PHE.

In our empirical research we use a panel-data approach and consider three different estimation methods to ensure robustness of our results across distinct estimation techniques. This approach can better detect and measure effects that otherwise could not be observed in pure cross-section or pure time-series data. The first estimation consists of combining cross-section and time-series data and performs least-square regression (LS) on the entire data set. The second and the third estimation methods improve the efficiency of the first least-square estimation process by applying fixed effects (FE) and random effects (RE) estimation techniques to the original model. Each of the three models is estimated twice, with and without time trend. The results are then compared, both in terms of significance and in terms of the sign of the parameters. Despite its increased popularity in applied research, both the FE and RE methods provide unbiased and consistent estimates, but several estimation and inferential problems remain. One of these problems is the issue of efficiency. To help us to choose between a more efficient model against a less efficient but consistent model—and make sure that the more efficient model also gives consistent estimates—the Hausman test is applied to our results.

4.4. Empirical findings

4.4.1. Descriptive statistics and correlation matrix

Since normal distribution is a key assumption behind most statistical techniques, it is important to know whether the variable underlying a frequency distribution can be fully described by its mean and variance, or if higher moments of probability distribution must be analyzed. Based on the descriptive statistics on the variables included in the model, and shown in Table 4.1, all the distributions are negatively skewed, indicating that the mean lies to the left of the median and the mode. In addition, except for LEB, all variables have distributions that are more concentrated (peaked) than normal. In sum, if GDP is excluded, all the other variables appear to reject the null hypothesis of normal distribution under the Jarque-Bera criterion.

Table 4.1. Descriptive statistics

	lnLEB	lnGDP	lnGST	lnPHE	lnPRHE
Mean	4.343406	9.900681	7.748745	7.077480	5.957480
Median	4.343805	9.931525	7.871290	7.123955	6.081419
Maximum	4.406719	11.02239	8.710772	8.274433	6.984439
Minimum	4.268298	8.980285	6.062561	5.388615	4.264087
Std. Dev.	0.029321	0.414919	0.559162	0.587344	0.525911
Skewness	-0.136068	-0.008416	-1.189558	-0.587224	-0.991857
Kurtosis	2.271826	3.046331	4.165681	3.100752	3.799027
Jarque-Bera	9.064442	0.036448	88.03002	18.52636	60.98085
Probability	0.010757	0.981941	0.000000	0.000095	0.000000
Sum	1563.626	3564.245	2332.372	2264.794	1906.394
Sum Sq. Dev.	0.308643	61.80468	93.79863	110. 0463	88.22968
Observations	360	360	301	320	320

As a further test of the data, Table 4.2 examines the correlation coefficients between all combinations of the dependent and independent variables. As expected, the correlation between each variable and itself is identical to 1. Other variables (or combinations of variables) are highly (but not perfectly) correlated with each other. The fact that the simple correlation between GDP and GST, GDP and PHE, and GST and PHE is larger than the correlation of either or both variables with the dependent variable (LEB) is an indication that multicollinearity may be a problem in the model. As a result, individual estimated parameters will alternate in over and under estimation of true parameters. This tells us that while the estimated parameters will remain unbiased estimators, the reliance that we can place on their value will be diminished and care should be given to the interpretation of the regression results.

Table 4.2. Correlation matrix

	lnLEB	lnGDP	lnGST	lnPHE	lnPRHE
lnLEB	1.0000	0.3952	0.3940	0.5390	0.6249
lnGDP	0.3952	1.0000	0.9110	0.9366	0.4730
lnGST	0.3940	0.9110	1.0000	0.9319	0.4998
lnPHE	0.5390	0.9366	0.9319	1.0000	0.5697
lnPRHE	0.6249	0.4730	0.4998	0.5697	1.0000

4.4.2. Results of the estimation model

The equation presented above was estimated for the 12 euro zone countries and the results are reported in Table 4.3, in the Appendix. If our expectations hold, evidence from this group of countries should show that a positive association exists between the socio-economic factors mentioned above and life expectancy at birth (LEB). For this purpose, six panel-data models were used; half of them with a time trend and the other half without it. As a result, there are three types of panel-data models: a pooled regression model, a panel-data fixed effects model and a panel-data random effects model.

4.4.3. Statistical significance of the results

In most instances, the regression output produced by our analysis shows estimated coefficients that are statistically significant at the 1 or 10 percent levels, thus indicating that the factors chosen to explain life expectancy at birth in the sampled countries have the necessary properties of "real explanatory variables". As a result, these highly significant t statistics are likely to offset part of the multicollinearity problems associated with this type of model-specification. With the exception of Model 2 and 6, where PRHE shows no significance or significance at the 10 percent level, both PHE and PRHE are positive and statistically significant at the 1 percent level in all of the six regressions. Concerning the other variables in Equation 1, the results are mixed and not always consistent with the empirical evidence documented in the economic literature. For instance, real per capita GDP is expected to have a positive effect in LEB, since higher GDP is consistently associated with lower mortality, but our expectations are only confirmed in Models 3 and 5, where the GDP coefficient is positive and statistically significant at the 1 percent level. In the other models, the GDP coefficient is either insignificant, or is negatively related to LEB. In addition, unlike previous research where significant rises in government social transfers are expected to increase longevity, our results show that the GST coefficient is negative and statistically significant in five of the six regressions. In addition, and since this is a model-specification problem in most panel-data regression, all of the models show (positive) first-order auto-correlated residuals. In sum, and despite the high determination coefficients and the statistically high significance of the six panel-data models, the fact that the R2 and Durbin-Watson (DW) values have increased considerably when other, more complex and more real,

models were introduced, suggests that Models 1 and 2 are inappropriate when life expectancy at birth needs to be explained.

4.4.4. Interpretation of the results

Although the results indicate positive intercepts on all of the models as well as confirm the importance of real per capita GDP, public and private health expenditures (PHE and PRHE), government social transfers (GST), and technical progress (proxied by a time trend, (t) to explain life expectancy at birth (LEB), a number of issues ought to be raised. First, although the coefficients are statistically insignificant when a trend is added to the models, evidence is consistently provided for a positive correlation between per capita GDP and LEB in both the fixed effects (Model 3) and random effects (Model 5). Thus the LEB elasticity of GDP is positive. On average, if per capita GDP were to rise by 1 percent, then LEB is expected to increase nearly 0.035 percent. Second, with the exception of PHE in the trended fixed regression (Model 4), all the results indicate a positive correlation (and positive elasticities) between LEB and each one of the following variables: PHE, PRHE and t. In the case of the first two variables, the magnitude of the effects is higher for PHE than for PRHE. Specifically, the results show that 1 percent increase in PHE results, on average, in a 0.043 percent rise in LEB. Likewise, a 1 percent rise in PRHE causes, on average, a 0.03 percent gain in LEB. Third, while more government social (cash) transfers—and more disposable income—are expected to increase longevity, the results point to a strong negative correlation (and negative elasticity) between GST and LEB. One possible explanation for this apparent paradox is that the relationship between disposable income and life expectancy is not all causal. Characteristics other than low disposable income may affect the life expectancies of a growing (less affluent) segment of the population. Finally, we consider the choice of whether to pool data using a fixed effects model (with and without a time trend) or a random effects model (with and without a time trend) and the statistical tests qualified to be used in the decision making process.. On the basis of the F and $x2$ distributions, the null of redundant fixed effects is rejected in both of the fixed effects models. As for the random effects models, the results are contradictory and dependent on whether or not the time trend is included. In this way, if t is included/not included as an explanatory variable, the empirical evidence edges on the side of not rejecting/rejecting the null hypothesis of correlated random effects. As a whole, and according to the Hausman test, the results are inconclusive and it is not possible to decide on the best model to use in explaining LEB in this panel of euro zone countries.

4.5. Conclusion and policy implications

The main purpose of this study is to assess the influence of health and social spending on longevity—factors that are likely to respond to changes in government policy. For this purpose, data for 12 euro zone countries for the period 1980-2009 and a panel-data methodology was used. In the process, we have estimated a production function where life

expectancy at birth (LEB) depends on per capita health and social spending (PHE, PRHE and GST), per capita income (GDP), and technical progress (t). In general, the results confirm that all of the variables are important determinants of euro zone life expectancy. Specifically, while GST has an opposing effect on euro zone longevity, per capita GDP, per capita PHE and PRHE, and t have positive effects on this health indicator. Having passed the trappings of model specification, the estimated results are only dependent upon the sample of observations and, therefore, are not always in conformity with empirical evidence documented in the economic literature.

Although our sample consists of a fairly homogeneous set of countries, differences within this group emerge. Most likely, results would have been different if this sample had been divided into low-income and high-income euro zone countries. Failure to satisfy this condition assumes a homogeneous health production function and may explain some of the regressions results associated with this study. For instance, while the magnitude of the effects appears to be higher for PHE than for PRHE, it is expected that as countries improve economically PRHE becomes increasingly more effective and PHE gradually loses its importance. In addition, the higher-income (Northern) Western European countries saw higher government social spending in 1980 than the lower-income (Southern) Western European countries. In the 2000s, as a result of the entitlement reforms undertaken by the higher-income countries and a slowdown in economic expansion, real growth of per capita GST fell as a share of GDP. By contrast, the share of government spending rose sharply in the lower-income countries. In terms of actual statistics, taking Western Europe as a whole, 2007 saw social spending declining from 34 percent to 29 percent of GDP (The World Bank, 2012). In the meantime, between 1980 and 2009, life expectancy continued to move upward and converge across euro zone countries. In this regard, two explanations emerge—government intervention in social and human development issues and economic growth.

Many aspects of society have the potential to become subject to public policy: however, only few such matters become political issues that demand policy responses. Certain issues develop, move into the forefront of the political process, and become prone to be acted upon. One of these issues concerns social policy objectives. Instructed in altering the conditions affecting society or the political system, these objectives generally deal with three Key areas of political action—health care, education, and social security. In this study we tested the soundness of government involvement in two critical areas—health care and social security. Although public sector outputs are often indivisible and difficult to quantify, when measured in terms of life expectancy, there is no systematic link from more government spending to higher efficiency. Indeed, as the results show, public spending is more effective in promoting good health care than basic social assistance for the poor. Even though a proper consideration of both types of spending would require a more disaggregated look at inputs and outputs for a range of outcomes, a suggestive interpretation shows that this difference in

performance may be directly related to the nature of the services rendered. Aside from the fact that public and private expenditures are to some degree substitutes, not all social sectors react favorably to both types of intervention. Health care, for example, can be delivered or purchased by the public sector and concerns about efficiency start to matter only after expenditures on health per capita reach an unwarranted level. Highly dependent on infrastructures and equipment, the level of efficiency in health care is prone to improvements and more can still be done with less. As for government social transfers, highly dependent on direct cash transfers, the results are mixed and suggest a counterproductive effect on longevity. Managed by national and local government agencies, this complex tangle of programs has produced an administrative maze designed to save money and people and tragically ends up doing neither.

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Appendix

Table 4.3. Estimation and tests results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model6
Type of model	pooled	pooled	Fixed effects	Fixed effects	Random effects	Random effects
With or without trend	Without	With	Without	With	Without	With
Type of panel						
Method of estimation of the model	PLS	PLS	PLS	PLS	EGLS	EGLS
Dependent variable						
LLEB	LLEB	LLEB	LLEB	LLEB	LLEB	LLEB
Independent variables/factors						
LGDP	-0,035379*	-0,022840*	0,0391*	*0,007524ns*	0,030599*	*0,005314 ns*
LPHE	0,064477*	0,019609*	0,054095*	-0,022061*	0,056354*	0,020121*
LPRHE	0,028002*	*0,003096 ns*	0,013495*	0,02087*	0,016704*	0,0687***
LGST	-0,027862*	*-0,001618 ns*	-0,029499*	0,003348*	-0,031336*	-0,020709*
Tecnical Progress (trend t)	(a)	0,002906*	(a)	0,002602*	(a)	0,002635*
Constant	4,288613*	4,381977*	3,721273*	4,232193*	3,786076*	4,248383*
Cross-section random - s.d.					0,018244	0,012754
Cross-sectionrandom - rho					0,8109	0,8458
Idiosyncraticrandom - s.d.					0,008811	0,005445
Idiosyncraticrandom - rho					0,1891	0,1542
Other elements						
R^2	0,536231	0,820729	0,906053	0,964265	0,841522	0,943606
$AdjR^2$	0,529386	0,817409	0,900633	0,962058	0,839182	0,942561
DW	0,084773	0,09662	0,343725	0,477783	0,317468	0,454579
F-statistic	78,33561*	247,2202*	167,168*	436,8046*	359,7528*	903,5421*
Prob (F-stat)	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
Type of panel	Unbalanced	Unbalanced	Unbalanced	Unbalanced	Unbalanced	Unbalanced
N. of observations	276	276	276	276	276	276
N. of cross-sections included	12	12	12	12	12	12
Estimator of component variance (method)					Swamy and Arora	Swamy and Arora
Period	1980-2009	1980-2009	1980-2009	1980-2009	1980-2009	1980-2009
Tests results:						
Redundant fixed effects test						
Cross-section F test			93,044565*	94,575681*		
F-stat. degrees of freedom (df)			11;260	11;259		
Cross-section qui-squared (χ^2) test			440,6773*	445,1267*		
χ^2 degrees of freedom (df)			11	11		
Decision			Reject H0	Reject H0		
Hausman test-correlated random effects						
Qui-squared (χ^2)					22,190558*	4,291793ns
χ^2 degrees of freedom (df)					4	5
Decision					Reject H0	don't Reject H0

*, **, ***, ns - significant at 1 percent, 5 percent, 10 percent, and non significant, respectively. (a) trend not included in the model.

Chapter 5

5. Crisis revisited: the 2008 economic recession and age-specific, male and female mortality in the European Union

5.1. Introduction

Previous studies have shown that economic downturns contribute to differences in the health status of individuals or groups (such as age, sex, class, and race) (Kentikelenis et al. 2011; Stuckler et al. 2009; Edwards, 2008). Much of the reasoning in their analysis revolves around two basic concepts: (1) economic changes can increase health risks and eventually affect mortality; and (2) age-sex differences in mortality result from the unique relationships between risk factors and mortality for men and women. To revisit this issue, we examine the way economic crisis and response may affect females and males differently. In the process, we use a standard panel regression approach and an unbalanced panel data set that includes variables for fifteen European Union (EU) countries plus Iceland over the period 1990–2011. Because many disease states are highly correlated with other disease states, or comorbid diseases, all-cause mortality is the dependent variable primarily used in all regressions. In describing the process under study, we draw on economic theory and the results of previous empirical studies and propose that the process underlying all-cause mortality is a function of social and health-specific spending along with a host of other factors, including real per capita GDP, and labor force participation (McCracken and Phillips, 2012; Marmot, 2002). In addition, we specify a time trend over the sample period and introduce time dummies, one for each year of the crisis, 2008–2011.

As can be seen in Tables 5.1–5.3, some estimates of interest are highly sensitive to changes in the model specification. But even after breaking down the data by age and gender, the empirical results consistently show that the public health and welfare expenditures terms are strong negative predictors of total, male and female all-cause mortality rates. Notably, the coefficient estimates on the public welfare expenditure term is statistically significant and its magnitude is economically meaningful in regressions using the total and female all-cause mortality rates as a dependent variable. Male all-cause mortality, on the other hand, seems to be more responsive to general conditions, such as the degree of active involvement in economic activities, and how generously governments spend on medical services. In general, without claiming to provide a full representation for what is a rather complex social issue, these results demonstrate that an economic crisis can be a key hazard to health. But not all

individuals are equally vulnerable; it depends, among other aspects, on the exposure to the risk factors, the level of social cohesion, and the composition and extent of public support aimed at assisting those in need.

Accordingly, this study is organized as follows. After the introduction, Section 5.2 discusses the existing evidence on the costs of downturns. Estimation technique, data, model design, variable description and analysis are presented in Section 5.3. Section 5.4 presents the empirical results for the benchmark estimations, robustness checks, and analysis of alternative model specifications. Discussion and concluding remarks are drawn in Section 5.5.

5.2. Existing evidence on the costs of economic downturns

Although there are limited human development data on the current crisis—information on health expenditures, disease and mortality data lags behind real time—it is already evident that through one of its major pathways (e.g., unemployment, loss of income, a breakdown in family and social structure, and loss of health care and social protection, etc.) the economic downturn that followed the United States and European financial crisis in 2008 is having a negative impact on population health and well-being (WHO, 2014; Karanikolos et al., 2013). This negative impact is expected to be most salient amongst the poor and in those countries experiencing the most rapid labor turnover, rising health care costs and low levels of social protection (Economou et al. 2013; OECD, 2013; McKee et al. 2012; Mladovsky et al. 2012; McKee et al. 2010; Weber and Piechulek, 2010; Stuckler et al., 2009). This view is supported by a profuse body of research from previous downturns and early data from this recession showing a strong and positive association at the level of the individual between adverse social contextual factors in people´s lives and poor physical and mental health (OECD, 2013; De Vogli et al. 2013; Suhrcke and Stuckler, 2012; Marmot and Bell, 2009).

A separate line of research challenges this reasoning by reporting that recessions can actually improve many aspects of physical (not mental) health and reduce mortality risk (Ruhm, 2015; Ionides et al. 2013; Kristjuhan and Taidre, 2012; Bougerol, 2009; Miller et al. 2009; Ruhm, 2008; Gerdtham and Ruhm, 2006; Tapia-Granados, 2005; Laporte, 2004). This pattern of mortality is confirmed by a number of quantitative studies, using both cross-sectional and panel data. Stuckler (2009), analyzing the association of over thirty causes of death with economic downturns over the past three decades in European Union (EU) countries, found that the only persistent adverse health impact of the crisis has been on suicides and homicides. Khang et al. (2005), referring to the economic crisis of 1997-2001 in South Korea, also point to relatively small short-term mortality effects, in absolute terms. To justify the counterintuitive nature of these findings, researchers have suggested that the apparent healthy interaction of economic downturns and physical well-being partially reflects changes in lifestyle factors through different budget constraints (i.e. reductions in work-related

activities, lower alcohol and tobacco consumption, more leisure time and increased social interaction) (Tapia Granados, 2008; Ruhm and Black, 2002).

Amidst contradictory evidence, it is important to realize that almost all related studies regarding health and periods of economic shocks have focused primarily on affluent countries and on the contemporaneous effects of economic conditions on health. But the clinical manifestations on health may, to a certain extent, only be evident many decades later, which means that negative long-term effects of economic recessions may outweigh any positive short-term effects (van den Berg, et al. 2011; Case et al. 2002). In addition, this relationship is not evenly distributed across geographical areas, aspects of health, or sectors of the population (Riva et al. 2011; Stuckler et al. 2009; Gerdtham et al. 2005). For example, Ruhm (2003) found consistent evidence that temporary economic downturns can be significantly damaging for working-age males. Although less relevant in societies that support a work-oriented identity, health inequality by sex has been shown to vary according to different welfare state regimes and the type of work that has been lost (Oksuzyan et al. 2014; OECD, 2013; Suhrcke and Stuckler, 2012; Riva et al. 2011; Navarro et al. 2006). But like gender, research on age and health is multifaceted and susceptible to wider shifts in the social and economic environment (Wilde, 2013; Willard et al. 2012; Hagquist, 2008; Tomkins et al. 2007; Ruhm, 2006).

5.3. Methods

5.3.1. Estimation technique

Although the econometric literatures discusses several alternative approaches by which time-series and cross-section data might be pooled, in general, the more realistic cases involve the inclusion of fixed and random effects in the method of estimation (see, for example, Baltagi, 2005). While the fixed-effects (FE) method adds dummy variables to the models to allow for changing cross-sections and time-series intercepts, the random-effects (RE) method handles the constants for each cross-section not as fixed, but as random parameters. Keeping this fundamental difference in the two approaches in mind, the choice between the FE and RE models took into account the value of the Hausman test statistic and the fact that our data set are a convenient sample of developed countries, whose health experiences are similar enough to support effective pooling, but different enough to allow for cross-national variation. Thus, the FE model (Model 2, Table 5.2) is the preferred method by which the data might be pooled and the analysis is based on the country-year units of selected fifteen European Union member countries plus Iceland for the period 1990–2011. In this way, this model is worthy of special attention because its structure serves as a basis for the econometric specifications in Tables 5.3 and 5.4.

5.3.2. Data and measures

To quantify the relationship between all-cause mortality and factors amenable to population health, we evaluated data collected by secondary sources for the sixteen countries included in this study (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain Sweden, and United Kingdom). This sample of developed countries allows us to rely on the assumption that mortality rates may decline over time as a result of common (constant) long-run advances in knowledge and technology. Like most of the empirical work on the economics of population health, this study builds on the framework developed by Ruhm (2000), with the data preparation and handling following the methods used in that study.

As shown in Table 5.1, the outcome measures of health used are total age-standardized mortality rates (SDR) per 100,000 individuals extracted from the WHO (2014) European Health for All database (HFA-DB) for each of the sixteen countries for which comparative data are available. In order to reflect the increased vulnerability to adverse economic conditions on the part of working age persons and their immediate families, the relationship of interest is also examined with respect to gender-specific mortality rates for two age groups: 0-64 and 65+ (Ruhm, 2006; Neumayer, 2004).

Table 5.1. Variables, notation and their sources

Variables	Notation		Source
Dependent variables:			
All-cause age-standardized mortality rates per 100.000 residents			
- All ages	lnM	(Models 1–4)	*1*
- Males:			
All ages	$lnMM$	(Model 5)	*1*
0-64 years of age	$lnMM_{0\text{-}64}$	(Model 7)	*1*
65+ years of age	$lnMM_{64+}$	(Model 9)	*1*
- Females:			
All ages	$lnMF$	(Model 6)	*1*
0-64 years of age	$lnMF_{0\text{-}64}$	(Model 8)	*1*
65+ years of age	$lnMF_{65+}$	(Model 10)	*1*
Independent variables:			
- Real per capita public social welfare expenditures – lagged (at constant PPPs in 2005 US$)	$lnSWE_{t\text{-}1}$		*2*
- Real per capita public expenditures on health – lagged (at constant PPPs in 2005 US$)	$lnPHE_{t\text{-}1}$		*2*
- Per capita out-of-pocket expenditures on health – lagged (in PPPs US$)	$lnOPHE_{t\text{-}1}$		*2*
- Real per capita GDP (at constant PPPs in 2005 US$)	$lnGDP$		*3*
- Labor force participation rate	$lnLFP$		*3*

Data **sources:** 1. World Health Organization (2014), "Health for All Database"; 2. OECD (2014); 3. The World Bank, *World Development Indicators,* 2014.

Income, labor force participation, social welfare expenditures, and medical services represent the conventional blocks of amenable factors influencing health. We also specify a time trend over the two decades, and a set of time dummies for the period 2008–2011. As with many of the studies examining the existing evidence on the actual and potential impact

of recessions on health, we also put forth the hypothesis that the level of effort exerted by national governments in providing formal insurance mechanisms against sudden losses of income affected health (Suhrcke and Stuckler, 2012; Stuckler et al., 2010). To further inform this debate, we disaggregated public social expenditures, as defined and collected by the Organization for Economic Cooperation and Development (OECD), into its social welfare and health components. Accordingly, we evaluated annual data on real (public) social welfare expenditure (SWE) per capita, by country, which includes expenditure on family support programs, old age pensions, survivor benefits, housing assistance, unemployment benefits, active labor market programs and support for people with disabilities.

Although intuition suggests that the level of health care spending may be correlated with observed mortality rates, the empirical evidence on this relation has been mixed. A significant number of studies that consider public and private health spending separately have found no evidence that public health related spending has any effect on health outcomes (e.g., Stuckler et al. 2010; Self and Grabowski, 2003; Filmer and Pritchett, 1999). This stands in marked contrast to the typical range of estimates showing that changes in the growth rate of public health expenditure are likely to promote or suppress health (ModreK et al (2013; Lichtenberg, 2004). Thus, real public health expenditure (PHE) per capita is added to the regression models in an attempt to account for the level of effort exerted by national governments in providing health services and improving the health level of their populations. In addition—because loss of eligibility for and accessibility to public health insurance programs—the inclusion of out-of- pocket health expenditure (OOP) per capita serves as a measure of capacity of individuals to consume private health goods. Annual data for 1990–2011 on real per capita heath expenditure, in PPPs USD, by source of funds (public vs. out-of-pocket) were extracted from the Organization for Economic Cooperation and Development database (OECD, 2014).

Research has shown that other factors can be modifiers of the economic condition-mortality relationship. Both through changes in living conditions and public spending, the impacts of loss of income on health can be direct in terms of loss of access to basic needs but also through a cascade of secondary impacts such as the exclusion from social safety net programs and decreased affordability of health care (ECDC, 2013; Portela and Thomas, 2013; Stuckler et al., 2009). Because of these diverse effects, in a series of macro-level studies the real income (GDP) per capita has been chosen as a measure of the capacity of households to consume both private and public goods, and area-level unemployment rates (UEMP) as indicator of how economic data translated into people´s lives (Bor et al., 2013; Borowy, 2013; Catalano et al., 2011). We must note, however, that the unemployment rate depends on past and current changes in income, as well as the extent of slack capacity in the economy (Williamson, 2014). To avoid the problem of having independent variables with a high degree of multicollinearity in the same specification, we opted to drop the unemployment variable

from the equation. In order to test the significance of the individual regression coefficients, data on the income variable, by country and year, was obtained from the World Bank (2015) World Development Indicators Database.

Another indicator of economic condition is the labor force participation rate. The empirical literature provides evidence that the extent to which men and women are actively involved in economic activities is correlated with some forms of mortality (Minoiu and Andrés, 2010; Burgard et al, 2009). Indeed, Pellegrini et al. 2014), in a study evaluating the United States labor market´s impact on health care spending and health outcomes, found that declining labor force participation is a health hazard. On this account, the labor force participation rate (LFP) is added to the regression models as a proxy for the multitude of socioeconomic factors that may affect mortality. Besides informing on the way in which shifts in participation in the labor market impact on health, it tends to co-move with unemployment levels and (in the case of women´s labor force participation) divorce rates (Hornstein, 2013; Stevenson and Wolfers, 2006; Bentzen and Smith, 2002). Thus, in noting these characteristics, we evaluate annual data on this economic control variable, as measured by the defined proportion of the population ages 15 and older that is economically active, obtained, by country, from the World Bank (2015) World Development Indicators Database.

5.3.3. Model design and analysis

Extending the choices of Ruhm (2000), we considered a pooled cross-sectional time series design as a way to deal with the issue of combining data for the sixteen countries over the twenty-two time periods. Since the central issue associated with pooling is one of efficiency, we followed Hausman´s (1978) suggestion for selecting between alternative estimation techniques. Thus, the specification, which will be used in this study, is a fixed-effects model in the form:

$lnMR_{it} = \beta_0 + \beta_1 lnSWE_{it-1} + \beta_2 lnPHE_{it-1} + \beta_3 lnOOP_{it-1} + \beta_4 lnGDP_{it} + \beta_5 lnLFP_{it} + \beta_6 Time + \beta_7 D_{08} + \ldots + \beta_{10} D_{11} + u_{it}$ (1)

This equation relates the various facets of mortality (MR_{it}), by country and year, to the real social welfare expenditure (SWE_{it-1}) per capita term, the real public and out-of- pocket expenditure on health (PHE_{it-1} and OOP_{it-1}) per capita term, the real income (GDP_{it}) per capita term, the labor force participation rate (LFP_{it}), a time trend (Time), and a set of time effect dummy variables ($D08….D11$). The u_{it} is the observation-specific error term and is likely to be serially correlated within and between panels.

Although several alternative transformations of the variables could be considered in estimating Equation 1, the log-log specification offers an appropriate functional form for investigating the potential impact of recessions on health (Asteriou and Hall, 2007). This form

allows the regression coefficients to be interpreted as elasticities, which are, therefore, assumed to be constant. From a practical standpoint, coefficients represent the percentage change in the value of the dependent variable corresponding to a 1 percent change in the value of the explanatory variable. The logarithmic transformation was not applied to the time trend and dummy variables. To improve the regression models, some of the variables considered in the analysis are introduced in one-period lagged form (namely, SWEit-1, PHEit-1 and OOPit-1). This is justified by the presence of two key considerations: (i) the fact that the influence of mortality patterns of economic and other variables are usually not contemporaneous, but the result of long periods of exposure, and (ii) the need for all independent variables to satisfy the strict exogeneity assumption (i.e., the need to ensure that we are measuring the effect of expenditure on mortality rather than the effect of mortality on expenditure). Because of the lag structure models are based on a time-series of 21 observations, rather than 22, as the year 1990 is dropped for lagging As for the vector of time-effects for the countries included in the sample, Dt takes a value 1 for years from 2008–2011 and 0 otherwise. The introduction of these time dummies, one for each year of the crisis, is used to test whether the mortality function shifts over time because of the 2008–2011 recessionary period.

While annual data on mortality in the general population, or in specific age and sex groups, and economic performance were available for most of the European Union countries plus Iceland, over the period 1990–2011, information on health and social (welfare) expenditure was amply available for sixteen countries only. In addition, observations for one or more variables were missing. The final cross-sectional data set was an unbalanced panel data set with approximately 352 observations. Regressions were performed by means of the statistical software EViews (version 8.0).

We used ten pre-specified model specifications, seven of these corresponding to another dependent variable, to address three questions: (i) do health, social welfare expenditure and socioeconomic conditions have a demonstrable impact on overall mortality, (ii) if so, are the potential effects equally experienced by men and women of different ages, and (iii) are these effects larger as a consequence of the outbreak of the current crisis? The first three models used the overall measure of mortality to test possible estimation techniques by which the data might be pooled. After having considered that the fixed effects estimator is more appropriate and adjustments have been made to guarantee unbiased, consistent, and efficient estimators, Models 4 through 6 (Table 5.3) used total, male and female all-cause mortality rates as a dependent variable. In order to account for time effects, time dummies were added to regressions using age-specific (0 to 64 and 65+ years of age groups), male and female all-cause mortality rates as a dependent variable (Models 7 through 10, Table 5.4).

5.4. Estimation results

5.4.1. Benchmark estimations

Equation (1) was estimated for the sixteen European countries included in our study and the results are reported in Tables 5.2, 5.3 and 5.4. Table 5.2 shows the results for three alternative baseline models. Models 1–3, which describe the simplest form of the mortality equation, show the parameter estimates of the pooled OLS, FE and RE estimators for total all-cause mortality. A quick glance at the results in Table 5.2 points to large differences between the pooled OLS, FE, and RE regressions. Thus, Table 5.2 also includes a series of unified tests to assist in making a choice between alternative estimators (Asteriou and Hall, 2007). The "Cross-section F" and "(Cross-section Chi-square" statistic values (104.82 and 554.72) and the associated p-values are highly significant and, therefore, we reject the null hypothesis that the cross-section effects are redundant. Likewise, a highly significant value of the Hausman test statistic (33.1539) suggests that the FE model (Model 2) is the preferred specification.

Table 5.2. Effects estimates of age-standardized total mortality

	MODEL 1	MODEL 2	MODEL 3
Dep. Variable	lnM	lnM	lnM
Methods:	Pooled OLS	Fixed-Effects (FE)	Random-Effects (RE)
	Panel LS	Panel LS	Panel EGLS
Variables	**Coefficient**	**Coefficient**	**Coefficient**
Constant	3.788972*	4.758818*	4.668137*
lnGDP	-.035370	-.346445*	-.316773*
lnLFP	-.004400	.215555**	.133613
$lnSWE_{t-1}$	.048049**	-.141591*	-.079985*
$lnPHE_{t-1}$	-.242588*	-.090166*	-.104920*
$lnOOP_{t-1}$	-.080647*	.008645	-.020173***
N (Unbl.)	286 (16 cross-sections)	286 (16 cross-sections)	286 (16 cross-sections)
Time bounds	1990-2011	1990-2011	1990-2011
R^2	.577115	.944576	.898957
Adjusted R^2	.569106	.940124	.897043
S.E.	.038795	.014462	.015661
F stat.	72.05670*	212.1811*	469.7506*
DW stat.	.110059	.700471	.565712
Specification Tests			
F Test Fixed-Effects		110.057422*	
Hausman test			51.053632*

Note: * significant at 1%; ** significant at 5%; *** significant at 10%

5.4.2. Diagnostic analysis

Before using this model for control or policy purposes, it is instructive to examine whether or not this specification satisfactorily describes the process under analysis. Thus, as shown in Table 5.3, we proceed with an evaluation of the model and continue with an analysis of adjustments which may be made to improve its fit and explanatory power.

Table 5.3: Effects estimates of total, male and female mortality

	MODEL 4	MODEL 5	MODEL 6
Dep. Var. Methods:	lnM Panel Least Squares with Fixed Effects (White cross-section S. E. & Cov. Matrix)	lnMM Panel Least Squares with Fixed Effects (White cross-section S. E. & Cov. Matrix)	lnFM Panel Least Squares with Fixed Effects (White cross-section S. E. & Cov. Matrix)
Variables	**Coefficient**	**Coefficient**	**Coefficient**
Constant	3.480368*	3.531580*	3.449059*
lnGDP	-.036024	-.010061	-.015832
lnLFP	-.014183	-.019734	-.110288
$lnSWE_{t-1}$	-.102456*	-.048884	-.116311*
$lnPHE_{t-1}$	-.022297	-.090797*	-.007009
$lnOOP_{t-1}$	.019472	.008999	.023002
TREND	-.007427*	-.007429*	-.007391*
AR(1)	.525230*	.470135*	.410227*
N (Unbl.)	248 (16 cross-sections)	248 (16 cross-sections)	247 (16 cross-sections)
Time bounds	1990-2011	1990-2011	1990-2011
R^2	.974614	.974405	.962136
Adj. R^2	.972132	.971903	.958417
S.E.	.009551	.010554	.012406
F stat.	392.6455*	389.3614*	258.7206*
D.W. stat.	2.241074	2.043993	2.304821

Note: * significant at 1%; ** significant at 5%; *** significant at 10%.

First, since mortality rates may decline over time with advances in knowledge and technology, we introduce a time trend variable in the model in order to capture possible deterministic tendencies in the data. Second, to ensure serial independence, we checked for the presence of serial correlation in the error term, as consistency of the estimates depended on it. Although some of the t statistics are highly significant, providing evidence that a number of the explanatory variables of interest have an influence on all-cause mortality, the low Durbin-Watson (DW) statistic of .70 strongly suggests the presence of positive first-order serial correlation and a downward biased standard error of the regression. Third, a simple inspection of a graphical representation of the actual and fitted residuals of the benchmark FE model revealed heteroscedasticity and non-linearity of the regression function. Likewise, the unstructured (i.e., not specified as panel) White´s test also indicated the existence of heteroscedasticity (we note, in connection with this procedure, that Eviews 8.0 does not provide White´s heteroscedasticity test for panels). Because of the preceding results, we re-estimated Model 2 (Table 5.2) using an iterative procedure for correcting for serial correlation, and the White´s (1980) method for obtaining heteroscedasticity-corrected regression results In this way, the coefficient estimates of Models 4–11 (Tables 5.3 and 5.4) can now be interpreted to be efficient and robustly statistically significant.

5.4.3. Analyzing alternative model specifications

While examining the complete regression output of Model 4 (Table 5.3), we notice that some improvements have taken place. Even if not guaranteed by the specification of the model, one can observe that the goodness of fit of the regression (as measured by the R2 and the

Adjusted R2) has increased as has the F statistic. A smaller standard error of the regression is also indicative of a gain in predictive power. Worthy of attention, however, is the fact that the Durbin-Watson (DW) statistic is substantially higher (2.23) than in the original regression (.70), but many of the t statistics have fallen. The results exhibited by the regression output show that some of the explanatory variables of interest (some of which have been identified in the original FE regression as important) do not seen to have a statistically perceptible impact on mortality rates (e.g., labor force participation rate and public health expenditures). Though we had a priori expectations concerning the sign and significance of the coefficient on the public health term (PHE), the empirical results suggest that government involvement in health care has no impact on total all-cause mortality, since the estimated coefficient is negative but is no longer statistically relevant at conventional levels of significance (i.e, 1 percent, 5 percent, and 10 percent levels). In the same vein, the previously significant income per capita term (GDP) is still inversely related to all-cause mortality, but its coefficient is no longer statistically significant. This result is consistent with empirical evidence pointing to a threshold level above which income no longer influences health (World Bank, 1993).

However, other factors do significantly influence total all-cause mortality. The real social welfare expenditures (SWE) per capita term is highly significant (at the 1 percent level) and inversely related to all-cause mortality. By examining the elasticities, we see that if social welfare expenditures (SWEt-1) per capita were to rise by 1 percent, all-cause mortality would be expected to fall about .10 percent in the following year. In addition, in this specification as in all estimations presented in Tables 5.3 and 5.4, the empirical findings also imply that all-cause mortality has decreased over time, possibly reflecting a downward deterministic trend in the data. Last, we must note that most of the country dummy variables possess negative and significant coefficient estimates, indicating that these countries (France, Greece, Iceland, Italy, Portugal, Spain, and Sweden) have s significantly lower all-cause mortality rate than the average for this sample of European countries, after holding other influences on all-cause mortality constant. This finding hints that unobserved factors may ultimately hold considerable responsibility in determining a country´s high/low all-cause mortality rate.

Models 5 and 6 (corresponding to male and female all-cause mortality) differ from Model 4 only in that the dependent variables differ. There is, of course, a close relationship between the coefficients in all three models since the information contained in each is very much alike. But findings also hint at existing differences in the underlying stochastic process describing gender-specific mortality rates. In relation to control variables, for example, only the time trend term is consistently negatively associated with total, male and female all-cause mortality (Models 4, 5 and 6, Table 5.3) at the 1 percent level of significance. As for government´s involvement in the promotion of "general welfare", the empirical evidence on

the SWE and the PHE terms is mixed and the estimated results need to be examined carefully. The coefficient estimates for the impact of public social welfare expenditures are non-negligible in regressions using the total and female all-cause mortality rates as a dependent variable (Models 4 and 6). For females, the coefficient estimates are negative and statistically significant at the 1 percent level of significance and appear to drive the result for total all-cause mortality rates. The extent of this impact appears to be less relevant among men, since the estimated coefficient is negative but only significant at the 27 percent level, possibly reflecting this group´s highest rate of exclusion from many of the safety net programs. In relation to government involvement in health care, only in one case (Model 5) do we find that the coefficient estimates on the public health expenditure (PHE) term is negative and statistically significant at the 1 percent level of significance: an increase in the level of public health expenditures by 1 percentage point leads to a reduction in male all-cause mortality rates by .09 percent in the subsequent year. The result, however, disappears in models for age-specific, male all-causes mortality rates (Models 7 and 9, Table 5.4).

In Table 5.4 (Models 7–10), four separate regression equations with time dummies are used to test whether external effects (such as the recession that occurred in 2008) had a statistically significant impact on age-specific, male and female all-cause mortality rates. In revisiting Table 5.3, we note that the significance and expected signs of the multiple regression coefficients can easily be inferred for several of the explanatory variables of interest. In Table 5.4, the results show strong differences with respect to gender and age. For instance, as far as economic control variables are concerned, the coefficient on the GDP per capita term appears to be statistically insignificant in all regressions (Models 7, 8 and 9) except the ones on older females (Model 10). In particular, a 1 percent increase in the real income per capita term causes a .22 percent increase in mortality in women aged 65 and older. On the other hand, although the acceptance for not participating in the labor force is higher among the young, its coefficients are statistically significant only in the regression explaining male (0 to 64 years of age) all-cause mortality rates—a finding that might reflect the effect of an omitted economic control variable, such as the unemployment rate which is positively correlated with both male all-cause mortality and alcohol consumption (Modrek et al. 2013; Borowy, 2011). In describing our findings for the "public action" variables, we see that results for the social welfare expenditure (SWE) term are consistently negative and statistically significant in all regressions using the female all-cause mortality rates as a dependent variable (Models 8 and 10). As a result, a 1 percent increase in real social welfare expenditures per capita causes a .12 to .23 percent decrease in all-cause mortality in the following year.

Table 5.4. Effects estimates of age-specific, male and female age-standardized mortality

	MODEL 7	MODEL 8	MODEL 9	MODEL 10
Dep. Var. Methods:	lnMM 0 - 64 Panel Least Squares with Fixed Effects (White cross-section S. E. & Cov. Matrix)	lnFM 0 - 64 Panel Least Squares with Fixed Effects (White cross-section S. E. & Cov. Matrix)	lnMM 65+ Panel Least Squares with Fixed Effects (White cross-section S. E. & Cov. Matrix)	lnFM 65+ Panel Least Squares with Fixed Effects (White cross-section S. E. & Cov. Matrix)
Variables	**Coefficiet**	**Coefficient**	**Coefficient**	**Coefficient**
Constant	3.467139*	2.405240*	3.941861*	4.744931*
lnGDP	.049763	.125196	.042677	-.222087**
lnLFP	-.403393**	.032866	.020296	.013821
$lnSWE_{t-1}$	-.093258	-.234198*	-.033247	-.116167**
$lnPHE_{t-1}$	-.029017	.048828	-.066434	.041238
$lnOOP_{t-1}$	-.002103	-.025283	-.001647	.042687**
TREND	-.009455*	-.010003*	-.008534*	-.004272**
D_{08}	-.005122*	-.003208**	-.005719	-.003378
D_{09}	.006058***	.004559	-.002052	-.017598**
D_{10}	.001784	.013518*	-.001597	-.019665**
D_{11}	.000182	.017839*	-.007641	-.028693*
AR(1)	.395285*	.318013*	.564405*	.432337*
N (Unbl.)	251 (16 cr. Sct.)	248 (16 cr. sct.)	248 (16 cr. sct.)	250 (16 cr. sct.)
R^2	.973706	.955003	.956151	.951259
Adj. R^2	.970654	.949707	.950992	.945525
S.E.	.014888	.017037	.013406	.014173
F stat.	319.0422*	180.3999*	185.3468*	165.8909*
D.W. stat.	2.183023	1.979866	2.277265	1.964325

Note: * significant at 1%; ** significant at 5%; *** significant at 10%.

However, the impact of public spending on health (PHE) is negative but statistically insignificant in all specifications using age-specific dependent variables, which suggests that government involvement in health care has no significant impact on age-specific all-cause mortality. The results indicate, however, that only among women in the 65+ years of age group do we find that higher levels of out-of-pocket health expenditures are significantly associated with all-cause mortality. More importantly, the individual time dummies were individually statistically significant only in regressions using the female all-cause mortality rates as a dependent variable, which is further evidence that the drivers of male and female mortality may not be the same.

5.5. Discussion and concluding remarks

In 2008, the European economy experienced a steep economic recession. In spite of the amount of support provided by European Union (EU) governments to protect their citizens from economic hardship, there is little doubt that this recession is significantly damaging to population health. Using a panel of fifteen European Union countries plus Iceland over the period 1990-2011, this study comprehensively examines the determinants of total, male and female all-cause mortality rates. Age-specific mortality rates—which are an incomplete measure of population health—were calculated for two age groups: 0-64 and 65+. In addition to the traditional factors that have been shown to affect health (namely, income, out-of-pocket health expenditure per capita, and labor force participation), we focus particularly on the estimated coefficients for the public welfare and health expenditure per capita terms. The sensitivity of the coefficient magnitudes and statistical significance for these aptly named "public action" variables were then tested under various model specifications and control variables using a standard panel regression approach.

From a theoretical and empirical standpoint, three main results were obtained from this study. First, we can see that the choice of model specification can have a significant effect on panel analysis of the associations between socio-economic variables and fluctuations in mortality. Second, after following Hausman´s (1978) suggestion for selecting between alternative estimation techniques and corrections for serial correlation and heteroscedasticity have been made to our preferred benchmark specification (Model 2, Table 5.2), only in the case of social welfare do we find that expenditures are significantly negatively associated with all-cause mortality rates in (most) estimations presented in Tables 5.3 and 5.4. This finding is consistent with empirical evidence from earlier studies and hints at the buffering effects on health of some social protection programs (for more details see, for example, Stuckler et al., 2009). Such programs are those that are designed to deal with unemployment and underemployment, on the one hand, and, on the other hand, those that are designed to provide assistance to those who should not work—such as children, single parents, the aged, the physically and mentally disabled, etc. Third, while mortality has shown a downward trend over the recent past, reflecting improvements in living conditions, we found consistent evidence that recessions can be significantly damaging to population health. Amidst this interaction, the extent of this effect is uneven across ages and has a higher impact (both in terms of statistical significance and magnitude) on all-cause mortality for females than males. This finding hints that economic crises are still deeply gendered and is further evidence of important differences in the underlying stochastic process describing male and female mortality rates.

It is in fact remarkable that the empirical results show that social welfare programs had a more significant impact on all-cause mortality than did public health care programs. Indeed,

the coefficient estimates on the public health expenditure term is negative and statistically significant only among males of all ages. This statistical significance disappears in regressions using female and age-specific all-cause mortality rates as a dependent variable. This finding does not imply that medical care is not (potentially) effective. It suggests, however, that the impact of public financing of health care is much more complex than the effectiveness of the medical services purchased.

Still, with the optimal composition of total consumer spending shifting towards health, governments—unable to influence all-cause mortality or control total spending on health—can act on both micro and macro levels to influence many of the proximal non-medical determinants of population health (e.g. income, demography, institutions and technologica-behavioral changes). While adapting, governments must also develop new patterns of activity likely to improve certain public health performance attributes, especially those that are likely to close the gap between the actual performance of the health care sector and the apparent potential of public spending in improving health status.

Perhaps macroeconomic policies can be realigned and the temporary disequilibrium that led to the downturn in economic activity will come to an end. But how long will this take and at what cost? Continuing empirical and theoretical inquiry will eventually give us better answers to these questions. It is our view, however, that this impact will depend on (i) the depth and extent of the crises and (ii) on the level of effort exerted by national governments in providing cushioning mechanisms against sudden adverse economic and health effects of the crises. In this setting, without social transfers, the crisis would have produced poorer health, especially among children, women, and the poor, and should be accounted for in future inquiry into the determinants of aggregate population health. Meanwhile, without providing a point of departure for future inquiry into the determinants of male and female mortality, the body of findings contained in this study should prove helpful in the formulation and adjustments of public policies and should serve as a basis for further and better research.

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Chapter 6

6. "Death by Economic Crisis": Measuring the Effects of Economic Conditions on Suicide and Self-Inflicted Injury in Europe

6.1. Introduction

A reality that is often denied by society, death by suicide was defined in 1999, for the first time, as a "public health hazard" by the United States (US) Surgeon General (US Public Health Service, 1999). Even though the official figures probably err on the low side—suicide is often under-reported or misclassified as another cause of death in some countries—estimates by the World Health Organization (2014) indicate that 804 000 suicide deaths occurred worldwide in 2012, representing an annual global age-standardized suicide rate of 11.4 per 100 000 persons. Statistically, the mean male-to-female ratio for suicide is 3.5 in high-income countries and 1.5 in low and middle-income countries. Nevertheless, when the data are separated by World Health Organization (WHO) regions, this rate rises to as high as 4.1 in low and middle-income countries in Europe. With regard to age, adolescents and young adults are among those most affected; suicide accounts for 17.6 percent of all deaths among 15-29 year olds and is the second leading cause of death globally among this age group. Although the absolute number of suicidal deaths has fallen globally by about 9 percent from 2000 to 2012, and the age-standardized suicide rate has fallen 26 percent during the 12-year period, different patterns are seen by region; the percentage change in total suicidal deaths varies from an increase of approximately 38 percent in low and middle-income countries in the African Region to a decrease of 47 percent in low and middle-income countries in the Western Pacific Region. This difference in mortality rates is even more pronounced when evaluating country-level data. In the European Union (EU), for example, the 2000-2012 change in age-standardized suicide rates ranged from a decline of 51 percent in Slovenia to an increase of 10.5 percent in Greece. Among these 28 countries, 18 (64.3 percent) experienced a drop in age-standardized suicide rates of over 10 percent, 8 (28.6 percent) remained practically unchanged, and only 2 (7.1 percent) experienced an increase of over 10 percent in age-standardized suicide rates over the 12 year period (WHO, 2014). Recently, however, an increase in suicide attempts and actual suicides has been reported across the EU region, especially in countries where anti-crisis policies have been accompanied by harsh austerity measures (Corcoran et al., 2015; Economou et al., 2013; Suhrcke et al., 2012; WHO, 2011).

Although the correlation between mental illness and suicide is well documented in the literature, factors over and above psychopathology must be involved and certain kinds of crises are most likely to trigger the extreme stress associated with suicidal behavior (Gvion and Apter, 2012). Most common are intense interpersonal crises associated with relational conflict, death of a loved one, or loss of hope and meaning that often accompanies terminal illness. Socioeconomic factors are also relevant to the understanding of suicide. Studies on the relationship between economic downturns and mental health indicate that changes in the economy can increase psychiatric pathology and potentially lead to suicide (Martin-Carrasco, 2015; Tapia-Granados and Rodriguez, 2015; De Vogli et al., 2013). Direct socioeconomic consequences, notably unemployment, loss of income and un-payable debt, as well as collateral consequences such as impoverishment, increased inequality, family disruption, and loss of status or social recognition can lead to a variety of mental health problems, most prominently depression, alcoholism and suicide (Christodoulou and Christodoulou, 2013; Karanikolos et al., 2013). A corollary of this fact is that recessions appear to be most risky when social safety programs are weak and people face low social support (Modrek et al., 2013).

The European Union (EU) economy is mired in its most severe slump since the 1930s. A different story—but the same patterns of failure—are evident from the millions of people that have lost jobs, or had homes foreclosed on, or lost all their life savings. It is the purpose of this study to contribute to the understanding of the health consequences of the current and prior recessions and to the development of preventive initiatives that will help reduce the increasing trend of suicide rates among the most vulnerable populations, especially in countries where austerity was harshest. To shed light on this issue, this study analyzes empirical data regarding suicides in the context of current socioeconomic theories. In the process, it seeks answers to the following questions: (i) are economic conditions responsible for triggering the extreme stress associated with suicidal behavior, (ii) if so, what is causing suicide rates to vary across EU countries, and (iii) if an answer can be found to questions i and ii, what cost-effective public policy measures are available for countering heightened risk of suicide? We address these questions using a fixed effects estimator and an unbalanced panel data set that includes variables for fifteen European Union (EU) countries plus Iceland, over a period that predates and coincides with the current recession—1990-2012. In allowing for the inclusion of a set of time dummies, the fixed effects estimator has the advantage of capturing any effects which vary over time but are common across the whole panel (Asteriou and Hall, 2007). Because individuals may have some tolerance level in facing adverse conditions and risk and protective factors may vary according to risk groups and across the life span, some of the variables considered in the analysis are introduced in the regressions in one-period lagged form and suicide rates are presented across sex and age groups (Garcy, A. and Vagero, D., 2013; Beautrais, 2006). In describing the process under study, our choice of methodology relies on evidence gathered by such writers as Corcoran et al. (2015), Latif (2015), Reeves et

al. (2012); Stuckler et al. (2011), Suzuki (2008) and, in particular, Minoiu and Andrés (2008). In this vein, it proposes that the process underlying suicide mortality is a function of national unemployment levels along with a host of other factors, including alcohol consumption, divorce and total fertility rates. In addition, two "public action" variables (namely, social and health-specific spending) are included in our specifications to account for possible differences in suicide patterns between Southern European (less affluent) countries and EU core countries, where austerity is more modest and safety nets were more effective in preventing the growth of social inequalities in health when economic conditions deteriorated. To account for a possible upward or downward movement in the values of the time series considered in our specifications and capture the full magnitude of the recession-suicide relation, we specify a time trend over the sample period, 1990-2012.

We find that public health spending actually had a less significant impact on suicide mortality outcomes than did other social welfare programs including direct income support, housing support and unemployment benefits. Although the coefficient estimates on the government variables are economically meaningful, we found weak evidence of the relationship between public intervention in health and suicides. Moreover, the results also confirm the impression conveyed by most of the empirical work on the economics of suicide that the combination of high or rising unemployment, divorce and total fertility rates, and increasing alcohol consumption were important determining factors of suicide mortality in the general population, or in specific age and sex groups. However, given that these variables have a higher impact (both in terms of statistical significance and magnitude) on male suicide rates than female suicide rates and rates in the younger age group than those in the older age group, it is possible that the determinants of female and elderly suicides may well differ from the ones we propose in this study.

The remainder of this article is organized as follows: Section 6.2 overviews the economic and sociological literature on suicide. Section 6.3 discusses the variables used in the baseline specifications, including average suicide rates by country, and summary statistics. Section 6.4 describes the methodology and findings. Section 6.5 concentrates on the discussion, policy implications and the concluding remarks.

6.2. The wider context

Most sectors of society have treated the issue of suicide with benign neglect. Either from guilt about their own success or the stigma and discomfort attached to this public health problem, societies have relegated to academics and health care professionals the task of mapping the pathways of the disease process. Described in review studies as the end point of a complex set of circumstances that, in the worst cases, can range from suicidal ideation to suicide, the display of this type of behavior(s) depends on the interaction of numerous factors–namely biological, psychological, genetic, social, environmental and situational (Gvion et al., 2012;

Apter, 2010; Nock, et al., 2008; Beautrais et al., 2005). Yet understanding how this interaction actually occurs, goes beyond the clinical perspective and remains a challenge to both academics and health care professionals. So the fact remains that although psychological autopsy studies carried out over the years show that about half of the suicide victims suffered from some form of mental illness, most do not attempt suicide and this type of behavior also characterizes non-psychiatric populations (Mann et al., 2010; Galfalvy et al., 2009). Even in cases where suicidal behavior coexists with mental health problems, some other element must be present which transforms the potential of predisposition into increased risk. Consistent with this hypothesis, Nock et al. (2008) suggests that stress is the key element interacting with psychiatric, psychological and biological factors to sway a person toward suicide.

Explanations of all human behavior in terms of economic conditions have been traced back to Morselli (1881) and Durkheim (1897). Durkheim´s belief that societal suicide rates were likely to be influenced by social integration and social regulation form the basis of historical and recent attempts to explain suicide and suicidal behavior (Hamermesh and Soss, 1974; Platt, 1984; Stack, 1989; Viren, 1996; Lester et al., 1996; Chuang and Huang, 1997; Ruhm, 2000). These studies, like many that immediately followed, converged on the assumption that economic and social factors were likely to influence suicide mortality (Sareen et al., 2011; Walsh and Walsh, 2011; Corcoran and Arensman, 2010; Stuckler et al., 2009; Minoiu and Andrés, 2008; Lucey et al., 2005). At this point, however, there is no debate that economic crisis transform and take lives (Oyesanya et al., 2015). Although the socioeconomic explanations may be categorized by the degree of influence the economic environment is believed to exert upon individuals and societies, the two major global crises that started primarily in developed countries are equally blamed for having a significant impact on health outcomes.

As in 2008, several features of life and death spawning from the United States (US) crash in 1929 suggest that overall mortality decreased for almost all ages, while suicide mortality rates increased in the most recessionary years, 1929, 1932, and 1938 (Anderson, 2011; Stuckler et al., 2011; Tapia Granados and Diez Roux, 2009). Luo et al. (2011), looking at the association between US national trends in suicide mortality and business cycles between the crisis of 1929 and 2008, suggest that suicide rates usually increase during recessions and fall during expansions. In the same vein, this pattern of mortality is confirmed by US death statistics for the period 1972-2006 (Miller et al. 2009; Ruhm, 2000). Increased suicide was also observed in Southeast Asia and Russia during the economic crises of the late 1990s, and in Europe during periods of rapidly increasing unemployment between 1970 and 2007 (Chang et al., 2009; Stuckler et al., 2009; Men et al., 2003). The recent economic downturn has also been associated with short-term increases in suicide in many countries. In Ireland, for example, five years of economic recession and austerity, over a period that coincides with

the current crisis (2008-2012), have had a considerable negative impact on rates of suicide in men and on self-harm in both sexes (Corcoran et al., 2015). In 2009, according to Chang et al. (2013), an analysis of 54 countries showed an excess of 4884 suicides compared with the number expected if the trend in 2000-07 had continued. Excesses of 680 suicides in Spain, 1000 suicides in England and 4750 suicides in the US have also been found in studies assessing the impact of the current economic recession on suicide over the years 2008-10 (Lopez Bernal et al., 2013; Barr et al., 2012; Reeves et al., 2012). Tapia-Granados and Rodriguez (2015) obtain a similar result for Greece (but not for Finland and Iceland), and Ruhm (2015) shows that suicides increase with joblessness, and the effect may have strengthened over the 1976-2009 period. This suggests that recessions are most risky when social safety net programs are weak and people face low social support (Modrek et al., 2013; Stuckler et al., 2010).

Similarly, the above-noted 1997-1998 East Asian economic recession saw a rise in (suicide) mortality in only those countries where governments have not leveraged crisis exposure with increased social expenditures (Chang et al., 2009; Khang et al., 2005). Lending weight to the "social safety net-effect" hypothesis, Suhrke and Stuckler (2012), while evaluating the association of economic cycles with health outcomes in OECD and non-OECD countries, conclude that adverse health impacts are greatest when economic changes are rapid, and social protection and cohesion are weak.

6.3. Variables and discussion

6.3.1 Male and female suicide

Suicide-related mortality rates are used in this study to account for the various factors influencing mental health and measure the effects of macroeconomic fluctuations on mental distress. We note, in connection with our choice of dependent variable, that risk and protective factors for suicide and suicidal behavior vary according to risk groups and across the life span (WHO, 2014; Djernes; 2006; Sher; 2006; Case and Paxon, 2005). Consequently, the mortality data used in this study is for males and females under the age of 65, who are more likely to be affected by changes in the economic environment, and for males and females that are 65 years of age and over, who rarely participate in the labor force and are less sensitive to changes in the economic environment.

We must note, however, that this proxy for human and social well-being—much to our dislike—is expected to misrepresent the true state of population´s mental health (Wittchen et al., 2011; Ruhm, 2000). This is only too evident in Wasserman (2009), where suicides are described as the visible side of a more generalized mental health problem. According to this author´s account, for each suicide there are at least two non-fatal suicide attempts and 100 new cases of depression. But inadequate information on psychiatric morbidity data has

limited—and will continue to limit—the research on economic downturns and mental health to the investigation of suicide.

6.3.2 Social expenditures and suicide-related mortality rates

Unlike some aspects of physical health which are conventionally believed to improve during economic downturns and deteriorate during economic expansions, a systematic review of published studies found that recessions can be significantly damaging to mental health and increase the risk of suicide (Glonti et al, 2015; Oyesanya et al., 2015; Modrek et al., 2013). This suggests that physical health and mental health may move in opposite directions (Ruhm, 2015). Looking at the chain of causation, crisis impacts negatively on government resources and social spending; this in turn leaves households poorer and makes individuals more likely to exhibit suicidal behavior (Sareen et al., 2011; Read, 2010). Yet, according to McDaid and Kennely (2009), the estimated average lifetime cost of each suicide exceeds €2 million in high income countries. For Stuckler (2009), this picture only looks less bleak because European governments cared to invest annually, in specially targeted social assistance, the financial resources deemed necessary for suicide levels not to be critically affected by economic downturns. While making an economic case for public intervention, these findings show that the mental health consequences of economic crisis depend on the level of investment in key areas of social protection (see among others Yur`yev et al., 2011; Stuckler et al., 2010; Marmot et al., 2008).

As with many of the studies examining the existing evidence on the actual and potential impact of recessions on health, we also use these expenditures as a measure for the overall effort exerted by national governments at providing for the primary care of high-risk mental health patients, as well as improving the financial conditions of those in disadvantaged circumstances (Suhrcke and Stuckler, 2012; WHO, 2011; Stuckler et al., 2009; Hagquist et al., 2008). On this account, we disaggregated public social expenditures, as defined and collected by the Organization for Economic Cooperation and Development (OECD), into its social welfare and health components. Accordingly, we evaluated annual data on real (public) health spending (PHS) per capita and real (public) social welfare spending (SWS) per capita, by country, which includes expenditures on family support programs, old age pensions, survivor benefits, housing assistance, unemployment benefits, active labor market programs and support for people with disabilities. To account for lags in response, both variables are introduced in the regressions in one-period lagged form.

6.3.3 Economic control variables and suicide-related mortality rates

As noted above, most of the existing research evaluating mortality in the general population, or in specific age and sex groups, in relation to periods of economic crises does not support the idea that recessions have harmful effects on health (Tapia-Granados and Rodriguez, 2015;

Ruhm, 2007). But recessions generally lead to higher rates of unemployment. This, in turn, has harmful consequences on both the physical and mental health of the unemployed, and on the health of those who remain in employment but face an increased risk of unemployment (Kim et al., 2013; Bargard et al., 2012; Bambra, 2010). A common thread in the literature on the health consequences of recessions is that unemployment itself leads to an increase in mental disorders such as depression and anxiety symptoms. The most consistent results relate to suicides (Barr et al., 2012; Stuckler et al., 2012; Tapia-Granados and Diez Roux, 2009; Miller et al., 2009). There is also ample evidence that working-age males are at the highest risk for suicide following job loss (Alvaro-Meca et al., 2013; De Vogli et al., 2013; Giuntoli et al., 2011). However, this relationship appears to be context specific because the increase in suicides during economic downturns is smaller in countries where the social safety net covers both genders more equitably (Oksuzyan et al., 2014; Modrek et al., 2013; WHO, 2011; Hagquist et al., 2008).

Given the level of information about the process in question, gross domestic product (GDP) growth rates and unemployment rates are introduced in the analysis as a reliable measure of the state of the economy and as a form of accounting for the everyday experiences of those groups of society that are more exposed to labor market fluctuations (Corcoran and Arensman, 2010; Stuckler, 2009; Minoiu and Andrès, 2008). In order to test the significance of both proxies for macroeconomic conditions, data on the unemployment and income growth variables, by country and year, was obtained from the World Bank (2015) World Development Indicators Database.

6.3.4 Social and life-style control variables and suicide-related mortality rates

There is a long history of research speculating that individual family economic shocks (such as job loss) increase the likelihood of family dissolution, which, in turn, increases the probability of suicide risk factors for newly-divorced and their family members (Amato and Beattie, 2011; Doiron and Mendolia, 2011). Thus divorce rates are portrayed in most studies as being positively associated with suicide (see for example Agerbo et al., 2007; Rodriguez, 2005). But vulnerabilities depend on both gender and age. The findings of consistent sex and age differences in suicide mortality suggest that males are twice as likely to commit suicide as females in case of a divorce, while youth-suicide is higher in children living with a divorced parent (Yamamura, 2008; Donald et al., 2006). We note, in connection with the inclusion of this variable, that empirical studies have found that the increased involvement in the labor force by women has forced a redefinition of gender and family relations (Braunstein and Folbre, 2001). Building on this framework, Stevenson and Wolfers (2006) and Bentzen and Smith)2002), show that the extent to which women are actively involved in the labor force is correlated with divorce rates. Given the documented relationship between these two

variables—the degree of women´s participation in the labor force and divorce rates—we opted solely for the latter.

The remaining variables that are thought to have a direct impact on the aggregate suicide rates are introduced in the analysis to control for social and life-style factors. Using the idea put forward by Andrés (2005) and Chuang and Huang (1997) with reference to Durkheim (1951) that societal suicide rates are influenced by social integration and social regulation, the fertility rate is included as an explanatory variable in the regression. In looking specifically at Durkheim´s analysis of facts, the presence of children heightens an individual´s ties to his or her family and to society, making it less likely for that person to commit suicide. Similarly, a role for alcohol has been claimed in many reports. While Stuckler et al. (2009) argues that becoming unemployed worsens alcohol-related harm, a study by the American Psychiatric Association (2003) found alcohol to be present in almost half of all persons who die by suicide. Lending weight to these interpretations, a number of reviews that explore the evidence for alcohol misuse and suicidal behavior conclude that both are highly associated, especially among young males (Norstrom et al., 2012; Walsh and Walsh, 2011; Martin et al., 2010).

6.4 Empirical Strategy and Findings

6.4.1 Data and sample characteristics

To quantify the effect of economic fluctuations on suicide, age-standardized and age-specific suicide mortality rates (SDR) per 100 000 individuals were taken from the WHO (2015) European Health for All database (HFA-DB), under the Disease Classification "Suicide and Self-Inflicted Injury", for each of the 16 countries for which comparative data are available (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain Sweden, and United Kingdom). This covers 1990-2012, although suicide-related mortality data for Iceland and France were available up to only 2009 and 2011 respectively. The above-mentioned data source also provided information on unemployment, measured as the percentage of the total labor force that is unemployed but actively seeking employment and growth in real GDP. Social spending data in the domains of old age, survivors, incapacity related, health, family, active labor market programs, unemployment, housing, and other social policy areas, as defined in the panel, were extracted from the OECD Health Data 2015 edition, expressed in constant (2005) PPP$ per capita. As a final consideration, the dataset for the crude divorce rate and the total fertility rate has been compiled from the Eurostat (2015) statistics database.

To assist with the choice of methodology, Tables 6.1 through 6.3 provide some relevant descriptive statistics for the variables used in Equation (1) and preliminary evidence on the

link between these variables and the various facets of suicide mortality for the 16 European countries included in our study.

Table 6.1: Country-specific average suicide rates for EU15 plus Iceland, 1990-2012 (OECD Health Data, 2016).

(1)	(2) $TSMR$	(3) $MSMR_{0-64}$	(4) $FSMR_{0-64}$	(5) $MSMR_{65+}$	(6) $FSMR_{65+}$
Austria	17.88	23.50	7.27	73.08	18.99
Belgium	18.14	24.41	9.04	51.04	16.10
Denmark	14.66	18.36	7.31	43.96	19.06
Finland	23.22	35.99	10.06	46.26	10.51
France	17.24	22.85	8.02	57.55	16.42
Germany	12.51	16.35	5.19	45.83	15.41
Greece	3.09	4.49	1.03	10.12	2.27
Iceland	12.15	19.26	5.09	16.84	6.15
Ireland	11.45	18.35	4.56	16.15	4.18
Italy	6.38	8.23	2.55	26.76	6.72
Luxembourg	14.58	18.81	7.27	48.91	13.23
Netherlands	9.07	11.38	5.47	21.63	9.32
Portugal	7.11	8.68	2.56	37.38	8.52
Spain	6.98	8.89	2.64	30.06	8.13
Sweden	13.11	17.01	7.19	33.94	11.16
United Kingdom	7.04	11.14	2.90	11.96	4.27

Looking at the raw data (Table 6.1), countries located in Northern and Central Europe have significantly higher average rates of male and female suicide compared to other (Southern European) countries. Along with their respective meanings, summary statistics like the mean and standard of deviation for the variables used in Equation (1) are listed in Table 6.2. Thus, from the output shown on Table 6.2 and supplementary tests of model adequacy (e.g., histogram of residuals and the Jarque-Bera test), we know that some of the variable frequency distributions are not perfectly normal. However, provided that our sample size is relatively large (see, for example, Tabachnick and Fidell, 2001) this lack of normality will not make a substantive difference in the analysis. In this way, except for the growth rate of real GDP, all independent variables are presented in level. However, for our purpose a natural log transformation is applied to the dependent variables used in our specifications.

Table 6.3, on the other hand, measures the degree of pair wise association among the independent variables used in the analysis. As expected, the correlation between each variable and itself is identically equal to 1. All other correlation coefficients have the expected signs and stand fairly distant from 1. This is a typical result when one is not working with highly trended data and an indication that multicollinearity may not be a problem in the model (Pindyck and Rubinfeld, 1998). Regression results are shown in Tables 6.4 and 6.5.

Table 6.2: Variables and general statistics (N = 309)

Description	Notation	Mean	St. Dev.
Dependent variables:			
Age-standardized suicide mortality rates per 100 000 inhabitants			
-All ages	$TSM_{i,t}$	2.351547	0.511905
-Males$_{0-64}$	$MSM0$-	2.663889	0.521874
-Females$_{0-64}$	$64_{i,t}$	1.515925	0.633584
-Males$_{65+}$	$FSM0$-$64_{i,t}$	3.367698	0.652602
-Females$_{65+}$	$MSM65+_{I,t}$	2.095788	0.743681
	$FSM65+_{I,t}$		
Independent variables:			
- Growth rate of GDP per capita (%)		2.284641	2.768661
- Unemployment, total (% of total labor force	$GDPG_{i,t}$	7.595405	3.951163
- Real per capita public social welfare expenditures – lagged	$UEMP_{i,t}$	5267.567	1876.126
(at constant PPPs in 2005 US$)	$SWS_{i,t-1}$	1827.020	658.0094
- Real per capita public expenditures on health – lagged	$PHS_{i,t-1}$		
(at constant PPPs in 2005 US$)		40.37832	16.66431
- Crude divorce rate (per 1000 inhabitants)	$DIV_{i,t}$	1.625178	0.256417
- Fertility rate, total (births per woman)	$TFR_{i,t}$	10.55194	2.236046
- Adult consumption of alcohol, per capita (liters)	$ALC_{i,t}$		

Table 6.3: Correlation matrix of dependent and independent variables

	TSM	GDPG	UEMP	SWS	PHS	DIV	TFR	ALC
TSM	1.00000							
GDPG	0.09958	1.00000						
UEMP	-0.19439	-0.17184	1.00000					
SWS	0.44835	-0.08057	-0.19368	1.00000				
PHS	0.26784	-0.06301	-0.34882	0.78588	1.00000			
DIV	0.51791	-0.10893	-0.15540	0.53097	0.42256	1.00000		
TFR	0.46860	0.08076	-0.37696	0.12366	0.21280	0.21729	1.00000	
ALC	0.20901	0.12398	-0.01298	0.19157	0.18688	-0.06875	-0.23005	1.00000

6.4.2 Model design and methodology

In evaluating suicide mortality in the general population, or in specific age and sex groups, in relation to macroeconomic fluctuations in the European Union, the following model specification was followed:

$$lnSM_{it} = \alpha_I + \beta_1 GDPG_{it} + \beta_2 UEMP_{it} + \beta_3 SWS_{it} + \beta_4 PHS_{it} + \beta_5 DIV_{it} + \beta_6 TFR_{it} + \beta_7 ALC_{it} + u_{it} \qquad (1)$$

Equation (1) relates the natural log of suicide mortality to the growth rate of real GDP (GDPG), the unemployment rate (UEMP), the per capita real social welfare spending (SWS), the per capita public health spending (PHS), the divorce rate (DIV), the total fertility rate (TFR), and per capita alcohol consumption (ALC). While the αI term is time invariant and captures country-specific effects that are not included in the model, the uit is the observation-specific error term. Finally, while annual data on suicide mortality and economic performance were available for most of the European Union countries plus Iceland, over the period 1990–2012, information on health and social (welfare) spending was amply available for sixteen countries only. In addition, observations for one or more variables were missing.

Thus, the subscript i = Austria, ….., United Kingdom and t = 1990, ….., 2012 represent countries and time periods, respectively, for which comparative data are available. The final cross-sectional data set was an unbalanced panel data set with approximately 309 observations. Regressions were performed by means of the statistical software EViews (version 9.0).

Table 6.4: Effects estimates of age-standardized total suicide mortality

	Model 1	Model 2	Model 3
Dep. Variable Methods:	lnTSN Pooled OLS Panel LS	lnTSM Fixed-Effects Panel LS	lnTSM Random-Effects Panel EGLS
Indep. Variables			
C	-0.619151*	1.963434*	1.730091*
GDPG	0.013563**	-0.004509	-0.003707
UEMP	0.001743	0.018831*	0.017624*
SWS	0.000122*	-0.000066*	-0.0000651*
PHS	-0.000310*	-0.0000978*	-0.000129*
DIV	0.011502*	0.004876*	0.005111*
TFR	0.980687*	0.114603	0.177019**
ALC	0.074990*	0.047773*	0.053555*
R^2	0.591321	0.951660	0.429168
Adjusted R^2	0.581817	0.947941	0.415893
S.E. of regression	0.331034	0.116798	0.121080
DW Statistic	0.160692	0.892823	0.794860
F statatistic	62.21712*	255.9273*	32.32866*
Type of Panel	Unbalanced	Unbalanced	Unbalanced
N. of observations	309	309	309
N. of cross-sections	16	16	16
Period	1990-2012	1990-2016	1990-2016
Specification Tests			
F Test Fixed-Effects Hausman test		142.127147*	29.223249*

*, **, *** - significant at 1%, 5%, 10%, respectively.

Bearing in mind the estimation and inference problems associated with panel data analysis, in evaluating Equation (1), eight pre-specified model specifications were estimated, five of these corresponding to another dependent variable (total, and age-specific, male and female suicide mortality rates). Using the overall measure of suicide mortality, the first three models (Models 1-3, Table 6.4) are used to assess alternative estimation techniques by which the data might be pooled.

In making a choice between the fixed effects and random effects approaches, we tested Hausman´s null hypothesis that random effects are consistent and efficient, against the alternative hypothesis that random effects are inconsistent. After having decided that the

fixed effects method of estimation (Model 3) was the preferred specification, a check was made to test whether or not the disturbance term in the original specification followed the classical assumptions, namely (i) that the its variance was the same for all cross-sectional units, and (ii) that it was not serially correlated within and between panels. In the presence of heteroscedasticity and serial correlation, we then proceeded with the adjustments that had to be made to guarantee unbiased, consistent and efficient estimations.

6.4.3 Estimation results

Tables 6.4 and 6.5 summarize our results in models that have been repeatedly used, following Hamermesh and Soss (1974), to estimate the effect of macroeconomic fluctuations on suicide mortality. Using all the available data for the fifteen European Union countries plus Iceland over the period 1990-2012, Table 6.4 emphasizes relationships using three alternative methods of estimation: (i) with a common constant, (ii) allowing for fixed effects (FE), and (iii) allowing for random effects (RE(. With the exception of the common constant method (Model 1), the results for FE and RE models are in accordance with economic theory and the results of previous empirical studies. Before putting too much weight on the results, however, it was important to evaluate the consistency and/or efficiency issue associated with the pooling process. Thus, Table 6.4 also includes a series of unified tests to assist in making a choice between the above-mentioned methods of estimation (Asteriou and Hall, 2007). The "Cross-section F" and "(Cross-section Chi-square" statistic values (142.12 and 659.61) and the associated p-values are highly significant and, therefore, we rejected the null hypothesis that the cross-section effects were redundant. Likewise, the Hausman test clearly rejected the null hypothesis that the random effects were uncorrelated with one or more explanatory variables, for the estimated chi-square value of 29.22 and 7 d.f. was highly significant. Therefore, for the purpose of this study, we focused on fixed effects to estimate total, male and female (0 to 64 years of age and 65 years of age and older) suicide mortality regressions (Table 6.5). For now, however, it is instructive to examine the complete regression output in Model 3 (Table 6.4) carefully.

It is expected that the logarithm of total suicide mortality (lnTSM) tends to be negatively related to income growth, social welfare and health spending (GDPG, SWS, PHS) and positively related to alcohol consumption, unemployment, divorce and total fertility rates (ALC, UEMP, DIV, TFR). In Model 3, while the results are consistent with this notion (six significant t values, an R2 of .917 and a standard error of the regression that is approximately 10 percent of the dependent variable mean), the low Durbin-Watson (DW) statistic indicates that serial correlation is likely to be present in the estimated residual. Likewise, a simple inspection of a graphical representation of the actual and fitted residuals of the benchmark FE model and the unstructured (i.e., not specified as panel) White´s test allows us to conclude that heteroscedasticity is present (we note, in connection with this procedure, that Eviews 9.0 does not provide White´s heteroscedasticity test for panels). This suggests that

unless corrections are made for the presence of serial correlation and heteroscedasticity, parameter estimates are likely to be unbiased and consistent, but they are not efficient.

To improve our results, we re-estimated the total suicide mortality equation (Model 3, Table 6.4) using an iterative non-linear method for estimating generalized differencing results with AR(1) errors to correct for serial correlation, and White´s heteroscedasticity consistent covariance matrix estimators to correct for heteroscedasticity. Additionally, two of the economic variables previously considered in the analysis as having contemporaneous effects on suicidal behavior (namely, social welfare and health spending) are now introduced in this regression in one-period lagged form.

This is justified by the need to account for lags in response to changes in given policy variables, and the need to ensure that we are measuring the effect of expenditures on suicide mortality rather than the effect of suicide mortality on expenditures. Finally, a linear function of time is also included in this regression. Besides capturing possible deterministic trends in the data, it acts as a proxy for common shocks to the model. Consequently, the coefficient estimators reported in Models 4--8 (Table 6.5), which were obtained from the transformed equations, can now be interpreted to be efficient and statistically robust to general assumptions and model specifications.

A comparison of Model 3 (table 6.4) with Model 4 (Table 6.5) makes it clear that the Durbin-Watson (DW) statistic is closer to 2.0, which is indicative of no serial correlation, and the standard error of the regression is smaller (0.095 versus 0.117 before). However, from the specifications just discussed we note that some of the variables which have been identified in the original regression as important do not seem to hold a perceptible impact on total suicide mortality rates (e.g., the per capita alcohol consumption and public health spending terms). As for the remaining explanatory variables, there is no significant difference in the estimated coefficients of the two models. Except for the per capita income growth term (GDPG), all variables maintain the expected signs and all are individually statistically significant (at the 1, 5, and 10 percent levels). For example, since all regression coefficients are interpreted as semi-elasticities, every additional percentage point increase in unemployment and every additional divorce (per 1000 persons) is associated with a 1.6 and .41 percent increase in total suicide mortality rates. Likewise, the effect of a demographic control variable, such as total fertility rate, is positive but marginally statistically significant (at the 10 percent level). More importantly, the empirical results suggest that greater government involvement in social protection programs other than health care has a considerable impact on total suicide mortality rates. Hence, a $100 rise in real social welfare spending (SWSt-1) per capita causes a .623 percent drop in total suicide mortality in the following year. The public health spending term, on the other hand, is negative but only significant at the 60 percent level.

Table 6.5: Fixed effects estimates of age-standardized suicide mortality

Methods:	Model 4 Fixed Effects Panel LS	Model 5 Fixed Effects Panel LS	Model 6	Model 7 Fixed Effects Panel LS	Model 8
Dep. Variable:	lnTSM	$lnMSM_{0-64}$	$lnFSM_{0-64}$	$lnMSM_{65+}$	$lnFSM_{65+}$
Indep. Variables:					
C	2.012016*	2.345458*	0.632487	3.550062*	2.636129*
GDPG	0.002139	0.002172	0.002112	0.000966	-0.015516***
UEMP	0.016174*	0.020878*	0.017016*	0.013323*	0.010995
SWS(-1)	-0.0000623**	-0.0000939*	-0.0000430	-0,0000649	-0.0000111
PHS(-1)	-0.0000445	-0.0000513	-0.0000123	-0.0000759	-0.0000134
DIV	0.004060*	0.004579*	0.004520*	0.002845*	0.004352**
TFR	0.202704***	0.258175**	0.074142	0.120720	-0.065351
ALC	0.019129	0.016236	0.071013*	0.005120	0.028825
TREND	-0.007022	-0.002855	-0.006131	-0.015087*	-0.013396
AR(1)	0.571339*	0.482932*	0.337375*	0.061310	-0.056518
Other Elements:					
R^2	0.966574	0.958899	0.927119	0.861645	0.733828
$AdjR^2$	0.963512	0.955134	0.920442	0.848971	0.709446
S.E. of regression	0.095910	0.107900	0.176217	0.242101	0.394611
DW Statistic	2.088829	1.848094	2.034884	2.243198	2.061816
F Statistic	315.6756*	254.6897*	138.8699*	67.98642*	30.09698*
Type of Panel	Unbalanced	Unbalanced		Unbalanced	
N. of observations	287	287		287	
N. of cross-sections	16	16		16	
Period	1990-2012	1990-2012		1990-2012	

*, **, *** - significant at 1%, 5%, 10%, respectively.

These results were subsequently endorsed by regressions using male and female suicide rates as a dependent variable and coincide with previous panel data studies on the health consequences of recessions internationally (Modrek et al. 2013); Stuckler et al. 2010). However, evidence of the sensitivity of suicide rates to country-specific influences other than social welfare and health spending, alcohol consumption, income growth, unemployment, divorce and total fertility rates is given by the reported unobserved heterogeneity effects ai. The estimated coefficient on the constant term is positive and statistically significant in this case and in all regressions. Final points worth noting in interpreting these results concern the possibilities that the determinants of male and female suicides may not be the same and that suicide as a cause of death may vary greatly by age.

To answer these concerns and bring this macro-level study closer in line with micro-level ones, Models 5 – 8 (Table 6.5) disaggregates total suicide mortality rates by gender and age.

We note, in connection with these results, that our models explain male suicide rates better than female rates and rates in the 0-64 age groups better than those in the 65 and older age groups. For males, the explanatory power of the regression is relatively high in the 0-64 age group but comparatively lower for the 65 and older age group. Not surprisingly the coefficient estimates for younger males appear to drive the results for total suicide rates (Model 4, Table 6.5). This is illustrative of the relatively constant predominance of suicide rates in males over suicide rates in females (males account for the largest share of suicide acts, as is illustrated by the 3.0 to 3.9 male/female ratio of age-standardized European suicide rates), and the fact that currently more young people than elderly people are dying from suicide (WHO, 2014). In relation to control variables, the coefficients on the unemployment, divorce and total fertility rates are positive and significant in the 0-64 age groups, but the coefficient estimate for the latter is negligible among older males.

The empirical findings also imply that higher levels of social welfare spending per capita are associated with lower suicide rates among males, but only in the 0-64 age group. Our estimate for this age group seems to drive the result for total suicide rates since for older males and females the estimated coefficient is negative but only significant at levels that exceed 10 percent—a finding that is in contrast to that of Minoiu and Andrés (2008) for United States panel data. Specifically, a $100 rise in social welfare spending per capita causes male (0-64 years of age) suicide mortality to decline by .94 percent. Finally, looking at the coefficient estimates presented in Table 6.5, we note that the trend variable is negative in both regressions and statistically significant in the regression using senior male suicide rates as a dependent variable (Model 7). This suggests that suicide mortality rates have fallen over time, probably due to advances in mental health management (e.g. timely and effective evidence-based interventions, treatment and support).

For females, the coefficient estimates were generally lower and less significant than for males. For example, while the divorce rate was consistently positive and statistically significant in the 0-64 and 65 and older age groups, the unemployment and alcohol coefficients were positive and statistically different from zero only among younger females (Model 6). It is noteworthy, however, that the income growth term (GDPG) is positive and statistically insignificant in all regressions (Models 4—7) except the one on senior female suicide rates (Model 8). The empirical results suggest that lower income growth is associated with higher suicide rates among older females since the estimated coefficient is significant at the 10 percent level. Hence, from the lack of statistical relevance of most of the variables explaining female suicide rates (Models 6 and 8), we conclude that male suicide behavior is more responsive to adverse economic fluctuations, as opposed to female behavior, and that the proposed model (Equation 1) does not fully account for the determinants of female suicide.

6.5   Discussion and Concluding Remarks

Globally, suicides account for nearly half of all violent deaths in men and nearly three quarters in women. In view of attempts that are never reported and self-inflicted deaths that are officially certified as having resulted from causes other than suicide, experts estimate that the true dimension of this public health problem is even more serious than official figures indicate. In this study, we provide an evidence-based account on this public health issue and make response suggestions based on empirical evidence on the relation between the socioeconomic determinants of a crisis and suicide mortality using data for sixteen European countries over the period 1990 and 2012. Because this dimension of mental health may be affected by a variety of mechanisms that have heterogeneous impacts across segments of the population, we assess the contribution of these variables to explain suicide rates for total, and for males and females in two age groups from 0-64 years to 65 and over. With regard to the choice of econometric technique, Equation 1 was estimated using a fixed-effects (FE) approach, which resulted in biased and inefficient estimates of the coefficients. We then subjected our estimates to a series of transformations, including corrections for serial correlation and heteroscedasticity, and inclusion of lagged values of public social welfare and health spending (SWSt-1 and PHSt-1) to correct for possible biased results.

Our findings support the hypothesis that rising unemployment, higher divorce rates and higher levels of alcohol consumption have led to increased suicide mortality among males and females of all ages. The unemployment rate is statistically significant in all regressions except the one on older female suicide rates (Model 8), while the coefficient on the divorce rate term is statistically significant in all estimations and appears to be the only sociological control variable which is consistently significant in models explaining female suicide rates (Models 6 and 8). Also, we note that only in one case (Model 6) do we find that alcohol consumption is a significant influence on suicide mortality among younger females. For total suicide rates the magnitude of this coefficient is negligible, which is further evidence that the underlying stochastic process describing gender-specific suicide rates may not be the same. More importantly, the empirical results reveal that public spending has a buffering effect on suicide mortality since the estimated coefficients on the government variables are negative in all regressions. We note, however, that social welfare spending (SWS) matters more than public health spending (PHS) when evaluated either in terms of coefficient size or statistical significance. While the social welfare spending term is negative in all estimations and statistically significant in regressions using total and younger male suicide rates as a dependent variable, the statistically insignificant results on the public health spending term suggest that many public health systems and services fail to provide timely and effective help to people most in need of assistance. It is thus suggested that the suicide rate would have climbed higher in the current recession had it not been for the substantial buffering effects of social protection programs on mental health, especially among working-age males and their

children. Moreover, given that most of the explanatory variables are not generally significantly associated with female suicide rates, as opposed to male suicide rates, we conclude that male suicide behavior better reflects this group´s greater involvement in market employment and increased vulnerability to adverse economic fluctuations. Our proposed model specifications, however, are of only limited use in predicting female suicide behavior and hints at the possibility of future research into the determinants of female suicide mortality.

While making a definite case for public intervention, we must note that suicides cost lives, pain and emotional stress. But suicides can be avoided and its prevention should be prioritized as a public health issue. With suicidal risk heightened for people with some mental illnesses, interventions must rely on models of mental health promotion that address the issue at different levels–measures designed to strengthen individuals and family ties, strengthen communities, and reduce structural barriers to mental health. Moreover, given that mental health problems are both a cause and a consequence of social, economic, and environmental inequalities, nothing except the elimination of mental illnesses would contribute as much to a general solution of this problem as would public measures aimed at controlling key aspects of poverty–namely structural unemployment, low levels of education, low income or material standard of living, and poor physical health.

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Chapter 7

7. Summary and future work

7.1. Summary

Discoursing before the Medical Committee for Human Rights in 1966, Dr. Martin Luther King, Jr. is said to have made a statement which, coming from a theologian, was quite startling. "Of all forms of discrimination and inequalities," he said, "injustice in health is the most shocking and inhuman." Although different versions of Dr. King´s quotation regarding injustice in health care have been published over the years, it is clear from this statement that the emergence of an altogether new order of human possibility has brought with it an altogether new order of challenge to constructive ingenuity and to ethical sensitivity. And yet, the major shortcomings of health care systems in the world are becoming more visible, as rising costs and lack of access to health care is contributing to ever-increasing inequalities in health. In light of this, this study aims to contribute to this patient up-building of civility and social justice, by looking at empirical evidence on which to base a judgment on the benefits and costs associated with different types of health outcomes and different spending-policy areas. Using information from Pordata, the World Health Organization (WHO), and the Organization for Economic Cooperation and Development (OECD), and economic concepts from previous empirical research, this study evaluates the health care system of Portugal and a group of other countries, with respect to such fundamental issues as cost and financing of health care, and how well health systems (and its key stakeholders) succeed in producing health outcomes in individuals and populations. The results are reported in five contributions to the literature, each corresponding to a different chapter of this thesis.

In Chapter 2 (Can government add to the demand for health care? Evidence from Portuguese health data, 1970 -2011) we present an introduction to the problematic issue of unsustainable growth in health care spending in most developed nations, and look at key aspects of health systems, particularly the efficiency with which they deliver health care services. Yet no two health systems are alike and each pursues its multiple objectives in a variety of different ways. Given this empirical concern, this item of research uses Portuguese health data and standard econometric techniques to systematically examine the factors that are behind this country´s push for expenditure growth, and in particularly whether government involvement in health care adds to the demand (and costs) for health care.

Although the private provision of health care is thought to reduce the government´s fiscal burden and encourage better resource utilization (i.e., deliver more or better health care services at the same overall costs), we had no a priori knowledge concerning the expected

sign of the coefficient on the government term. The results for this specific case suggest that government participation in health care has no significant impact on the levels of spending. The coefficient estimate on the government variable is positive and numerically small, although not statistically different from zero. Faced with this apparent lack of control of total health care spending, perhaps government can indirectly influence the health care sector by creating an environment that best allocates resources in areas where they can be most effective in improving health and equity in health, while guaranteeing a balance between sustainability and access. The results indicate, however, that real per capita health care expenditure increases with real per capita income (GDP). The coefficient estimate on the income variable is greater than one and statistically different from zero, which suggests that as people (and the country) become wealthier, they are willing to consume more (and pay more) for a given improvement in health status. Unless more decisive action is taken to correct existing imbalances at their roots, this response of health consumption to increases in income poses serious concerns about long-term sustainability of current trends of spending. In addition—although the observed increase in spending seems to occur at diminishing rates—the findings also imply that health care expenditure has increased over time, most likely reflecting the growth of cost-enhancing technologies. Given the possibility that these forces that are driving up costs and demand for health care cannot be easily contained if not though rationing, the case for further increases in spending on health will become harder to make in terms of the returns on this investment. We note, of course, that the marginal product of health care may change over time, and this evidence may be misleading as a guide to future levels of spending. Surprisingly, however, the results indicate that the cost of maintaining previous levels of health may actually decrease as life expectancy increases, which suggests that the onset of disability occurs later in life and at a less rapid rate than the increase in life expectancy at age 65. Although this effect may not be sufficient to offset current imbalances in spending, this implication points to the possibility that less long-term care resources will be required in the future, as the population ages.

But these points may apply to the provision of health care in general, both for individual countries and across countries. Thus, Chapter 3 of this thesis (Health Expenditure and Government Intervention in Health: Evidence from OECD Health Data) extends this analysis to a cross-section of OECD countries using data from 1995-2013. Besides reaffirming that government participation in health care has no significant impact on overall costs and levels of spending, at least for this particular sample of OECD countries, its conclusions are threefold. First, in view of the fact that changes in demography are found to be largely responsible for the rapid expenditure growth in health care, increased spending at current rates should be continued—otherwise average standards of care would actually fall. Second, given that the share of spending that is funded from public (state) sources has decreased over the years as a consequence of the ongoing economic recession, its findings highlight the rising importance of individual (and household) responsibility in providing for their own health care

needs. Third, although higher income leads to higher health care expenditures, the magnitude of the estimated elasticity (.52) suggests that health care has non-luxury good characteristics and thus poses no serious concern to the sustainability of current trends of health care consumption.

And yet, as suggested in Chapter 4 (Living Longer: An Assessment of Euro-Zone Life Expectancy Trends Using a Panel-Data Approach) health systems are designed to promote long and healthy lives. Using life expectancy data from 12 European Union countries as a measure of the actual returns to investment in health care, the results from this study support the view that there is a positive link between health care expenditure (public and private) and health. But according to this study, the financial inputs to health care services are only one of a number of factors determining population life expectancy at birth. Clearly, this measure of health is associated with technical progress and a country´s level of income (GDP). Thus, through a variety of non-health care mechanisms (i.e., better housing, nutrition, education, environmental infrastructure and so on), as income increases so too does health. Likewise, one expects that more government social (cash) transfers—and more disposable income—leads to increased longevity. The results, however, point to a strong negative correlation (and negative elasticity) between government social transfers and life expectancy at birth. One possible explanation for this apparent paradox is that the relationship between disposable income and life expectancy is not all causal. Characteristics other than low disposable income may affect the life expectancies of a growing (less affluent) segment of the population, and thus a less limited and more representative sample of countries (and observations) may be required to draw meaningful policy conclusions from the disposable income-life expectancy relationship.

Equally important, the financial resources that translate into health outcomes may decrease during an economic crisis, with the stock of public health likely to be affected by the economic climate. Thus, Chapter 5 (Crisis Revisited: The 2008 Economic Recession and Age-Specific, Male and Female Mortality in the European Union) evaluates the impact of the recent (2008) economic crisis on overall death rates in Europe, paying particular attention to whether health care delivery systems and social safety nets can be modifiers of the recession-health relation. To answer such important question, this study investigates the effect of socioeconomic and demographic factors on age-specific, male and female all-cause mortality rates using panel data for 15 European Union countries plus Iceland over a period that leads up to, and coincides with the ongoing recession (1990-2011). Unlike the counter-cyclical pattern of health documented during previous recessions, the results show that public health and welfare expenditures are strong predictors of all-cause mortality. Besides yielding literature-consistent, statistically significant and economically meaningful coefficients, the findings show that without social transfers, the current crisis would have produced poorer

health, especially among women, the poor, and their children, and should be accounted for in future inquiry into the determinants of aggregate population health.

Yet these findings for the safety net term may be contested, as multicollinearity and potential undetected confounding may constrain one´s ability to isolate the effects of social welfare spending on population health. To screen for this problem, Chapter 6 ("Death by Economic Crisis": Measuring the Effects of Economic Conditions on Suicide and Self-Inflicted Injury in Europe) models the behavior of age-specific male and female suicide rates over the period 1990-2012, where it is more likely to see a short-term relation between mortality from this cause and social welfare spending. Our findings are in line with the results from the all-cause mortality regressions (Chapter 5), and support the hypothesis that social welfare spending is as relevant, if not more so, than public health spending in moderating increased vulnerabilities to adverse economic shocks, especially for those groups in society that are more exposed to fluctuations in the job market, such as, for example, younger males.

To summarize, in this thesis we conclude that:

> ●With governments responsible for the greater share of health care expenditure and pressures to spend more likely to continue, controlling health care spending is a problem that all developed nations face and one which most governments have to grapple with. To determine the effect of government involvement in health care on costs and spending, we examined health-related expenditure data for Portugal and other countries that belong to the Organization for Economic Cooperation and Development (OECD). Although a more representative set of countries may be required to draw a meaningful conclusion on this relationship, the findings from our research fail to support the basic hypothesis that greater government involvement in or financing of health care leads to lower levels of spending.

> ●However, other factors do significantly influence health care spending. Besides the growth in numbers of the elderly that is likely to add to the demand for health care and the rising costs of new medical technologies, the estimated income elasticity obtained in our research appears to be smaller than unity, suggesting that health care service is a necessary good. Given that the income elasticity for most goods and services is less than unity, this leaves room for future growth in health care spending without the need for sacrificing other forms of public and private spending as long as the economy grows in real terms—although the sustainability or affordability arguments for-or-against higher levels of spending on health care are by no means clear-cut.

●At the same time that governments are unable to directly influence health care expenditures and costs, these may also be unable to influence mortality, as the impact of public spending on health is quite small, with coefficients that are typically both economically un-meaningful and statistically insignificant at conventional levels. We note, however, that there are some limits regarding the interpretation of these findings. It is possible, for example, that increased public spending may have created other welfare gains that were not accounted for in our model specifications. This may have had an additional effect on mortality, and thus, the precise efficiency of publicly funded health care systems may not be given by these results.

●But other roles for governments do in fact exist. Out analysis of econometric panel data covering a period that extends to recent years (1995--2012) among European Union countries found that public intervention in health actually had a less significant impact on mortality outcomes during the recessionary period than did other social welfare programs. Thus, at a time when needs are greater but choices are constrained by lack of means, choosing reforms that increase competitiveness and income (including those that promote jobs and job training) are likely to induce positive changes in health outcomes. These measures may also allow countries to address their fiscal problems now and yield the productivity gain that once more makes it viable to address the moral claims of all present and future generations.

7.2   Suggestions for future research

It is possible that before empirical generalizations can be made and policy implications can be safely drawn, more research is needed on the relationship between government involvement in health care and the performance of the health care sector. However, given that this impact may be different depending on whether government is directly involved in provision and/or financing of medical care, observations used in future research should be arranged according to levels of development and the degree to which their health care systems are regulated or nationalized. Moreover, it may be beneficial for future research to more carefully examine the actual health outcomes arising from health care activities, and the value society places on the benefits of existing care programs, rather than focusing on spending. Provided that governments control the greater share of health care spending, this would help to assess how relevant these activities are to population health and better inform on what comes out of policy-making processes (i.e., the way in which an issue of public policy is defined, discussed, and resolved).