



## Health care expenditure and income in the OECD reconsidered: Evidence from panel data<sup>☆</sup>

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### ABSTRACT

This paper reconsiders the long-run economic relationship between health care expenditure and income using a panel of 20 OECD countries observed over the period 1971–2004. In particular, the paper studies the non-stationarity and cointegration properties between health care spending and income. This is done in a panel data context controlling for both cross-section dependence and unobserved heterogeneity. Cross-section dependence is modelled through a common factor model and through spatial dependence. Heterogeneity is handled through fixed effects in a panel homogeneous model and through a panel heterogeneous model. Our findings suggest that health care is a necessity rather than a luxury, with an elasticity much smaller than that estimated in previous studies.

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### 1. Introduction

Health care expenditure in the OECD<sup>1</sup> varies substantially over time and across countries. From 1970 to 2004, per-capita health expenditure has increased markedly in the OECD with an annual average rate of 11.5%. Such temporal dynamic has been characterized by large differences across countries, leading to marked geographical heterogeneity in the level of spending. For example, a snapshot in 2004 shows that the US, with an average of \$6037<sup>2</sup>, has the highest amount of health expenditure, followed by Switzerland (\$4045), Norway (\$4103), and Germany (\$3169). On the other hand, countries that devote less resources to health care are Turkey and Mexico, with an average per-capita expenditure of \$562 and \$655, respectively. As a share of Gross Domestic Product (GDP), health care spending in the OECD has almost doubled over this period, increasing from 4.9% in 1970 to 8.8% in 2004. However, there is a substantial heterogeneity across these OECD countries. In fact, while several countries continued

to experience an increase in their share in the 80s and 90s, others have experienced modest declines, possibly associated with reforms aimed at limiting the percentage rise in health care spending as a proportion of GDP. Over time, the shares of health care spending as a percentage of GDP, ranged between 2.5 and 7.0% in the 70s, compared to 5.5 and 15.2% in 2004.

Since the work by Kleiman (1974) and Newhouse (1977), income has been identified as the most important factor explaining differences across countries in the level and growth of health care expenditure. Therefore, earlier research focused on measuring the size of the income elasticity of health care, and on its policy implications for the financing and distribution of health care resources. Advocates of health care being a luxury good, argued that it is a commodity much like any other and is best left to market forces. On the other hand, advocates of health care being a necessity, often support the idea of more government intervention in the health care sector (see Culyer, 1988; Di Matteo, 2003). We will review the empirical literature for the OECD countries in the next section. Several empirical studies pointed to the possible non-stationarity of health care spending and income, which in turn cast doubt on prior inference on income elasticity obtained from spurious regressions. This literature focused on studying the time series properties of health expenditure and income, and on assessing whether there exists a long-run relationship between them.

A number of non-income determinants of health care spending have been identified in the literature. For example, the age structure of the population has been traditionally flagged as an important factor in explaining variations of health care expenditure across countries (Leu, 1986; Culyer, 1988). Indicators such as the share of young (e.g., under 15 years) and old people (e.g., above 65 or 75 years) over the

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<sup>1</sup> Organisation for Economic Cooperation and Development.

<sup>2</sup> The levels of total health expenditure per capita shown in U.S. dollars have been adjusted for purchasing power parity (PPP).

active or total population have been included in regression models explaining per-capita health spending. Nevertheless, little evidence exists on a significant effect of these variables (Leu, 1986; Hitiris and Posnett, 1992; Di Matteo and Di Matteo, 1998; Grossman, 1972). Another determinant of health expenditure is the extent to which health care expenditure is financed by the government, though only few empirical studies support its effect on health care spending (Leu, 1986; Culyer, 1988; Hitiris and Posnett, 1992).

Microeconomic theory emphasizes the role of real prices for health care services in determining the demand for health care (Grossman, 1972). A positive effect of relative prices on health spending would support the so-called Baumol (1967) cost disease theory that productivity in the health sector is low relative to other sectors. Hence, prices for health services will rise relative to other prices because wages in low productivity sectors must keep up with wages in high productivity sectors. However, there is no empirical consensus on the effect of real prices on health care spending. See (Hartwig, 2008; Okunade et al., 2004), who report a positive and statistically significant effect, and (Gerdtham et al., 1992; Murthy and Ukpolo, 1994) who report an insignificant effect. Yet, there are skeptics who do not recommend the use of price indexes in health care, especially across countries that provide health care at no cost or at very low cost, see Berndt et al. (2000). In fact, Hartwig (2008, p.6) argues that “...we have to recognize that medical care price indices can probably not be relied on as deflators or explanatory variables.” Given the paucity of data on price across the OECD, the diverse national schemes of price regulation, and the problems with measuring quality of health care in obtaining this medical price index, we decided not use this variable in our empirical analysis (see Section 5).

Since the work by Newhouse (1992), technological progress has been seen as an important driver of health care expenditure. However, very few studies have attempted to study the relationship between technological progress and health care expenditure due to the difficulty of finding an appropriate proxy for changes in medical care technology. A number of proxies have been considered in the literature, such as the surgical procedures and the number of specific medical equipment (Baker and Wheeler, 2000; Weil, 1995); the R&D spending specific to health care (Okunade and Murthy, 2002); life expectancy and infant mortality (Dregen and Reimers, 2005). Some other papers have proxied the effect of technical change by adding a time index (Gerdtham and Lothgren, 2000), or time-specific intercepts (Di Matteo, 2004) in the regression specification.

To summarize, while income has been recognized as an important determinant of health care spending, there is still no consensus on which other factors may be associated with the remaining largely unexplained variation in per-capita health expenditure.<sup>3</sup> Some attribute this failure to identify other non-income determinants to the limited availability of health care data at the macro level, others even blame the weakness of the econometric methods used, or the informal economic theory used to model per-capita medical care expenditure (Wilson, 1999).

This paper studies the long-run economic relationship between health care expenditure and income in the OECD countries, ultimately assessing whether health care is a luxury or a necessity. Using a panel of 20 OECD countries followed over the period 1971–2004, we investigate the non-stationarity and cointegration properties between health care spending and income. The dynamics of health expenditure and income and their relationship are investigated by estimating a heterogenous panel model with cross sectionally correlated errors. Initially a factor structure is included in the econometric specification with the intent to synthesize the effects of shocks that may hit health spending and that are not directly measurable by the econometrician, such as advances in

medical care technology, policy shifts, new diseases, and shifts in preferences and expectations by users of health services. The factor structure can capture any contemporaneous correlation that arises from the common response of countries to such unanticipated events. We then model cross-section dependence by assuming that the regression errors follow a spatial autoregressive process. Indeed, consumption of health care resources of a single country may be related to unobservable general population characteristics of neighbouring countries. Another explanation for the geographical concentration of health spending is the diffusion of technology across countries (see for example Skinner and Staiger, 2005). A very recent strand of literature has recognized that cross-section dependence is an important characteristic of health data, and has tried to incorporate it in their models (Jewell et al., 2003; Freeman, 2003; Carrion-i-Silvestre, 2005; Wang and Rettenmaier, 2006; Chou, 2007). We also check the robustness of our results by including in the regression specification variables recognized by the literature to play an important role, such as government expenditure on health, and the age structure. The aim is to assess income elasticity more accurately, controlling for various alternative forms of cross-section dependence, as well as non-income determinants of health expenditure.

The plan of the paper is as follows. Section 2 summarizes the prior empirical results on this topic. Section 3 introduces the econometric methods adopted. Section 4 presents the data. Section 5 summarizes our empirical results, and points to some of the limitations of our study. While, Section 6 gives our concluding remarks.

## 2. Income elasticity in the OECD

This short review summarizes some of the existing studies that have used panel data sets to measure the relationship between health care spending and income in the OECD.

We start with Gerdtham et al. (1992) who estimated a regression for health care spending as a function of GDP and a number of other variables, including institutional and socio-demographic factors. Using data on 20 OECD countries over the period 1960 and 1987, they estimated an income elasticity that is larger than one, thus finding that health care is a luxury good. This finding is in line with previous results based on a single cross section (e.g., Kleiman, 1974; Newhouse, 1977; Leu, 1986). Using the same data, Hitiris and Posnett (1992) estimated a regression model for health care expenditure and income, controlling for unobserved heterogeneity by adding country-specific effects. They measured an income elasticity close to one, thus questioning the luxury attribute of health care raised by Gerdtham et al. (1992). As observed by Hansen and King (1996), one limitation of the above studies is that they have ignored the possibility of non-stationarity in health data and income. Using the same data set as Gerdtham et al. (1992), they computed Dickey Fuller statistics for health care spending, GDP, and residuals from a regression of GDP on health expenditure, for each country separately. While detecting non-stationarity for health care spending and GDP for the majority of OECD countries, they did not find evidence of cointegration among the variables. Using data on 24 OECD countries observed over the period 1960 to 1991, Blomqvist and Carter (1997) computed the Phillips and Perron *t*-ratios for health care spending and GDP and for regression residuals. The authors conclude that their results cast doubt on pooling and upon the notion of an elasticity larger than one.

McCoskey and Selden (1998) revisited the work by Hansen and King (1996), applying for the first time non-stationarity tests that exploit the panel nature of the OECD data. The low power of country-by-country tests employed in previous studies is one of the major motivations for the use of panel unit root tests. Specifically, McCoskey and Selden (1998) computed the tests by Im, Pesaran, and Shin (2003), and rejected the joint hypotheses of unit root in *all* countries for both health care spending and income, though observing that results are sensitive to the inclusion of a time trend in the augmented Dickey–Fuller equation. Using data on 21 countries followed over the years

<sup>3</sup> For example, one might prefer to use wealth, rather than income, as key determinant of health spending. However, it is very difficult to construct measures of wealth that are comparable across countries.

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