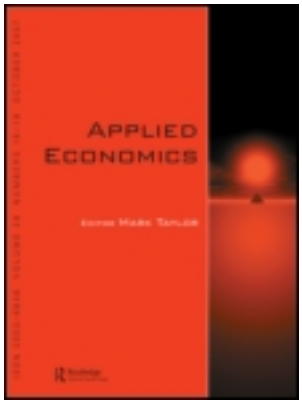

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Does morbidity matter? Perceived health status in explaining the share of healthcare expenditures

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Does morbidity matter? Perceived health status in explaining the share of healthcare expenditures

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We argue that the demand for healthcare services can be better explained by individual need based variables rather than by macro variables such as the Gross Domestic Product (GDP) per capita and the share of public healthcare expenditures. This study introduces a self-rated health variable called *morbidity* that describes individual needs for health care – healthy individuals *need* less health care than sick ones – and that is measured through personal interviews conducted by the Organization for Economic Co-operation and Development (OECD). In addition, stationary properties of the series are considered in order to understand the effect of shocks to expenditure behaviour on health care. Stationary test results show that we should not only use differenced values for the model variables but also incorporate time-specific effects into the model. Using the appropriate specification and accounting for the time effect, we find evidence supporting the hypothesis that the share of healthcare expenditure in GDP rises with the increased *need* for health care. The *need* for health care is also found to be more important than per capita GDP when explaining the change in the share of healthcare expenditures for the examined countries.

Keywords: healthcare expenditures; morbidity; two-way model

JEL Classification: I10; H51; C23

I. Introduction

Former studies have concentrated on the effect of income on healthcare expenditures. For example, in his study of 13 Organization for Economic Co-operation and Development (OECD) countries, Newhouse (1977) found Gross Domestic Product (GDP) to be the only factor that matters for healthcare expenditure levels. However, countries with similar levels of income offer different levels of healthcare expenditure share in their GDP. Among OECD countries, for example, annual per-capita spending on healthcare services is 1535 USD in Spain, 2297 USD in Finland and 5635 USD in the USA; whereas, the share of health expenditure in GDP is about 7.7% in Spain, 7.4% in Finland and

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15% in the USA.[1] In other words, while countries with a higher GDP tend to spend a greater proportion of their GDP on health care, there is wide variation, as GDP is not the sole factor influencing health expenditure levels. Hence, many researchers find it counterintuitive to conclude that income is the only factor that determines the level of health spending and look for new factors that may affect healthcare expenditures (Kleiman, 1974; Leu, 1986; Culyer, 1988; Gerdtham *et al*., 1992). For example, Leu (1986) proposed that an increase in the size of the public share would increase spending on healthcare services. Two reasons for this proposition are the typical incentives of bureaucrats for maximizing institutional budgets on public choice literature and the moral hazard problems of individuals on insurance markets. As a proxy for the *need* for health care, Leu (1986) used a ratio of the number of people under 15 and over 65 to the rest of the population, because very young and very old people generally require more medical attention. Along with income and public financing, Gerdtham *et al*. (1992) found significant effects of urbanization for 19 OECD countries. A much more ambitious study follows by Gerdtham *et al*. (1998) in which they examined the effects of different institutional structures and social and behavioural dynamics on health expenditure levels, using data for 22 OECD countries for the period 1970 to 1991. They found that income, tobacco consumption per capita and the percentage of public in-patient care expenditure in total expenditure had positive effects on healthcare expenditures.

Recent studies, however, rather than questioning existing and/or additional factors that may explain healthcare expenditures, focus on the appropriateness of the econometric methods used in the estimations (Hansen and King, 1996; Blomqvist and Carter, 1997; McCoskey and Selden, 1998; Gerdtham and Lothgren, 2000; Roberts, 2000). While many of these studies question the stationary properties of using levels in regressions, some question the simultaneity problem in the models.[2]

This study introduces a new indicator as a proxy for the need for healthcare in order to explain the share of healthcare expenditures in OECD countries, along with existing factors that are widely discussed in the literature. This is a relatively direct measure, when compared to the existing variables for the need for health care: that is, the 'perceived health status (morbidity)' measure. This *morbidity* variable was measured in personal interviews conducted by the OECD by asking the respondent: 'Would you say your health is excellent, very good, good, fair or poor?' The ratio of the population who answered that his/her health status was good, very good or excellent is reported as the *morbidity* variable. We believe this measure to be a better proxy than the other measures for estimating the *need* for health care.[3] By using this variable in our estimations, we place the arguments in a more individual/self-framework in explaining the (demand for) healthcare expenditures.

The remainder of this article is organized as follows: Section II describes the data and the model along with the discussions of the appropriate specification of the model. Section III discusses the stationary process and employs the two-way panel model; the estimation results are also presented in this section. Section IV provides our conclusions and suggestions for further research.

II. Data and the Estimation

The data were obtained from the OECD Health Data (2006) database, released in October 2006. This database includes extensive health and health systems information at a micro-level for 30 OECD countries. Among 10 main parts of healthcare statistics, we focus on the variables regarding self-reported perceived health status (morbidity), expenditure on health (total and public expenditures), demographic references (population age structures) and economic references (GDP).

As our main concern is the effect of perceived health status – morbidity – by individuals, we consider five OECD countries: Finland, the Netherlands, Sweden, the US and the UK in our estimations. Morbidity data were available from 1983 to 2004 for these countries, with no missing information except for the UK, which presented data from 1991 to 2004. Other OECD countries present morbidity variables, but data are scattered for these

[1] OECD Health Data (2006). GDP per-capita values for 2006 for Spain, Finland and USA were about 27 K, 40 K and 44 K USD, respectively, in 2006.

[2] As health care is a normal good, for example, a higher per-capita GDP results in an increase in per-capita healthcare expenditures. In addition, higher healthcare expenditures can be regarded as a positive investment in human capital, and, in turn, as an input to production, which causes an increase in GDP. Healthier individuals are more energetic and physically and mentally robust, and thus more productive. They are also less likely to be absent from work due to illness.

[3] See McGee *et al*. (1999), Burstrom and Fredlund (2001), Heistaro *et al*. (2001) and Hillen *et al*. (2000) for the positive relationship between self-rated and actual health outcomes.

Table 1. Descriptive statistics of dependent and independent variables for five countries

Variables		Finland	The Netherlands	Sweden	UK	USA
Share of health care expenditures in GDP	Mean	7.40	7.93	8.50	6.73	12.51
	Median	7.25	7.90	8.35	6.90	13.10
	Min	6.70	7.10	8.10	5.90	9.90
	Max	9.00	9.20	9.30	8.10	15.30
GDP per capita	Mean	19 889	21 900	21 201	19 562	26 707
	Median	18 269	21 134	19 902	18 410	26 040
	Min	12 004	12 419	12 995	10 669	15 008
	Max	29 778	32 978	31 139	30 822	39 772
Share of public healthcare expenditures in total healthcare expenditures	Mean	77.6	67.4	87.7	83.8	42.8
	Median	76.5	67.5	87.2	83.9	43.6
	Min	75.1	62.3	84.9	80.4	39.6
	Max	81.1	73.6	91.6	87.4	45.7
Share of elderly people in total population	Mean	0.138	0.129	0.174	0.156	0.123
	Median	0.138	0.130	0.175	0.158	0.124
	Min	0.122	0.117	0.166	0.149	0.116
	Max	0.155	0.138	0.178	0.160	0.127
Morbidity	Mean	67.80	78.78	75.41	75.31	89.75
	Median	66.95	78.60	75.55	74.85	89.50
	Min	65.70	77.00	72.40	74.20	88.60
	Max	74.60	80.90	77.80	77.20	90.90

countries, and hence, we exclude them from our data set.

We explain the healthcare expenditures in terms of the share of healthcare expenditures in GDP. The first explanatory variable in our model is GDP per capita. We expect to see that the share of healthcare expenditures in GDP increases as a nation gets wealthier. The second and third variables are the share of public healthcare expenditures in total healthcare expenditures and the share of elderly people in total population. In general, old and very old require more health care than young and middle aged. Many studies use the percentage of population over 65 as a proxy for this demographic shift. Most studies have concluded that ageing societies are spending more on health services.[4] The last variable in our model is our primary interest 'morbidity'. Even though it is almost certain that other factors including lifestyle of individuals and disease incidences,[5] environment and climate of the countries can affect health spending, data availability and other econometric problems have caused us to limit our analysis on our main interest 'morbidity'. Table 1 presents descriptive statistics for these variables.

Among these variables both healthcare expenditure and GDP exhibit nonstationary series (Hansen and King, 1996; Blomquist and Carter, 1997; Gerdtham and Lothgren, 2000). However, we should note that the reliability and accuracy of the health expenditure data have been questioned by many researchers. Especially heterogeneous definition of the 'health care' across countries and across time for the same country is a widespread problem. For example, expenditure for nursing homes are included in statistics of some countries while is not included in other countries.[6] Nevertheless, all the variables in our model exhibit strong trends and are not stationary. Nonstationarity invalidates classical estimation procedures, which ignore the time-series properties of the variables, leading to inconsistent estimates. Therefore, a naive application of regression analysis may yield spurious results.

Stationarity properties of the series are essential for understanding the nature of shocks to the expenditure behaviour on health care. Differencing or de-trending can produce stationary series, and tests can be performed using a conventional *t*-test with a revised set of critical values that were derived by

[4] See for example Gerdtham *et al.* (1992).
[5] Recent analyses by the WHO show that countries vary considerably on disease incidences. If individuals in a country get sick frequently, the need for health care and health spending is usually high (WHO, 2009).
[6] See Kanavos and Mossialos (1999) and Gerdtham and Jönsson (2000) for more discussion about the issue.

Table 2. Panel unit-root test results including individual and time-specific effects for ΔHCE, ΔGDPK and ΔPUBHE

Specific effects	τ	Adj. τ LL1	Adj. τ LL2	τ IPS
ΔHCE				
Individual specific effects	−2.15	−1.10	0.66	−1.20
Individual and time-specific effects	−13.78	−14.10	−12.34	−2.48
ΔGDPK				
Individual specific effects	2.87	4.52	6.27	1.07
Individual and time-specific effects	−30.04	−32.28	−30.52	−1.84
ΔPUBHE				
Individual specific effects	−1.45	−0.31	1.44	−1.18
Individual and time-specific effects	−33.84	−36.53	−34.77	−2.36

Notes: Unit-root panel test critical values when specific effects are included for $N = 5$ and $T = 25$ are −4.76 and −4.26 at 1% and 5% significance levels, respectively, where N stands for number of countries, and T stands for time period. Critical values of IPS t-statistics for DF regressions containing only an intercept when $N = 5$ and $T = 25$ are −2.46 and −2.18 at 1% and 5% significance levels, respectively. Adj. τ stands for adjusted t-statistics.

Dickey and Fuller (1981). Cointegration is another application that produces stationarity. Nonetheless, it is well-known that these tests have low strength unless the number of observations is large. However, recent studies that emphasize the low power of univariate tests have found that stationarity can be achieved for both healthcare expenditures and GDP with a panel unit root approach (Blomqvist and Carter, 1997; McCoskey and Selden, 1998; Gerdtham and Lothgren, 2000). These findings are questioned by other researchers in terms of the omission of time trend in the analyses (Hansen and King, 1996; Jewell *et al.*, 2003). Most panel tests apply the Im, Pesaran and Shin (IPS, 1997, 2003) test (e.g. McCoskey and Selden, 1998), and some include structural breaks (e.g. Jewell *et al.*, 2003; Carrion-i-Silvestre, 2005).

III. Estimation Results

Stationary process

Following the literature, we start by examining the stationarity of the variables in our model at the country level, with a panel approach. A panel approach improves estimation efficiency by including a large number of data points in the regression and utilizing the variation across individuals. We use the panel approach and employ two specifications of the Augmented Dickey–Fuller (ADF) equation: first with individual effects only, then with both individual and time-specific effects. Including time-specific effects is no different than allowing for a structural break in each year that is common to all countries in question. This inclusion should reflect technological advances, which lead to large increases in healthcare expenditures.[7] New medical techniques and treatments and innovations in pharmaceutical products, such as the development of Magnetic Resonance Images (MRIs) and arthroscopic medical procedures and the introduction of expensive heart diseases drugs, have been responsible for rising health expenditures. Thus, by including time-specific effects, we can surrogate technological improvements in the health sector.[8] Table 2 presents the stationarity results for the change in the share of healthcare expenditures in GDP (ΔHCE), the change in GDP per capita (ΔGDPK) and the change in the share of public healthcare expenditures in total healthcare expenditures (ΔPUBHE).[9]

We obtained the adjusted t-statistics, stated as LL1 and LL2, after correcting for the negative bias of the t-values, as Levin and Lin (1992, 1993) suggest. According to the adjusted t-statistics, the presence of the unit root is not rejected for all the variables when individual specific effects are accounted for. Thus, country-specific variation does not achieve stationarity for the series when panel tests are conducted. The IPS test also supports this result.

[7] Structural breaks specific to individual countries can be captured by other indicators such as public healthcare expenditure, because such expenditure correlates with fluctuations in the business cycle in that country. We note that IPS tests can be sensitive to the inclusion of structural breaks and should be approached with a substantial degree of skepticism.
[8] See Matteo (2005) for a discussion of the significance of technological innovations.
[9] The share of elderly people in the total population and the morbidity variables are stationary; therefore, the differenced values are also stationary, regardless of the specific effects.

Table 3. Panel estimation results with a two-way model

	OLS	GLS		Test statistics
		Fixed effects	Random effects	
Dependent variable: ΔHCE				
Constant	0.2945***	0.3764***	0.3646***	
	(4.71)	(5.62)	(3.28)	
ΔGDPK	−0.16E−03***	−0.26E−03***	−0.24E−0.3***	LM-statistics = 22.90
	(−3.04)	(−4.03)	(−4.35)	Favours GLS over OLS
ΔPUBHE	0.0755***	0.0314	0.0436**	
	(3.41)	(1.61)	(2.34)	
ΔOPOP	−30.15	−23.14	−22.78	Hausman's $\chi^2 = 8.79$
	(−1.45)	(−1.12)	(−1.18)	Favours GLS random effects model with a probability value of 0.07
ΔMORB	−0.0257	−0.0286*	−0.0257*	
	(−1.37)	(−1.77)	(−1.66)	

Note: *, ** and *** denote significance levels at 10, 5 and 1% levels, respectively.

On the other hand, when both individual and time-specific effects are included in the model, we achieve stationarity for all series.[10] The results suggest that while a country-specific effect by itself does not help us to understand the behaviour of the share of healthcare expenditures, the per-capita GDP, or the share of public healthcare expenditures in total healthcare expenditures, country differences including time-specific effects play an important role in explaining the behaviour of the series.[11] Indeed, new medical technology places further demands on health systems. For example, the introduction of a new technology, such as a new drug or operation method, which can provide opportunities for previously untreatable patients, would enlarge the potential market size for health care. Accordingly, in the remainder of the study, we use the differenced values of the variables with time-specific effects.

The two-way model

The appropriate specification of the model to estimate the share of healthcare expenditures is as follows:

$$\Delta \mathrm{HCE}_{it} = \beta_0 + \beta_1 \Delta \mathrm{GDPK}_{it} + \beta_2 \Delta \mathrm{PUBHE}_{it} + \beta_3 \Delta \mathrm{OPOP}_{it} + \beta_4 \Delta \mathrm{MORB}_{it} + \varepsilon_{it}$$

In this model, i denotes the country, t denotes the year and ε_{it} states the disturbance with zero mean and σ^2 variance. ΔHCE defines the change in the share of healthcare expenditures in GDP, ΔGDPK defines the change of per-capita GDP and ΔPUBHE is the change in the rate of public healthcare expenditures in the total health expenditures. ΔOPOP defines the change in the proportion of people over age 65 in the total population, and ΔMORB defines the change in the morbidity; simply, it indicates whether people feel better or worse about their health since the previous year.

Stationary test results showed that we should not only use the differenced values for the model variables but also incorporate time-specific effects into the model. This is because, regardless of the differencing, the omission of time-specific effects leads to nonstationary series. Therefore, we applied the fixed-effects model for a two-factor design including an overall constant as well as a 'group' effect for each group and a 'time' effect for each period. The two-way model produces the estimates in the same fashion as the one-way model does.

We reported the two-way model results in Table 3, including both Ordinary Least Squares (OLS) and Generalized Least Squares (GLS) estimation results with test statistics. The reason we report both estimations is that there may be some exogenous factors omitted from the list of independent variables

[10] In a simulation study, Karlsson and Löthgren (2000) found that for small-t panels, LL-tests exhibit distortions. However, based on our results, t-values are large enough to model the series as stationary when time-specific effects are accounted for. See Maddala and Wu (1999) for arguments about the shortcomings of Levin and Lin tests and of IPS tests and for a comparison of these two tests with the Fisher test. Also see Banerjee (1999) for an overview and discussion of these tests. Also see Im *et al.* (1997) for a power comparison of Levin and Lin tests with t- and LM-tests for different N and T and when errors are serially correlated.

[11] These results are consistent with the studies of Hansen and King (1996) and Jewell *et al.* (2003).

or they may be correlated with health expenditures, and if these variables are not correlated with the right-hand side variables, both OLS and GLS will be consistent, but OLS will be inefficient. However, if these variables are correlated with the right-hand side variables, OLS is consistent, but GLS is not. The Lagrange Multiplier (LM) and Hausman's χ^2 test statistics help us to favour one of these models by testing the orthogonality of the random effects and the regressors. The null hypothesis states no correlation; thus, low values of the test suggest a statistical preference for a random-effects model specification.[12]

The findings suggest three determinants that may explain the change in the share of healthcare expenditures: First, the change in per-capita GDP has a negative, significant, but negligible effect on the share of healthcare expenditures. The data show that the share of healthcare expenditures in the examined countries generally increases each year, however, at a decreasing rate. With the time effect, we observe an increase in the share of healthcare expenditures with a slower growth, in the examined countries.[13]

Second, as the perceived health status of individuals in a country rises, the share of health spending declines. According to our estimation results, a 1% rise in the ratio of population responded to the survey as healthy, lowers the share of healthcare expenditures by 2.57 base points. Indeed, healthy people who feel they are healthy are generally healthier than individuals who do not feel they are healthy. One interesting finding is that the perceived health status of individuals is an important factor with GDP; however, the effect of a change in the perceived health status of individuals is more important to healthcare expenditures than a change in GDP.

Third, the ratio of public healthcare expenditures to total healthcare expenditures has a significant effect on the change in the shares of healthcare expenditures. An increase in the ratio by 1% is estimated to increase the share of healthcare expenditures about 4.36 base points. Public financing naturally reduces the price paid by the consumers of medical services. Similar to moral hazard problem in insurance markets that decline in the price paid by the consumer might cause the overconsumption of health care services. Gerdtham and Jönsson (2000) separate these effects as static and dynamic effects. Faced with less than full price, consumers tend to utilize health services even if the benefits are small (Pauly, 1968). Zweifel (2000) notes that in the health economics literature static effects are confirmed beyond doubt. Specifically RAND Health Insurance Experiment estimated the pure price elasticity for medical care as −0.2. In addition to that static effect which results overutilization of health care services there is also a dynamic effect. Overutilization of health care services in the short run creates a potential market for new and more expensive medical technology in the long run (Weisbrod, 1991). Thus it has been argued that public financing would increase the demand and thus expenditure for health care (Leu, 1986). Moreover, Leu argued that public financing is expected to increase the medical care spending because of two more reasons. First one is due to typical incentives of bureaucrats for maximizing institutional budgets on public choice literature. Second one is the presumed inherent inefficiency of public institutions compared to private companies. However, on the first point relying on political choice making process arguments Buchanan (1965)[14] suggested the opposite effect of public financing on health expenditures. Culyer (1988) noted that private companies are not necessarily more efficient than public agencies. Moreover, when governments pay a significant portion of health spending, they might take actions to lower the prices of health services. Previous empirical studies on that issue have mixed results.[15] Our results suggest that positive effects of public financing on health spending is more dominant than negative effects.

[12] Although our tests suggested that the omission of time-specific effects would lead to a nonstationary process, we also applied a one-way model. Thus, we included only the country effect in our panel estimation. According to the estimation results, the morbidity variable provided no statistically significant explanation for the share of healthcare expenditures in explaining the share of healthcare expenditures. The results suggested that GDP per capita and public share were the only factors that could explain healthcare expenditures. However, note that the inclusion of time-specific effects into the model in addition to the country-specific effects greatly improved the test statistics.

[13] Another way of interpreting a negative coefficient would be to look at short-term effects. When the economy grows quickly, people may feel healthier and need less medical attention. In addition, the higher opportunity cost of missed working days or the decrease in productivity due to treatment might encourage individuals to postpone treatment for their health problems. On the other hand, stagnant economies cause personal stress levels to rise. Indeed, physiological stress is believed to be a strong trigger for significant health problems, such as diabetes and cancer. Thus, people may need more medical attention but may spend less on health care when the economy grows quickly.

[14] His argument is based on political decision-making process.

[15] For a study which found negative effect of public financing on medical spending see Gerdtham *et al.* (1992). For a study which found positive effect of public financing on medical spending see Leu (1986).

IV. Conclusion

This article highlights the factors that may explain the share of healthcare expenditures in the OECD countries. In addition to the factors used in existing models, this article adds a relatively direct measure of healthcare expenditures by using a 'perceived health status (morbidity)' indicator that defines the *need* for health care. It also defines the appropriate specification of the model and accounts for time-specific effects when investigating the relationship between the share of healthcare expenditures and the factors in question.

Following the attempt to designate the correct specification of the model, (hence, employing panel unit root tests), we find that the inclusion of time-specific effects, which mimics technological advances, into our panel approach improves the test statistics greatly when compared to the model that includes group effects only. In addition, the panel results for stationary series suggest that in addition to the change in per-capita GDP, the perceived health status of individuals also has a significant effect on the change in the share of health expenditures. As the perceived health status of individuals in a country declines, the share of health spending in GDP increases.

In conclusion, factors that define the *need* for health care relatively directly are found to be more important than per-capita GDP when explaining the change in the share of healthcare expenditures for the five examined OECD countries. Among these variables, an individual-based variable – such as the change in the morbidity – was more effective in explaining the share of healthcare expenditures when compared to the other measures.

One extension of this study could be to examine such relationship by accounting for the endogeneity problem. We were aware that estimating the relationship with OLS would overestimate the slope of the true relationship, if there was a potential simultaneity between the dependent variable and the regressors. Because healthcare is a normal good, for example, a higher per-capita GDP increases per-capita healthcare expenditures. In addition, higher healthcare expenditures can be regarded as a positive investment in human capital; and a positive investment in human capital, as an input to production, causes an increase in GDP. Healthier individuals are more energetic and robust physically and mentally, and thus, more productive. They are also less likely to be absent from work because of illness. This potential simultaneity between the two indicators should be accounted for in empirical studies. Nevertheless, many studies that analysed the causality between income and health indicated such a problem (Chapman and Hariharan, 1994; Devlin and Hansen, 2001; Nair-Reichert and Weinhold, 2001; Hurlin, 2004). We also found that this problem exists for the levels of the series. However, defining the series in terms of shares and differences eliminated this problem from our analysis.

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