Eur J Health Econ
DOI 10.1007/s10198-010-0221-y

ORIGINAL PAPER

Health care expenditures and gross domestic product: the Turkish case

Seher Nur Sülkü · Asena Caner

Received: 2 July 2009 / Accepted: 19 January 2010

Abstract Our study examines the long-term relationship among per capita gross domestic product (GDP), per capita health expenditures and population growth rate in Turkey during the period 1984–2006, employing the Johansen multivariate cointegration technique. Related previous studies on OECD countries have mostly excluded Turkey—itself an OECD country. The only study on Turkey examines the period 1984–1998. However, after 1998, major events and policy changes that had a substantial impact on income and health expenditures took place in Turkey, including a series of reforms to restructure the health and social security system. In contrast to earlier findings in the literature, we find that the income elasticity of total health expenditures is less than one, which indicates that health care is a necessity in Turkey during the period of analysis. According to our results, a 10% increase in per capita GDP is associated with an 8.7% increase in total per capita health expenditures, controlling for population growth. We find that the income elasticity of public health expenditures is less than one. But, in the case of private health care expenditures, the elasticity is greater than one, meaning that private health care is a luxury good in Turkey.

Keywords Health care expenditure · Income elasticity · Cointegration · Health care reform · Turkey

JEL Classification I11 · H51 · C22

S. N. Sülkü
Turkish Ministry of Health, Mithatpaşa Cad. No. 3, Sıhhiye, Ankara 06434, Turkey
e-mail: sehernur.sulku@saglik.gov.tr

S. N. Sülkü
Econometrics Department, Karadeniz Technical University, Trabzon 61080, Turkey

A. Caner (✉)
Department of Economics, TOBB-Economics and Technology University, Söğütözü Cad. No. 43, Söğütözü, Ankara 06560, Turkey
e-mail: acaner@etu.edu.tr

Introduction

For policymakers, it is crucial to know the long-term relationship between national income and health expenditure. Knowing this relationship enables them to make judgements on how much aggregate health expenditures will change in the coming years, based on a forecast of the trend in national income. It helps policymakers to plan health reforms and to allocate resources efficiently. Although there are many studies on the links between health expenditures and gross domestic product (GDP) in OECD countries, not much is known about the case in Turkey—itself an OECD member. Studies using OECD data have excluded Turkey due to data availability or data comparability issues.

In this contribution, we examine the long-term relationship among per capita GDP, per capita health expenditure and population growth rate in Turkey during the period 1984–2006, using the Johansen multivariate cointegration technique. To the best of our knowledge, Kiymaz et al. [15] is the only study in the literature that examines this link in Turkey. These latter authors used data for the 1984–1998 period from the OECD Health Data 2002 and found that the GDP elasticity of health expenditures is greater than one, thereby reaching the conclusion that health care is a luxury good in Turkey. However, after

Published online: 12 February 2010

1998, some major events and policy changes that had a substantial impact on income and health expenditures took place in Turkey. These events and policy changes are so important that they have surely affected the relationship between income and health expenditure; therefore, a new analysis is needed.

Our study contributes to the literature in an important way. We extend the analysis period to 1984–2006, thereby incorporating the effects of the events that took place after 1998. As this time period includes important events and sudden changes, it is likely that taking it into account will have an effect on the long-term relationship between health expenditures and GDP. Moreover, as we employ a longer time series, we do a better job in terms of estimating long-run relationships. In contrast to the cited study, we find that the income elasticity of total health expenditures is less than one, suggesting that health care is a necessity good in Turkey. According to our findings, a 10% increase in per capita GDP is associated with an 8.7% increase in total per capita health expenditure.

In the following section, "Related literature", we review the literature on the long-run relationship between income and health expenditure. In the section "Major events in the post-1998 period Turkey", we report on the major events that happened after 1998, which we expect to influence the long-term relationship between our two variables of interest. We also briefly describe the provision and financing of the health system prior to the Health Transformation Program (HTP) reforms. The section "Data and methodology" describes the data and methods used in the econometric analysis. We explain our findings in the section "Empirical findings". The final section summarises and concludes our study. In the Appendix, we provide the chronology of the HTP reforms.

Related literature

It is well known that there is a significant relationship between national expenditure on health care and GDP. Many studies find a strong and positive correlation between these two variables. However, there is no consensus on the magnitude of the income elasticity of health expenditures. Estimates vary depending on the country sample, the time period and the analysis technique used. Reported income elasticity estimates in the literature are often greater than one [5, 8, 10, 13 (public health expenditures), 15, 20, 21 (for some OECDcountries), 23], but estimates that are less than one [1, 4, 7, 13 (private health expenditures)] or around one [12, 13, 19] have also been reported. Some other studies find no long-term relationship between the two variables of interest [3, 11, 17, 21 (for some OECD countries)].

Earlier studies in this literature have usually performed cross-sectional regression analyses with a small number of observations and a few variables. For example, Newhouse [20] used data from 13 developed countries in (or closest to) the year 1970 to estimate income elasticity that is greater than one. Using a larger dataset and purchasing power parity prices instead of exchange rates to compare expenditures in different countries, Parkin et al. [23] found that health care is closer to being a necessity than a luxury good. Gerdtham et al. [8] estimated the income elasticity of health expenditures as 1.33 (and significantly greater than one) based on data from 19 OECD countries in 1987.

Another group of studies took advantage of the panel structure of the OECD data to analyse the statistical relationship between per capita real health care expenditure and aggregate income. Based on pooled cross-sectional, time-series data for 22 OECD countries from 1972 to 1987, Gerdtham [7] found that health care expenditure does not appear to be income elastic, contrary to the results of earlier studies. This group of studies confirmed the finding that aggregate income is the most important determinant of health care expenditure. Again, based on pooled OECD data, Hitiris and Posnett [12] estimated income elasticity to be at or around unity, but also suggested that OECD countries should not be regarded as a single, homogeneous group.

The third and the most recent group of studies, some of which are cited below, include analyses of the existence of cointegrating relationships between per capita income and health expenditure. Realizing that the variables used in econometric analyses are not stationary, researchers started using techniques designed for handling such variables, such as unit root tests, cointegration and vector error correction models. The findings of these studies have varied depending on the data and the technique used. Moreover, despite the large amount of literature produced, the issues of the existence of cointegration and the magnitude of income elasticity are still controversial.

Murthy and Ukpolo [19] found evidence for cointegration and estimated that the income elasticity of per capita health expenditure was not significantly different from one, using US data from the 1960–1987 period. Another study that followed the same methodology examined data from 20 OECD countries in the 1960–1987 period and conducted a separate analysis for each country [11]. Interestingly, these authors found no cointegration relationship between income and health expenditures for most of these countries. They speculated that this finding was due to the shortness of the time series, and probably also to misspecification of the model.

Increasing availability of data from a higher number of countries and for longer periods, has enabled researchers to conduct panel data analyses. Blomqvist and Carter [1]

examined the long-term relationship between income and health spending in 19 OECD countries in a 32-year time period from 1960 to 1991. Based on the results from a cointegration model that included country dummies and a linear time trend, the authors argued that previous studies overestimated income elasticity, whose true value should be closer to one. The authors argued that overestimation is due to ignoring the time series properties of the variables and also to not including a time trend in the analysis. Gerdtham and Löthgren [9] also found a cointegration relationship between health expenditures and income (both per capita real) by using time series and panel data analyses. Their study used data from 21 OECD countries from the period 1960–1997.

Due to structural differences between developed and developing countries, the results obtained for the former group may not be relevant for the latter group. In developing countries, economic stagnation, debt, structural adjustment programs and health sector reform are more common. Jaunky and Khadaroo [13] conducted cointegration analysis based on data from 28 African countries in the period 1991–2000, and found that the income elasticity of public health expenditure is greater than one, whereas the income elasticity of private health expenditure is less than one. The authors do not find this result surprising, since in Africa the rich minority already purchases high-tech private health care services, while the public sector struggles to provide basic services to the poor majority, making health a luxury good for the poor. Although not a time-series study, the paper by Jowett [14] is relevant here as it discusses health expenditures in low-income countries. This paper examined the period from 1990 to 1995 in 44 low-income countries and found that private health expenditures were substituted for public health expenditures due to the structural adjustment and privatisation policies in these countries. Despite the substitution, total health expenditures declined. The observation that changes in health expenditures and income are in opposite directions is surprising and runs counter to the experience in developed countries.

A very recent study uses a panel threshold regression model to derive country-specific and time-specific income elasticities for 17 OECD countries in the period 1975–2003 [4]. This latter study finds that health care is a necessity rather than a luxury, similarly to the finding of our analysis, but using a different technique.

Kiymaz et al. [15], which is so far the only empirical study in the literature on the relationship between health expenditures and GDP in Turkey, is based on an analysis of the 1984–1998 period data using the Johansen cointegration method. The study uses total, public and private per capita health expenditure, per capita national income and population growth rate data from the OECD 2002 database, and estimates that the GDP elasticity of health expenditures is greater than one. In particular, the authors find that a 10% increase in GDP leads to a 21.9% increase in total health expenditure. Rather than reflecting long-term trends, the findings of this study explain the dynamics in the 1984–1998 period. Due to reasons explained in the next section, the income–health expenditure relationship has probably changed in the period since 1998. Therefore, a new analysis that covers the post-1998 period is required.

Major events in the post-1998 period in Turkey

After 1998, some major events and policy changes that affected the income–health expenditure relationship took place in Turkey. Figure 1 shows the annual percentage changes in per capita real GDP (GDPGR) and in per capita total health expenditures (TOTGR). As can be seen in the figure, TOTGR and GDPGR mostly had the same sign before 1998. Furthermore, the magnitudes of these variables were quite different. However, this pattern seems to have changed in the post-1998 period. In 1999 and 2001, the earthquake and the crisis years, respectively, these variables not only took different signs but their magnitudes were also very different. In other years, both of the two variables had a positive sign and were very close to each other in magnitude. In other words, health expenditures and GDP increased at almost the same rate every year after 1998, with the exceptions being years 1999 and 2001.

In August 1999, an earthquake of magnitude 7.4 struck the northwest part of Turkey. More than 17,000 people were killed, more than 43,000 were injured and more than 500,000 people lost their homes [2]. The disaster area was the industrial centre of the country, therefore the economic

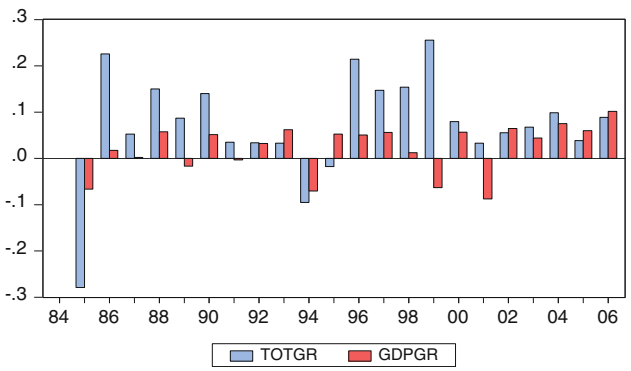

Fig. 1 Per capita real total health care expenditures and per capita real gross domestic product (GDP) annual percentage changes: 1984–2006 period. *TOTGR* Annual percentage change in per real capita total health expenditure, *GDPGR* annual percentage change in real per capita GDP. Source: Authors' calculations based on the OECD Health Data 2007 for the period 1984–2005 and the Ministry of Health 2007 data for 2006 [18]

loss caused by the earthquake was substantial. Based on the OECD Health Data 2007, in 1999 GDP per capita declined by 6% while total health expenditure per capita increased by 25% relative to the previous year.

In 2001, the country suffered an economic crisis. GDP per capita declined by 8.77%, while per capita total health expenditure increased by 3.28% with respect to 2000, according to OECD Health Data 2007. Therefore, changes in per capita GDP and per capita health expenditure during 2001 were in opposite directions. Health expenditure was rising fast and uncontrollably, along with concerns about accessibility and equity issues regarding health care services.

During the 2002–2006 period, the Turkish economy recovered very quickly. Real per capita GDP growth rate was as high as 10% in 2006, according to OECD Health Data 2007. Significant gains were reported in keeping inflation under control. Indeed, during the 1984–2006 period, the country experienced single-digit inflation for the first time in 2004. During the recovery from the 2001 crisis, the government adopted an "Urgent Action Plan" which included a proposal for reform in the health and social security system called the "Health Transformation Program" (HTP).

Before the HTP reforms, Turkey's health financing and delivery systems were complex and fragmented. Health care delivery in Turkey comprised of public and private providers. There were three main public providers: the Ministry of Health (MoH), Sosyal Sigortalar Kurumu (the Social Insurance Organization), and universities. There were three different social security schemes: Sosyal Sigortalar Kurumu (SSK) covering private sector employees and blue-collar public sector employees, Emekli Sandigi (Government Employees Retirement Fund—GERF) covering retired civil servants, and Bag-Kur (Social Security Organisation for Artisans and the Self-Employed) covering self-employed people. These security funds provided both pension and health insurance. Health spending of active civil servants was financed from the general government budget through the budget of the public institution they work for. The Green Card scheme, directly funded by the government budget, provided free health services for people earning less than a minimum level of income. Separate public health insurance schemes had varying benefit packages and regulations; GERF had the deepest health benefit package while the Green Card scheme had the shallowest [22, 26].

The "Health Transformation Program" (HTP) was launched in 2003. Implementation of this reform proposal led to major changes affecting health expenditure.[1] The introduction of a performance-based wage scheme in public hospitals has led to an increase in the volume of services provided along with an increase in the earnings of health care personnel. Indeed, improved access to health care services has caused an increase in demand for health care services.[2] This increased demand has been counterbalanced by increased productivity of health staff in the MoH facilities. Contractual agreements have been made with private health care facilities to increase service availability. Private health providers were allowed to charge up to 100% above the prices set by Social Security Institute (SSI).[3] Consequently, SSI health expenditure increased rapidly, with the private sector payment growing fastest. In response to rapidly rising health expenditures, the SSI negotiated with MoH for a capped annual budget (global budget) for all MoH hospitals. Private health facilities were restricted to charge at most 30% above the prices set by SSI. In addition, a global budgeting system for private hospitals that are under contract with the SSI has been proposed. There have been major policy changes regarding payments to the pharmaceutical sector with the aim of restraining costs. A reference price system has been established. According to this system, the medication prices in five (or at most ten) European Union countries are followed and the cheapest are taken as a reference for prices in Turkey. Consequently, significant savings have been achieved despite improved access of both Green Card holders and SSK members to private pharmacies [22].

Moreover, in 2008, Universal Health Insurance (UHI) was initiated. With this program, benefits packages across various health insurance schemes will be eventually unified.[4] In the long run, the policy changes just described are expected to bring unit costs down by increasing the efficiency of the healthcare system, by improving health indicators of the general public and by triggering labour productivity increases. Therefore, if these reforms can be implemented successfully, they can have substantial positive effects on the Turkish economy. Indeed, during 2002–2006, the growth rates of health expenditure and real GDP were comparable, which suggests that health expenses were sustainable during this period (see Fig. 1).

[1] Please see Appendix for a chronology of reforms.

[2] SSK health facilities were transferred to the MoH; SSK members gained access to all MoH hospitals. The range of services provided for Green Card holders, which included only inpatient healthcare services prior to HTP, has been expanded over time to include outpatient health expenses.

[3] The extra charges of private health facilities are paid by the patient as an out of pocket payment.

[4] UHI aims to cover the whole population. However, the reform process will take time; GERF members and green card holders are planned to be covered by UHI in 3 years. In this study we cannot examine the effect of the introduction of the UHI since we have data only up to 2006.

Data and methodology

Our data are composed of annual time series of total, private and public health expenditure, GDP and population growth rate in the 1984–2006 period. For the period 1984–2005, health care expenditure data and the GDP series are taken from the OECD Health Data 2007.[5] Both health care and GDP series are in per capita terms at constant 2000 prices. Data for 2006 were acquired from the Ministry of Health [18] in nominal terms. To convert them into real per capita terms, the GDP deflator and population size were employed, acquired from the IMF World Economic Outlook and the OECD Health Data 2008, respectively. Finally, during the 1984–2006 period, annual population growth rates were calculated using the population series obtained from the OECD Health Data 2008. All of the series, total (LNTOT), public (LNPUB) and private (LNPRI) health care expenditure series and GDP series (LNGDP), except for the population growth rate (POPGR) were transformed into natural logarithms.

Johansen cointegration methodology was employed to explore the long-term relationship among health care expenditure, GDP and population growth rate in Turkey during the period 1984–2006. According to cointegration theory, first, the integration order of variables should be checked. If a series y_t must be differenced d times to be stationary, it is said to be "*integrated of order d*", denoted by $y_t \sim I(d)$. In our study, the integration orders of variables are determined by using the well known Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) unit root tests,[6] which test the null hypothesis of nonstationarity against the alternative hypothesis of stationarity.

In the application of the Johansen procedure, a vector autoregressive (VAR) model is constructed to obtain a long-term relationship among the stochastic variables. The VAR model can be expressed as:

$$\Delta x_t = \Gamma_1 \Delta x_{t-1} + \Gamma_2 \Delta x_{t-2} + \cdots + \Gamma_{k-1} \Delta x_{t-k+1} + \pi x_{t-k} + \mu c_t + \varepsilon_t, \quad (1)$$

where Δ is the first difference operator, x_t is an $n \times 1$ vector of variables, π is an $n \times n$ matrix of rank 'r', c_t is the intercept and ε_t is an $n \times 1$ vector of residuals with zero mean and variance matrix Ω. We define the vector x_t as (LNHealth, LNGDP, POPGR)', where LNHealth stands for either LNTOT, LNPUB or LNPRI depending on the case, since we examine total health expenditure as well as public and private health expenditure.

The rank of the π matrix determines the dimensionality of the cointegrating space, where

$$\pi = \alpha \beta' \quad (2)$$

is the matrix of long-run responses, where α and β are $n \times r$ matrices for n variables and r cointegrating vectors. If $0 < r < n$, there are r cointegrating vectors; but if $r = 0$, there is no cointegration between health care expenditure, GDP and POPGR series. The case of $r = n$ implies the stationarity of the GDP, population growth and health care expenditure series in their levels; therefore a cointegrating relation cannot exist among them. The α matrix is called the loading matrix and gives the weight attached to each cointegrating vector in every equation. β is the matrix of cointegrating vectors, which can be estimated as the eigenvectors associated with the r largest, statistically significant eigenvalues found by calculating

$$|\lambda S_{kk} - S_{k0} S_{00}^{-1} S_{0k}| = 0 \quad (3)$$

In the above equation, S_{00} is the residual moment matrix from the least squares regression of Δx_t on $\Delta x_{t-1},\ldots,$ Δx_{t-k+1} and S_{kk} is the residual moment matrix from the least squares regression of x_{t-k} on Δx_{t-k+1}. S_{0k} is the cross product moment matrix. Using these eigenvalues one can test the hypothesis that there are at most r cointegrating vectors by using the eigenvalues and calculating the likelihood test statistics

$$(-2)\ln(Q) = -T \sum_{i=r+1} \ln(1 - \lambda_i), \quad (4)$$

where $\lambda_{r+1},\ldots, \lambda_n$ are the $(n - r)$ smallest eigenvalues, and this is called the trace test. There is also a likelihood ratio test, called the maximal eigenvalue test (λ Max), in which the null hypothesis of r cointegrating vectors is tested versus the alternative of $r + 1$ cointegrating vectors. In this study, we use the trace test.

Empirical findings

We present the descriptive statistics of our variables in Table 1. Among the health expenditure series, the public health expenditure series has the highest variation followed by total and private health expenditures. The variation of the LNGDP series is lower than that of any of the health expenditure series. Except for the LNPUB and POPGR series, all of the series have positive skewness (i.e. the mean of the series is greater than the median). All of the

[5] Both OECD Health Data 2007 and 2008 provide the same health expenditures series up to year 2005. However, regarding the GDP data, the 2008 version has the new GDP series recently adjusted by the Turkish Statistics Institute, whereas the 2007 version has the old series. The new GDP series has been adjusted starting from 1998. Therefore the 1984–2006 series has a break in year 1998. To avoid this problem, we have chosen to use the old GDP series in the 2007 version of the OECD Health Data.

[6] Since these tests are very commonly used in the literature, we do not provide detailed information on them. Please see Dickey and Fuller [6] and Phillips and Perron [25] for details.

Table 1 Distributional characteristics of the variables used in the analysis

Variables	*N*	Mean	Standard deviation	Skewness	Kurtosis
LNPRI	23	3.29	0.37	0.36	1.66
LNPUB	23	3.84	0.67	−0.17	1.92
LNTOT	23	4.32	0.52	0.18	1.76
LNGDP	23	7.43	0.14	0.59	2.85
POPGR	23	0.02	0.004	−0.06	1.99

All variables, except for the population growth rate, are in natural logarithms and per capita terms at 2000 prices. Source: Authors' calculations based on the OECD Health Data 2007. *LNPRI* Real per capita private health expenditure in natural logarithms, *LNPUB* real per capita public health expenditure in natural logarithms, *LNTOT* real per capita total health expenditure in natural logarithms, *LNGDP* real per capita GDP in natural logarithms, *POPGR* population growth rate

series are leptokurtic (i.e. the distribution has a sharper peak and a fatter tail than the normal distribution). The average population growth rate is 2%. The time series graphs of the variables are shown in Fig. 2. In the LNGDP graph, the negative effects of the 1999 earthquake and the 2001 crisis are visible. After 2001, LNTOT has been increasing steadily but at a slower rate than LNGDP.

As explained in "Data and methodology", the first step in cointegration analysis is to determine the integration order of the variables. Therefore, the ADF and PP unit root tests are conducted on both levels and first differences of series by using the E*Views* 6 package (http://www.eviews.com/). The results are reported in Table 2. For the ADF regression, lagged differences are introduced into the model so that the residuals are white noise processes. The numbers in parentheses in the ADF test represent the highest order of lag for which the *t*-statistic in the regression is significant. The lag lengths are determined according to the Schwartz information criterion. For the PP test, Parzen kernel spectral estimation method is chosen and the Newey–West procedure is used in order to adjust the standard errors. The numbers in parentheses in the PP test represent the bandwidth of the Newey-West procedure.[7] Except for the LNPUB and LNTOT variables, there is a consensus between the ADF and PP tests results.[8] According to the ADF test all of the series, all time series except LNPUB are I(1) processes, which means that they are nonstationary, and become stationary when they are first-differenced. For the LNPUB series, it is possible to reject the hypothesis that the series is nonstationary at the 1% significance level. But, when we apply the PP test, the entire series including LNPUB are found as I(1) processes at the 1% significance level except for LNTOT. According to the PP test, the LNTOT series is stationary at its level. With these exceptions in mind, it is reasonable to conclude that all of the series are integrated of order one, I(1).

Since the cointegration results are sensitive to the lag length of VAR, the optimum lag length of the cointegration was found according to the Schwarz criterion. We consider the VAR(1) and VAR(2) models. Since our data are annual, the maximum length is chosen as two. The models are estimated without a constant. The minimum of Schwarz criterion for each gives the optimum lag length for the VAR model. The Schwarz test values for all models are shown in Table 3. VAR(1) models were found to be optimal in all cases.

The long-term relationships among the health expenditure, per capita GDP and population growth rate series were explored using the Johansen procedure without an intercept term in the equation. The cointegration analysis is computed by E-views version 6, which derives the critical values for the trace test using MacKinnon-Haug-Michelis [16] *P*-values. The results of multivariate cointegrating analyses are reported in Table 4. Regarding LNPUB, the trace test indicates two cointegrating vectors at the 1% level. Similarly, the trace test results of LNTOT suggest two cointegrating equations at the 5% level. However, the results of LNPRI model show that the null hypothesis of no-cointegrating relationship can be weakly rejected at 5% significance level, which indicates only one cointegrating relationship among LNPRI, LNGDP and POPGR.

Finding evidence for the existence of a cointegration relationship tells us that there is a long-term relationship among the health care expenditure, GDP and population growth series. In order to understand how the GDP and population growth rate series affect the health care expenditure series, we normalised the cointegrating vectors with respect to the coefficient of health care expenditure. The signs and the magnitudes of the normalised coefficients are given in Table 5.

The results shown in Table 5 indicate that there is a positive relationship between per capita real GDP (LNGDP) and each of the per capita real health care expenditure series. However, there is a negative cointegrating relationship between population growth and each of the per capita real health care expenditure series. These results are as expected, since during the 1984–2006 period POPGR has a negative time trend, whereas all of the healthcare expenditure series have positive trends (see Fig. 1).

[7] E-views employs the MacKinnon critical values in the ADF and PP tests.

[8] Even though the ADF and PP tests are asymptotically equivalent, they may differ in finite samples because of the different ways in which they correct for the serial correlation of the test regression. Please see Perron and Ng [24] and Schwert [27] for a detailed comparison of these techniques.

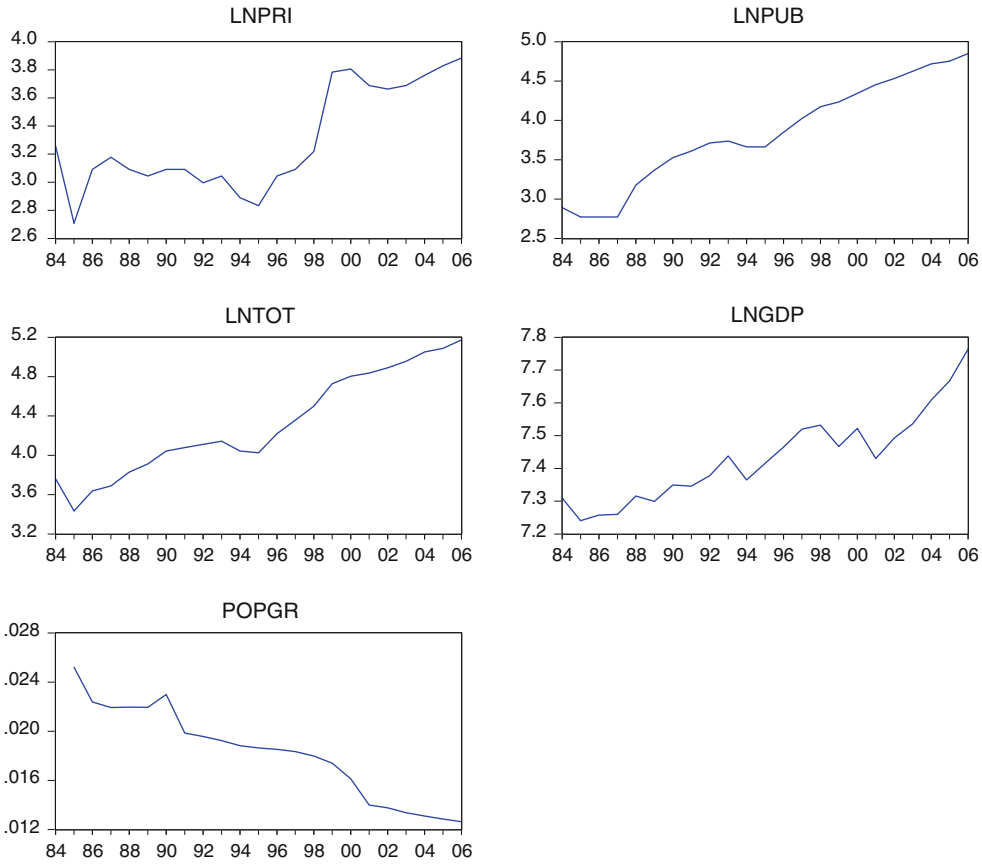

Fig. 2 Time series graphs of the variables used in the analysis. *LNPRI* Real per capita private health expenditure in natural logarithms, *LNPUB* real per capita public health expenditure in natural logarithms, *LNTOT* real per capita total health expenditure in natural logarithms, *LNGDP* real per capita GDP in natural logarithms, *POPGR* population growth rate. Source: Authors' calculations based on the OECD Health Data 2007

Table 2 Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) unit root tests

Variable	ADF level (with constant and trend)	ADF first difference (with constant)	PP level (with constant and trend)	PP first difference (with constant)
LNPRI	−2.77 (0)	−6.41** (0)	−2.83 (3)	−6.12** (3)
LNPUB	−4.78** (4)	−3.72* (0)	−2.26 (9)	−4.41** (12)
LNTOT	−1.70 (1)	−7.15** (0)	−3.36* (1)	−7.15** (0)
LNGDP	−2.26 (0)	−5.59** (0)	−2.45 (5)	−5.54** (4)
POPGR	−3.25 (0)	−5.60** (0)	−3.25 (7)	−10.07** (13)

Source: Authors' calculations based on the OECD Health Data 2007 using EViews 6

**, * Significant at 1 and 5% levels, respectively

Table 3 Selection of the vector autoregressive (VAR) model

	VAR (1)	VAR (2)
LNPRI	−14.3	−13.8
LNPUB	−15.6	−15.2
LNTOT	−16.1	−15.7

The Schwarz criterion is used to find the optimum lag length of the VAR models. Source: Authors' calculations

In our model, the coefficient of the LNGDP variable can be interpreted as an estimate of the income elasticity of health care expenditures. We know that if the income elasticity of a good is between 0 and 1 (or greater than 1), that good is defined as a necessity (or a luxury). When the cointegration model exploring the long-term relationship between LNPUB and LNGDP is considered, it is seen that the estimated coefficients of both of the cointegrated vectors are statistically significant. The estimated coefficients are 0.89 and 0.75 according to vector 1 and vector 2, respectively. As a result, a 10% increase in GDP will cause either a 8.9 or 7.5% increase in public health expenditure. Since the income elasticity is less than 1 in both cases, we conclude that public health care services were a necessity in the 1984–2006 period.

When the model presenting the cointegrating relationship between LNPRI and LNGDP is examined, the

Table 4 Johansen multivariate cointegration tests

H_0	H_A	Trace test	5% Critical value	Probability[a]
LNPUB				
$R = 0$	$r = 1$	35.2**	24.2	0.00**
$r \leq 1$	$r = 2$	18.6**	12.3	0.00**
$r \leq 2$	$r = 3$	3.8	4.1	0.06
LNPRI				
$R = 0$	$r = 1$	24.0*	24.2	0.05*
$r \leq 1$	$r = 2$	7.0	12.3	0.32
$r \leq 2$	$r = 3$	0.2	4.1	0.65
LNTOT				
$R = 0$	$r = 1$	28.6**	24.2	0.01**
$r \leq 1$	$r = 2$	13.4*	12.3	0.03*
$r \leq 2$	$r = 3$	0.8	4.1	0.39

Source: Authors' calculations

**, * Significant at 1 and 5% levels, respectively

[a] MacKinnon-Haug-Michelis [16] *P*-values. If the *P*-value is less than 0.01 (or 0.05) then the null hypothesis is rejected at 1% (or 5%) level

Table 5 Cointegration coefficients normalised with respect to the coefficient of the health expenditures variable

	LNGDP	POPGR
LNPUB		
Vector 1	0.89 (0.03)**	−145.49 (10.51)**
Vector 2	0.75 (0.10)**	−131.73 (38.9)**
LNPRI: Vector 1	1.81 (0.46)**	−351.33 (179.3)*
LNTOT		
Vector 1	0.30 (0.24)	−11.08 (97.78)
Vector 2	0.87 (0.02)**	−118.02 (7.11)**

The estimated standard errors of the coefficient estimates are presented in parentheses. Source: Authors' calculations

**, * Significant at 1 and 5% levels, respectively

estimated LNGDP coefficient is found to be 1.81, which is statistically significant. Therefore, a 10% increase in GDP will lead to an 18.1% increase in private health care expenditure. Since the income elasticity of LNPRI is greater than 1 in this case, we can say that private healthcare service was as a luxury in the 1984–2006 period.

Finally, the cointegrating vectors establishing the long-term relationship between LNTOT and LNGDP was examined. It was observed that only the second vector (vector 2) has statistically significant coefficients. The estimated LNGDP coefficient of vector 2 is 0.87, which means that a 10% increase in GDP will create a 8.7% increase in total health care expenditure. As a result, total health care expenditure has an income elasticity less than 1, thus during the 1984–2006 period LNTOT represented a necessity.

Summary and conclusions

In this study, we examined the long-term relationship between health care expenditure and national income in Turkey. We applied the Johansen multivariate cointegration technique to investigate the cointegrating relationship among per capita health expenditure, per capita GDP, and population growth rate in Turkey during the period 1984–2006. Based on the ADF and PP unit root tests, all of these series are integrated of order one, $I(1)$. Following tests of nonstationarity, we performed cointegration analyses. We found evidence for multivariate cointegrating relationships among the health care expenditure (public, private, total), GDP and population growth series. The existence of a cointegration relationship tells us that there is a long-term relationship among the considered series.

Since we are also interested in estimating the income elasticity of health expenditures, the cointegrating vectors were normalised with respect to the coefficient of health care expenditure. When the cointegration model of public health care expenditure and GDP was considered, two significant cointegrating vectors were observed. The normalised coefficients of the LNGDP variable are 0.89 and 0.75 with respect to vector 1 and vector 2. Thus, a 10% increase in per capita GDP will cause a 7.5–8.9% increase in public health expenditure while controlling for population growth. In the case of private health expenditures, we find only one cointegrating vector. We observed that a 10% increase in GDP will lead to an 18.1% increase in private health expenditure. Furthermore, we found that the income elasticity of total health expenditure is less than one, which indicates that health care in Turkey during the period 1984–2006 can be classed as a necessity. According to our results, a 10% increase in per capita GDP was associated with an 8.7% increase in total per capita health expenditure while controlling for population growth.

Although there have been numerous studies on the relationship between health expenditure and GDP in OECD countries, the literature on Turkey is very small and incomplete and there are no analyses that cover the recent post-reform period. Our findings indicate that the major events and changes that took place after 2000 have had a non-negligible influence on the long-term relationship between our two variables of interest as, in contrast to previous findings, we find that health care is a necessity in Turkey. The Ministries of Health and Finance as well as other related government bodies play important roles in regulating and financing the health care sector. Long-term planning and analysis of national health strategy requires a cointegration analysis of national income and health expenditure. Indeed, deviations of the current state from its long-term relationship will be fed into its short-term dynamics. Consequently, we believe that our findings will also help policymakers to make a better judgement on how much aggregate health

expenditures will change in the coming years, given a forecast of the trend in national income.

Acknowledgments We are grateful to our colleagues Taylan Bali and Rezzan Kaynak for their contribution to, and comments on, an earlier unpublished version of this study.

Appendix

Recent developments in the Turkish health care system: the chronology of HTP reforms (Sources: OECD [22], TEPAV [28] and our research.)

2004

January—Performance-based supplementary payment system was initiated in MoH health facilities.

January—MoH and SSK signed protocol for common use of their health facilities.

March—Value added tax rate of prescription drugs dropped to 8% from 18%.

April—Reference price system was established.[9]

May—Green Card holders were granted coverage for outpatient health expenses.

2005

January—Green Card holders were allowed to access private pharmacies.

January—Value added tax rate of health services and non-prescription drugs dropped to 8% from 18%.

February—SSK health facilities were transferred to MoH.

February—SSK pharmacies were closed; SSK members were permitted to access private pharmacies.

May—Green Card holders were required to pay 20% contribution for outpatient prescription drug expenses.

June—"Licensing Regulation" for pharmaceuticals were passed; expiry time for licenses was established as 5 years.

July—Generic drug application was expanded to 333 active groups, up from 77 groups.

September—Family Medicine was initiated in Duzce.

[9] According to this system, 5 (or at most 10) European Union countries' drug prices were followed and the cheapest were taken as a reference for drug prices in Turkey.

2006

January—All reimbursement institutions started to use one common positive list.

May—Law 5502 was implemented. Social Security Institution (SSI) was established; SSK, Bag-Kur and GERF were integrated under one institution.

2007

June—SSI established the health budget law [*Saglik Uygulama Tebligi*, SUT (acronym in Turkish)].

July—Primary care became free for all citizens (even if not covered under social security).

2008

April—Law 5754 "Social Security and UHI Law and its amendments" was accepted.

July—All private hospitals under contract with SSI were allowed to charge patients at most 30% above SUT prices; contracted private hospitals were required to provide cancer therapy, emergency and intensive care to patients (insured by SSI).

October—UHI system was initiated.

2009

January—The SSI agreed with the MoH on a capped annual budget (global budget) for all MoH hospitals.

References

1. Blomqvist, A.G., Carter, R.A.L.: Is health care really a luxury? J. Health Econ. **16**, 207–229 (1997)
2. Bolt, B.A.: Earthquakes. Freeman, New York (2004)
3. Carrion-i-Silvestre, J.L.: Health care expenditure and GDP: are they broken stationary? J. Health Econ. **24**(5), 839–854 (2005)
4. Chakroun, M.: Health care expenditure and GDP: an international panel smooth transition approach, Munich Personal RePEc Archive Paper No. 14322, May, online at http://mpra.ub.uni-muenchen.de/14322/ (2009)
5. Clemente, J.J., Marcuello, C., Montañés, A., Pueyo, F.: On the international stability of health care expenditure functions: are government and private functions similar? J. Health Econ. **23**, 589–613 (2004)
6. Dickey, D.A., Fuller W.A.: Likelihood ratio test statistics for autoregressive time series with a unit root. Econometrica. 49, 1057–1072 (1981)
7. Gerdtham, U.G.: Pooling international health care expenditure data. Health Econ. **1**(4), 217–231 (1992)
8. Gerdtham, U.G., Sogaard, J., Andersson, F., Jönsson, B.: An econometric analysis of health care expenditure: a cross-section study of the OECD countries. J. Health Econ. **11**, 63–84 (1992)

9. Gerdtham, U.G., Löthgren, M.: On stationarity and cointegration of international health expenditure and GDP. J. Health Econ. **19**, 461–475 (2000)
10. Hagist C., Kotlikoff L.J.: Who's going broke? comparing growth in healthcare costs in ten OECD countries, NBER working paper no. 11833 (2005)
11. Hansen, P., King, A.: The determinants of health care expenditure: a cointegration approach. J. Health Econ. **15**, 127–137 (1996)
12. Hitiris, T., Posnett, J.: The determinants and effects of health care expenditure in developed countries. J. Health Econ. **11**(2), 173–181 (1992)
13. Jaunky, V.C., Khadaroo, A.J.: Health care expenditure and GDP: an African perspective. Appl. Econom. Int. Dev. **8**(1), 131–146 (2008)
14. Jowett, M.: Bucking the trend? Health care expenditures in low-income countries 1990–1995. Int. J. Health Plann. Manage. **14**, 269–285 (1999)
15. Kiymaz, H., Akbulut, Y., Demir, A.: Tests of stationarity and cointegration of health care expenditure and gross domestic product. Eur. J. Health Econ. **7**(4), 285–289 (2006)
16. MacKinnon, J., Haug, A.A., Michelis, L.: Numerical distribution functions of likelihood ratio tests for cointegration. J. Appl. Econom. **14**(5), 563–577 (1999)
17. McCoskey, S., Selden, T.M.: Health care expenditures and GDP: panel data unit root test results. J. Health Econ. **17**, 369–376 (1998)
18. Ministry of Health: Türkiye'de Sağlığa Bakış (A look at health in Turkey 2007), Hıfzıssıhha Mektebi Müdürlüğü. T.C. Sağlık Bakanlığı, Ankara, Türkiye (2007)
19. Murthy, N.R.V., Ukpolo, V.: Aggregate health care expenditure in the United States: evidence from cointegration tests. Appl. Econ. **26**, 797–802 (1994)
20. Newhouse, J.P.: Medical-care expenditure: a cross-national survey. J. Human Res. **12**(1), 115–125 (1977)
21. Okunade, A., Karakus, M.: Unit root and cointegration tests: time series versus panel estimates for international health expenditure models. Appl. Econ. **33**, 1131–1137 (2001)
22. OECD: Reviews of health systems Turkey, OECD and the International Bank for Reconstruction and Development/The World Bank (2009)
23. Parkin, D., McGuire, A., Yule, B.: Aggregate health expenditures and national income: is health care a luxury good? J. Health Econ. **6**, 109–127 (1987)
24. Perron, P., Ng, S.: Useful modifications to some unit root tests with dependent errors and their local asymptotic properties. Rev. Econ. Stud. **63**(3), 435–463 (1996)
25. Phillips, P., Perron, P.: Testing for a unit root in time series regression. Biometrika **75**(2), 335–346 (1988)
26. Savas, S.B., O. Karahan, O. Saka: Health care systems in transition: Turkey. In: Thomson, S., Mossialos, E. (eds.) European Observatory on Health Systems and Policies, 4(4), Copenhagen (2002)
27. Schwert, G.W.: Test for unit roots: a Monte Carlo investigation. J. Bus. Econ. Stat. **7**(2), 147–159 (1989)
28. TEPAV Turkey Health Report, Project No: 106G133, Economic Policy Research Foundation of Turkey (TEPAV), Ankara, Turkey (2008)