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The Link Between Health Care Expenditure and Life Expectancy: Turkey (1975-2015)

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ABSTRACT: *This paper aims to investigate the link between health care expenditure and life expectancy in Turkey, causality and co-integration relationship between health care expenditure (HCE) and life expectancy (LE) in Turkey for the period 1975-2015. In this paper we also used real GDP per capita and some demographic variables such as dependency ratio of the old-aged populations, the number of practicing physicians per hundred thousand persons that may explain the variations in HCE. According to the results of analyze, drperpop, gdp, hce, le65, le70, le75 variables are stable at 1% significance in the first I(1) difference value. The AGE valuable is stable 1% at the level value. There are two long-term cointegration relationships between health spending and life expectant variables. AGE → DGDP, AGE → DLE40, AGE → DLE60, DHCE → DDRPERPOP, DLE80 →DDRPERPOP, DHCE → DGDP and DLE60 → DLE80 shows the direction of granger causality.*

Keywords: *Life expectancy, Health care expenditure, Johansen Cointegration, Granger Causality.*

I. INTRODUCTİON

Life expectancy is an important indicator of how long someonelives on average. Health care expenditure and life expectancy relations in the literature use this indicator commonly measurement of population health and often used as a measure when comparing different populations. In the nineteenth century Life expectancy has been on the rise mostlyin Western countries. In developing countries, life expectancy has increased markedly in recent years, and per capita health spending has increased significantly. Question is whether the medical expenditure has played an important role (Baal, Obulqasim, Brouwer, Nusselder and Mackenbach, 2013). Health spending is an important indicator of health care quality and population health. In many empirical studies, there appears to be a significant relationship between life expectancy and health expenditure (i.e. Hermanowski et al. 2015).

In most developed countries, there is a direct correlation between health care spending and life expectancy because healthcare is one of the major development challenges facing the continuously evolving world today. (Deshpande, Kumar and Ramaswami, 2014). It is expected that the health expenditures will increase as the population ages.(Bjorner, Arnberg, 2012).Health spending may change due to increases in LE(Shiu and Chiu, 2008). Because of the economy is based on the distribution of scarce resources, the state is also expected to allocate the necessary resources to health spending. For this reason, it is expected that the increase in health expenditures, will increase life expectancy and a higher quality of health. It is important to examine this relationship; Because government spending is more effective on health spending (Deshpande, Kumar, Ramaswami, 2014).

In this paper we study the link between health care expenditure and life expectancy in Turkey as a function of health care spending, available real per capital personal health care expenditures, real per capital gross domestic product, dependancy ratio of the old aged population, life expectancy for population (LE65: 65-69, LE70: 70-74 and LE75: 75-79) and number of practicing physicians per hundred thousand personsvariables. The data were collected from the (Organization for Economic Cooperation and Development Statistics) OECD STAT.In this study is investigated the link between life expectancy and healthcare expenditure for Turkey. The study consist of chapter. The first part of study is an introduction to the subject. The second part deals withpopulation ageing, life expectancy and health care expenditure. The third part includes a literature review. The econometric methodology and the findings are examined in the fourth section and fifthsection of article consist of conclusion and discuss.

II. POPULATİON AGEİNG, LİFE EXPECTANCY AND HEALTH CARE EXPENDİTURE

The aging of the population affects the aging population and the health care expenditures and aging of the population. More than 80% of diseases, death and medical costs increase after age 65. Diseases are mostly

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chronic diseases brought about by aging. Older people spend more on health and use health care than people under 65 years old. LE is a statistical measure of the average life span of a given population.In advanced age groups, LE represents the expected time of death, and is also significantly affected by changes in morbidity and health status(Shiu and Chiu, 2008).

"*According to the "red-herring" hypothesis, the positive correlation between age and HCE is exclusively due to the fact that mortality rises with age and a large share of HCE is caused by proximity to death. As a consequence, rising longevity through falling mortality rates may even dampen the increase in HCE. However, a weakness of previous empirical studies is that they use cross-sectional evidence to make inferences on a development over time*" (Breyer, 2011).

According to Fries (1980),*"Red Herring hypothesis is in perfect agreement with the compression of morbidity thesis which stated that the onset of disability is postponed and the time span of severe illness leading to death shrinks when life expectancy increases. On this issue, while the study by Zweifel et al. (1999) is suffered from the weakness of concentrating on patients in their last two years of life, subsequent studies by several authors mainly confirm the red-herring hypothesis* (Felder, 2013).

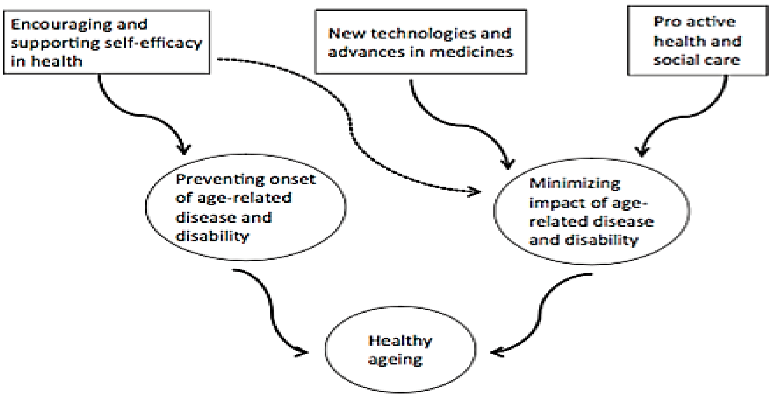

Figure 1. Three components of healthy ageing strategy
Source: Kenneth Howse (2012), "Healthy Ageing: The Role Of Health Care Services", Perspectives in Public Health, Vol. 132, No. 4, 171-177.

Although the definitions of healthy aging differ (by extending the quality of life as much as possible in relation to health), the basic idea of a successful healthy aging strategy is "Life to years as well as years to life". A second component of a healthy aging strategy is possible by expanding biomedical technology and technological innovation. The third component of a healthy aging strategy is the restructuring and regulation of health delivery systems for people with age-related illness and disability (Howse, 2012).

III. LİTERATURE REVİEW

A group of literature in recent years has tried to examine the link between health expenditure and life expectancy.

Deshpande, Kumar and Ramaswami (2014) seek to examine whether or not there is a relationship between healthcare expenditure and national life expectancy in order to gain perspective on how to efficiently increase the quality of health in a state. According to the results from estimation of single regression, it is found that positive relationship between health expenditure and life expectancy so increase in spending would increase life expectancy.

Cundiff (2010) studiesthe relationship among life expectancy, health care spending, medical resource availability and lifestyle variables in the United States relative to other member countries in OECD. According to analyze result United States performs very poorly relative to its peers. While United States spends more per capita by far than any other country, because it has lower life expectancy and fewer medical resources than most member countries is probably caused by the United States' lack of health care resources relative to the peers with high obesity rate.

Jaba, Balan, Robu (2014) aim to analyze the relationship between the dynamics of the inputs and the output of the health care systems for the period 1995-2010. For the analyze to estimate life expectancy,panel data method is employed. The obtained results show a significant relationship between health expenditures and life expectancy. Country effects are significant and show the existence of important differences among the countries.

Bjorner, Arnberg (2012), "Terminal costs, improved life expectancy and future public helath expenditure", in this paper presents emprical analysis of public health expenditures on individuals in Denmark. The analysis separates out the individual effects of age and proximity to death (reflecting terminal costs of dying) and employs unique micro data from the period 2000 to 2009, covering a random sample of 10% of the Danish population. Health expenditure includes treatment in hospitals, subsidies to prescribed medication and health care provided by general practitioners and specialists and covers about 80% of public health care expenditure on individuals. According to analysis results when life expectancy increases, terminal costs are postponed but the increases in health expenditure that follow from longer life expectancy are not as large as the increase in the number of elderly persons would suggest healthy ageing is expected to reduce the impact of increased life expectancy on real health expenditure by 50% compared to a situation without healthy ageing.

Breyer, Felder (2006), “Life expectancy and health care expenditures: A new calculation for Germany using the costs of dying”, in this article aims to analyze the impact of population ageing on future health care expenditures will be quite moderate due to the high costs of dying. If not age per se but proximity to death determines the bulk of expenditures, a shift in the mortality risk to higher ages will not affect lifetime health care expenditures as death occurs only once in every life so to take this effect into account when is calculated the demographic impact on health care expenditures in Germany.

Ogungbenle, Olawumi, Obasuyi (2013), “Life Expectancy, Public Health Spending and Economic Growth in Nigeria: A Vector Autoregressive (VAR) Model”,the main focus of this article study is to empirically analyze the relationship existing among life expectancy, public health spending and economic growth in Nigeria. According to the results of the study revealed that there is no bi-directional causality between life expectancy and public health spending in Nigeria and the study also revealed that there is no bi-directional causality between life expectancy and economic growth in Nigeria over the years. However, the study define that there is bi- directional causality between public health spending and economic growth in Nigeria.

Obrizan, Wehby (2012), “Health Expenditures and Life Expectancy Around the World: a Quantile Regression Approach”, in this paper was evaluated the heterogeneity in country health expenditure effects throughout the life expectancy distribution applying quantile regression to an assembled dataset of 177 countries. In the analyze found significant heterogeneities in expenditures effects on life expectancy that are completely masked by ordinary least squares (OLS), which underestimates (overestimates) the expenditure returns for countries ranking at low (high) life-expectancy quantiles. The largest returns from increased spending are for countries at the left margin of the life expectancy distribution (mainly at quantiles 0.25 and lower), for which a $100 increase in per capita spending leads to 11.5 and 11 months of life for males and females, respectively. The results suggest that increasing healthcare spending in these countries may have significant population-wide life expectancy returns.

Memarian (2015), “The Relationship between Health Care Expenditure, Life Expectancy and Economic Growth in Iran”, in this article is investigated with ARDL econometric technique for period from 1989 to 2011 considering the importance of healthcare for human workforce in modern society and increasing trend of life expectancy in developed countries.The results of analyze indicate that life expectancy and healthcare expenditures have a significant positive impact on Gdp both in the short-term and in the long-term. An increase in life expectancy and health care expenditures causes an increase in economic growth.

Lubitz, Cai, Kramarow and Lentzner (2003), “Health, Life Expectancy, and Health Care Spending among the Elderly”, in this article investigate calassified persons’health according to functional status and whether or not they were institutionalized and according to self-reported health using multistate life-table methods 1992-1998 Medicae Current Beneficiary Survey and microsimulation to estimate life expectancy for persons in various states of health. We linked annual health care expenditures with transitions between health states. As a result of analyze elderly persons in better health had a longer life expectancy than those in poorer health but had similar cumulative health care expenditures until death. A person with no functional limitation at 70 years of age had a life expectancy of 14.3 years and expected cumulative health care expenditures of about $136,000 (in 1998 dollars); a person with a limitation in at least one activity of daily living had a life expectancy of 11.6 years and expected cumulative expenditures of about $145,000. Expenditures varied little according to self-reported health at the age of 70. Persons who were institutionalized at the age of 70 had cumulative expenditures that were much higher than those for persons who were not institutionalized.

IV. DATA AND METHODOLOGY

Emprically Results

Table 1. Variables and Definitions of Regression

Variable	Definitions
HCE	Real per capital personal health care expenditures
GDP	Real per capital grossdomestic product
AGE	Dependency ratio of the old-aged population
LE65	Life expectancy for population aged 65-69
LE70	Life expectancy for population aged 70-74
LE75	Life expectancy for population aged 75-79
DRPERPOP	Number of practicing physicians per hundred thousand persons

$$Model\colon\ HCE_t = \beta_1 + \beta_2 GDP_t + \beta_3 AGE + \beta_4 LE65 + \beta_4 LE70 + \beta_5 LE75 + \beta_6 DRPERPOP + \mu_t$$

Table 2. Augmented Dickey-Fuller (ADF Test)

LevelValue				1stDifference Value			
Değişkenler	ADF-Test İstatistiği	Gecikme Uzunluğu	%1 Kritik Değer	Değişkenler	ADF-Test İstatistiği	Gecikme Uzunluğu	%1 Kritik Değer
AGE	-3.314	4	-2.945 (%5)	ΔAGE	_	_	_
drperpop	-0.945	4	-3.626	Δdrperpop	-3.896	3	-3.626
gdp	0.999	0	-3.605	Δgdp	-6.133	0	-3.610
hce	1.343	1	-3.610	Δhce	-3.685	0	-3.610
Le65	1.628	0	-3.605	Δle40	-6.504	0	-3.610
Le70	0.674	0	-3.605	Δle60	-6.570	0	-3.610
Le75	0.677	0	-3.605	Δle80	-6.600	0	-3.610

In the table 2, drperpop, gdp, hce, le65, le70, le75 variables are stable at 1% significance in the first I(1) difference value.The AGE valuable is stable at the level value. After determining that the variables are stationary with the applied unit root test, Johansen Juselius cointegration analysis and Maximum Eigen value and Trace (trace) statistics are used to determine whether there are long-term relationships between the variables. The Johansen cointegration test was undertaken to determine the number of delays that play an important role in the established VAR when investigating the long-run relationship between variables.

Table 3. Lag Length Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-496.098	NA	3244.998	27.94991	28.25782	28.05738
1	-305.383	296.6674	1.302794	20.07687	22.54012	20.93661
2	-251.1262	63.30033	1.346402	19.78479	24.40338	21.39680
3	-155.9828	74.00038	0.286583	17.22127	23.99521	19.58555
4	**9.791752***	**64.46788***	**0.008150***	**10.73379***	**19.66308***	**13.85035***

In the table 3, the information criteria are examined as AIC, SIC and HQC, lag lenght is determined p=4.

Table 4. Johansen Juselius Cointegration Tests (UnrestrictedCointegration Rank Test-Trace)

Hypothesized	Eigenvalue	Trace Statistic	%5 critical value
None* (r=0)	0.831006	215.429	139.275
At most 1* (r=1)	0.784355	149.647	107.346
At most 2* (r=2)	0.636893	92.884	79.341
At most 3* (r=3)	0.516039	55.401	55.245
At most 4 (r=4)	0.380184	28.548	35.010
At most 5 (r=5)	0.253340	10.850	18.397
At most 6 (r=6)	0.001107	0.0409	3.8414

* Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level

In the table 4, according to based on the maximum likelihood method, the Johansen cointegration analysis is sensitive to the lag length. The delay length is determined as 1 according to the Akaike Information Criteria, Schwarz Information Criteria, and Hannan-Quinn Information Criteria, which provide the stability condition of the model within the VAR model framework. In Table 4, there is no cointegrated vector between the variables if the trace statistic is greater than the critical value at the 5% significance level according to Johansen cointegration results, and the null hypothesis (r = 0, r=1, r=2, r=3) is rejected. In this case, there is three cointegrated vector among the variables (r = 4) hypothesis is accepted. According to this, life expectancy and health expenditures have a long-term coexistence relationship.

Table 5. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized	Eigenvalue	Max-Eigen Statistic	%5 critical value
None* (r=0)	0.831006	65.782	49.586
At most 1* (r=1)	0.784355	56.762	43.419
At most 2* (r=2)	0.636893	37.483	37.163
At most 3 (r=3)	0.516039	26.852	30.815
At most 4 (r=4)	0.380184	17.698	24.252
At most 5 (r=5)	0.253340	10.809	17.147
At most 6 (r=6)	0.001107	0.0409	3.8414

* Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level

In the table 5, according to the Johansen cointegration test results, there is a cointegrated vector between the variables when the maximum eigenvalue statistic is greater than the critical value at the 5% significance level. The hypotheses r = 0, r = 1 and r = 2 are rejected. In this case, there is two cointegrated vector among the variables (r = 3) hypothesis is accepted. According to this, life expectancy and health expenditures have a long-term coexistence relationship.Generally, there is no contradiction in trace statistic and maximum eigenvalue test, but the maximum eigenvalue statistic will be preferred as it gives more precise results when encountered (Tarı, 2014). That is, there are two long-term cointegration relationships between health spending and life expectant variables.

Table 6. Granger Causality Test

Direction of Causality	Obs.	F-Statistic	Prob.
1- $AGE \rightarrow DGDP$	36	2.81341	0.0451**
2- $AGE \rightarrow DLE40$	36	2.85657	0.0428**
3- $AGE \rightarrow DLE60$	36	2.95077	0.0382**
4- $DHCE \rightarrow DDRPERPOP$	36	3.49991	0.0199**
5-$DHCE \rightarrow DGDP$	36	3.49881	0.0200**
6-$DLE60 \rightarrow DLE80$	36	4.29151	0.0081*
7-$DLE80 \rightarrow DDRPERPOP$	36	4.72319	0.0051*

* 1%, the level of significance
** 5%, the level of significance

According to table 6, analysis results show that at a level of significance of 5%, we can reject null hypotesiz that is we can not accept null hypotesiz so AGE does cause DGDP (AGE → DGDP), AGE → DLE40, AGE → DLE60, DHCE → DDRPERPOP,DHCE → DGDP,and level of significance of 1%, we can reject null hypotesiz that is we can not accept null hypotesiz so DLE80 →DDRPERPOP and DLE60 → DLE80 shows the uni direction of causality.

V. CONCLUSİON AND DİSCUSS

In a developed world have experienced a significant increase in life expectancy in last years and per capita health care expenditure has increased dramatically. There is a consensus amongst researchers that health expenditures, reflecting the quality of healthcare, may have a positive impact on the population health status and that this impact should be evaluated.A positive and significant relationship between life expectancy and healthcare expenditure has been found in many empirical studies (i.e. Hermanowski et al. 2015).There is a direct relationship between health expenditures and average life expectancy.

Ageing of the population is a crucial driver of health care expenditure (HCE) and effect population ageing on health and increasing health care cost. Population ageing has become or is becoming a medical and social problem in most developed countries.Ageing of the population is driver of health care expenditure (HCE) and effect population ageing and increasing health care cost. “Red-herring” hypothesis is that positive correlation between age and HCE is exclusively due to the fact that mortality rises with age and a large share of HCE is caused by proximity to death, but does not apply to the results of our work. According to the results of analyze, drperpop, gdp, hce, le65, le70, le75 variables are stable at 1% significance in the first I(1) difference value. The AGE valuable is stable 1% at the level value. There are two long-term cointegration relationships between health spending and life expectant variables. There is a uni direcitonal granger causality, AGE → DGDP, AGE → DLE40, AGE → DLE60, DHCE → DDRPERPOP, DLE80 →DDRPERPOP, DHCE → DGDP and DLE60 → DLE80.

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