THE RELATIONSHIP BETWEEN ECONOMIC FACTORS AND HEALTH PERSONNEL EMPLOYMENT IN TURKEY: AN ECONOMETRIC ANALYSIS

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ABSTRACT

This study applies the ARDL (Autoregressive Distributed Lag) bounds testing approach developed by Pesaran, Shin and Smith (2001) to reveal the relationship between economic factors and health personnel employment in Turkey between 1974-2015. While the health personnel data includes the number of physicians and other health personnel (midwives and nurses), reel GDP (Real Gross Domestic Product) and economic crises are included as economic factors in the study. In terms of long-run relationships between economic growth and health personnel number, this study shows that while the employment of the physicians is made independently of economic growth, other health personnel are employed directly proportional to the increase in income in Turkey. The findings of the study show that the 1994 economic crisis has had a significant decreasing effect on only the number of other health personnel. Both the results of long-run relationships and impacts of economic crises in this study shows that the politicians pay more attention to the physicians than other health personnel. As health care services are based on teamwork, cuts in the number of other health personnel during any economic hardship will make it difficult to meet the health services needs of population in terms of quality and quantity. Therefore, politicians need to pay more attention to the recruitment of other health personnel too.

Keywords: Economic Factors, Economic Crisis, Health Personnel Number, Turkey, ARDL Bounds Testing.

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TÜRKİYEDE EKONOMİK FAKTÖRLER VE SAĞLIK İŞGÜCÜ İSTİHDAMI ARASINDAKİ İLİŞKİ: EKONOMETRİK BİR ANALİZ

ÖZ

Bu çalışma, 1974-2015 arası Türkiye'de ekonomik faktörler ve sağlık personeli istihdamı arasındaki ilişkiyi ortaya koymak için Pesaran, Shin ve Smith (2001) tarafından geliştirilen ARDL (Otoregresif Dağıtılmış Gecikme Modeli) sınır testi yaklaşımını uygulamaktadır. Sağlık personeli verisi hekim, diğer sağlık personeli (ebe ve hemşire) sayısını kapsamakta iken, reel GSYH ve ekonomik krizler çalışmaya ekonomik faktörler olarak dahil edilmiştir. Ekonomik büyüme ile sağlık personeli sayısı arasındaki uzun dönemli ilişki açısından bu çalışma, Türkiye'de hekim istihdamının ekonomik büyümeden bağımsız olarak yapıldığını, ebe ve hemşire istihdamının ise doğrudan ekonomik büyüme ile orantılı yapıldığı ortaya koymaktadır. Çalışmanın bulguları, 1994 ekonomik krizinin sadece ebe ve hemşire sayısı üzerinde önemli şekilde azaltıcı etkisinin olduğunu göstermektedir. Çalışmanın hem uzun dönem ilişkilere hem de krizlerin etkilerine dair sonuçları politikacıların hekimlere ebeler ve hemşirelerden daha fazla önem verdiklerini göstermektedir. Sağık hizmetleri ekip çalışmasına dayalı olduğu için bir ekonomik zorluk döneminde ebe ve hemşire sayısında yapılacak kesintiler toplumun sağlık hizmeti ihtiyacının nicelik ve kalite açısından karşılanmasını zorlaştıracaktır. Bu yüzden politikacıların diğer sağlık personeli istihdamına da daha fazla önem vermesi gerekmektedir.

Anahtar Kavramlar: Ekonomik Faktörler, Ekonomik Krizler, Sağlık Personeli Sayısı, Türkiye, ARDL Sınır Testi.

INTRODUCTION

Health personnel or health workforce can be defined as workforce that produces every kind of health services in the public or private sector. Health personnel is classified in various forms in the literature. However, health workforce statistics published by the World Health Organization summarize the health workforce under 29 headings and, physicians, dentists, pharmacists, veterinarians, nurses, physiotherapists and laboratory technicians are included in this classification (Islek, 2005). The services in the health institutions are heavily provided by teams and the division of labor between physicians, nurses and other health personnel shows that health care cannot be provided by a single professional group (Cirakli, Celik and Beylik, 2015).

Although health care services are provided by teams, especially physicians and nurses play an important role in the functioning of hospitals (Imirlioglu, 2009). Because health manpower statistics between 1974-2015 in Turkey show that about 35% of the total health staff are nurses, and about 36% of the total health staff are physicians. When the midwives are included in the number of nurses, nurses constitute about 55% of total health staff (Turkish

Statistical Institute, 2016). Researches show that the increase in nurse numbers is linked to the decrease of inpatient mortality in the hospitals (Duffin, 2014; Palese and Watson, 2014). It is not possible to provide health services effectively and of high quality without sufficient health personnel.

It is also stated that midwives and nurses should form the base of the pyramid in the distribution of team. But the most frequent subject in quantitative evaluation in Turkey is that the number of physicians should be increased (Kilic, 2007). On the other hand, Turkey has not also a good place in the rankings among OECD countries in terms of the number of nurses per hundred thousand people, as well as the physicians' shortage. According to 2015 data, the number of physicians, nurses and midwives per hundred thousand people in Turkey are 179, 162 and 67 respectively, while the OECD countries' average are 339 for physicians, and 1071 for nurses and midwives (Republic of Turkey Ministry of Health General Directorate of Health Research, 2016). So increasing only the physician number without increasing the number of nurses and other health staff will not be a realistic approach (Kilic, 2007).

Regarding the models of health determinants, it seems that economic factors are among the important determinants of health. Therefore, any economic change will have an effect on the health independently (negatively or positively) (Cirakli, 2019; Cirakli and Yildirim, 2018, 2019). Cooper et al. (2002) states that there is a correlation between the growth of GDP and growth of health personnel number, and they find that most of the growth in the health workforce between 1929-2000 in the United States has involved ancillary personnel, so physicians become a proportionately smaller component. On the other hand, Cirakli (2019) and Cirakli and Yildirim (2018, 2019) states that policies or policy choices of politicians emerge as an important factor in determining the direction of the effects of economic changes on health and h0ealth personnel employment. Because, the social determinants of health are highly affected by the distribution of income, resources and power and, these factors are generally shaped by political institutions (Yildirim, 2015). In this context, it is possible to say that increasing or decreasing the number of any kind of health staff is based on a political choice. This research aims to investigate the relationship between economic factors and health personnel numbers within the context of political choice in Turkey between 1974-2015.

For Turkey, the number of comprehensive studies of the effects of economic factors including economic growth and economic crisis on health personnel employment is limited. The studies about the relationship economic growth and health are usually related to the effect of economic growth on health expenditures or the relationship between human capital and economic growth (Ecevit and Kuloglu, 2016; Ecevit and Cetin, 2010). Therefore, it is thought that this study will make a significant contribution to the national literature in this field. On the other hand, the results of the study should be evaluated in the scope

of some limitations that the study have. First of all, the scope of the study is limited to national data for Turkey. Thus, the results of the study cannot be generalized for other countries. Second, because data of the study related to economic factors includes only real GDP and economic crisis, the results of the study are valid under the assumption of the other factors being ceteris paribus.

I. METHOD

A. STUDY DESIGN

To investigate the relationship between economic factors and other health personnel employment, ARDL cointegration analysis, which is also called ARDL bounds testing, will be applied within the scope of the time series analysis as an econometric method. Cointegration tests are used to determine the long-run relationships between variables. Assumption of the stationarity of the series lie at the basis of the cointegration analyzes, developed for the determination of long-run relationships between time series and variables. Stationarity means that mean, variance and covariance of the time series do not change over time. Therefore, a stationary time series is one whose statistical properties such as mean, variance, covariance is all constant over time. ln the presence of non-stationary variables, there might be a spurious regression, which has a high R2 statistics that appear significant, but the relationship between variables are not real. Thus, the series must be stationary in the cointegration analyzes. The non-stationary series can be made stationary by applying differencing process to the series. If it is necessary "d" times differencing to make stationary a non-stationary Y_t time series, this time series is stationary at its "d" order difference value, and can be shown as $Y_t \sim I(d)$ (Narayan ve Narayan, 2004; Narayan ve Narayan, 2006; Ciftci, 2009).

Ordinary least squares (OLS) technique can be used if all variables are stationary at the level values, i.e. I(0).19 Nevertheless, macroeconomic time series data are generally stationary at their first difference, not in level values (Gujarati, 2004, 2011). Some cointegration techniques including Engle and Granger (1987), Johansen (1988), Phillips and Hansen (1990) and Johansen and Juselius (1990) can be used instead of the standard regression technique when all the variables to be used in econometric analysis are stationary at their first difference, i.e. I(1) (Erdogan and Bozkurt, 2008; Ciftci and Yildiz, 2015). ARDL bounds testing approach developed by Pesaran, Shin and Smith (2001) is also one of these tests used to determine a log-run relationship between variables. ARDLs (Auto regressive distributed lags) are standard least squares regressions that include lags of both the dependent variable and explanatory variables as regressors (Greene, 2008). This model has advantage to predict future results based on past results because it includes lagged affects, and also ARDL bounds testing approach gives robust and effective results in studies with few observations (Narayan ve Narayan, 2004; Narayan ve Narayan, 2006; Wang, 2009; Erdem, Ilgün ve Dumrul, 2011) Because the results of economic

events are not immediately apparent, ARDL approach is a powerful method to account for lagged impacts (Narayan ve Narayan, 2004; Narayan ve Narayan, 2006).

ARDL procedure can be carried out in four stages (Ciftci, 2009; Tuncsiper and Bicen, 2013). The first stage is to test for stationary of time series, also called unit root test. The second stage is to estimate an Unrestricted Error Correction Model (UECM) and to perform bounding test. This model includes the lagged values of variables with the appropriate differencing, one period lagged level values of variables, and dummy variables if needed (economic crisis as dummy variables in this study). In this stage, an UECM is estimated with ordinary lest squares technique (OLS) and the bounding test (wald test) is performed for the joint significance of the coefficients of the one period lagged level values. Then it is decided whether there is a long-run relationship (cointegration relationship) between dependent variable and explanatory variables by comparing F-statistic value obtained from Wald test with the upper and lower critical values derived by Pesaran, Shind and Smith (2001). If the F test value exceeds the upper critical values, then it is decided that there is a long-run relationship between variables. However, in this stage diagnostic tests including Breusch-Godfrey autocorrelation LM test, Jarque-Bera normality test, ARCH test, Ramsey Reset test and, CUSUM and CUSUM-SQ stability test should also be performed to determine whether the predicted model is valid and appropriate.

After detecting cointegration relationship between variables, the third stage is to estimate an ARDL model with OLS technique to determine the long-run coefficients. In the model at this stage, the variables are introduced into analysis with their level values, and dummy variables are also included if there are. Once the coefficients for the long-term relationship have been determined, the model's diagnostic tests are performed again to decide whether the model is appropriate or not. The last stage is to build an Error Correction Model (ECM) to estimate the short-term coefficients. ECM can be derived from ARDL model through a simple linear transformation, which integrates short run adjustments with long run equilibrium without losing long run information. ECM includes error correction term, which refers to one period lagged value of the model's residuals in which the long-term relationship between variables is obtained, and the lagged values of the differences of all variables. The coefficient of the ECM term indicates how much of an imbalance in the short run after shocks will be corrected in the long run. The error correction term is expected to be negative and significant. Therefore, the coeffients of dummy variable as economic crises in this stage will give us the impacts of economic crisis on the health personnel number.

B. DATA AND STATISTICAL ANALYSIS

The data of the study were obtained annually with a total of 42 observations between 1974 and 2015. These data are shown in Table 1. In the study, while real GDP is used as independent variable, number of physicians and, number midwives and nurses are used as dependent variables. In addition to these data, three crisis dummy variables were added for the economic crises of 1994, 2001 and 2009.

Table 1. Data, Abbreviations and Data Source

Data	Abbreviation	Data Source
Number of physicians	NPHYC	TurkStat (2016)
Number of midwives and nurses	NOHP	TurkStat (2016)
Real GDP	RGDP	World Bank (2016)

Sources: TurkStat, 2016; World Bank, 2016.

To perform the ARDL cointegration method, the EViews 9.5 statistical program was used. The ARDL method was carried out in four stages. First, unit root tests for time series were performed. The Augmented Dickey-Fuller (ADF) test and Phillipd-Perron test were used for the unit root test (Dickey and Fuller, 1979, 1981; Phillips and Perron, 1988). Second, an Unrestricted Error Correction Model (UECM) was built, the model was estimated with the OLS technique, and the bounds testing (Wald test) was performed. Then, it was decided whether there was a cointegration relation between the variables by comparing F-statistic value obtained from the Wald test with the upper and lower critical values derived by Pesaran, Shin and Smith (2001). Akaike information is used to calculate the optimal lag length for each variable in the UECM. In the determination of the maximum lag length of the estimated model, the lag length at which no autocorrelation is found is taken into account. Whether autocorrelation is present or absent was determined by the Breusch-Godfrey LM test for autocorrelation. Due to the fact that the lagged values of the dependent variable are included in the model as explanatory variables, Breusch-Godfrey autocorrelation LM is used instead of the Durbin-Watson test statistic in investigating the autocorrelation problem. In addition, diagnostic tests of the selected model have been carried out. In this context, the Jarque-Bera test for normal distribution fit, the ARCH test for heteroskedasticity, and the Ramsey Reset test for the functional form misspecification were performed. Moreover, CUSUM and CUSUM-SQ tests were performed to determine the stability of the models.

In the third stage, the ARDL model was estimated to determine the long-term coefficients. At this stage, the Akaike information criterion was used to determine the maximum lag length. For the estimated model, the Breusch-

Godfrey autocorrelation LM test, Jarque-Bera normality test, ARCH test, Ramsey Reset test, and CUSUM and CUSUM-SQ stability tests were performed. In the fourth stage, the Error Correction Model (ECM) was created by using the ARDL model and this model was estimated with the OLS technique.

C. LIMITATIONS AND ASSUMPTIONS

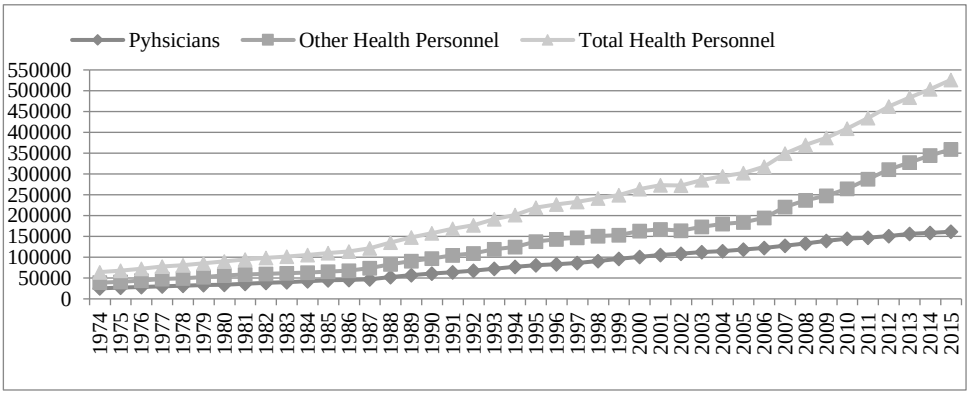
It is accepted that the data obtained for our study is accurate. Real GDP has been used as independent (explanatory) variable in our study. There are many factors besides this variable that affects health personnel numbers. In this context, the results are limited only the variables used in the study. The data with 42 observations can also be assumed as small in terms of the time series analysis.

II. RESULTS AND DISCUSSIONS

A. BASIC STATISTICAL RESULTS

The number of health personnel in Turkey has been assessed under the number of physicians and the number of other health staff. The number of physicians includes dentists and other practitioners and specialist physicians, while the number of other health personnel is composed of midwives and nurses. The graph 1 below shows the health personnel numbers between 1974 and 2015.

Graph 1. Health Personnel Number in Turkey Between 1974-2015



Source: TurksStat, 2016.

As seen in the Graph 1, the number of physicians in Turkey, has steadily increased from 1974 until 2015. The number of other health personnel, which was 39048 in 1974, increased to 359263 in 2015. The number of other health personnel also showed a tendency to increase, but in 2002, following the 2001 crisis, it decreased by about 2%. But decreases were seen in only two professions as nurses and midwives and, the decrease in the number of nurses was about %2.5.

B. RESULTS OF UNIT ROOT TESTS

In this study, the ADF unit root test and Phillps-Perron test were used to determine the stationarity of the time series used in the analysis. The results of unit root tests are shown in Table 2 and are only given for the models which are used in the ARDL bound tests. In Table 2, LRGDP means logarithmic real gross domestic product, LPHYC means logarithmic physician number and LOHP means logarithmic other health personnel number. Also "t" shows value of t-statistic and "p" shows probality values for t-statistics. According to the unit test results, all the variables meet the condition of not being stationary in their level values but being stationary in their first difference values.

Table 2. Results of Unit Root Tests

	Variables	Models	Level Values		First Difference Values	
			t	p	t	p
ADF Test	**LRGDP**	Intercept	-0.39	0.9013	**-6.44*** **	0.000
	LPHYC	Intercept	-2.21	0.204	**-3.60** **	0.010
	LOHP	Intercept	-0.23	0.925	**-4.46*** **	0.000
	Variables	**Models**	**Level Values**		**First Difference Values**	
			Adjusted t	**p**	**t**	**p**
Phillips-Perron Test	**LRGDP**	Intercept	-0.37	0.9054	**-6.62*** **	0.000
	LPHYC	Intercept	-2.33	0.1690	**-3.71*** **	0.007
	LOHP	Intercept	-0.17	0.9340	**-4.47*** **	0.000

* shows %10 level of significance, ** %5 level of significance, *** %1 level of significance

Notes: For the ADF test, maximum lag length of 9 and Akaike Information Criteria for maximum lag length were choosen. For the Phillips-Perron test, Newey-West bandwith with automatic selection were choosen. Critical values for the ADF test were -3.60, -2.93 and -2.60 for intercept respectively at 1%, 5% and 10% significance levels in MacKinnon (1996).

C. RESULTS OF UECM (BOUNDS TESTING)

The results of ARDL Bound tests are shown in the Table 3. According to test results, it is observed that the model related to the physician number has cointegration at %5 level of significance, and the model related to the other health personnel number has cointegration at %1 significance level. Note that, diagnostic tests including the Breusch-Godfrey autocorrelation LM test, Jarque-Bera normality test, ARCH test, Ramsey Reset test and, CUSUM and CUSUM-SQ stability tests were performed for all UECM models shown in Table 3. There was a small overflow in CUSUM-SQ of LOHP. According to Yakisik and Cetin (2014), such small overflows do not disturb the stability of the model as long as they return to the confidence interval. In this context, it can be said that the coefficients belonging to the model are stable since the small overflow in the CUSUM-SQ graph of the estimated model.

Table 3. Results of ARDL Bounds Testing

Estimated ARDL Model	**LPHYC [2, 0]**			
k	**F**	**p**	**R^2**	**A-R^2**
3	4.74	0.008	0.35	0.17
Diagnostic Tests*	**S.E:** 0.017 **S.S.E:** 0.008; **LM.:** 0.35, p: 0.702; **JB.Nor.:** 0.23, p: 0.890; **ARCH:** 0.09, p: 0.758; **Ramsey:** 2.08, p: 0.143			
Estimated ARDL Model	**LOHP [1, 0]**			
k	**F**	**p**	**R^2**	**A-R^2**
3	5.95	0.002	0.35	0.21
Diagnostic Tests*	**S.E:** 0.026 **S.S.E:** 0.022; **LM.:** 1.80, p: 0.118; **JB.Nor.:** 0.98, p: 0.609; **ARCH:** 0.95, p: 0.333; **Ramsey:** 0.22, p: 0.638			

Critical Values		
The Significance Level	**Lower Limit**	**Upper Limit**
%1	3.65	4.66
%2.5	3.15	4.08
%5	2.79	3.67
%10	2.37	3.20

* Meaning of the abbreviations in diagnostic tests section; S.E: Standard error, S.S.E: Sum of sguared errors, LM.: Breusch-Godfrey LM test for autocorrelation, JB.Nor.: Jarque-Bera normality test, ACCH.: ARCH test, Ramsey: Ramsey Reset test

D. Results of ARDL Error Correction Models

At this stage, with the Eviews 9.5 package program, a general ARDL model is estimated by the OLS technique by choosing a maximum lag length of 3 for the number of physician's model and 2 for the number of other health personnel model, using Akaike Information Criteria for maximum lag length and then the most appropriate ARDL model was decided. The selection of the most appropriate ARLD model is made automatically by the Eviews 9.5 package program according to the selected information criterion and the maximum lag length. The results of ECM model for the number of physicians are shown in Table 4.

Table 4. ARDL Model Long and Short Term Estimation Results: Number of Physicians

Estimated ARDL Model: [2, 0]							
Long-Term Model				**Short-Term Model (ECM)**			
Dependent Variable: LPHYC				**Dependent Variable: ΔLPHYC**			
Variables	**Coefficient**	**t-statistics**	**p**	**Variables**	**Coefficient**	**t-statistics**	**p**
LRGDP	0.783	1.796	0.082	**ΔLRGDP**	0.001	0.019	0.985
D_1994	0.607	0.927	0.360	**ΔD_1994**	0.022	1.777	0.085
D_2001	0.267	0.601	0.552	**ΔD_2001**	0.014	1.181	0.246
D_2009	0.309	0.614	0.543	**ΔD_2009**	0.008	0.619	0.540
C	-7.460	-0.642	0.525	**ECM(-1)**	-0.040	-3.960***	0.000

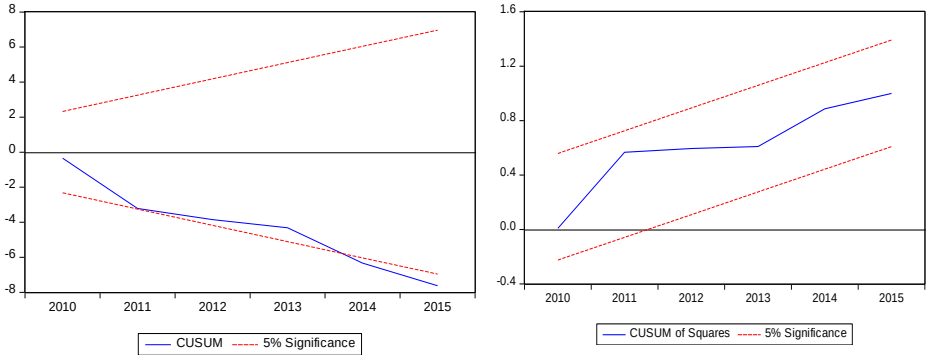
ECM= LPHYC - (0.7829*LRGDP + 0.6071*D_1994 + 0.2669*D_2001 + 0.3094*D_2009 -7.4605)

Diagnostic Tests	**Statistics**	**p**
R^2	0.992	
Adjusted R^2	0.990	
Standart Error	0.017	
Sum of Squared Errors	0.009	
F-Statistic	7061.46	0.000
F-Statistic of Breusch-Godfrey Autocorrelation LM Test	0.15	0.960
Jarque-Bera Test Statistic	1.04	0.592
F-Statistic of ARCH Heteroscedasticiy Test	0.02	0.872
F-Statistic of Ramsey Reset Test	6.66	0.015

* shows %10 level of significance, ** %5 level of significance, *** %1 level of significance

According to the results given in Table 4, it is understood that ARDL [2, 0] model has not got any problem in terms of diagnostic statistics (autocorrelation, normal distribution fit, heteroscedasticity and functional form misspesification). Similarly, from CUSUM-SQ graph (Figure 1) it is seen that there is no problem in terms of stability.

Figure 1. ARDL CUSUM ve CUSUM-SQ Graphs: Number of Physicians



According to the error correction model results shown in the Table 4, it is observed that the coefficient of ECM (-1) is negative and statistically significant as expected. From this coefficient (-0.04), it can be said that 4% of the deviations in the long-term equilibrium of the system after the shocks that can occur in the short-term period in the system will be eliminated in next period.

From the results for the long term model in Table 4, it is seen that the long term coefficient of real GDP (0.783) is not statistically significant (p>0.05). This result shows that there is no significant effect of the real GDP on the number of physicians in the long run. It is evaluated that the most important factor in this result is that recruitment of physicians is made according to the chart of personnel distribution without being subject to an examination in Turkey, and to meet the need for physicians' workforce in Turkey is thought to be politically important. It is also argued that the fact that physicians are the main decision makers in the health care services and the majority of the health care claims are determined by doctors is among the main reasons for that result (Newhouse, 2002).

The results given in Table 4 show that the economic crises of 1994, 2001 and 2009 did not significantly affect the number of physicians (p>0,05). On the other hand, it was found that the 1994 economic crisis significantly (p=0,045) negatively (-0,03) affected the number of other health personnel. But, the 2009 economic crisis had no significant effect on the number of other health personnel (p>0.05). For the total number of health personnel, it is observed that the economic crisis has no significant effect (p>0.05).

A general ARDL model is estimated by the OLS technique by choosing a maximum lag length of 2 for the number of other health personnel model, using Akaike Information Criteria for maximum lag length and then the most appropriate ARDL model was decided. The selection of the most appropriate

ARLD model is made automatically by the Eviews 9.5 package program according to the selected information criterion and the maximum lag length. The results of ECM model for the number of other health personnel are shown in Table 5.

Table 5. ARDL Model Long and Short Term Estimation Results: Number of Other Health Personnel

Estimated ARDL Model: [2, 0]							
Lon Term Model				**Short Term Model (ECM)**			
Dependent Variable: LOHP				**Dependent Variable: ΔLOHP**			
Variables	**Coefficients**	**t-statistics**	**p**	**Variables**	**Coefficients**	**t-statistics**	**p**
LRGDP	1.339	25.154***	0.000	**ΔLRGDP**	0.108	1.069	0.293
D_1994	0.080	0.498	0.622	**ΔD_1994**	-0.038	-2.081**	0.045
D_2001	-0.002	-0.014	0.989	**ΔD_2001**	0.010	0.576	0.569
D_2009	0.014	0.087	0.931	**ΔD_2009**	-0.018	-0.999	0.325
C	-21.261	-16.220***	0.000	**ECM(-1)**	-0.204	-5.010***	0.000

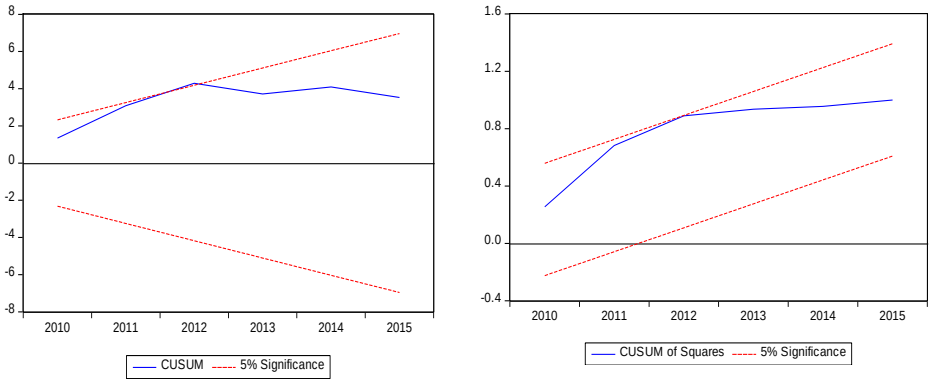
ECM= LOHP - (1.3328*LRGDP + 0.0186*D_1994 -0.0249*D_2001 -0.0154*D_2009 -21.1914)

Diagnostic Tests	**Statistics**	
R^2	0.999	
Adjusted R^2	0.998	**p**
Standart Error	0.02	
Sum of Squared Errors	0.02	
F-Statistic	3667.30	0.000
F-Statistic of Breusch-Godfrey Autocorrelation LM Test	1.42	0.255
Jarque-Bera Test Statistic	0.61	0.736
F-Statistic of ARCH Heteroscedasticiy Test	0.67	0.416
F-Statistic of Ramsey Reset Test	0.05	0.822

* shows %10 level of significance, ** %5 level of significance, *** %1 level of significance

It is understood that the ARDL [2, 0] model in Table 5 does not have any problem in terms of diagnostic statistics (autocorrelation, normal distribution fit, heteroscedasticity and functional form misspesification). In addition, CUSUM and CUSUM-SQ test results are graphically shown in Figure 2 to show whether long term coefficients are stable. According to the CUSUM and CUSUM-SQ graphs, it is understood that the long term coefficients of the model are stable.

Figure 2. ARDL CUSUM and CUSUM-SQ Graphs: Number of Other Health Personnel



According to the results of the error correction model in the Table 5, it is seen that the coefficient of ECM (-1) is negative and statistically significant as expected. It is possible to say that the deviations in the long term equilibrium of the system after the shocks which may occur in the system in the short term will be eliminated after about five periods later (-0,20).

From the information on the long term coefficients in Table 5, it has been found that there is a long term cointegration relationship between the number of other health personnel and real GDP and, the increase in real GDP has a significant ($p<0.05$) increasing effect on the number of other health personnel. Basically, this long term relationship between income growth and the increase in the number of other health personnel is expected. However, real GDP in Turkey does not affect significantly the number of physicians but affect the number of other health personnel is interesting. This result can be thought of as a sign that politicians attach more importance to physicians than to midwives and nurses.

For the effects of economic crises on the number of other health personnel, it has been found that the 1994 economic crisis significantly ($p<0.05$) and negatively (-0.03) affected the number of other health personnel and that the economic crises of 2001 and 2009 were not significant ($p>0.05$). From these results it can be stated that the 1994 economic crisis has had a reducing effect on the number of other health personnel. Eurofound (2014) suggests that personnel cuts are clearly linked to the crises. It is also possible to say that the personnel cuts are directly the results of a political choice. In this context, it is considered that the reducing affect of 1994 economic crisis on the other health personnel is a sign of the political preference. Because health care based on teamwork, it is possible that heal services quality and availability may adversely be affected from this situation. In addition, sometimes these interruptions can lead health professionals to go to other countries (HOPE, 2011; Eurofound, 2014).

CONSLUSION

This study shows that there is not any long term relationship between real GDP (economic growth) and physician number. On the other hand, there is a cointegration relationship (long term relationship) between economic growth and other health personnel number, and when real GDP increases, other personnel number increases too. These long terms relationships between the economic growth and health personnel numbers show that while the recruitment of the physicians is carried out indepently of economic growth, the recruitment of other personnel is related to the increase of income. Cooper et al. (2002) similarly find that employment of other health personnel is correlated to economic growth. They also find that employment of physicians is also correlated to economic growth but physicians' increase rate is low when compared to other health personnel.

Additionally, the results show that the number of physicians will not probably effected negatively but the number of other health personnel will be effected negatively in case of an economic crisis in Turkey. It is evaluated that political choice is an important factor in this result. And politicians pay more attention to the recruitment of physicians than other health personnel. Since the health sector is a labor-intensive and teamwork-based sector, it is going to be difficult to meet the increasing health care service needs of population when the number of other health personnel is cut in case of an economic crisis. For this reason, politicians need to give more importance to the employment of other health personnel.

The main aim of this study was to evaluate the relationships between economic factors and health personnel employment in Turkey. From the results of the study, it can ben concluded that the employment of nurses and midwives in Turkey is correlated to the economic growth, but the employment of physicians in Turkey is not. This study is important to provide scientific evidence for the relationship between economic factor and health personnel employment. On the other hand, some limitations of the study require that the results should be evaluated carefully. Because of having data for only Turkey, the results of the study can not be generalized for other countries. Also study only includes only real GDP and economic crisis as economic factors the results of the study are valid under the assumption of the other factors being ceteris paribus. When considering the limitations of this study, a future study with more economic factors and more countries' data may provide better evidence. Also a study that using the budget of the ministry of health instead of real GDP may give better results about health personnel employment in Turkey.

REFERENCES

Cetin, M. and Ecevit, E. (2010). The effect of health expenditures on economic growth: a panel regression analysis on OECD countries. *Doğuş University Journal, 11*(2), 166-182.

Cirakli, U. (2019). Investigation of the relationship between macroeconomic factors and health expenditures and ministry of health budget in Turkey through ARDL bounds testing approach. *Afyon Kocatepe University Journal of Social Sciences, 21*(2), 581-596. https://doi.org/10.32709/akusosbil.449527.

Cirakli, U., and Yildirim, H. H. (2018). Health policy choices and countermeaures taken in times of economic crisis from 1994 to 2014 in the world: A theoretical review. *Health Care Academician Journal, 5*(4), 43-51.

Cirakli, U., and Yildirim, H. H. (2019). The impacts of economic crisis on the public health in Turkey: An ARDL bounds testing approach. *Hacettepe Sağlık İdaresi Dergisi, 22*(2), 259-280.

Cirakli, U., Celik, Y. and Beylik, U. (2015). The importance and benefits of effective teamwork in health care: A literature survey. *Health Care Academician Journal, 2*(3), 140-146. https://doi.org/10.5455/sad.2015131452108477.

Cooper, R. A., Getzen, T. E., McKee, H. J. and Laud, P. (2002). Economic and demographic trends signal an impending physician shortage. *Health Affairs, 21*(1), 140-154. https://doi.org/10.1377/hlthaff.21.1.140.

Dickey, D. A. and Fuller, W.A. (1979). Distribution of the estimators for autoregressive Time Series with a unit root. *Journal of the American Statistical Association,* 74, 427–431.

Dickey, D. A. and Fuller, W.A. (1981). Distribution of the estimators for autoregressive time series with a unit root. *Econometrica,* 49, 1057-1072.

Duffin, C. (2014). Increase in nurse numbers linked to better patient survival rates in ICU. *Nursing Standart, 28*(33), 10-10. https://doi.org/10.7748/ns2014.04.28.33.10.s8.

Ecevit, E. and Kuloglu, A. (2016). The Relationship between human capital and economic growth in Turkey. *IOSR Journal of Economics and Finance, 7*(6), 69-72.

Engle, R. F. and Granger, C. W. J. (1987). Co-integration and error correction: representation, estimation and testing. *Econometrica, 55*(2), 251-276. http://dx.doi.org/10.2307/1913236.

Erdem, E., İlgün, M. F. ve Dumrul, C. (2011). Finansal İstikrarın Bankacılık Sisteminin Borç Verme Politikaları Üzerindeki Etkisi: 2008 Küresel Krizi Çerçevesinde Türkiye Üzerine Bir İnceleme. *BDDK Bankacılık ve Finansal Piyasalar, 5*(1), 9-34.

Erdogan, S. and Bozkurt, H. (2008). The relation between life expectancy and economic growth: an analysis with ARDL model. *The Journal of Knowledge Economy and Knowledge Management, 3*(1), 25-38.

Eurofound (European Foundation for the Improvement of Living and Working Conditions). (2014). *Access to healthcare in times of crisis.* Luxembourg: Publications Office of the European Union.

Greene, W. H. (2008). *Econometric analysis* (6th ed.). Prentice Hall.

Gujarati, D. N. (2004). *Basic econometric* (4th ed.). The McGraw-Hill Companies.

Gujarati, D. N. (2011). *Econometrics by example*. Palgrave Macmillian.

HOPE (European Hospital and Healthcare Federation). (2011). The Crisis, Hospitals and Health Care. European Hospital and Healthcare Federation.

Imirlioglu, I. (2009). The Sources of Stress for the Medical Doctors and the Nurses That Work for the State Hospitals and Their Views on the Affects of Stress on Their Performances (An Example of the Province of Ankara). *Verimlilik Dergisi*, 4, 53-101.

Islek, N. (2005). *Evaluation of nursing service performance and manpower planning based on a workload analysis of nursing services* (Unpublished Master Thesis). Hacettepe University.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control,* 12, 231-254. https://doi.org/10.1016/0165-1889(88)90041-3.

Johansen, S. and Juselius, K. (1990). Maximum likelihood estimation and inferences on cointegration-with applications to the demand for money. *Oxford Bulletin of Economics and Statistics,* 52, 169-210. https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x.

Kilic, B. (2007). Health manpower planning and employment policies for Turkey. *TAF Preventive Medicine Bulletin, 6*(6), 501-514.

MacKinnon, J.G. (1996). Numerical distribution functions for unit root and cointegration tests. *Journal of Applied Econometrics,* 11, 601-618.

Narayan, P. K. and Smyth, R. (2006). What determines migration flows from low-income to high-income countries? an empirical investigation of Fiji-US migration 1972–2001. *Contemporary Economic Policy, 24*(2), 332–342. https://doi.org/10.1093/cep/byj019.

Narayan, S. and Narayan, P. K. (2004). Determinats of demand of Fiji's exports: an empirical investigation. *The Developing Economics, 42*(1), 95-112. https://doi.org/10.1111/j.1746-1049.2004.tb01017.x.

Newhouse, J. P. (2002). *Pricing the priceless: a health care conundrum.* MA: MIT Press, Cambridge.

Palese, A. and Watson, R. (2014). Nurse staffing and education in Europe: if not now, when? *The Lancet,* 383, 1789-1790. https://doi.org/10.1016/S0140-6736(14)60188-4.

Pesaran, M. H., Shin, Y. and Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289-326. https://doi.org/10.1002/jae.616.

Phillips, P. C. B. and Hansen, B. E. (1990). Statistical inference in instrumental variables regression with I(1) processes. *Review of Economic Studies,* 57, 99-125. https://doi.org/10.2307/2297545.

Phillips, P. C. B. and Perron, P. (1988). Testing for a Unit Root in Time Series Regression. *Biometrika, 75*(2), 335–346. doi:10.1093/biomet/75.2.335.

Republic of Turkey Ministry of Health General Directorate of Health Research. (2016). *Health statistics yearbook 2015.* Ankara: Republic of Turkey Ministry of Health General Directorate of Health Research.

Tuncsiper, B. and Bicen, O. F. (2013). The effects of European debt crisis on Turkey's exports. In: S. Sarı, A. H. Gencer, I. Sozen (Eds.),

Proceedings of international conference on Eurasian economies (pp. 486-495). St. Petersburg, Russia.

TurkStat. (2016, 4 August). Health statistics. Accessed http://www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=254.

World Bank. (2016, 4 August). World development indicators. Accessed http://databank.worldbank.org/data/reports.aspx?source=2&country=TUR#.

Yakisik, H. and Cetin, A. (2014). The impacts of education, health and level of technology on economic growth: ARDL bound test approach. *Socio-economics, 21*(21), 169-186.

Yildirim, H. H. (2015). *Health and politics articles*. Ankara: ABSAM Publications.