Hacettepe Sağlık İdaresi Dergisi, 2019; 22(2):259-280

RESEARCH ARTICLE

THE IMPACTS OF ECONOMIC CRISIS ON THE PUBLIC HEALTH IN TURKEY: AN ARDL BOUNDS TESTING APPROACH

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ABSTRACT

The main aim of this study is to evaluate the impacts of economic crises on the public health in Turkey. In this context, the impacts of 1994, 2001 and 2009 economic crisis on 10 indicators related to the public health in Turkey between 1974-2015 were investigated through the ARDL (Autoregressive Distributed Lag) bounds testing approach. As a result of the analyses made, it has been found that 1994 economic crisis affected the 3 of the 10 indicators significantly ($p<0.05$) in a negative way, namely, under-five mortality rate, crude death rate, crude suicide rate. In addition, there were no significant positive effects of the 1994 economic crisis on any variable ($p>0.05$). The 2001 economic crisis was found to have a significantly negative effect on 2 out of 10 variables as infant mortality rate and crude suicide rate. On the other hand, it was found that the 2001 economic crisis affected 5 variables significantly positive, which are maternal mortality rate, DPT, polio and measles vaccination rates and, death rates from traffic accidents. For 2009 economic crisis, there was no significant negative health affect ($p<0.05$). However, the 2009 economic crisis was found to have significantly positive effect on only infant mortality rate ($p<0.05$). Conclusively, in this study, it has been found that economic crises have both negative and positive impacts on the public health in Turkey. However, it is possible to say that vulnerable people such as infants and children are more affected from economic crises in terms of health. From the results of study, it can be said that the severity of crises, in what way the health-related behaviors will evolve, and the effects on the healthcare system within the scope of policy preference are also important factors in the impacts of economic crises on health.

Key Words: *Economic Crisis, Public Health, Health Policy, ARDL Bounds Testing, Turkey*

ARTICLE INFO

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Recieved: 07.06.2018
Accepted: 04.03.2019

Cite This Paper:

Çıraklı, Ü., Yıldırım, 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

ARAŞTIRMA MAKALESİ

EKONOMİK KRİZLERIN TÜRKİYE'DE HALK SAĞLIĞI ÜZERİNDEKİ ETKİLERİ: BİR ARDL SINIR TESTİ YAKLAŞIMI

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ÖZ

Bu çalışmanın temel amacı, ekonomik krizlerin Türkiye'de halk sağlığı üzerindeki etkilerini değerlendirmektir. Bu kapsamda, 1994, 2001 ve 2009 ekonomik krizlerinin, 1974-2015 yılları arasında Türkiye'de halk sağlığı ile ilgili 10 gösterge üzerindeki etkisi ARDL (Otoregresif Dağıtılmış Gecikme) sınır testi yaklaşımı ile incelenmiştir. Yapılan analizler sonucunda, 1994 ekonomik krizinin beş yaş altı ölüm hızı, kaba ölüm hızı ve kaba intihar hızı olmak üzere, 10 değişkenden üçünü anlamlı bir şekilde ($p<0,05$) negatif yönde etkilediği bulunmuştur. Ayrıca, 1994 ekonomik krizinin anlamlı pozitif etkisi olan değişken bulunmamıştır ($p>0,05$). 2001 ekonomik krizinin bebek ölüm hızı ve kaba intihar hızı olmak üzere 10 değişkenin 2'si üzerinde anlamlı negatif etkide bulunduğu tespit edilmiştir. Diğer taraftan, 2001 ekonomik krizinin anne ölüm hızı, DBT, polio ve kızamık aşılama oranları ve trafik kazalarından ölüm oranı olmak üzere 5 değişkeni anlamlı bir şekilde pozitif yönde etkilediği bulunmuştur. 2009 ekonomik krizi için anlamlı negatif sağlık etkisi bulunmamıştır ($p>0,05$). Fakat 2009 ekonomik krizinin sadece bebek ölüm hızı üzerinde anlamlı ($p<0,05$) pozitif etkisinin olduğu tespit edilmiştir. Sonuç olarak bu çalışmada, ekonomik krizlerin Türkiye'de hem pozitif hem de negatif etkilerinin olduğu bulunmuştur. Yine de, bebekler, çocuklar ve yaşlılar gibi savunmasız grupların sağlık açısından ekonomik krizlerden daha fazla etkilendiğini söylemek mümkündür. Çalışmanın sonuçlarından, krizin şiddetinin, sağlık davranışlarının ne yönde gelişeceğinin ve politika tercihi kapsamında sağlık sistemi üzerindeki etkilerin ekonomik krizlerin halk sağlığı üzerindeki etkilerinde önemli faktörler oldukları da söylenilebilir.

Anahtar Kelimeler: *Ekonomik Krizler, Halk Sağlığı, Sağlık Politikası, ARDL Sınır Testi, Türkiye.*

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Gönderim Tarihi: 07.06.2018
Kabul Tarihi: 04.03.2019

Atıfta Bulunmak İçin:

Çıraklı, Ü., Yıldırım, 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

I. INTRODUCTION

In times of economic crisis, unemployment and poverty generally increase while public resources, household incomes and assets are decreasing (Fukuda-Par 2008; Labonte 2009; Kaplan 2012; Thomas et al. 2013). The decline in household incomes during the crisis periods makes financing of health care needs difficult. The unemployment of family members leads to the loss of employment-based health insurance, which in turn households increase out of pocket spending on health or postpone health care needs (Healthy Public Policy- HPC 2011). The increase in unemployment in economic crises, the weakening of savings and social security cause the conditions of nutrition, sheltering and sanitation to worsen (HPC 2011). Economic crises increase the risk of chronic mental and physical illness in the long run in the society (Ifanti et al. 2013). In economic crises, income and deprivation create a troubled environment for health systems as public resources are constrained while the increase of unemployment and poverty leave households in a difficult situation for health (Thomas et al. 2013). Crisis periods cause cuts in spending on many areas including health (Catalano 2009; Rucket, Labonte 2012; Barros 2012; Thomas et al. 2013). Evidence of the health effects of economic crises generally indicates that the health of vulnerable individuals, such as children, mothers, elderly people, patients and the poor will be more adversely affected (World Federation of Public Health Associations-WFPHA 2009; WHO 2009; Otker-Robe, Podpiera 2013). Economic crises have more impacts on poor people due to their limited means and capacity to be protected from the effects of the crisis (Otker-Robe, Podpiera 2013). Previous studies on the effects of economic crises on health indicate that effect is linked to the level of development of the economy (Kim, Serra-Garcia 2010). In poor countries where resources are already inadequate, there are important negative effects of crises on health (Labonte 2012). In high-income countries, economic crises usually have a positive impact on health, while in low-income countries the effects are often negative (Kim, Serra-Garcia 2010).

It is possible to assume that due to the economic crisis, the burden of illness will increase and health will be affected (Catalano 2009). Many studies have shown that adverse factors of economic crises such as unemployment, job insecurity, stress increase and loss of income have a negative impact on health (Cutler et al. 2000; Tangcharoensathien et al. 2000; Christian 2009; Kim, Serra-Garcia 2010; Vandoros et al. 2013; Alexander et al. 2014). Similarly, many studies show that there is a strong relationship between job loss and many physical and mental illnesses, and increases in suicide and homicide cases (Tangcharoensathien et al. 2000; Catalano 2009; Karanikolos et al. 2013; McKee 2013). In addition to studies showing the negative effects of economic crises on health, there are also studies showing that crises have a positive effect on health or do not have any effect on health (Ruhm 2000; Ruhm 2003; Neumayer 2004; Gerdtham, Ruhm 2006; Borowy 2011; Lammintausta et al. 2012; Mattei et al. 2014). Some of the studies that have shown that economic crises are associated with relatively better health outcomes are often explained by mechanisms such as increasing demand for work and hours, increasing alcohol and tobacco consumption and driving, and lowering levels of physical activity, leisure and social interaction at times when the economy is good (Ruhm 2000; Ruhm 2003; Gerdtham, Ruhm 2006; Riva et al. 2011; McClure et al. 2012). Again, these studies suggest that economic crises may increase health-promoting behaviors such as doing exercise, decreasing alcohol, cigarette and unhealthy food consumption, or less driving (Ruhm 2000; Ruhm 2003; Gerdtham, Ruhm 2006; McClure et al. 2012; Karanikolos et al. 2013). Some studies point to the differences in selected data and methods in research (Neumayer 2004; Lehto et al. 2012), while some express the effects of the crisis have been avoided as a result of political measures (Borowy 2011; Mattei et al. 2014).

The main aim of this study is to evaluate the impacts of economic crises on the public health in Turkey. In this context, the impacts of 1994, 2001 and 2009 economic crisis on 10 indicators related to the public health in Turkey between 1974-2015 were investigated through the ARDL (Autoregressive Distributed Lag) bounds testing approach. The number of comprehensive studies of the impacts of economic crises on public health in Turkey is limited. Therefore, it is thought that this research with ten public health indicators will provide an important contribute to the national literature in this field. On the other hand, the method used in this study can make an important contribution to the literature related to the impacts of economic crisis on health. The ARDL method contains error correction factors for previous years, therefore it is possible to use ARDL approach in a set of variables including economic crises (Wang 2009). Since the health effects of economic crises are often delayed (Tangcharoensathien et al. 2000; Kim, Serra-Garcia 2010; Belvis et al. 2012; Lehto et al. 2012; Stuckler et al. 2011; EUROFOUND 2014), and the lagged values of the variables are taken into account in the ARDL method, it is possible to reveal the impacts of the economic crises on health in a better way.

II. METHOD

2.1. Study Design

To investigate the health impacts of economic crises, ARDL cointegration analysis will be applied within the scope of the time series analysis as an econometric method. The stationary of the series lie at the basis of the cointegration analyzes, which is developed for the determination of long-run relationships between time series and variables. In this context, ordinary least squares (OLS) technique can be used if all variables are stationary at the level values, i.e. I(0), (Ciftci, Yildiz 2015). Nevertheless, macroeconomic time series data are generally stationary at their first difference, not in level values (Gerdtham, Ruhm 2006; Gujarati 2004; Gujarati 2011). Some cointegration techniques such as 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 of the variables to be used in econometric analysis are stationary at their first difference, i.e. I(1) (Erdogan, Bozkurt 2008; Ciftci, Yildiz 2015).

The ARDL bounds testing approach developed by Pesaran and others (2001) does not require all of the explanatory variables to be I (1), unlike the other cointegration techniques. Therefore, it is not a necessity to test whether the variables carry the unit root in the ARDL approach (Pesaran et al. 2001; Bahmani-Oskooee, Raymond 2002). On the other hand, there is a need for dependent variable in the model being I(1), and also that none of the planned variables used in the analysis should be I(2). Because the upper and lower critical values given by Pesaran et al. (2001) were obtained according to the cases of series being I(0) and I(1). Therefore, it is useful to determine the stationary levels of the series by performing unit root tests before using the ARDL approach to ensure at least that these conditions are met (Ciftci 2009). It is also stated that the ARDL boundary test approach provides robust and efficient results in studies with few observations (Narayan, Narayan 2004; Narayan, Smyth 2006; Wang 2009; Musa 2014; Yakisik, Cetin 2014). In addition to this, since it includes error correction factors for previous years, analysis of error correction and lag difference terms can allow testing of both long and short term relationships between variables. For this reason, the ARDL approach can be used within a set of variables, including economic crises (Wang 2009). In the ARDL procedure, there are many studies that introduce the variables such as economic crisis, policy changes to the model as dummy variables, and investigate the impacts of these variables on the independent variable (Salleh et al. 2007; Wang 2009; Babych 2011; Erdem et al. 2011; Oskanbayev et al. 2011). The introduction of economic crises as a dummy variable is usually done by assigning 1 for the years of crisis and 0 for

other years (Salleh et al. 2007; Wang 2009). Since the health effects of economic crises are often delayed (Tangcharoensathien et al. 2000; Kim, Serra-Garcia 2010; Belvis et al. 2012; Lehto et al. 2012; Stuckler et al. 2011; EUROFOUND 2014), and the lagged values of the variables are taken into account in the ARDL method, it is possible to reveal the impacts of the economic crises on health in a better way.

2.2. Data

The data of the study were obtained annually with a total of 42 observations between 1974 and 2015, and these data are shown in Table 1. In addition to these data, three crisis dummy variables were added for the economic crisis of 1994, 2001 and 2009. The coding of these variables was carried out by giving 1 for negative years of Real GDP and 0 for other years. Between 1974 and 2015, there are more cases that may be expressed as economic crises (1979-80, 1988-1989, 1991, 1999). Because of insufficient number of observations, and being major economic crises that affect Turkey significantly in the data period of research (Yurekli 2004; Ergenc 2009; Yucel, Kalyoncu 2010; Pusti 2013), the economic crisis of 1994, 2001 and 2009 were only included in the study.

Table 1. Data, Abbreviations and Data Source

	Data	Abbreviation	Data Source
Mother and child health indicators	Maternal mortality rate (per 100,000)	MMR	World Bank (2016a, OECD (2016)
	Infant mortality rate (per 1,000)	U1MR	World Bank (2016a)
	Under 5 mortality rate (per 1,000)	U5MR	World Bank (2016a)
	DPT vaccination rate (%)	DPTVR	WHO (2016)
	Polio vaccination rate (%)	PVR	WHO (2016)
	Measles vaccination rate (%)	MVR	WHO (2016)
Mortality indicators	Crude death rate (per 1,000)	CDR	TURKSTAT (2016b), World Bank (2016b)
	Death rate from traffic accidents (Population, per 1,000)	DRFTA	TURKSTAT (2016c)
Suicide	Crude suicide rate (per 100,000)	CSR	TURKSTAT (2016d, 2016e)
Tuberculosis	Incidence of tuberculosis (per 100,000)	IOTB	WHO (2016)
Macroeconomic indicators (Independent variables)	Real GDP	RGDP	World Bank (2016a)
	Unemployment rate	UNEPM	TURKSTAT(2016a), Bulutay (1995)
	Inflation rate	INF	World Bank (2016a)

2.3. Statistical Analysis

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 was used for the unit root test (Ciftci 2009; Tuncsiper, Bicen 2013). Second, an Unrestricted Error Correction Model (UECM) was build and 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 Wald test with the upper and lower critical values derived by Pesaran and others (2001). Akaike information criterion 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. Because 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-Berra test for normal distribution fit, the ARCH test for heteroscedasticity, 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, Jaque-Berra 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.

2.4. Limitations and Assumptions

It is accepted that the data obtained for our study is accurate. Real GDP, unemployment, and inflation rates have been used as independent (explanatory) variables in our study. There are many factors besides these variables that affect health-related variables. In this context, it is assumed that the results of the estimation obtained from the related models in our research are limited to the variables included in the model of the study. Also in our research, the years when the real gross domestic product was negative were taken as indicators of an economic crisis. Although, there are more cases that may be expressed as economic crises (1979-80, 1988-1989, 1991, 1999) between 1974 and 2015, because of insufficient number of observations, and being major economic crises that affect Turkey significantly in the data period of research, only three economic crises as 1994, 2001 and 2009 economic crisis were only included in the study. If the other crisis periods were included in the study, the results are very likely to be different. Another important limitation of our research is related to the number of observations. The data with 42 observations can be assumed as small when evaluated in the scope of the time series analysis.

III. FINDINGS

3.1. Unit Root Test Results

In this study, the ADF unit root test was used to determine the stationarity of the time series used in the analysis. The ADF unit root test can be done in different situations such as

models with constant, with constant and trend, and without constant and trend. According to relevant situations, the ADF unit root test equations can be shown as follows (Eren 1995):

$$\Delta Y_t = \delta Y_{t-1} + \sum_i^p \delta_i \Delta Y_{t-i+1} + \varepsilon_t \quad \varepsilon_t \sim WN(0, \sigma^2) \qquad (1.1)$$

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_i^p \delta_i \Delta Y_{t-i+1} + \varepsilon_t \quad \varepsilon_t \sim WN(0, \sigma^2) \qquad (1.2)$$

$$\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + \sum_i^p \delta_i \Delta_{Yt-i+1} + \varepsilon_t \quad \varepsilon_t \sim WN(0, \sigma^2) \qquad (1.3)$$

The above equations represent, respectively, the model without constant and trend (1.1), with only constant (1.2), and with constant and trend (1.3). In these equations, "Δ" is the first difference operator, "Yt" is the series that is tested for stationary, "α" is the constant term, "t" is the trend variable, "p" is the optimal number of lags determined by the information criterion, and "εt" refers to the error term with white noise characteristic, with zero mean and constant variance. The ADF test statistics (τ, ττ, τμ, respectively) for the series "Yt" are compared with the critical values derived from MacKinnon (1996). The test hypotheses established for this purpose are as follows:

H0: Series carry unit root (δ=0) and, Ha: Series does not carry unit root (δ<0)

If the τ statistic calculated in the ADF test exceeds the critical value of MacKinnon (1996) as the absolute value, the null hypothesis that the series carries the unit root is rejected and it is decided that the series is stationary. In the opposite case, the null hypothesis cannot be rejected and it is understood that the series is not stationary.

The results of unit root tests are shown in the Table 2 and are only given for the models which are used in the ARDL bound tests. According to the unit test results, it seen that all the variables have the condition of not being stationary in their level values but being stationary in their first difference values.

Table 2. The Results of Unit Root Tests

Variables	Models	Level Values		First Difference Values	
		t	p	t	p
LINF	Intercept	-0.88	0.7816	**-6.26*** **	0.0000
	Int. and Trend	-2.05	0.5540	**-6.53*** **	0.0000
	No Int. and Trend	-0.53	0.4802	**-6.32*** **	0.0000
LRGDP	Intercept	-0.39	0.9013	**-6.44*** **	0.0000
	Int. and Trend	-3.20	0.0983	**-6.35*** **	0.0000
	No Int. and Trend	6.21	1.0000	**-2.66*** **	0.0090
LUNEMP	Intercept	-2.14	0.2273	**-5.50*** **	0.0000
	Intercept and Trend	-2. 40	0.3723	**-5.43*** **	0.000
	No Int. and Trend	0.40	0.7951	**-5.54*** **	0.0000
LMMR	Intercept	1.50	0.999	**-2.68***	0.0857
U1MR	Intercept and Trend	-2.10	0.522	**-3.46***	0.057
U5MR	Intercept and Trend	-1.62	0.764	**-4.35*** **	0.007
LDPTVR	Intercept	-1.94	0.307	**-8.23*** **	0.000
LPVR	Intercept	-1.86	0.346	**-8.41*** **	0.000
LMVR	Intercept	-1.984	0.292	**-7.536*** **	0.000
LCDR	Intercept	-1.73	0.4050	**-5.50*** **	0.000
LDRFTA	Intercept	-1.23	0.649	**-6.41*** **	0.000
LCSR	Intercept	-1.50	0.521	**-8.26*** **	0.000
LIOTB	Intercept	-0.13	0.938	**-5.26*** **	0.000

* p<0.10, ** p<0.05, *** p<0.01

3.2. The Results of ARDL Bounds Testing (UECM)

An example of the UECM model created for bounds testing is shown in the following equation. This example is only a model with constant, and it can be done with other types such as with constant and trend, with constant and trend free.

$$\Delta LMMR_t = \alpha + \sum_{i=1}^{m} \lambda_{1i}\, \Delta LMMR_{t-i} + \sum_{i=0}^{n} \lambda_{2i}\, \Delta LINF_{t-i} + \sum_{i=0}^{p} \lambda_{3i}\, \Delta LRGDP_{t-i} + \sum_{i=0}^{q} \lambda_{4i}\, \Delta LUNEMP_{t-i} + \gamma_1 LMMR_{t-1} + \gamma_2 LINF_{t-1} + \gamma_3 LRGDP_{t-1} + \gamma_4 LUNEMP_{t-1} + \gamma_5 \Delta d\_1994 + \gamma_6 \Delta d\_2001 + \gamma_7 \Delta d\_2009 + \varepsilon_t$$

In the above equation, α is the constant component of the model, Δ is the first difference operator, L means logarithmic transformation and ε is constant error term with the white noise. The model estimates a UECM model with maximum lag lengths (m, n, p, q). F test (Wald test) is performed to determine the joint significance of the lagged level values of the UECM model according to the model types. Decision for the cointegration of the above equation is made by comparing the F-test value obtained for the model with comparing with the lower and upper critical values in Pesaran, Shin and Smith's (2001) Table CI (ii) (Pesaran et al. 2001). The relevant hypothesis is:

H0: $\alpha = \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0$ (all of the coefficients are equal to zero, no cointegration)

Ha: at least one of the coefficients ($\alpha, \gamma_1, \gamma_2, \gamma_3, \gamma_4$) is non-zero, there is cointegration

The results of ARDL bounds testing are shown in the Table 3. According to test results, it is seen that LIOTB model (Incidence of Tuberculosis) have cointegration at %2.5 level of significance, and LCSR mode (crude suicide rate) have cointegration at %10 level of significance. The other models all have F-test values that higher than upper limit critical values for %10 level of significance, so they have cointegration. Note that, diagnostic tests including Breusch-Godfrey autocorrelation LM test, Jarque-Berra normality test, ARCH test, Ramsey Reset test and, CUSUM and CUSUM-SQ stability tests were performed for all UECM models shown in Table. According to the results of diagnostic tests, there were not any problem in the models except for the result of CUSUM-SQ for LCDR (Crude death rate). There was a small overflow in CUSUM-SQ of LCDR. According to Yakisik and Cetin (2014), such small overflows do not disturb of 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 predicted model is return to the confidence interval again.

Table 3. The Results of UECM

Estimated ARDL Model		**LMMR (5, 5, 5, 4)**	**LDPTVR (2, 5, 5, 3)**	**LPVR 4, 2, 2, 4**	**LMVR (3, 1, 1, 2)**	**LCDR (4, 4, 4, 4)**	**LDRFTA (1, 4, 5, 4)**	**LIOTB (1, 1, 2, 0)**
Pesaran et al. (2001) Table CI (ii) *	**k****	3	3	3	3	3	3	3
	F	12.37	5.09	7.73	5.53	8.21	5.06	4.34
	p	0.004	0.014	0.001	0.002	0.002	0.011	0.005
	R	0.99	0.91	0.82	0.76	0.88	0.85	0.51
	A-R^2	0.98	0.69	0.55	0.56	0.57	0.54	0.23

*** Critical Values for Table CI (ii)**

Significany Level:	**1%**	**2.5%**	**5%**	**10%**
Lower Limit:	3.65	3.15	2.79	2.37
Upper Limit:	4.66	4.08	3.67	3.20

Estimated ARDL Model		**U1MR (2, 1, 2, 0)**	**U5MR (2, 0, 0, 4)**
Pesaran et al. (2001) Table CI(iv) *	**k**	3	3
	F	7.12	7.28
	p	0.000	0.000
	R	0.998	0.9989
	A-R^2	0.996	0.998

Estimated ARDL Model		**LCSR (3, 0, 0, 4)**
Pesaran et al. (2001) Table CI(iii) *	**k**	3
	F	3.79
	p	0.019
	R	0.75
	A-R^2	0.54

Critical Values for Table CI (ii)

Significancy Level:	**1%**	**2.5%**	**5%**	**10%**
Lower Limit:	4.3	3.80	3.38	2.97
Upper Limit:	5.23	4.68	4.23	3.74

*** Critical Values for Table CI (iii):**

Significany Level:	**1%**	**2.5%**	**5%**	**10%**
Lower Limit:	4.29	3.69	3.23	2.72
Upper Limit:	5.61	4.89	4.35	3.77

3.2. The Results of ARDL Error Correction Models

In Table 4, the results of ARDL error correction model are shown, and they are only given for estimation results of the short term coefficients for the economic crisis variables, although both long term and short term estimations are done.

Table 4. The Results of ARDL Error Correction Models

ARDL Model: (5, 5, 5, 4) Ind. Var.: ΔLMMR	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**ECM(-1)**	**C**
	Coefficient	0.016	-0.034	-0.003	-0.077	28.101
	t	1.532	-3.209***	-0.338	-6.821***	11.828***
	p	0.153	0.008	0.741	0.000	0.000
ECM= LMMR - (0.5635*INF -0.8973*LRGDP-2.0438*LUNEMP +0.1707*D_1994 -0.3691*D_2001 -0.1176*D_2009 +28.1016)						
Diagnostic Tests*: R^2: 0.999 A-R^2: 0.997 SE: 0.010 SSE: 0.001; S.C.: 1.50, p: 0.315; J.-B.Nor.: 0.38, p: 0.824; Het.: 0.13, p: 0.718; F.Res: 0.73, p: 0.481						

ARDL Model: (2, 2, 2, 4) Ind. Var.: ΔU1MR	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**C**	**ECM(-1)**	**Trend**
	Coefficient	-0.053	0.183	-0.135	-0.576	-0.024	-3.031
	t	-1.156	3.711***	-2.492***	-5.666***	-6.647	-6.059***
	p	0.261	0.001	0.021	0.000	0.000	0.000
ECM= U1MR - (0.1182*INF + 0.0000*RGDP + 1.8831*UNEMP -2.5739*D_1994 + 7.1296*D_2001 -7.3941*D_2009 -3.0317*@TREND)							
Diagnostic Tests: R^2: 0.998 A-R^2: 0.996 SE: 0.053 SSE: 0.056; S.C.: 0.66, p: 0.424; J.-B.Nor.: 3.09, p: 0.212; Het.: 0.01, p: 0.892; F.Res: 0.88, p: 0.385							

ARDL Model: (3, 0, 0, 0) Ind. Var.: ΔU5MR	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**C**	**ECM(-1)**	**Trend**
	Coefficient	0.146	0.036	-0.008	0.01	-0.013	-2.786
	t	2.416**	0.605	-0.117	0.216	-6.176***	-2.077**
	p	0.022	0.549	0.907	0.83	0.000	0.047
ECM= U5MR - (0.0582*INF + 0.0000*RGDP + 1.9457*UNEMP + 6.2335*D_1994 + 4.1532*D_2001 -4.0133*D_2009 -2.7870*@TREND)							
Diagnostic Tests: R^2: 0.997 A-R^2: 0.996 SE: 0.077 SSE: 0.168; S.C.: 0.42, p: 0.787; J.-B.Nor.: 0.50, p: 0.77; Het.: 0.86, p: 0.357; F.Res: 0.6, p: 0.459							

ARDL Model: (2, 5, 5, 3) Ind. Var.: ΔLDTP	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**ECM(-1)**	**C**
	Coefficient	0.024	0.372	-0.014	-0.415	-9.709
	t	0.28	3.786***	-0.174	-5.538***	-2.421
	p	0.783	0.002	0.865	0.000	0.029**
ECM= LDTP- (0.1947*LINF + 0.3979*LGSYH + 1.4144*LUNEMP -0.0845*D_1994 +0.8830*D_2001 -0.0482*D_2009 -9.7093)						
Diagnostic Tests: R^2: 0.946 A-R^2: 0.871 SE: 0.089 SSE: 0.121; S.C.: 0.66, p: 0.658; J.-B.Nor.: 0.22, p: 0.893; Het.: 0.25, p: 0.619; F.Res: 9.44, p: 0.008						

ARDL Model: (5, 3, 3, 5) Ind. Var.: ΔLPOLIO	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**ECM(-1)**	**C**
	Coefficient	0.011	0.232	0.049	-1.826	-8.178
	t	0.158	3.649***	0.775	-7.194***	-9.436***
	p	0.877	0.003	0.451	0.000	0.000
ECM= LPOLIO - (0.1175*LINF + 0.4297*LRGDP + 0.6716*LUNEMP -0.0509*D_1994 + 0.1230*D_2001 + 0.0001*D_2009 -8.1782)						
Diagnostic Tests: R^2: 0.946 A-R^2: 0.860SE: 0.075 SSE: 0.079; S.C.: 1.21, p: 0.378; J.-B.Nor.: 1.40, p: 0.496; Het.: 0.84, p: 0.366; F.Res: 3.46, p: 0.065						

ARDL Model: (4, 2, 2, 3) Ind. Var.: ΔLMEASLES	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**ECM(-1)**	**C**
	Coefficient	0.017	0.447	0.064	-1.124	-20.421
	t	0.139	3.453***	0.519	-6.015***	-9.865***
	p	0.891	0.003	0.609	0.000	0.000
ECM= LMEASLES - (0.2144*LINF + 0.8954*LRGDP + 0.7280*LUNEMP + 0.0018*D_1994 + 0.4426*D_2001 + 0.0680*D_2009 -20.4213)						
Diagnostic Tests: R^2: 0.935 A-R^2: 0.880 SE: 0.135 SSE: 0.367; S.C.: 0.92, p: 0.472; J.-B.Nor.: 1.50, p: 0.472; Het.: 0.02, p: 0.885; F.Res: 2.05, p: 0.167						

Table 5. The Results of ARDL Error Correction Models – Continue

ARDL Model: (5, 5, 5, 5) Ind. Var.: ΔLCDR	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**ECM(-1)**	**C**
	Coefficient	0.055	-0.013	-0.03	-0.925	15.429
	t	2.371**	-0.448	-1.297	-8.214***	26.308***
	p	0.039	0.663	0.223	0.000	0.000
ECM= LCDR - (-0.1601*LINF -0.4428*LRGDP -0.9044*LUNEMP +0.0467*D_1994 -0.0581*D_2001 -0.0474*D_2009 +15.4295)						
Diagnostic Tests: R^2: 0.995 A-R^2: 0.982 SE: 0.025 SSE: 0.006; S.C.: 0.68, p: 0.656; J.-B.Nor.: 2.06, p: 0.355; Het.: 0.33, p: 0.564; F.Res: 2.47, p: 0.150						

ARDL Model: (1, 0, 1, 1) Ind. Var.: ΔLDRFTA	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**ECM(-1)**	**C**
	Coefficient	0.071	-0.23	0.067	-0.225	17.458
	t	0.888	-2.730**	0.752	-4.846	2.293***
	p	0.381	0.01	0.458	0.000	0.029
ECM= LDRFTA - (-0.3165*LINF -0.5786*LRGDP -2.1378*LUNEMP + 0.4719*D_1994 -1.4386*D_2001 + 0.0620*D_2009 +17.4581)						
Diagnostic Tests: R^2: 0.923 A-R^2: 0.901 SE: 0.112 SSE: 0.394; S.C.: 1.52, p: 0.216; J.-B.Nor.: 2.78, p: 0.248; Het.: 0.40, p: 0.840; F.Res: 1.67, p: 0.206						

ARDL Model: (1, 4, 0, 0) Ind. Var.: ΔLCSR	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**ECM(-1)**	**C**
	Coefficient	0.186	0.301	0.064	-0.484	-4.293
	t	2.557**	4.247***	0.825	-3.871***	-3.840***
	p	0.017	0	0.417	0.001	0.001
ECM= LCSR - (-0.1016*LINF + 0.4528*LRGDP -0.4520*LUNEMP + 0.4042*D_1994 + 0.7049*D_2001 + 0.1840*D_2009)						
Diagnostic Tests: R^2: 0.945 A-R^2: 0.922 SE: 0,.087 SSE: 0.199; S.C.: 2.45, p: 0.076; J.-B.Nor.: 0.31, p: 0.853; Het.: 0.19, p: 0.662; F.Res: 0.20, p: 0.653						

ARDL Model: (1, 2, 3, 0) Ind. Var.: ΔLIOTB	**Variables**	**ΔD_1994**	**ΔD_2001**	**ΔD_2009**	**ECM(-1)**	**C**
	Coefficient	0.014	0.028	-0.038	-0.386	26.852
	t	0.205	0.392	-0.502	-5.497***	7.586***
	p	0.839	0.698	0.62	0.000	0.000
ECM= LIOTB - (0.1121*LINF -1.0207*LRGDP + 0.6624*LUNEMP -0.0543*D_1994 + 0.0261*D_2001 + 0.0231*D_2009 +26.8522)						
Diagnostic Tests: R^2: 0.98 A-R^2: 0.97 SE: 0.083 SSE: 0.179; S.C.: 0.43, p: 0.782; J.-B.Nor.: 3.59, p: 0.165; Het.: 0.37, p: 0.546; F.Res: 0.84, p: 0.366						

* Meaning of the abbreviations in diagnostic tests section; SE: Standard error, SSE: Sum of squared errors, S.C: Breusch-Godfrey LM test for autocorrelation, J.-B.Nor: Jarque-Berra normality test, Het.: ARCH test, F. Res.: Ramsey Reset test

* $p<0.10$ significance level, ** $p<0.05$, *** $p<0.01$

According to the error correction model results shown in Table 4, it is seen that all the coefficients of ECM(-1) are negative and statistically significant as expected. These coefficients are interpreted as follow examples:

- For the maternal mortality rate, the error correction model coefficient (-0.077) shows that after the short term shocks, 7.7% of the deviations in the long term equilibrium of the system will be eliminated in a period later.
- The coefficient of the error correction model for the polio vaccination rate is found to be -1,82. As stated by Narayan and Smyth (2006), when the absolute value of the coefficient is greater than 1, the system will balance by fluctuating, and this fluctuation will decrease every time and return to the balance in the long term.

The results in Table 4 shows that only the 2001 economic crisis affected the maternal mortality rate in statistically significantly (p=0.008) negative direction (-0.034) (positive result), 1994 and 2001 economic crises did not have a statistically significant effects (p>0.05) on maternal mortality rate. For the impacts of economic crisis on infant mortality rate, it is detected that while the 2001 economic crisis effected one mortality rate significantly negative (c=0.183 and p=0.001), the 2009 economic crisis effected one mortality rate significantly positive (c=–0.135 and p=0.021). There has been found no significant effect of 1994 economic crisis on infant mortality rate. For the impacts of economic crisis on under-five mortality rate, it has been found that while the 1994 economic crisis have had an effect on under-five mortality rate in significantly positive direction (c=0.146) (p=0.22), the other crises have had no statistically significant effect on under-five mortality rate (p>0.05). When the effects of economic crises on vaccination rates are examined, from short term coefficients it is found that only the 2001 economic crisis effected vaccination rates of DPT, Polio and Measles in a significant positive direction (c>0, and p=0.002), but the economic crises of 1994 and 2009 have had no significant effect on vaccination rates of DPT, Polio and Measles (p>0.05).

When the effect of economic crises on the crude death rate is examined, it has been detected that the 1994 economic crisis affected the crude death rate in a right direction (0.055) and statistically significant (p= 0.039). In other words, the 1994 economic crisis have had an effect that increased the rate of crude death. It was also found that the 2001 and 2009 economic crises did not significantly affect the crude death rate. According to the results for the death rate from traffic accidents, it was found that the coefficients of 1994 and 2009 economic crises are positive, but these crises have no significant effect on traffic accident death rate (p>0.05). On the other hand, it was found that the 2001 economic crisis affected the death rate from traffic accidents in the negative direction (-0.230) and this affect was statistically significant (p=0.010). According to the information provided in the table on the short-term coefficients (Table 38), it has been determined that the economic crises of 1994, 2001 and 2009 have had no significant effect on tuberculosis incidence (p>0.05).

IV. DISCUSSIONS

In this study, it was found that 2001 crisis have had a significant positive impact on the maternal mortality rate in Turkey. But Cruces et al. (2011) concluded that maternal mortality rates have been affected significantly negative way by the economic crises between 1993 and 2005 in Argentina. In this study, the fact that the 2001 economic crisis significantly affected the maternal mortality positively may be related to the severity of the crisis. Because the 2001 crisis was the most severe economic crisis with a decline of -5.7% in real GDP from 1974-2015. Due to the severity of the crisis, mothers may have had important improvements in some important indicators for maternal mortality such as prenatal and postnatal care under the supervision of health personnel and in the health facility paying more attention to their own health in prenatal and postnatal period, and improvements in health-promoting behaviors such as healthy nutrition and exercise. Turkey Demographic and Health Survey 2008 shows also that Turkey have had important improvements in these indicators, which are important for maternal mortality. Also in the last fifteen years, the fact that governments attach great importance to improving maternal and child health (HUIPS – Hacettepe University Institute of Population Studies 2014) may have influenced the negative impact of the crisis.

This study shows that while the 2001 economic crisis affected negatively the infant mortality rate, the 2009 crisis' affect was positive. Strengthening of primary health care services especially after 2010 with the introduction of the Family Medicine System (Official Gazette 2010; Official Gazette 2011) may be an important factor in the fact that the 2009

economic crisis has had a positive impact on infant mortality rate. In this study, it has been found that the 1994 economic crisis affected significantly negative the under-five mortality rate. Undernutrition is an important factor in the effect of economic crisis on child health (Paxson, Schady 2004; Cader, Perera 2011). In the period from 1994 to 1998, the percentage of undernutrition in the under-five age group was higher than the other periods (HUIPS 1994, 1999, 2003, 2009). In this context, it is evaluated that the 1994 economic crisis may have affected the under-five mortality rate by affecting the factors related to malnutrition of children.

In terms of child health indicators, the finding of the increase in infant mortality in the 2001 economic crisis in this study is similar the findings reported by UNICEF (1991) in Mexico, Cutler and others (2000) in Mexico, Paxson and Schady (2004) in Peru, Alexander and others (2009) in the OECD countries, Cruces and others (2011) in Argentina during economic crisis. But the positive finding obtained for the 2009 economic crisis is contrast to these studies. On the other hand, the findings of this study are similar to the study by Schady and Smitz (2010), which found that the effects of economic crises on infant deaths were in general mixed.

From the results of this study, it can be said that vaccination rates generally increased during the 1994, 2001 and 2009 economic crisis. For significant positive of 2001 crisis, considering that the 2001 crisis was more severe decline in real GDP terms, the families might have paid more attention to the immunization services to protect the health of their children. At the same time, the crisis may have a positive contribution in terms of time needed for vaccination services. The results of this study about the vaccination rates support the studies that say economic crises may have positive effects on health (Ruhm 2003; Neumayer, 2004; Gertham, Ruhm 2006; Mattei et al. 2014; Riva et al. 2011; McClure et al. 2012).

The significant negative impact of the 1994 economic crisis on the crude death rate is considered to be related to the following situations:

- In 1994, a significant devaluation Turkish lira has led to an increase in the prices of medical goods and services for Turkey which is still a net importer of medical equipment and supplies (Sargutan 2009; Ministry of Development of Turkey 2014) Thus, people may have delayed the health care needs.
- The fact that negativities such as unemployment and low income, especially devaluation and high inflation (106%) may have increased unhealthy food consumption,
- Mental health may have been more adversely affected by 1994 economic crisis.
- Considering that health has become a significant political priority for governments in the last 15 years (Yildirim, 2015), the conditions of the 1994 economic crisis may have given priority to non-health areas.

While the result of a negative impact of the 1994 economic crisis on the crude death rate in this study is in contrast to the studies that have found the overall mortality rate has decreased in times of economic crisis (Ruhm 2000; Granados 2005; Neumayer 2004; Gerdtham, Ruhm 2006; Franco et al. 2013), it is similar to the results of some studies that have found all causes of mortality rates generally increased in crisis periods (Cutler et al. 2000; Kim et al. 2004; Stuckler et al. 2009; Montgomery et al. 2013; Benmarhnia et al. 2014).

From the findings obtained here, it can be said that the 2001 economic crisis positively affected the death rate from traffic accidents. This result is similar to the results of Kim and

others (2004), Stuckler and others (2009) and Afroz and others (2012). The decline in car use, especially because of high oil prices, may be reason of this result.

From the findings about crude suicide rate, it can be said that there is possibility that economic crisis will have usually negative impact on the crude suicide rate. Most of the studies examining the effects of economic crises on health outcomes indicate that suicide rates increased in times of crisis (Chang et al. 2009; Pirkola et al. 2009; WHO 2011; Afroz et al. 2012; Belvis et al. 2012; Wada et al. 2012; Lopez Bernal et al. 2013; Breuer 2014; Rachiotis et al. 2015). It is considered that the severity and duration of the crisis, the strength of health and social security system, and good management of the crisis process economic are important factors in the impacts of economic crises on suicide rates. In this context, it is evaluated that the 2009 economic crisis did not significantly affect the suicide rates, because the social security system was gathered under one roof, especially after 2006, and the system was strengthened by social security of the whole population with the GSS and crisis process was managed psychologically well. In this study, we found that economic crises did not significantly affect the incidence of tuberculosis.

V. CONCLUSION AND SUGGESTIONS

The main aim of this study was to evaluate the impacts of the economic crisis on health in Turkey. In this context, the impacts of the 1994, 2001 and 2009 economic crisis on 10 indicators related to health in Turkey were investigated by ARDL Cointegration approach. The main contributions of this study can be stated under three topics. Firstly, this study uses different methodology (ARDL method) in the literature of the effects of economic crises on health. In literature review, it has been found no study using the ARDL method in the field of the health impacts of economic crisis. Second, this study provides not only theoreticial discussion but also empiricial findings to national literature. In national literature, the number of ampirical studies about the impacts of economic crises on public health in Turkey is limited. Last but not least this study uses ten different public health indicators and thus provides comprehensive findings.

In Table 5, the impacts of economic crisis on the variables used in this study are summarized. As a result of the analyses made, in terms of the impacts of economic crises on health in Turkey, it was found that the 1994 economic crisis affected the 3 of the 10 indicators significantly ($p<0.05$) in a negative way, namely, under-five mortality rate, crude death rate, crude suicide rate. In addition, no variable was detected that the 1994 economic crisis have had significant positive effect on ($p>0.05$). The 2001 economic crisis was found to have significantly negative affect 2 out of 10 variables; infant mortality rate and crude suicide rate. On the other hand, it was found that the 2001 economic crisis affected the variables as mother mortality rate, DPT, polio and measles vaccination rates and, death rates from traffic accidents significantly positive. For 2009 economic crisis, there was no significant negative health affect ($p<0.05$). However, the 2009 economic crisis was found to have significantly positive effect on only infant mortality rate ($p<0.05$).

It can be concluded from the results of this study that the effects of the crises on public health in Turkey generally vary. Nevertheless, it is possible to say that vulnerable people such as infants and children are more affected from economic crisis in terms of health. This is supported by the fact that under-five mortality rate increased in the 1994 economic crisis and, an infant mortality rate increased in the 2001 crisis. In the effects of the economic crises on public health, however, it has been considered that the severity of the crisis, in what way the health-related behaviors will evolve, and the effects on the healthcare system within the scope of policy preference are also important factors. It is especially suggested in Turkey

that the healthcare expenditures should be increased during crisis to prevent the possible negative effects of the economic crises on public health.

Concluding, in this study it has been found that economic crises have both negative and positive impacts on public health indicators. The positive effects of economic crises on public health should not be perceived as a good phenomenon for economic crises. Positive impacts of economic crisis may actually reflect the negative impacts of economic growth periods on the public health. Therefore, it should be emphasized that factors that enable economic crises to have a positive impact on these public health indicators are determined and how these factors are maintained at a time when the economy is good and how to prevent the possible negative effects of economic growth periods on health.

As stated in the limitations and assumptions section, this study only includes some macroeconomic indicators as independent or explanatory variables. There are many factors besides these variables that affect public health-related variables. Again in this study, there are more cases that may be expressed as economic crises (1979-80, 1988-1989, 1991, 1999) between 1974 and 2015. Because of insufficient number of observations, and being major economic crises that affect Turkey significantly in the data period of research, only three economic crises as 1994, 2001 and 2009 economic crisis were only included in the study. If the other crisis periods were included in the study, the results are very likely to be different.

Some of the variables used in this study include only crude public health indicators such crude death rate, crude suicide rate. Therefore, it is recommended that a study with age-specific or cause specific mortality rates or suicide rates by reason may provide more information about the impacts of economic crisis on public health. Also this study uses ten public health indicators as dependent variables. But public health is a broad concept there are a lot of health indicators related to public health. Thus a study that includes health behaviors-related indicators like alcohol and cigarette consumption or health system-related indicators like health expenditures may be used to determine health impacts of economic crisis.

Table 6. The Impacts of the Economic Crisis on Ten Health Indicators in Turkey

Independent Variable	**The Impacts of Economic Crisis**		
	1994	2001	2009
Mother Mortality Rate	-	+	+
Infant Mortality Rate	+	-	+
Under-five Mortality Rate	-	-	+
DPT Vaccination Rate	+	+	-
Polio Vaccination Rate	+	+	+
Measles Vaccination Rate	+	+	+
Crude Death Rate	-	+	+
Death Rate from Traffic Accidents	-	+	-
Crude Suicide Rate	-	-	-
Incidence of Tuberculosis	-	-	-
Total minuses / number of significant relationship	6 / 3	4 / 2	4 / 0
Total pluses / number of significant relationship	4 / 0	6 / 5	6 / 1

Note: " – " sign shows adverse negative effect, " + " sign shows positive effect. In addition, colored squares indicate a significant relationship at 95% confidence level.

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