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The Relationship between Education Expenditure and Economic Growth in Turkey: Bounds Testing Approach[1]

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Abstract:

The relationship between education expenditures and economic growth is among the practical studies attracting high interest in Economics literature. The analysis was carried out with the bounds testing approach developed by Pesaran et al. (2001) and besides the constant model, constant and trend model was also used unlike the literature. In this study, a positive relationship between education expenditures and economic growth was found in the Turkish economy for the quarterly period 1980:Q1-2012:Q4. Thus it appeared that education expenditures in Turkey had a positive effect on economic growth positively. A greater allocation of resources on education expenditures could make the Turkish economy more dynamic. Furthermore, in short term analysis coefficient of error correction terms were negative and statistically significant. So the deviations occurring between the variables converge to the long term balance level. In Granger causality analysis, a two-way relationship was determined between the education expenditures and economic growth.

Key words: Education Expenditure, Economic Growth, Turkey, Bounds Testing

Jel Codes: H52, I25, P36.

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1. Introduction

Education has a significant role in the development of countries. On one hand, it fulfils its function in providing qualitative and quantitative labour required in the development process, while on the other hand, with its production and dissemination of knowledge function, it encourages countries to follow and develop modern manufacturing technologies and to transfer them to the production process. The increase in labour productivity as the level of education increases affects the competitiveness of countries positively and facilitates openness. Differences in education level are one of the main reasons of economic performance differences between developed and developing countries.

As one of the most important components of human capital, improvements in educational status are the source of significant increases in individual earnings with the contributions to business life such as increasing productivity, and thus the wages and employment opportunities of the individuals, whereas the risk of unemployment is decreased. With these aspects, increasing the level of education stands out as an effective political instrument in the struggle against unemployment and poverty especially in developing countries.

The fact that education has important effects on economic growth today is accepted beyond argument. The studies to display the effect of education and education expenditures on growth are highly important in Economics theory. There is a wide range of literature on this issue.

The effects of education expenditures on economic growth in the Turkish economy for 1980:Q1-2012:Q4 are presented in this study. In this context, it is aimed to briefly review the literature of the relationship between education and education expenditures and economic growth and to present the results of the econometric analysis, the theoretical framework of which is primarily featured.

2. Literature Review

Besides the importance of knowledge, competence and talent in the economy have been highlighted for a long time as interest in educational issues has increased and significant literature has been published on this issue. The importance of new technologies, and having the labour to transfer and use the technology in the production process, which is the main strategic issue, was understood in the 18th century.

There are several approaches to the relationship between education and education expenditures and growth in literature. Among these, in the Neo-classical approach, economic growth is expressed with the human capital factor included in model and the role of human capital is highlighted in the process of income differences between countries and convergence (Gümüş 2005, 100). The main objective of the model is to explain the source of growth differences in different countries and at different times. The Neo-classical approach in the model is an instrument to estimate long-term growth trends consistently. Although the Neo-classical growth model, which was developed in the middle of the 20th century is a headstone in economic analysis, it has not been sufficiently successful in differentiating the human and physical capital effects (Dahlin 2002, 18).

With endogeneous technological development depending on human capital accumulation, the new growth theory decreased the restraints in the neo-classical growth model by accepting income according to scale (Dahlin 2002, 29). In the new endogeneous growth models, human resource is central to the growth process (McMahon 1998, 159). The relationship between education and economic growth was expressed by Nelson and Pelps (1966), Lucas (1988), Becker, Murphy and

Tamura (1990), Rebelo (1992), Mulligan and Sala-i Martin (1992) and Barro and Lee (1992) with a human capital model, one of the forms of the new endogenous growth model (Kaya 2004, 300).

In one of the main studies in education-economic growth literature, Barro (1991) expressed the existence of a strong positive relationship between education and economic growth (Barro 1991, 407-443). Barro and Sala-i Martin (1995) stated that access to the education variable, measured by the average time in secondary and high school, has a tendency to display a significant relationship with growth (Barro and Martin 1995, 431).

In spite of several studies expressing the relationship between education and economic growth, some studies have suggested that there is no significant relationship between these two variables. Griliches (1997) emphasizes that there is no relationship between education and economic growth with his sensational findings. Although it is claimed that these conflicting results are derived from the low data set quality and measurement errors, Griliches (1997) denies these claims. The absorption of the expansion in human capital by the public sector is indicated as the reason for this conflict in the study.

Hirsch and Sulis (2009) came to the conclusion that wealth and accumulation of human capital were an important determinant for growth in Italy. According to this, it is mentioned that human capital has an important and positive effect on growth in the sectors where human capital is widely used (Hirsch and Sulis 2009, 23). In Guatemala Loening, Rao and Singh (2010) expressed that human capital has significant and positive effects on growth (Loening 2010).

Among the studies researching the causality relationship between education and economic growth in Turkey, Kar and Ağır (2003), Taban and Kar (2006, 159-181) and Başkaya, Savaş and Şamiloğlu (2010, 43-62) concluded that education and economic growth made important mutual contributions. Afşar (2009) determined a causality relationship from education investments to economic growth and concluded that there was no inverse relationship. However, Genç, Değer and Berber (2009) determined that the relationship between human capital and income per capita changed according to the levels of education. For example, while there was two–way causality at primary school level, there was a one–way causality from human capital to income per capita. However, Telater and Terzi (2010, 197-214) determined that there was a one-way positive causality from income per capita to the number of higher education graduates. So it is estimated that the increase in income per capita may cause an increase in the number of higher education graduates. In their study supporting the endogeneous growth theory Şimşek and Kadılar (2010, 115-140) expressed that human capital accumulation supported long-term economic growth, while on the other hand, economic growth increased human capital accumulation. In their studies researching the relationship between education and economic growth, Çalışkan, Karabacak and Meçik (2013, 29-48) found that there was a positive relationship between the student numbers in high and higher education levels and Gross Domestic Product.

2. Analysis

In this study covering 1980:Q1-2012:Q4 periods quarterly data have been used and total two variables have been used. In the symbols used for the variables, *y* indicates the real gross domestic products (2000=100) and *edu* indicates the total expenditures to the education variables are included to the analysis logaritmic. Variables have been obtained from The World Bank (World Bank 2013).

In order to search the effect of education expenditures on economic growth in this study, the bounds test approach developed by Peseran et al. (2001) was used. This approach, when compared to the cointegration methods developed by Engle-Granger (1987), Johansen (1988) and Johansen-Juselius (1990), is considered to be more useful. In these methods, the series included to the analysis should have unit root in the level and when the difference is taken, should integrate at the same order. Therefore, when one or part of the series is stationary at the level, cointegration relationship is unsearchable. However, there is no such restriction in bounds testing approach. When dependent variable is I(1), although the stationarity levels of the series is different, the presence of cointegration relationship can be tested (Pesaran et al. 2001). In addition, another adventage of bounds test approach is that the model estimation is possible with also the data including less observation (Narayan and Narayan 2004). Before beginning the analysis some tests and transactions were carried out about the variables used in the study. First of all stationarity levels of series was searched by Augmentd Dickey Fuller (ADF) and Phillips-Perron (PP) unit root test was implemented.

3.1. Unit Root Test

Stationarity levels of variables were first analyzed by using Dickey-Fuller (1979) test; and then, in order to compare the results of this test, Phillips-Perron (1988) test was used. According to the Table 1 where ADF and PP test results are shown, in 5% significance, all the variables are not stationary in level value. When the first order difference of the series has been taken, they became stationary. So, all series was determined as I(1). As can be observed in Table 1, these results obtained with the ADF test, are supported with the results obtained with the PP test.

Table 1: Unit Root Test Results (ADF and PP)

Variables	**ADF Test**	**PP Test**	**Critical Values**		
			1%	**5%**	**10%**
y	-0,67[8]	-1,02[10]	-3,48	-2,88	-2,57
Δy	-3.07[8]	-11.02[8]	-3,48	-2,88	-2,57
edu	-2,98[7]	-0,33[1]	-4,03	-3,44	-3,14
Δedu	-3,44[6]	-7,53[10]	-3,48	-2,88	-2,57

Note: Δ symbol indicates that the first differences of variables were taken. The values in [ ] point out the optimal lag lenght which determined to Akaike information criterion (AIC) for ADF test, Newey-West Criterion for PP test.

3.2. Granger Causality Analysis

Granger (1969), assuming that there exists two variables like *x* and y in equation (1), expressed that *x* variable would be the causality for *y* variable if the addition of information about *x* variable to the model was contributed to the forecast of *y* variable and he indicated the direction of the causality was from *x* variable to *y* variable.

$$y_t = a_1 + \sum_{i=1}^{p} b_{1i}\, y_{t-i} + \sum_{i=1}^{p} b_{2i}\, x_{t-i} + v_{1t} = 0 \quad (1)$$

$$x_t = c_1 + \sum_{i=1}^{p} d_{1i}\, x_{t-i} + \sum_{i=1}^{p} d_{2i}\, y_{t-i} + v_{2t} = 0 \quad (2)$$

The relations of variables in each other which were researched by Granger causality test are presented at Table 2. There are two-way causality relationship between the education expenditure and economic growth.

Table 2: Granger Causality Test Results

Null Hypothesis Direction of Causality	**Observation Number**	**F-stat.**	***p*-value**
y→edu	129	8,237	0.000
edu→y	129	3,747	0,026

Note: 5% significance level and 2 lag is taken. Stationary levels of the series have been used in the analysis.

3.3. Cointegration Analysis

Level value of many macroeconomic variables is not stationary. If there is a cointegration relationship between series, in other words, series moves together in long term, we wil not see a fake regression problem in the analysis with level values. (Peseran et al. 2001; Gujarati 1999). However, dynamic behaviours of variables moving together in long term period indicate some deviations (Enders 1996). This is a main characteristics of cointegrated variables and it has a determining role on short-term dynamics. The dynamic model appearing along with this process is called error correction model (Enders 1995).

First of all, an unrestricted error correction model (UECM) is established to implement the bounds test approach. The adapted form of this model is like this:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i} \Delta y_{t-i} + \sum_{i=0}^{m} \alpha_{2i} \Delta edu_{t-i} + \alpha_3 y_{t-1} + \alpha_4 edu_{t-1} + u_t \quad (3)$$

where, *m* expresses the optimum lag length, Δ indicates difference operator, u_t indicates the error term and the other abbreviated letters indicate the meanings in variable definitions. In this survey optimum lag lenght has been determined by means of Akaike Criterion. According to Kamas ve Joyce (1993) there musn't be autocorelation between error terms of model's optimum lag length so that the test can give healthy result. If there is autcorolation in the lag lenght in which Akaike Criteria is the lowest, lag lenght, in which there is one big AIC value is taken as optimum lag lenght.

The test result of lag lenght are presented in Table 3. In the Table 3 where maximum lag lenght is taken as 8, optimum lag lenght for the bounds testing was determined as 8 and it was observed that there is no autocorelation in this lag lenght.

Table 3: Lag Lenght for Bounds Test

	Model with Constant		Model with Constant and Trend	
m	**AIC**	**LM Test**	**AIC**	**LM Test**
1	-4.31	0.06	-4.41	0.01
2	-4.32	0.00	-4.43	0.00
3	-5.03	0.00	-5.05	0.00
4	-5.29	0.01	-5.34	0.00
5	-5.31	0.41	-5.39	0.88
6	-5.28	0.00	-5.35	0.00
7	-5.56	0.00	-5.58	0.00
8	**-5.69***	0.09	**-5.75***	0.01

After determining the lag length, it was passed two cointegration testing process between the variables. In bounds testing approach, cointegration relationship between the variables is made by means of testing the zero (H_0:α_3=α_4=0) hypotesis. Accepting or rejecting the zero hypotesis is determined with F test. Caltulated F statistical value is compared to table lower and upper critical values in Pesaran et al. (2001). In the first case, if the calculated F statistical value is smaller than lower critical value, it is decided that there is no cointegration relationship between the series. In the second case, if the calculated F statistical value is smaller than lower critical value is between lower and upper critical value, no definite comment can be made, in other words it stays undecided. In this case, alternative cointegration methods must be tried. Finally, if the calculated F statistical value is more than table upper critical level, it is decided that there exists a cointegration relationship between the series. According to this, in order to test the H_0 hypotesis, calculated F statistical value is compared with critical values obtained from Pesaran et al. (2001) in Table 4. This critical values are given for 1 independent variables and %1 level of significance. Thus, because cointegration relationship is determined, in order to search long and short term relationships between the variables, it was passed to estimating process of the autoregressive distributed lag (ARDL) models.

Table 4: Bounds testing results

	k	**F-stat.**	**Lower Bound**	**Upper Bound**
Model with Constant	1	3,58	3,02	3,51
Model with Constant and Trend	1	5,23	4,04	4,78

Note: k, represents the number of independent variable. Critical values were taken from Table CI(ii) and CI(iii) in Peseran et al. (2001).

3.4. Long Term Analysis

ARDL model established in order to study the long term relationship is defined like this:

$$y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i} y_{t-i} + \sum_{i=0}^{n} \alpha_{2i} edu_{t-i} + u_t \qquad (4)$$

Here m and n are lag length and they are determined by using AIC. This transaction has been carried out with the method that Kamas and Joyce (1993) proposed in their causality analyses so as to determine lag length. According to this, first of all, regression of the dependent variable is made according to its own regressive values, and the lag length of without autocorrelation model, which gives the lowest AIC value, is found. Then, by keeping the identified lag length of dependent variable stationary, regression models were formed with all possible regressions of the first independent variable, and by taking AIC value into consideration, regression number of this independent variable is identified. Optimum regression number was obtained by repeating similar transactions for other variables. For constant model and constant and trend model the long term ARDL (8.2) model was determined. The diagnostic test results of the model shows that the estimation is successful.

The estimated results of long term ARDL models and long term coefficients calculated by depending on these results are presented in Table 5. Long-term coefficients were calculated by dividing the sum of coefficient or coefficients of the independent variables (for example, if there is a regression, both its own value's and the lagged value's) to 1 difference from the sum of the coefficients of the dependent variables (Johnston and Dinardo 1997: 245). Diagnostic test results of the model show that the estimation is successful. Breusch Godfrey autocorrelation test, the White heteroscedasticity test, Jarque Bera normality test and Ramsey's model establishing error in regression statistics are in an acceptable level. In addition, the Cusum and CusumQ graphs shown in Figure 1, also show that the regression coefficients are stationary.

According to Table 5, coefficient of education expenditures in constant model is in statistically significant and interpretable level and it affected the economic growth positively in accordance with the theoretical expectations. A 1%

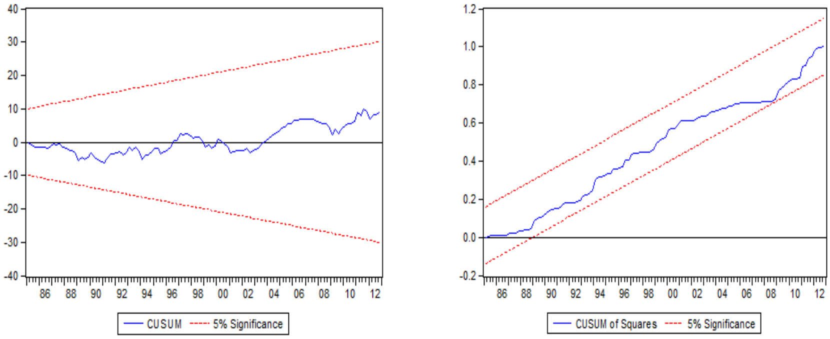
of increase in education expenditures increases the economic growth in 0.28% rates. This result is interpreted as an important evidence that education expenditures has effects on growth. However, in constant and trend model the coefficient of education expenditures is not statistically significant.

Table 5: Long Term ARDL Models, Coefficients and Diagnosis Test

Model with Constant ARDL (8.2)			**Model with Constant and Trend ARDL (8.2)**	
Variables	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**
y_{t-1}	1.5691	18.5431*	1.5037	17.8527*
y_{t-2}	-1.0390	-8.3250*	-1.0160	-8.4303*
y_{t-3}	0.8618	6.8741*	0.8431	6.9694*
y_{t-4}	-0.5966	-4.1457*	-0.5822	-4.1952*
y_{t-5}	0.4147	2.8894*	0.4306	3.1111*
y_{t-6}	-0.7978	-6.2676*	-0.8189	-6.6657*
y_{t-7}	0.8965	7.4174*	0.8820	7.5666*
y_{t-8}	-0.3231	-4.3083*	-0.3502	-4.8103*
edu_t	0.1059	7.0024*	0.1036	7.0983*
edu_{t-1}	-0.1592	-6.0833*	-0.1476	-5.7899*
edu_{t-2}	0.0575	3.3809*	0.0460	2.7394*
c	0.2803	1.3273***	2.5648	3.3521*
Long Term Coefficients				
edu	0,2868	3,1936*	0,0184	0,4946
c	19,223	9,2366*	23,778	33,634*
Diagnosis Test				
R^2=0,99		$\chi^2_{BGAB}(2)$ =1,05(0,3)	R^2=0,99	$\chi^2_{BGAB}(2)$ =2,73(0,06)
$\bar{R}^2$ =0,99		χ^2_{WDV} =0,11(0.73)	$\bar{R}^2$ =0,99	χ^2_{WDV} =0,002(0.96)
F.ist.=8393,6(0,00)		χ^2_{JBN} =1,12(0,57)	F.ist.=8285,2(0,00)	χ^2_{JBN} =2,39(0,30)
DW=2,11		$\chi^2_{RRMKH}(2)$=1,08(0.28)	DW=2,18	$\chi^2_{RRMKH}(2)$=0,10(0.91)

Note: Here χ^2_{BGAB}, χ^2_{WDV}, χ^2_{JBN} and χ^2_{RRMKH} are the statistics of Breusch-Godfrey otocorrelation, heteroscedasticity, Jarque-Bera normality test and Ramsey model making error in turn. The values in paranthesis indicate p-possibility values. *, ** and *** represents, 1%, 5% and 10% significance level in turn.

Figure 1: Cusum and CusumQ



3.5. Short Term Analysis

The short term relationship between variables was searched by means of ARDL Error Correction Model based on the bounds test approach. According to this, the adapted form of model to our study is like this:

$$\Delta y_t = \alpha_0 + \alpha_1 ec_{t-1} + \sum_{i=1}^{m} \alpha_{2i} \Delta y_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta edu_{t-i} + u_t \qquad (5)$$

where, ec_{t-1} is error correction terms and it stands for one term lagged series of error terms series which is obtained from long term relationship. This coefficient for this variable points out how many of the deviations in short period will improve after one term. If the sign of this coefficient is negative, deviations occuring in the series will converge to the long term balance value; if it is positive, it will diverge from the long term balance value.

In this model, while the lag lengths of the variables are determineted, the process in determining the long term ARDL model is repeated. For short term bounds test constant and for constant and trend models ARDL (7.1) models were determined.

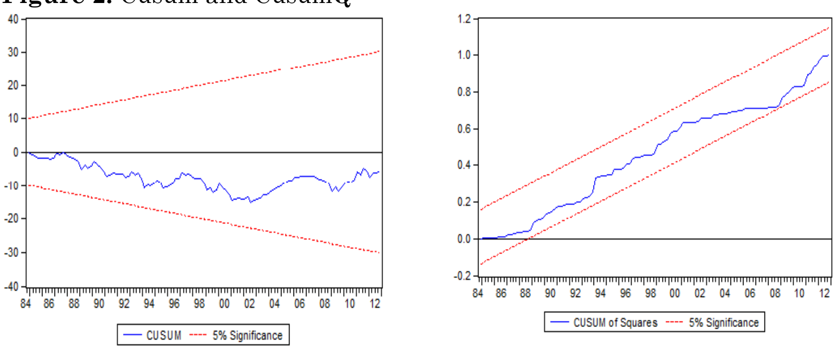
In Table 6 the estimation results for short term ARDL (7.1) models are presented. Diagnostic test results of model indicate that estimation results are successful. Statistics of Breusch-Godfrey autocorrelation test, White heteroscedasticity test, Jarque-Bera normality test and Ramsey's model establishing error in regression are in an acceptable level. However, Cusum and CusumQ graphs shown in Figure 2, indicate that the regression coefficients are steady.

Table 6: Short Term ARDL Models and Diagnosis Test

Model with Constant ARDL (7.1)			**Model with Constant and Trend ARDL (7.1)**	
Variables	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**
$\boldsymbol{ec_{t-1}}$	**-0.0145**	**-1.3933*****	**-0.1078**	**-3.4460***
y_{t-1}	0.5836	6.9750*	0.6115	7.5727*
y_{t-2}	-0.4554	-6.8516*	-0.4047	-6.1523*
y_{t-3}	0.4064	5.3391*	0.4387	5.9696*
y_{t-4}	-0.1902	-2.2884*	-0.1434	-1.7693**
y_{t-5}	0.2244	2.9365*	0.2871	3.7884*
y_{t-6}	-0.5733	-8.3352*	-0.5318	-7.8999*
y_{t-7}	0.3231	4.3471*	0.3502	4.8759*
edu_t	0.1059	7.1257*	0.1035	7.3811*
edu_{t-1}	-0.0574	-3.4470*	-0.0460	-2.8304*
c	-0.0005	-0.0001	0.0010	0.3966
Diagnosis Test				
R^2=0,84	$\chi^2_{BGAB}(2)$ =1,02(0,36)		R^2=0,86	$\chi^2_{BGAB}(2)$ =2,65(0,07)
$\overline{R}^2$ =0,83	χ^2_{WDV} =0,11(0.73)		$\overline{R}^2$ =0,84	χ^2_{WDV} =0,002(0.96)
F.ist.=63,49(0,00)	χ^2_{JBN} =1,12(0,57)		F.ist.=69,95(0,00)	χ^2_{JBN} =2,39(0,30)
DW=2,11	χ^2_{RRMKH} (2)=1,64(0.10)		DW=2,18	χ^2_{RRMKH} (2)=1,69(0.09)

Note: Here χ^2_{BGAB}, χ^2_{WDV}, χ^2_{JBN} and χ^2_{RRMKH} are the statistics of Breusch-Godfrey successive dependency, heteroscedasticity, Jarque-Bera normality test and Ramsey model making error in turn. The values in paranthesis indicate p-possibility values. *, ** and *** represents, 1%, 5% and 10% significance level in turn.

Figure 2: Cusum and CusumQ



As can be observed in Table 6, the effect of the education expenditure on economic growth in a short term is statistically significant in a 5% significance and are in line with theoretical expectations, and when compared to the long term, it remained small. This result is important in terms of defining that economic growth is sensitive to the changes in the education expenditure in Turkey. The coefficient of error correction term in both models is statistically significant and negative as expected. So, error correction term of the model works. That is, the deviations occuring in a short term between the series moving along together in long term disappear, and the series converge again to the long term equilibrium value.

4. Results and Policy Implications

The most important advantage of developed countries is that they have the capacity for the well educated and qualified labour keeping pace with the rapid changes in manufacturing process and producing high technology. The improvements in educational level affect the economic growth positively by increasing both the labour productivity and the capacity of knowledge production.

The performance of a country in development process is closely related with the effectiveness of educational system. Besides its several positive contributions in social, cultural and political areas, an effective education system increases the competitiveness and contributes to the economic growth by training the qualified labour and productivity increase in economical aspects. With this regard, policy makers should primarily centre the mission of training qualified and productive labour to the fundamentals of education system. Making polices to increase the education expenditures about the education levels from primary to higher education can be told that as a second advice for that.

In this study the relationship between education expenditures and economic growth for Turkey in 1980:Q1-2012:Q4 periods was searched. As a parallel result with the studies in literature, it was found that there was a positive and significant relationship between education expenditures and economic growth. More resource allocations on education especially on higher education which will have important contributions to the economic growth process of Turkey will have positive effects on the performance of Turkey economy by increasing the transfer opportunities of knowledge production and sharing and manufacturing process of universities.

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