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EDUCATION AND INCOME RELATIONSHIP IN TURKEY

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ABSTRACT

This paper examines the causal relationship between four different measures of education and income in Turkey using time series data for the period 1971-2013. The four measures are: (a) gross primary-school enrolment, (b) gross secondary-school enrolment, (c) gross higher-school enrolment and (d) government expenditure on education relative to total government expenditure. The analysis employs a Toda and Yamamoto (1995) *approach to Granger non-causality. The empirical findings indicate evidence of a unidirectional causality running from secondary-school enrolment to GDP per capita and higher-school enrolment to GDP per capita. The results also indicate that primary education and government spending on education do not Granger cause economic growth and vice versa.*

Keywords: Education, Economic growth, Government expenditure, Toda-Yamamoto, Granger causality, Human capital.
JEL Classification: H52, I28, O40

Contribution/ Originality

This study contributes in the existing literature on the relationship between education and growth. This study is one of very few studies which have investigated the causal relationship between four different measures of education and GDP per capita in Turkey using time series data for the period 1971-2013.

1. INTRODUCTION

The importance of education in economic growth is one of the issues that have attracted attention of both researchers and policy makers over the fifty years. The growth theories predicate at least two important mechanisms through which education is related to economic growth. First, according to augmented neoclassical growth theories, education can increase labor productivity which in turn promotes economic growth (e.g. (Mankiw *et al.*, 1992)). Second, theories of endogenous growth attribute growth to education. Accordingly, education increases innovative capacity of a country or facilitates to adopt and imitate new technologies invented by others (e.g. Nelson and Phelps (1966); Lucas (1988); Romer (1990)).

The empirical literature on the importance of education which is used commonly as a proxy for human capital in economic growth is mixed at best and far from being conclusive. Some of these studies use panel data of countries to estimate the effect of education variables on gross domestic product (GDP) per capita. Barro (1991) finds that years of schooling has a positive impact on the growth rate of per capita income in a sample of 98 countries over the years 1960-1985. Similar results are reported by Mankiw *et al.* (1992) for 98 countries between 1960 and 1985; Knight *et al.* (1993) for 98 countries between 1960 and 1985; and Levine and Zervos (1993) for 98 countries between 1960 and 1985. Other studies estimate the relationship between different levels of education and growth. For instance, Barro and Lee (1993) find that levels of primary, secondary, and higher education have positive and significant effect on economic growth in a sample of 129 countries from 1960 to 1985. Similarly, Agiomirgianakis *et al.* (2002) report that all levels of the education have significantly positive effect on economic growth in a sample of 93 countries. Gylfason and Zoega (2003) find that secondary education has significantly positive impact on economic growth in a group of 87 countries from 1965 to 1998. Gyimah-Brempong *et al.* (2006) report that all levels of education including higher education have positive and significant effect on economic growth in a sample of 34 African countries from 1960 to 2000. Blankenau *et al.* (2007) report positive correlation between public spending on education and economic growth in a sample of 24 developed countries from 1960 to 2000.

Since in these studies group of developing and group of developed or mixed group of developing and developed countries are used, these studies insufficient to give information on within country variations. Therefore, some of the studies examine education-growth nexus using a single country data. Sari and Soytas (2006) discover evidence of unidirectional causality running from primary and secondary enrollments to GDP and bi-directional causality between higher education enrolment and GDP in Turkey from 1937 to 1996. Al-Yousif (2008) report that there is unidirectional causality running from to the ratio of government spending on education to GDP to GDP per capita income in Oman and Qatar from 1977 to 2004. His results also indicate unidirectional causality from GDP per capita to both ratio of government spending on education to GDP and government education spending per worker. Fei-Xue and Cheng (2010) report that number of students enrolled in higher education has positive impact on GDP in China from 1952 to 2004. Beskaya *et al.* (2010) find evidence of bi-directional long-run causality between per capita income and all levels of enrolment rates in Turkey over the period 1923-2007. Mercan (2013) finds positive and significant relationship between education expenditure and economic growth in Turkey for over the period 1980:Q1-2012:Q4. However not all the studies find positive relationship between education variables and economic growth. Among those papers are Levine and Renelt (1992); Devarajan *et al.* (1996); Benhabib and Spiegel (1994); Griliches (1997); Keller (2006); Hanushek and Kimko (2000) and Yildirim *et al.* (2011).

In order to contribute to the growing literature on the education- growth nexus, this paper considers the causal relationship between education and GDP per capita in Turkey over the period of 1971-2013. The causal relationship between GDP and education variables is carried out by applying Toda-Yamamoto Granger causality test within a bivariate VAR framework. The rest of the paper is organized as follows: Section II discusses the data and methodology used; Section III presents the empirical results while Section IV concludes the paper.

2. DATA AND METHODOLOGY

Various studies on education and growth have used different variables as proxies for human capital. Among those variables enrolment ratios, years of schooling attained and government expenditure on education have been most commonly used to measure education. In this paper enrollment ratios for three levels of education and government expenditure on education are used as education variables. Enrolment ratios of three levels of education are primary (PE), secondary (SE), and higher (HE). Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Government education expenditure (GEE) is the ratio of government expenditure on education to total government expenditure. Real per capita gross national product (GDP) is used as proxy for economic growth and expressed in natural logarithms. Data on enrolment ratios are downloaded from the World Bank's World Development Indicators while data on government education expenditure is extracted from the Republic of Turkey Ministry of Finance's website.

In empirical studies, causal relationship between two variables is commonly estimated by applying traditional Granger-Causality test proposed by Granger (1969). While, the traditional Granger-Causality test is easy to carry out, it has its limitations. For instance, Granger-Causality test is sensitive to model specification and the number of lags included. Maddala (2001) and Gujarati (2006) argue that the exclusion of relevant variables causes spurious significance and inefficient estimates. Gujarati (2006) also points out that when the variables are integrated F-statistic may not be used to jointly test the Granger-Causality since the test statistics do not have a standard distribution. Toda and Yamamoto (1995) develop a different procedure which involves estimating a vector autoreggression (VAR) model in levels. This procedure requires testing each of the time series to determine maximal potential order of integration, d_{max}. Causality rest is applied after estimating an augmented VAR with the p= k + d order, where k is the optimal lag length in the VAR model. This guarantees the asymptotic chi-square distribution of the Granger-Causality Wald statistic. Toda and Yamamoto (1995) Granger-Causality procedure has an advantage in that it can be applied even when the variables of the model are integrated at the different order. To apply Toda and Yamamoto's procedure an augmented bivariate VAR (k + d_{max}) is represented as follows:

$$X_t = \partial + \sum_{i=1}^{k} \theta_i \ X_{t-i} + \sum_{i=k+1}^{k+dmax} \theta_i X_{t-i} + \sum_{i=1}^{k} \delta_i \ Y_{t-i} + \sum_{i=k+1}^{k+dmax} \delta_i Y_{t-i} + \varepsilon_1 \qquad (1)$$

$$Y_t = \propto + \sum_{i=1}^{k} \emptyset_i \ Y_{t-i} + \sum_{i=k+1}^{k+dmax} \emptyset_i Y_{t-i} + \sum_{i=1}^{k} \omega_i \ X_{t-i} + \sum_{i=k+1}^{k+dmax} \omega_i X_{t-i} + \varepsilon_2 \qquad (2)$$

Where X is the GDP, Y is the education variables (PE, SE, HE, and GEE), ∂, θ, δ, $\propto, \emptyset$, ω are parameters of the model. ε_1 and ε_2 are error terms that are assumed to be white noise.

3. EMPİRİCAL RESULTS

The Toda and Yamamoto procedure involves two steps. At the first step, the maximum order of integration (d) and the optimal lag length (k) of the variables in the bivariate VAR models are determined. To determine the order of integration for the respective variables, Dickey and Fuller (1979) ADF tests are carried out with and without a time trend variable. As shown in Table 1, the ADF test results indicate that HE with constant is stationary in levels while the PE with constant and trend, SE, GDP, and GEE are stationary variables in first-differences. Hence, the maximal order of integration is determined as one (d_{max} = 1). The optimal lag lengths (k's) of the VARs in levels between the PE and GDP, SE and GDP, HE and GDP and GEE and GDP are selected based on the usual information criteria, such as Akaike and Schwarz Information Criteria (thereafter AIC and SIC, respectively). The selected optimal lag lengths (k's) are presented in Table 2. Having determined the maximum order of integration (d) and the optimal lag length (k) of the variables in the bivariate VAR models, augmented bivariate VARs (k + d_{max}) are estimated.

Table-1. The ADF unit root test results

Variable		Level	First Difference	Order of Integration
PE	wc	-3.18**	-	I(0)
	wct	-3.04	-8.71*	I(1)
SE	wc	0.29	-5.60*	I(1)
	wct	-2.48	-5.56*	I(1)
HE	wc	7.97*	-	I(0)
	wct	4.72*	-	I(0)
GDP	wc	-0.08	-6.47*	I(1)
	wct	-2.67	-6.43*	I(1)
GEE	wc	-2.24	-6.78*	I(1)
	wct	-2.31	-6.80*	I(1)

Notes: *, **, and *** indicate significant at 1%, 5%, and 10%, respectively. wc and wct are the test statistics for a unit root with a constant and with constant and trend. The lag lengths are selected based on SIC.

Table-2. Selection of the order of the VARs (k*)

Variables of the augmented VAR	AIC				SIC				Optimal (k*)
	1	2	3	4	1	2	3	4	
PE, GDP	1.92	2.05	2.09	2.16	2.18	2.48	2.69	2.93	1
SE, GDP	2.25	2.42	2.40	2.47	2.51	2.85	3.00	3.25	1
HE, GDP	0.66	0.69	0.86	1.02	0.92	1.13	1.47	1.79	1
GEE, GDP	0.30	0.47	0.57	0.73	0.56	0.90	1.17	1.50	1

Note: (k*) indicates the selected order of the VARs.

The second step of the Toda and Yamamoto procedure involves the modified Wald procedure to test the VARs (k + d_{max}) for causality. The Wald test results are presented in Table 3.

The results reported in Table 3 provide evidence of a unidirectional causality running from SE to GDP per capita and HE to GDP per capita for the study period. For Turkey, changes in secondary and higher education enrolment ratios have significant impact on GDP per capita. This means that increases in secondary and higher education enrolment ratios generate a continuous rise in income.

Table-3. Toda and Yamamoto Granger-Causality test results

Null Hypothesis	Chi-square	Direction of causality
GDP Granger causes PE	0.25 (0.614)	None
PE Granger causes GDP	1.44 (0.230)	None
GDP Granger causes SE	7.71 (0.173)	None
SE Granger causes GDP	10.83 (0.054)	SE → GDP
GDP Granger causes HE	0.0004 (0.983)	None
HE Granger causes GDP	7.73 (0.005)	HE → GDP
GDP Granger causes GEE	1.60 (0.20)	None
GEE Granger causes GDP	0.08 (0.78)	None

Notes: The reported estimates are asymptotic Wald statistics. The values in the parentheses are the p-values.

The [k+d]th-order level VAR is estimated with maximal order of integration (d) being 1.

The results also indicate that primary education and government spending on education do not Granger cause economic growth and vice versa in Turkey for the study period.

4. CONCLUSION

This present paper explores the relationship between education variables namely three levels of education enrollment ratios and government expenditure on education and GDP per capita in Turkey employing a Toda-Yamamoto Granger causality test for the period 1971-2013. The empirical results reveal that the causality is unidirectional running from the secondary and higher education to GDP per capita income. The results also indicate that primary education and government education expenditure do not lead to economic growth in Turkey. Yildirim *et al.* (2011) also report similar findings. They find no causality running from real per capita government education expenditure to GDP per capita. As a policy implication, to achieve higher per capita income, policy makers should apply policies to increase enrolment ratios both in secondary and higher education.

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