DOES EDUCATION CAUSE ECONOMIC GROWTH IN IRAN?

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Abstract

This paper examines causal relationships between education and economic growth for Iran using annual data over the period 1970-2010. The Gregory-Hansen (1996) cointegration technique, allowing for the presence of potential structural breaks in data, is applied to empirically examine the long-run co-movement between these variables. The results suggest that there is no long-run relationship between these variables. The Granger Causality test indicates strong unidirectional effects from GDP to education. But there is no evidence that education contribute to economic growth. Moreover, the main results in this paper confirm that there is an instantaneous as well as unidirectional causal link running from GDP to education. The lack of strong link from education to economic growth is not necessarily a reason to reallocate education investment away from the education sector. The vital problem is to make education system and spending more effective in improving education outcomes.

JEL classifications: O40, O15, I20, C33, C10

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1. Introduction

Economic growth means continual increase of per capita real national production in a country, being a criterion for measuring social welfare. Most of the economists emphasize on formation of physical capital and human capital as main determining factor of economic growth and development. In new theories of growth, role of human capital on economic growth is more emphasized and the educated manpower is introduced as basis of technology and productivity growth. Quantitative focus of capital including formation of industrial units and machinery and qualitative focus of capital as enjoying more desirable services of education, health and promotion of scientific and skill level play essential role in growth and development of society (Almasi, M. & Sohayli, k. & Sepahban, GH. 2009).

While physical capital has traditionally been the center of attention of economic studies, factors affecting the expansion of human skills and capacity are increasingly marked in the studies of social sciences. Human capital stands for the investment improving their economic productivity.

The human capital theory depend on the hypothesis that formal education is greatly useful and even necessary to progress the productivity (e.g. Harrod, 1939; Domar, 1946; Solow and Swan, 1956; Lewis, 1956; Schultz, 1971; Harbinson, 1973; Mincer, 1973 and Romer, 1989). human capital theorists show that an educated population enjoy higher productivity.

On the other hand; one could argue this causality running from economic growth to education. An increase in income can lead to an increase in human capital. For example, if a part of the additional income is allocated to teach the family or at the government level, applied to improve education. Also, higher income may improve human development though its impact on life expectancy(Ranis et a1,2000).

This paper investigates the causality between egucation and economic growth in Iran during 1970-2010. Section 2 discusses the methodology and data. We also present the empirical results of the paper in section 2, and section 3 concludes.

2. Methodology and Empirical Results

In this section we use the Granger causality to study the causal relationship between education and economic growth in Iran. The macroeconomic variables used in the model are school

enrolment rates (EDU) and logarithm of real GDP (GDP). The data series are obtained from Central Bank of Iran (CBI). The data are annual from 1970-2010, reflecting data availability. Considering the short sample period, a bivariate model is used to empirically examine the long-run co-movement and the causal relationship between investment and real GDP.

2.1. Zivot and Andrews Unit Root Test

Conventional tests for identifying the existence of unit roots in a data series include that of the Augmented Dickey Fuller (ADF) (1979, 1981) or Phillips-Perron(1988). So in the first step of the empirical analysis, the Phillips - Perron unit-root tests have been carried out for the both variables: gross domestic investment and GDP per capita, both in logarithm. The results reported in Table 1, indicate that both of the variables are nonstationary. However, recent contributions to the literature suggest that such tests may incorrectly indicate the existence of a unit root, when in actual fact the series is stationary around a one-time structural break (Zivot and Andrews, 1992; Pahlavani, et al, 2006). Zivot and Andrews (ZA) (1992) argue that the results of the conventional unit root tests may be reversed by endogenously determining the time of structural breaks. The null hypothesis in the Zivot and Andrews test is a unit root without any exogenous structural change. The alternative hypothesis is a stationary process that allows for a one-time unknown break in intercept and/or slope. Following Zivot and Andrews, we test for a unit root against the alternative of trend stationary process with a structural break both in slope and intercept. Table 1 provides the results. As in the Phillips-Perron case, the estimation results fail to reject the null hypothesis of a unit root for both variables. The same unit root tests have been applied to the first difference of the variables and in all cases we rejected the null hypothesis of unit root. Hence, we maintain the null hypothesis that each variable is integrated of order one or I(1).

Table 1: Unit-root tests of Phillips-Perron(PP) and Zivot and Andrews (ZA)

school enrolment rates (EDU)		Real GDP	
PP	ZA	PP	ZA
-0.63	-1.70(1979)	-1.69	-2.39(1979)

Note: The break point in ZA unit root test is presented in brackets. Empirical results fail to reject the null hypothesis of unit-root in all cases. The lag lengths for the ZA and PP tests are chosen by using SC's information criterion and Newey and West (1987) method respectively. Critical values for ZA tests were obtained from Zivot and Andrews (1992). Break points are reported in ( )

2.2 The Gregory-Hansen Cointegration Analysis

Cointegrationtest means looking for a stationary long-run relationship between non-stationary variables. It has been introduced for the first time in 1980's by Engle and Granger (1987), Johansen (1988, 1991), Johansen and Jeslius (1990, 1992) and the others. There are some methods for testing for cointegration the most well-known of which is Johansen test. However, as noted by Perron(1989), ignoring the issue of potential structural breaks can render invalid the statistical results not only of unit root tests but also of cointegration tests. Kunitomo (1996) argues that in the presence of a structural change, traditional cointegration tests, which do not allow for this, may produce spurious cointegration. Therefore one has to be aware of the potential effects of structural effects on the results a cointegration test, as they usually occur because of major policy changes or external shocks in the economy.

The Gregory-Hansen approach (1996) (hereafter, GH) addressed the problem of estimating cointegration relationships in the presence of a potential structural break by introducing a residual-based technique so as to test the null hypothesis (no cointegration) against the alternative of cointegration in the presence of the break (such as a regime shift). In this approach the break point is unknown, and is determined by finding the minimum values for the ADF t-statistic.

By taking into account the existence of a potential unknown and endogenously determined one-time break in the system, GH introduced three alternative models. The first model includes intercept or constant (C) and a level shift dummy. The second alternative model (C/T) contains an intercept and trend with a level shift dummy. The third model is the full break model (C/S),

which includes two dummy variables, one for the intercept and one for the slope, without including trend in model. This model allows for change in both the intercept and slope.

These tests detect the stability of cointegrating vectors over time in the presence of structural breaks in the form of level shift, level shift with trend, and regime shift. Table 2 reports all cases. when dependent variable is gross domestic investment, the null hypothesis of no cointegration relationships is rejected in favor of the existence of one cointegrating relationship, allowing for a one time structural break (although not rejected when GDP is dependent variable). The results show that the variables under examination do drift apart for Iran and there is no long run relationship between them even after allowing structural shifs

Table 2: Gregory-Hansen cointegration tests

Dependent Variable	Model	Test Statistic	Break Point
EDU			
	C	-2.65	1980
	C/T	-1.54	1980
	C/S	-2.10	1980
GDP			
	C	-.91	1980
	C/T	-0.51	1979
	C/S	-1.11	1980

Notes: C denotes level shift, C/T denotes level shift with trend, and C/S denotes regime shift. The lag length is chosen based on minimum SC.* denotes significant at the 5% level. Critical values were obtained from Gregory and Hansen (1996).

2.3. Granger Causality Tests

The non-existence of cointegrating relationship between EDU and GDP for Iran suggests that there must be no long run Granger causality (Hatanaka, 1996). In this section, we test for short run Granger Causality between school enrolment rates (EDU) and log of real GDG per capita

(GDP) in first difference. The causality relationship between the two series is examined based on the following equations:

$$\Delta EDU = \alpha_{y_{t-1}} + \sum_{i=1}^{n} \gamma_{Bi} \Delta GDP_{t-i} + \sum_{i=1}^{n} \delta_{Bi} \Delta EDU_{t-i} + \varepsilon_{Bi} \qquad (1)$$

$$\Delta GDP = \alpha_{\varepsilon} + \sum_{i=1}^{n} \gamma_{yi} \Delta GDP_{t-i} + \sum_{i=1}^{n} \delta_{yi} \Delta EDU_{t-i} + \varepsilon_{yi} \qquad (2)$$

where Δ is a difference operator; and the $\varepsilon_{it}s$ are disturbance terms assumed to be uncorrelated and random with mean zero.

Sources of causation can be identified by testing for significance of the coefficients on the lagged variables in Eqs. (1) and (2). First, by testing $H_0 : \gamma_{yi} = 0$ for all i in Eq. (1) or $H_0 : \delta_{Bi} = 0$ for all i in Eq. (2), we evaluate Granger weak causality. This can be implemented using a standard F-test. Masih and Masih (1996) and Asafu-Adjaye (2000) interpreted the weak Granger causality as 'short run' causality in the sense that the dependent variable responds only to short-term shocks to the stochastic environment.

Another concept related to Granger-causality is that of instantaneous causality. Roughly speaking, a variable EDU is said to be instantaneously causal for another time series variable GDP if knowing the value of EDU in the forecast period helps to improve the forecasts of GDP. It turns out, however, that in a bivariate VAR process, this concept reduces to a property of the model residuals. More precisely, let $\varepsilon_t = (\varepsilon_{Bt}, \varepsilon_{yt})$ be the residual vector of $y_t = (\Delta EDU, \Delta GDP)$; then, ΔEDU is not instantaneously causal for ΔGDP if and only if ε_{Et} and u ε_{Rt} are uncorrelated. In turn, ΔEDU is instantaneously causal for ΔGDP if and only if ε_{yt} and ε_{Et} are correlated. Consequently, the concept is fully symmetric. If ΔGDP is instantaneously causal for ΔEDU, then ΔEDU is also instantaneously causal for ΔGDP. Hence, the concept as such does not specify a causal direction. The causal direction must be known from other sources. Still, if it is known from other sources that there can only be a causal link between two variables in one direction, it may be useful to check this possibility by considering the correlation between the residuals (Lutkepohl, 2004).

The results of the tests on causality are presented in Table 3. The evidence strongly indicates that GDP Granger-causes EDU. The coefficient lagged explanatory variables are significant in

the EDU equation which indicates that short run causalities run from GDP to EDU. The results for the other equation suggest that EDU has no effect on GDP in short- and long-run. Therefore, there is unidirectional Granger causality running from GDP to EDU.

Table 3:Result of causality tests

	ΔEDU	ΔGDP
Null hypothjesis	F-statistics	
EDU does not cause GDP	0.67	-
p-value	(0.83)	
GDP does not cause EDU	-	6.01
p-value		(0.00)

Notes: the lag length has been chosen based on minimum SC.
Δ denotes series in first difference.

Testing for instantaneous causality can be done by determining the absence of instantaneous residual correlation. Because only one correlation coefficient is tested to be zero, the number of degrees of freedom of the approximating chi-square distribution is one. Clearly, it is sufficient to report the test result for only one instantaneous causal direction because the test value for the other direction is identical given that it tests the very same correlation coefficient. The test statistics based on the residuals of the VAR in first difference is 12.32, being highly significant.

These results imply that, there is instantaneous as well as unidirectional Granger causality running from GDP to EDU, while education has an insignificant effect on GDP in both the short- and long-run.

3. Conclusion

This paper applies Gregory-Hansen (1996) cointegration and error correction modeling techniques in order to test causal relationship between education and real GDP in Iran based on annual data from 1970 to 2010. Prior to cointegration analysis, the Zivot and Andrews unit root test has been applied to test the stationarity of the variables. The empirical results indicate that we cannot find enough evidence against the null hypothesis of unit root. However, for the first difference of the variables, we rejected the null hypothesis of unit root. It means that the variables are I(1). The results show that there is a no long-run relationship between education and GDP.

We also find strong support for the exogeneity of GDP. The main results in this paper confirm that there is an instantaneous and unidirectional causal link running from GDP to EDU. The findings of this paper do not support the traditional view that human capital is the key to economic growth. Moreover, findings stress that the causal link between growth and education runs in the opposite direction, implying that capital formation depends on income. The results of this research show that, it is necessary to revise the formal education system to improve education returns.

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