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Investigating the Mutual Relationship between Private and Public Educational and Health Care Expenditures with the Economic Growth of Iran (a Causality Approach)

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Abstract:
Investment in education and health sector, as human capital, has an important role in economic growth and its enhancement in many countries. Lots of studies have been carried out in this field; however, the effect of simultaneous analysis of education and health, by both private and public sectors in economic growth of Iran has not been investigated. Thus, in the present study mutual relationship between private and public educational and health care expenditures with the economic growth of Iran from 1965 to 2014 has been surveyed. Therefore, in the present paper variables were tested by using Integration Adjusted Dickey – Fuller test. Then for choosing the appropriate causality test, the co-integration between variables was tested by ARDL method. Then, by using Granger, Toda and Yamamato causality tests, the two ways causal relationship between variables was assessed. First, findings showed a lack of long-run relationship between variables. Second, the results of causality tests indicated that there is no causal relationship between private and public educational expenditures with economic growth because the educational system faces serious problems such as discordance between the educational system and needs of society and labour market. Also, the obtained results delineated that there is no causal relationship between private sector and public sector health care expenditures with economic growth.

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1. Introduction

Economic growth is one of the main concerns of Iranian policy makers. In the past, formation of physical capital was a growth-driving force and the role of workforce diversity didn't have the required position in theoretical analysis. Today, theoretical and empirical literature has shown that development of human capital, improving quality of workforce and his health is one of the main ways of increasing economic growth in communities and this important factor has a key role in productivity. Increasing of productivity and human resources income leads to rising higher quality of life and saving that, in turn, has great importance in permanent dynamic economic growth.

On the other hand, economic growth can achieve necessary conditions to improve quality of labour force. Considering the importance of quantitative investigation of this relationship in Iran economy, this study has been trying to survey the mutual relationship between educational and health expenditures in private and public sectors and economic growth of Iran, separately. To do this, the subsequent chapters are as follows: In the second chapter theoretical studies will be discussed and the third one will delineate empirical studies. Chapter four will explain methodology of the research. Then in chapter five, by applying the achieved data from 1965-2014, first integration of variables will be tested by Adjusted Dickey–Fuller test. Then for choosing the suitable causality test, the co-integration between variables will be tested by ARDL approach. Therefore, by using Granger and Toda and Yamamato tests, mutual causality relationship between variables will be tested. In the final Chapter, findings and political recommendations will be presented.

2. Theoretical Bases

The theoretical models of growth show that various factors are effective in economic growth of countries. In this regard, Barro showed that human capital is an important one and education and health are the most important factors of providing human capital. Human capital that reflects skills, capacities and individual capability via training human resources, increases the quality and

quantity of production (Beyengju, 2002). Based on Generalized Solow Model, human capital in the initial studies entered in the form of education, as input in production function along with
 :al capital. Then, it was defined in the form of health and an exact analysis of the effect of human capital on economic growth was presented.

Most economists indicate that residual factor, as an illustrative of the important sector of developed countries growth, depends on education directly and indirectly (Emadzade, 2000). Thus, investing on education was taken into account in the early 1960s by economists and policy makers. In this period, investing on formal and informal education increased the skill of human resources and improved labour force and Total Factors Productivity and provided the required dynamics for the economic and social progress in developed countries (Elmi and Jamshidnejad, 2007). In the theoretical framework of human capital theory, Schultz (1961) believed that education expenditure increases productivity and real wage of people. Romer endogenous growth theory is based on the framework that creation of a new idea directly depends on human capital. It is expected that investing on education and improvement of the expenditures and R&D capital accumulation increase economic growth. People by permanent accumulation of knowledge as "Intentional effort", or as "learning by doing" increase capital and labour productivity. Thus, it lagged descending returns rule in practice and increased economic growth. Second, education improves adaptability and allocated efficiency. Because skilful workers allocate the resources with high efficiency, they are more capable in responding to the new situation (Heckman, 2005). Third, education leads to benefit overflow or positive social external outcomes (Self and Grabowski, 2004). The health labour force is strong and prepared mentally and physically and by high productivity can receive high wages. Higher wage leads to higher saving, consumption and finally higher economic growth (Weil, 2005). On the other hand, health improvement via the reduction of sick leaves, increasing life expectancy, reducing morality rate;

increasing the participation of the poorest people in the society in labour market and the number of capital return years and labour force; moreover, more saving for retirement increases the physical investment and production (Weil, 2005). Third, better health in case of stability of other conditions reduces the health care expenditures of the government in future and possibly more investment in human and non-human capital. Howitt (2005) believes that mother and child health has an important role in person's childhood human capital and increase of economic growth. He considered this issue as a good justification for government investment in children and mothers health care. Scheffler (2004) showed that in most developing countries, birth rate and dependency burden are high. Thus, saving and investment and production are low. In these countries, health services in family control and population control reduce birth rate and the dependency load. Muysken (2001) believed that the investment expenditure in health is necessary to increase production.

The general condition of economy including current and future growth rates can change the human capital condition of society by affecting real and expected values of variables as determining factors of human capital. Totally, we can consider some major channels for the effect of income and economic growth on human capital:

1. The effect of expected return of investing on human capital: We can say that separation of the conditions in which economy has many problems and moving to economic growth can lead to boosting expected returns of investing on resources in health, education and other human capitals and increasing productivity (Mojtahedi and Javadipour, 2005).
2. Reduction of discount rate: Reduction of discount rate leads to high reliability about returning of all kinds of investment and investing on human capital. The key aspect of this effect is the perception of policy makers of sustainable growth features. Because more transparent and durable is the growth strategy related policies, more continues is this influence.

3. (Mojtahedi and Javadipour, 2005).
4. Increasing current income: The third important effect of growth and production on human capital is via increasing current income and demand for health, education, consumption of goods and capacity creation for autonomous funding of investment in human capital. This effect can reduce final cost of investment in human capital and balance level of investment in human capital increases (Mojtahedi and Javadipour, 2005).
5. Simultaneous development of different types of markets: As the product market development leads to increasing expected return of investment on human capital, we can expect the equilibrium level of investment on human capital being increased. The development of labour market due to the rise of expected return of investment of the poor on health and education could be important. The development and merging of credit markets can reduce the costs of receiving credits for those living in slums and investment on human capital increases through poor people (Mojtahedi and Javadipour, 2005).
6. Increasing the dominance of government on relevant resources of GDP: The effect of income on health and education expenditures depends on allocated resources to health and education.

The more resources are allocated to the health and education and efficient is this allocation, more possibility of production and economic growth effects is on health ad education. (Mojtahedi and Javadipour, 2005).

Also, education is associated with national income in two ways. On the one hand, formation of human capital by educational investment can lead to high abilities of people and increasing production and national income. On the other hand, high income can lead to growth of saving (the source of capital). As productivity of capital goods is associated with variety of human capitals and experts, along with economic growth, the society increasingly needs well-educated and trained people. Thus, education leads to growth of production and national income, and consequently increasing national income will lead to high

investments on education and human capital (Tari, Arzeromchiler, 2002).

3. Review of literature

To establish the theoretical background for the present study, this chapter primarily tries to explain foreign studies that investigated positive and negative relationship between education and health expenditures with economic growth. In the second strand, this study provides a review of the empirical research about mutual relationship between education and health expenditure and economic growth. Finally, local research is presented in this chapter.

3.1. Foreign research about positive relationship of under study variables

Asterious and Agiomirgianakis (2001) by Johansen co-integration method and Lucas growth model (1988) investigated the long-term relationship between economic growth and education in Greece during 1960-94. In the present study, it is assumed that education is the mechanism of human skill development. The results of the study showed that there is a long-term positive relation between economic growth and registration rate in various sections. The results of the study of Clarke and Islam (2003) during 1995-99 showed that the effect of health care expenditures of government on economic growth in Thailand was more than developed country of Australia. Akram et al., (2008) by Romer and Barro model and co-integration methods of Engle–Granger and Johansen showed that per capita GDP of Pakistan during 1972-2006 in long–term had positive relation with health index. Barro (2002) by panel data of 100 countries during 1960 to 1990 explained that educating men, 25 years of age or more in high school and higher levels had significant effect on growth. Beraldo et al., (2003) by MRW[4] model and group panel data method from OECD countries suggested that the effect of public expenditures on production was higher compared to health care

[4] Mankiw, Romer and Weil

expenditures in private sector. The effect of public and private expenditures of education on economic growth was not statistically significant. Rivera and Curias (2004) by developing Solow model (1956) and using panel data method of various regions in Spain argued that government infrastructure expenditures in health and education didn't have significant effect on economic growth but the current expenditures of government health had positive relationship with economic growth of Spain. Park (2006) by endogenous growth model and data of 94 developed and developing countries during 1960-95 showed that dispersion index of human capital of population increased the productivity and provided the economic growth improvement and provided high development of human capital and education compared to other locations. Baldacci et al., (2007) by endogenous growth model and panel data of 118 developing countries during 1971-2000 indicated that education and health care expenditures developed economic growth. Li and Huang (2009) by MRW model, investigated the data of 128 provinces of China during 1978-2005. The results of the study showed that health and education had a positively significant effect on economic growth. The findings of Bloom et al., (2009) showed that increasing life expectancy and reduction of fertility rate of improving health in the society are the main factors of economic growth in China and India during 1960-2000. However, education of labor force had a significant effect on growth of these two countries. Shindo (2010) demonstrated that the increase of Education subsidies in long term improved the economic growth of two regions of Jiangsu and Liaoning during 1985-2000. Narayan et al., (2010) by augmented production function, Westerlund co-integration methods and panel data during 1974-2007 described health and research and development expenditures in long-term had positive effect on economic growth of five southeast Asian countries but the education expenditures didn’t have any significant effect on growth. Laabas and Weshah (2011) on a 30-country sample of developing and developed countries showed that education quality had a positive

effect on economic growth of both groups of countries. The study of Neagu (2012) showed that education alone and health and education together had positive effecst on economic growth of Romani. Hanushek (2013) showed that educating labor force in developing countries had positive effect on economic growth.

a. **Foreign research on negative relationship of under study variables**

Some studies showed that it is possible for the effect of education and health on economic growth to be negative. Such studies are Diamond (1989) and Kewka and Morrissey (2000). Diamond applied private investment, total government expenditures to GDP, infrastructural expenditures ratio to GDP and current expenditures of social sector to GDP and current education expenditures to GDP as explanatory variables of economic growth in 38 developing countries and found that except for current expenditures of social sector and education with negative effect on growth, other variables had positive effects on economic growth. Lau et al. investigated 58 developing countries, from 1960 to 1986. In this study real GDP was considered as the dependent variable and some variables as quantities of capital, labour, and average educational attainment of the labour force were considered as explanatory variables. They measured the percentage change in a region's real GDP in response to an increase of one year in the average education. The results showed that in some developing countries, increasing a year of education didn't have a significant effect on GDP growth and it had negative effect in some countries. The results of the study were consistent with the empirical study has been done by Islam based on pooled data. Also, Kewka and Morrissey (2000) by co-integration methods of Engle–Granger and Granger causality showed that public expenditures of education and health didn't have significant effect on economic growth of Tanzania during 1965-96. Some studies like Cullis and West (1979) showed that health care expenditures had no significant effect on economic growth. Easterly and Rebelo (1993) found that the

effect of health expenditures on the growth of countries was negative and insignificant.

3.2. Foreign research on mutual relationship of under study variables

Posnett and Hitiris (1992) in evaluation of the relationship between health per capita expenditures and GDP by the data of developed countries found that there was a strong and bidirectional relationship between GDP and health per capita expenditures.

The study of Cheng and Hsu (1997) is the first study that evaluates the causal relationship between human capital and economic growth. The results of their study showed that there was a two-way relationship between human capital and economic growth in Japan.

Rivera and Currais (1999) in the study by data of 24 OECD countries found that there was a positive and significant association between health expenditures and GDP.

Hopkins and Mcdonald (2000) by bounds test and Johansen co-integration test delineated that in Australia as GDP had positive and significant effect on health expenditures, health expenditures didn't have significant effect on production.

Chuang (2000) evaluated the causality relationship between capital accumulation, export and economic growth for Taiwan and also evaluated co-integration and error-correction methods. He found that human capital had a positive and significant effect on two other variables and caused expert and economic growth in Taiwan during 1952-1995. Thus, endogenous growth theory based on human capital is supported.

Devlin and Hansen (2001) by Granger causality evaluated the mutual relationship between health expenditures and income in 20 OECD countries during 1987-1995 and found that the relationship was mutual. Erdil and Yetkiner (2004) in a set of countries with different income levels during 1990-2000 evaluated the causality between health expenditures and GDP. Based on the results, in countries with low and average income, there is causality only from income to health expenditures but in

high income countries, health expenditures were effective on GDP.

Butt and Bukhaari(2007) by Hopkins and Mcdonald (2000) method showed that in Pakistan during 1972-2005, causality was form GDP to health expenditures and health expenditures had no effect on production.

Amiri and Ventelo (2010) in the study evaluated a one-way causal relationship from health expenditures to GDP for the total period. According to the study of Bronerini and Pisili (2009), only one-way causal relationship from human capital on total productivity of production factors was supported.

Rahman et al., (2011), investigated the causal relationship among health expenditure, education expenditure and GDP for Bangladesh. From the empirical study, they found the existence of bidirectional causality from education expenditures to GDP and also from education expenditure to health expenditure and only unidirectional causality is obtained from health expenditure to GDP.

Asghar et al., (2012), investigated the role of human capital in terms of education and health on economic growth of Pakistan during 1974-2009. In their study Long-run relationship among variables was confirmed through Johansen and Juselius co-integration test whereas the long-run and short-run dynamics were observed by VECM specification. For causality purpose both VECM based causality and Toda-Yamamoto causality tests were employed. The results indicate the strong positive impact of human capital on economic growth despite the fact that Pakistan has been spending less percentage of GDP on education and health facilities to create human capital.

Awel (2013) examined the causal relationship between human capital and economic growth for Sweden over the period 1870-2000. The result from the Granger causality test illustrates that there is bidirectional causality running from human capital to output per worker and vice versa. Moreover, using vector error correction model, the paper shows that human capital has a significant positive impact on economic growth in Sweden.

Uche et al., (2013), examined the commitment of the federal government of Nigeria to education through her budgetary allocations and also assessed the causal relationship between the government expenditure on education and economic growth from 1981-2011using time series data. The result reveals that Expenditure on education is positively related to GDP while Gross fixed capital formation is negatively related to GDP.

Zerihun (2014) investigated the relationship between education and health that have been accepted as an indicator of human capital and economic growth was tested empirically. The study aimed at decomposing the relationship between human capital (using health index and education index as a proxy) and economic growth using time series data from 1971-2011 in Ethiopia using modern econometrics technique. Long-run relationship among variables was confirmed through Johnson co-integration analysis whereas the long-run and short-run dynamics were observed by VECM specification. For causality purpose VECM based causality tests were employed. The finding indicates that in long-run, investment on education and health would affect further economic growth.

Sen et al., (2015), analysed the possible existence of Granger causality among three variables; education expenditure, health expenditure, and economic growth for the selected eight developing countries of Argentina, Brazil, Chile, India, Indonesia, Mexico, South Africa, and Turkey over the period 1995-2012. Analysis showed no robust evidence of Granger causality among education expenditure, health expenditure and economic growth for all the countries included in this study; only in two of the eight developing countries- Brazil and Mexico- a positive and significant causality running from both education and health expenditures to economic growth was observed; however, this result was significantly negative for Indonesia.

3.3. Local researches

In local studies, the relationship between education and health was investigated. Salehi (2002) by human capital model MRW showed that academic years and education expenditures had

positively significant effects on economic growth in Iran during 1966-1996. Mojtahedi and Javadipour (2004) by augmented Solow growth model (1956) and panel data technique used in 33 developing countries showed that human capital as physical capital had a positive effect on economic growth. Taghavi and Mohammadi (2006) by endogenous growth model and Granger co-integration test during 1959-2002 and empirical-scientific study of Jamshid nejad (2007) by Lucas growth model (1988) during 1972-2003 supported the effect of improvement of indices as adult's literacy rate and academic years' rate of labour force and generally education on economic growth of Iran. Also, Ghanbari and Baskha (2008) by neoclassic growth model and Johansen and Juselius method found that physical capital, active population, health expenditures of government had positively significant effects on economic growth of Iran during 1959-2004. Almasi et al., (2008) introduced endogenous economic growth as a function of human capital, physical capital and foreign debt. Also, by five-step Johansen method, they showed that the long-term effect of human capital (the ratio of educated labour force) on economic growth of Iran during 1971-2005 was more than physical capital. Almasi and Sepahban (2009) by applying Granger causality relation showed that in short-term and long-term, there was a mutual relationship between literacy rates of adults of economic growth of Iran during 1971-2005. Emadzade et al., (2009) by production function based on production function on Mincer wage equation and panel data of 75 countries separated by three income groups showed that human resources' education and health are significantly effective on production of two groups of the countries such as high and middle income but in the countries with low income, only education had a positive effect on economic growth. Salmani and Mohamamdi (2009) by Augmented Product Factor (APF) and ARDL method found that health expenditures of government in long-term had a positively significant effect on Iran economic growth during 1971 to 2002. The results of vector error-correction model (VECM) of the study of Mahdavi and Naderian (2010) showed that there is a mutual

relationship between human capital and non-petroleum Iranian economic growth during 1961-2001 in long-term and short-term. There was no short-term relation between economic growth and human capital but there was a long-term mutual relation. Ahmadi Shad Mehri et al., (2010) by ARDL showed that average education years of labour force and health care expenditures ratio to GDP had a positively significant effect on productivity level and economic growth of Iran during 1978-2005. Also, the results of causality test showed a one-way casual relation from human capital and total factor productivity. Behbudi et al., (2011) investigated the relationship between per capita health expenditures and income per capita in the countries with low and average income and Iran was in this group. The results showed a causal one-way relation from income to per capital health expenditures. Komeijani et al., (2012) by ARDL showed that human capital in high education had a positive effect on productivity of labour force and economic growth in Iran. Haji Khodazade et al., (2013) investigated the elasticity of education in Uzawa–Lucas's Growth Model for Iran economy. Findings showed that education had a positively significant effect on Iran economy growth. Finally, Tari et al., (2013) by ARDL method showed that public health expenditures had positive effect and private sector health expenditures had a negative effect on economic growth of selected developing countries.

As it was shown, many empirical studies emphasized on the positive effect of education and health on human capital and increasing productivity, income and economic growth. There are other empirical studies showing the insignificance or negative effect of human capital on economic growth. The contradictory results without considering the political, structural and institutional differences of the studied countries can be due to different methodologies and the type of applied econometric technique.

To evaluate the views of those researchers believing in insignificance and negative effect of human capital on economic

growth, we can use causal method to support or reject the relationship between human capital and economic growth.
The study of empirical research showed that human capital in education dimension emphasized on the average education years and education expenditures and in health dimension emphasized on life expectancy and health expenditures. As life expectancy is dependent on the health condition of the society, using education and health expenditures separate the public and private investment on education and health. The present study investigates the relationship between mutual causality of human capital with economic growth based on variables in education and healthcare expenditures in private and public sectors separately.

4. Methodology

The purpose of this study is to investigate mutual causality relationship between education and health expenditure with economic growth. But before testing the causality relationship, integration and co–integration tests were done. Based on this, first, ARDL method will be explained and then Granger causality and Toda and Yamamoto test will be illustrated. Finally, data and variables will be presented.

4.1. Auto Regressive Distributed Lag (ARDL) method

Due to estimation of the long-run relationship among variables of a model, Engle and Granger (1987) developed a two-stage strategy. First the equation $y\ t = \beta x\ t + \varepsilon t$ is estimated via ordinary least squares (OLS), then after examination the stationary of $x\ t$, $y\ t$ variables and being certain that their integration is of order one I(1), integration of disturbance terms ($\varepsilon\ t$) of the above equation is assessed. Lack of any unit root in residuals resulted from the above regression, proves presence of a long-run relationship among variables and the estimated coefficients in the above mentioned regression indicates co-integrated vector or in other words long-term parameters of the model (Engle and Granger ,1987).

Generally speaking, applying the co-integration method of Engle –Granger shows lots of limitations; for example in small sample sizes the obtained estimations are biased. Also, limit distribution of least squares estimators is not normal; therefore, testing the hypothesis via ordinary statistics is invalid. Moreover, Engle-Granger method is based on the assumption of existence of a co-integration vector and if there are more than one co-integration vectors, using this method leads to inefficiency. However, in spite of these limitations in using Engle-Granger method, some other methods can be used (Tashkini, 2005).

Several studies have utilized Johansen technique for determining long-run relationship among the variables. However, in recent investigations, an alternative method known as ARDL has been developed. This method has certain privileges compared to Johansen technique. First, the ARDL model is statistically more productive for determination of co-integration relation in small samples; though the Johansen technique needs larger sample size in order to be valid. The second advantage of ARDL method is that, while other co-integration methods require all variables to be highly integrated, the ARDL method can be applied when variables are I (1) and I (0).

Therefore, the ARDL method prevents problems of preliminary tests with standard methods of co-integration that involve classification of variables into two I (1) and I (0) categories (Pesaran et al, 2001).

Since the first stage in any technique of co-integration is determining order integration among variables and the results of this stage depends on the test used, different tests may lead to different and sometimes paradoxical results. For instance, application of the traditional tests of unit root like adjusted Dickey-Fuller test (ADF) may incorrectly conclude that there is unit root in the series, however, in fact the time series around a structural break in model is reliable. Thus, when we are uncertain about characteristics of the unit root of data via ARDL method, it would be possible that different variables in the stages of estimation of long-term relation have different number of optimal

intervals; though in Johansen technique-based models, this is rare to happen. The ARDL model is stated in general through the following equations:

$$
\begin{aligned}
&ARDL(p,q_1,q_2,...,q_K)\\
&\phi(L,p)y_t=\sum_{i=1}^{k}\beta_i(L,q_i)x_{it}+\delta'\omega_t+u_t\\
&\phi(L,p)=1-\phi L+\phi_2L^2-...-\phi_pL^p\\
&i=1,2,...,k\\
&\beta_i(L,q_i)=1-\beta_{i1}L-\beta_{i2}L^2-...-\beta_{iq_i}L^{q_i}
\end{aligned}
\qquad (1)
$$

Where, L represents lag operator and ω is an $s \times 1$ vector of determinant variables such as intercept, artificial variables, time trend, and other exogenous variables with constant lags. In this method, optimal lag is determined based on Akaike and Schwarz–Bayesian criteria. Long-term sensitivity in estimation method of long-run relationships of selected ARDL can be extracted from the following relations (Pesaran and Pesaran, 1997).

$$\hat{\theta_i}=\frac{\hat{\beta_{i0}}+\hat{\beta_{i1}}+...+\hat{\beta_{iq}}}{1-\hat{\phi_1}-\hat{\phi_2}-...-\hat{\phi_q}} \qquad (2)$$

And the long-run relationship of co-integration is shown as below:

$$y_t-\hat{\theta_.}-\hat{\theta_1}x_{1t}-\hat{\theta_2}x_{2t}-...-\hat{\theta_k}x_{kt}=\varepsilon_t \qquad t=1,2,...,n \qquad (3)$$

In this equation, the constant factor or intercept is computed as follows (Pesaran and Pesaran, 1997):

$$\hat{\theta_i}=\frac{\hat{\beta_0}}{1-\hat{\phi_1}-\hat{\phi_2}-...-\hat{\phi_p}} \qquad (4)$$

Empirical research like the present study uses the ARDL method in two stages the same as below.

Stage 1: This stage is for ascertaining the availability of co-integration and long-run relationship and is performed in a bivariate model.

$$\Delta x_t = \alpha_0 + \sum_{i=1}^{k} b_{i1}\Delta x_{t-1} + \sum_{i=1}^{k} c_{i1}\Delta y_{t-1} + \sigma_1 x_{t-1} + \sigma_2 y_{t-1} + \varepsilon_{1t}$$
$$\Delta y_t = \alpha_0 + \sum_{i=1}^{k} b_{i2}\Delta y_{t-1} + \sum_{i=1}^{k} c_{i2}\Delta x_{t-1} + \omega_1 y_{t-1} + \omega_2 x_{t-1} + \varepsilon_{2t} \quad (5)$$

In the first equation of relation (8) that variable x is the dependent variable, H0:σ1 =σ 2 = 0, which assumes there is no long-run relationship between variables, is tested versus the counter variable *H*1:σ1 ≠σ 2 ≠ 0 by using statistic F known as Fx(X/Y). Asymptotic distribution of this statistic without considering level of co-integration of independent variables is not standard.

As a result, Pesaran and Shin (1996) presented critical values based on number of available variables in the model and existence or non-existence of intercept or time trend of production.

These critical values include two columns one of which is calculated by assuming that all variables are *I*(0) and the other by assuming that all variables are *I*(1).

If the computed statistic exceeds the highest limit of the critical values provided by Pesaran and Colleagues, H0 is rejected. If the calculated statistic is smaller than the limit, H0 is not rejected and finally if the computed statistic is within the range of critical values, an end condition of variables for concluding becomes important. In some occasions the result is unpredictable and hard to be inferred. In case of rejecting H0 and acceptance of long-run relationship, the second stage that is selection of a proper ARDL and estimation of long-term coefficients initiates.

4.2. Granger causality test

For measurement of casual relationship between two variables, the causal models are used. The most well-known causality test in literature of econometrics is Granger causality test. Granger

uses this fact that future cannot be a result of past and states that if current values of *y* can be predicted by using *x* past values more precisely than when *x* past values are not used, then, *x* is called Granger causality of *y*. The bivariate figure of Granger causality is as follows:

$$y_t = \alpha + \sum_{i=1}^{p} \alpha_i y_{t-i} + \sum_{j=1}^{q} \beta_j x_{t-j} + u_t$$
$$x_t = b + \sum_{i=1}^{r} \gamma_t x_{t-i} + \sum_{j=1}^{s} \delta_j y_{t-j} + \nu_t \quad (6)$$

H_0 in the Granger model is that in the first regression, *x* is not the Granger causality of *y* such that if $j = 1,2,3,....q$, the statement $\beta = 0$ is true. For the second equation, also *y* is not the Granger causality of *x*, if $j = 1, 2, 3, ...s$, then $\delta = 0$.

Geweke (1984) stated that validity of this test depends on the rank of VAR and how reliable variables are. If variables are unreliable, the test validity decreases. Granger (1986) said that this causality test in form of the above-mentioned equations is valid only when variables are not co-integrated. So, first the reliability of variables then their co-integration should be determined. If variables are integrated in degree 1 but not co-integrated, it could be possible to apply the above VAR on first–order difference and then perform the test. With this test, short-term causality is assessed. Moreover, Granger (1988) stated that in case of any co-integration between two variables, Granger causality will be among them at least in one direction.

Generally, although the co-integration test determines the presence or the absence of Granger causality among variables, the direction of causality is impossible to be defined. Engle and Granger (1987) announced that if two variables x and y are co-integrated, an error-correction model will always exist in between. Therefore, for evaluation of Granger causality among variables, a vector error-correction model can be utilized.

If the research variables, for example, are integrated in degree 1 as well as co-integrated, using a vector error-correction model for examining the relationship, the Granger causality between variables, due to eliminating a part of error-correction,

maximizes the variance of regression equation, so the desired Wald statistic becomes skewed. This problem brings some incorrect judgment about direction of the casual relation. The error-correction model explains that changes in dependent variable are a function of deviation from long-term balance relation (that is stated by part error-correction) and changes in other explanatory variables. This model that connects short-time and long-time behaviour is expressed as below:

$$\begin{aligned}\Delta y_t &= C_. + \sum_{i=1}^{k} \beta_i \Delta y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta x_{t-1} + \rho_i ECT_{t-1} + u_t \\ \Delta x_t &= C_. + \sum_{i=1}^{k} \gamma_i \Delta x_{t-1} + \sum_{i=1}^{k} \mu_i \Delta y_{t-1} + \eta_i ECT_{t-1} + \nu_t\end{aligned} \quad (7)$$

This model is for when two variables are I(1) and co-integrated. In above relations, ρ and η are short-time adjustment coefficients. In any short-run period, these coefficients delineate the percentage of deviation from the equilibrium relation that is amended. In relation (7) the Granger causality can be examined through following procedures:

a. Using t-test in case of significance of coefficients of error-correction lag

b. Using F-or Wald test in case of significance of total lags per each explanatory variable.

c. Using F or W test in case of significance of total lags per each explanatory variable with coefficient of error-correction statement.

In addition to determining the Granger causality direction among variables, the model of vector error-correction makes it possible to distinguish between short-term and long-term causality.

Insignificance of error-correction coefficients along with the sum of explanatory variable lags shows lack of short-term causal relationship (Engle and Granger, 1987). In the present research, a

second causality model was used; Toda and Yamamoto, which was introduced in 1995.

4.3. Toda and Yamamoto causality test

In 1995 Toda and Yamamoto introduced a simple method in the form of estimation of an adjusted VAR model for evaluation of the Granger causality. They reasoned that this method is valid even in presence of a co-integrated relation among variables. In this simple method, first, you must determine the number of optimal lags of VAR model (*k*) through criteria like Akaike and Schwarz–Bayesian's criteria. The highest degree of integration (*d* max) of the variables can be specified using common tests. Then, a VAR model with (*k* +*d* max) number of lags is created. The process of choosing lag is valid when *d* max ≤ *k*. If we consider the below bivariate model and assume that *k* +*d* max= 2, then:

$$\begin{pmatrix} x_t \\ y_t \end{pmatrix} = \begin{pmatrix} a_1 \\ a_2 \end{pmatrix} + \begin{pmatrix} a_{11}^{(1)} & a_{12}^{(1)} \\ a_{21}^{(1)} & a_{22}^{(1)} \end{pmatrix} \begin{pmatrix} x_{t-1} \\ y_{t-1} \end{pmatrix} + \begin{pmatrix} a_{11}^{(2)} & a_{12}^{(2)} \\ a_{21}^{(2)} & a_{22}^{(2)} \end{pmatrix} \begin{pmatrix} x_{t-2} \\ y_{t-2} \end{pmatrix} + \begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix} \quad (8)$$

Where, $\begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix}$ is vector of disturbance terms and a sort of white noise?

In order to test hypothesis that "y is not Granger causality of x", the constraint $a_{12}^{(1)} = a_{12}^{(2)} = 0$ is tested in this method. The used statistic test is Wald that has asymptotic χ^2distribution with the degree of freedom equal to the number of H0 constraints. The used statistic test regardless of x and y reliability in any degree of freedom, co-integrated or non-co integrated is valid.

Data and variables

The population consists of the whole country of Iran. Library method was used in order to collect the information. Data of the study was obtained from Database of Islamic Republic of Iran central bank. The study period was 1965-2014 and the variables are based on billion Rials and the real price of 1997. In the present research, *lGDP* is GDP logarithm; *lGE* is government expenditures logarithm; *lPE* is private sector expenditures

logarithm; *lGH* is government health expenditures logarithm; *lPH* is private sector health expenditures logarithm. The data was analysed through econometric models Auto-Regressive Distributed Lags (ARDL) method, Granger causality and Toda and Yamamoto causality by Micro fit software.

5. Findings

This section presents the obtained results, the research model, achieved important advantages of the model compared to the previous researches and description of explorations. Table 1 shows the results of adjusted Dickey-Fuller test. As it can be seen, all under study variables are integrated of order 1 because the critical value is lower than the value of test statistic for all variables.

Table 1: Results of Adjusted Dickey-Fuller Test (Adf)

Variable	Optimal lag	Value of test statistic	Value of test statistic	Critical value	Critical value	Result
	SBC	Without trend	With trend	Without trend	With trend	
LGDP	1	-1.5647	-2.6336	-2.9287	-3.5136	I(1)
DLGDP	0	-4.0606	-4.0122	-2.9303	-3.5162	I(0)
LPH	0	-2.0257	-1.5936	-2.9287	-3.5136	I(1)
DLPH	0	-5.7057	-6.1215	-2.9303	-3.5162	I(0)
LPE	1	-1.8651	-3.3122	-2.9287	-3.5136	I(1)
DLPE	0	-4.6741	-4.6603	-2.9303	-3.5162	I(0)
LGH	0	-2.0915	-2.5904	-2.9287	-3.5136	I(1)
DLGH	0	-7.028	-6.9982	-2.9303	-3.5162	I(0)
LGE	0	-2.5963	-2.8383	-2.9287	-3.5136	I(1)
DLGE	0	-8.0486	-8.1219	-2.9303	-3.5162	I(0)

Source: Researcher calculations

For a full identification of the correct form of Granger causality test in accordance with the data, first any possible co-integration relationship between the variables must be examined. Table (2) presents results for ARDL test. It should be mentioned that based on Bahmani Oskoui and Goswami (2003) emphasis on the sensitivity of this test to the number of lags selected, the optimal lags are selected based on common criteria such as Schwarz Bayesian Criterion (SBC). However as annual data is used and due to limited observation, maximum number of lag is defined 1.

Table 2: Test Results of Long-Run Relationship by Ardl Method

Dependent variable	Independent variable	Test statistic	Critical bound with intercept		Critical bound without intercept		Long-run relationship
		F	Low value	High value	Low value	High value	
LGDP	LPH	2.2360	4.934	5.764			No
LPH	LGDP	2.2382			3.145	4.153	No
LGDP	LPE	4.3972	4.934	5.764			No
LPE	LGDP	1.8464			3.145	4.153	No
LGDP	LGH	1.6585			3.145	4.153	No
LGH	LGDP	4.6902	4.934	5.764			No
LGDP	LGE	1.7847	4.934	5.764			No
LGE	LGDP	4.0318			3.145	4.153	No

Source: Researcher calculations

In Table 2, in cases that estimation of equations is not intercepted, the critical value without intercept is used. Moreover, since all of the variables are I(1), high values of limits presented by Pesaran et al became a criterion for conclusion, Therefore, no vague and unclear condition could happen. According to the presented results in Table 2, existence of long-run relationship (co-integration) between variables is not confirmed, because the high critical value is more than F value of test statistic for all variables. Now, considering the results of reliability and co-integration tests, the correct form of Granger causality test in accordance with the research data was applied. Since the existence of co-integration relationship isn't confirmed, casualty test in form of equation (6) has been done. But instead of variables levels, their first-order difference was used. Results have been mentioned in table 3.

Table 3: Test Results of Granger Causality Between Non-Integrated Variables

Dependent variable	Independent variable	Optimal lag based on criterion SBC, AIC	LR statistic	Probability (P VALUE)	Granger causality relationship
DLGDP	DLPH	1	0.25849	0.611	No
DLPH	DLGDP	1	0.06216	0.803	
DLGDP	DLPE	1	0.5141	0.473	No
DLPE	DLGDP	1	3.3169	0.069	
DLGDP	DLGH	1	2.1106	0.146	No
DLGH	DLGDP	1	0.15107	0.698	
DLGDP	DLGE	2	5.9736	0.050	No
DLGE	DLGDP	2	0.64311	0.725	

Source: Researcher calculations, Significance level: 5%

As mentioned earlier, the results of causality test are sensitive toward selection of lags number; i.e. if selected lag length is shorter than actual lag, removing proper lags will cause biasness and if duration of the selected lag exceeds the length of actual lag, extra lags in the VAR model leads to efficient estimation; since it saves number of lags and less degree of freedom is lost and it fits small size samples (Pesaran and Shin, 1996).

The presented results in Table 3 indicate lack of Granger causality relationship between public and private education and health expenditures the economic growth's error level is 5%.

In the following, the findings of Toda and Yamamoto causality test will be presented in Table 4. The important point here is that the results obtained by Granger causality test are similar to Toda and Yamamoto test results because P- critical value is more than 0.05.

Table 4: Test Results of Toda And Yamamoto Causality Test

Dependent variable	Independent variable	Maximum stability based on test	Optimal lag of VAR model based on the criteria	Length of test lag	Test statistic	Probability	Toda and Yamamoto causality relationship
		ADF	SBC	Toda and Yamamoto	W	(P -VALUE)	
LGDP	LPH	1	1	2	1.2043	0.548	No
LPH	LGDP	1	1	2	0.29943	0.861	
LGDP	LPE	1	2	3	4.6047	0.203	No
LPE	LGDP	1	2	3	1.9608	0.581	
LGDP	LGH	1	1	2	1.8934	0.388	No
LGH	LGDP	1	1	2	5.7392	0.057	
LGDP	LGE	1	1	2	0.42998	0.807	No
LGE	LGDP	1	1	2	4.3857	0.112	

Source: Researcher calculations, Significance level: 10%

6. Conclusion

This paper investigated mutual relationship between private and public educational and health care expenditures with economic growth of Iran during 1965-2014. Therefore, first integration of variables was tested by Adjusted Dickey – Fuller test. Then for choosing the appropriate causality test, the co-integration between variables was tested by ARDL approach. Next, by using Granger and Toda and Yamamato tests, mutual causality relationship between variables was tested. Findings delineated that there is no co-integration relationship between variables. Causality tests results showed that there is no causal relationship between private and public educational expenditures with economic growth which is not surprising because educational system faces serious problems such as its low quality and discordance between the educational system and needs of society and labour market (Ejtehadi and Davoodi, 2007; Laabas and Weshah, 2011). Findings are compatible with Beraldo et al., (2003), Rivera and Curias (2004) and Narayan et al., (2010) results. However, they contradict Hanushk (2013), Uche et al., (2013), Zerihum (2014) and Sen et al., (2015) Findings. Also, achieved results indicated that there is no causal relationship between private and public health care expenditures with economic growth. These Findings are similar to Cullis and West

(1979), Easterly and Rebelo (1993), Butt and Bukhaari (2007), Tari et al., (2013) outcomes. However, they contradict Rahman et al., (2011) Asghar et al., (2012), Zerihum (2014) and Sen et al., (2015) results.

So, it is recommended to emphasize on quality of relationship between education and specialization of courses with manufacturing and services sectors needs by government rather than on quantitative increase of educational expenditures and number of learners.

Also, educational expenditures should be demand-oriented. Due to necessity of health care services (karimi, 2004; Van Zon and Muysken, 2001), government is recommended to continue its supportive role in the field of health in our society. Also, the accessibility to health services in urban and rural areas should be improved through regulations and supporting social insurance.

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