



Investigating the Relation between Health Expenditures and Economic Growth of Iran (After Islamic Revolution)

Ashkan Bazrafkan¹, Ebrahim Gashtasebi Poor², Hamide Fegghi², Vahid Rajabnezhad² and Zahra Jalilian²

¹Shahid Chamran University of Ahvaz, Faculty of Economics.

²Behbahan Paramedical Faculty.

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ABSTRACT

Health, in addition to being introduced as a right to the constitution, is regarded as a form of investment or as a means of maintaining the ability and productivity of labor. Health will have increasing productivity and economic growth directly by enhancing the health saving of individuals and indirectly by increasing the motivation for continuing the study and learning better skills. Therefore, the development of the health sector in the country is able to increase the economic growth. In this study, the effect of health expenditures on economic growth in Iran for the period of 1979-2016 is reviewed annually. Todayamamoto causality method for investigating the causality relation, and the ARDL method for evaluating long-run coefficients have been used. The results of the Todayamamoto causality method showed that there is a mutual and causality relation between health expenditure and economic growth in Iran. Also the results of ARDL method exhibited that health expenditure has a significant and positive effect on Iran's economic growth.

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1. Introduction

Human capital plays an important role in sustainable economic growth. As various theories of growth show, the role of human capital as a growth process is notable. The concept of human capital in economic literature is widely included education, health, immigration and other investments that strengthen the individual. However, growth economists who have employed human capital in growth studies have been considered more the analysis of the impact of education on economic growth, while they disregarded the role of human capital in health. Only in the past few years, the studies were pursuing health and were aimed at estimating the relation between health and economic growth (Akram et al., 2008).

There is a reciprocal relation between health and economic growth. Health and the other forms of human and physical capital will enhance GDP per capita by increasing the productivity of existing resources along with accumulation of resources and technical changes. Furthermore, one part of this revenue increase has been spent on investment in human capital, resulting in high per capita growth (Akram et al., 2008). Based on Fogel (1994), almost one-third of Britain's GDP between 1790 and 1980 is a result of health improvement, especially nutrition improvement, public health and medical care facilities, and this improvement in health centers should be regarded as increasing work changes. On the other side, economic development leads to nutrition improvement, better health, and innovation in medical technology; all of these contribute to life expectancy, reducing infant mortality rate, and subsequently making a mutual relation between health and economic growth.

The objective of this paper is to analyze the relation between health and economic growth in Iran using Todayamamoto causality method and obtaining long-run coefficients using the ARDL method annually for the period of 1979-2016. After introduction in theoretical framework of research, the third part is discussing about research background, the fourth part about details of data and related model, the fifth part about results and finally the sixth part about conclusion.

2. Theoretical Framework

The relation between health and economic growth is complicated and significant. As one of the components of human capital (with education), health can influence the economic growth as well as other input sources such as labor and physical capital (Weil, 2005). However, health is a multi-dimensional variable. So it may be exhibited by various indicators, including life expectancy, infant mortality rates and etc. Its multidimensional feature also indicates that there are ways which are able to reinforce health and make it a different tool to improve per capita income and welfare. For this reason, researches on health and economic growth are increasing (Menon, 2017). This illustrates that health, social and economic situations are much related to each other. While there are strong evidences that health affects economic growth, income growth also affects health. So, a mutual and causality relation can be observed between them (Deaton, 2003). Existing studies in different countries portrait that health affects growth by means of multiple channels. First, health improvement leads to an increase in employees' productivity. Thus, for example, reducing the overall level of anemia throughout the country improves the level of employees' subconscious production; and where adult survival rates are used as a proxy for public health, increasing

this level contributes to an enhance in economic growth (Weil, 2005). Second, improvement in nutrition, such as consumption equal to calorie, results in improvement of employees' productivity and thus in increment of economic growth (Strauss, 1986); third, improvement in nutrition leads to an increase in iron, iodine, zinc, calcium, and other key vitamins in the employees and finally in economic growth (Thomas, 2002). The fourth channel, which health influences the economic growth, is about the longevity and accumulation of human capital. The insight of this channel is that the reduction of mortality can potentially enhance the efficiency of human investments, which in turn raises education and thus economic growth (Weil, 2005). The fifth channel, based on which the health assumption affects economic growth, is a reduction in disease. The insight of this channel is that patients are failed to address their works according to their physical and mental abilities and thus create restrictions. Lack of health, such as malnutrition, has caused unwanted unemployment and thus can impress the productivity and economic growth (Ray, 1986). On the other hand, an increase in the rate of economic growth decreases mortality and consequently increases health in the community (Dreze and Sen, 2002). Health improvement, including reduction of contagious and non-contagious, raises the productivity and economic growth (Menon, 2017). Indicators such as health services improvement, health services and health insurances, which are representative of health variable, will augment the longevity and thus economic growth (Barnval et al., 2017). Health improvement can increase longevity and improve the quality of life of low-income groups and affect economic growth (Almond and Currie, 2010).

As it is obvious, based on the perspectives of different researches, health and economic growth rate are significantly correlated with each other through different channels.

3. Research Background

Barro (1996) investigated the relation between health and economic growth. The results of this study indicated that life expectancy (an indicator for health measurement) has a positive and significant effect on economic growth.

Rivera and Currais (1999), the relation between health expenditure and economic growth for 24 OECD countries using the data panel method has been investigated. They concluded that there was a positive and significant relation between health expenditure and economic growth.

Behrman and Rosenzweig (2004), using VAR method, examined the relation between health and economic growth. They concluded that there is a negative and significant relation between economic growth and the percentage of child's weight loss (a representative of health).

Howitt (2005), the relation between health and economic growth has been addressed. It was found out that government's investment on the of children's and mothers' health affected the economic growth.

Akram et al. (2008), studied the relation between health and Pakistan's economic growth rate by the use of ARDL method. The results showed that health in short-run duration does not have effect on the economic growth but in long-run duration it does.

The relation between India's health and economic growth was investigated by Menon (2017) and it was concluded that there was a positive and significant relation between India's health and economic growth.

Lotfalipour et al. (2010), In a research entitled "investigating the impact of health indicators on economic growth of Iran", studied the impact of human capital health

on per capita income growth in Iran for the period 1982-2007 by making use of simultaneous equations system. The results of their research showed that human capital has a positive and significant impact on the growth rate of per capita income.

Nazarpour et al. (2010), In a research entitled "The Impact of development on Health sector on economic growth of Iran" With the Constitutional Approach of the Islamic Republic of Iran", examined the effect of health sector evolutions on economic growth of Iran for the period 1979-2006 by use of vector error correction method. The results of their research indicated that health services evolutions in per capita hospital's bed and per capita doctor has a positive and significant effect on economic growth of Iran.

Rabiei et al. (2013), In a research entitled "the impact of health indicators on economic growth: A case study of developed and developing countries", investigated the effect of health indicators on the economic growth of developed and developing countries for the period 1990-2010 by means of data panel method. The results of their research exhibited that capital stock and life expectancy have a positive and significant impact on both groups of countries and the mortality rate of children under 5 years has a negative impact on developed and developing countries, and fertility rates has a positive impact on developed countries and negative impact on developing country.

Sarlak (2014), In a research entitled "The Impact of Health Indicators on economic growth in Provinces of the Country", investigated the impact of growth variables on household's health expenditure, growth of health capital, growth of household's education expenditure and growth of government's civil investment on economic growth of the provinces for the period of 2000-2011 by means of data panel method. The results of their research exhibited that household's health expenditures, growth of health capital, growth of household's education expenditure and growth of government's civil investment have a positive and significant effect on the economic growth in the provinces of the country.

Panahi and Aleemran (2015), In a research entitled "the study of the impact on the government's health expenditure on economic growth of country's Economic Cooperation Organization of the D8 Group", investigated the effects of government's health expenditure variables, fertility rates and net capital formation on economic growth of countries' Economic Cooperation Organization of the D8 Group for the period 1995-2012 by means of data panel method. The results of their research exhibited that the effect of government's health expenditures variables and net capital formation on economic growth in the studied countries is positive and significant and fertility rate has a negative and significant effect.

4. Methodology

4.1 Reliability and Unit Root Test

In econometric modeling and econometrics, the reliability of time series variables should be studied. One of the important kinds of statistical data used in empirical analysis is time series data, since this kind of statistical data has specific features for researchers in econometrics. Each time series can be viewed as a product of a stochastic or random process, and a continuous collection of data is a true realization of the original random process. The distinction between the stochastic process and its true realization is very similar to the distinction between society and its sample in cross-sectional data. As the sample data is used to infer a community, true realization in time series is used to infer the stochastic process. On this basis, the mean and variance of

variables are constant and time-independent, but the studies carried out since 1990 have illustrated that reliability for many macroeconomic time-series variables was improper and this variables are often time-dependent and unstable. Studies have indicated that in the absence of reliability assumption, the use of the statistics F and t is misleading and an increase can be seen in the probability of being the only false regression in the obtained results and no real equilibrium economic relation may not exist. So the reliability and unreliability of variables should be studied. Considering the need for information about the reliability degree of variables optimal interruption in the Toda-Yamamoto method, reliability of variables has been tested firstly by using the Dickey Fuller method.

4.2 The Todayyamamoto Causality Test

In the present research, using the TodaYamamoto causality method, the relation between health expenditure and economic growth rate has been investigated. After identifying the existence and direction of causality relation between two mentioned indicators, the coefficients of the variables will be considered with the use of ARDL method.

Todayyamamoto (1995) suggested a simple method for evaluating an adjusted VAR model to examine the Granger causality relation. They reasoned that this method is valid even in the context of co-integration relation between variables. In this method, firstly the number of optimal interruptions (K) of the VAR model, then the maximum degree of convergence (dmax) should be determined, and a VAR model with the number of interruptions (K + dmax) should be formed. The process of interrupt selection will be valid when it is $K \geq dmax$. Therefore, if we consider the following bivariate model, the Todayyamamoto causality test can be defined as follows:

$$\begin{aligned}
 HEALTH &= B_{1i} \sum_{i=1}^k HEALTH_{t-i} \\
 &+ B_{2j} \sum_{j=k+1}^{dmax} HEALTH_{t-j} \\
 &+ y_{1i} \sum_{i=1}^k G_{t-i} + y_{2j} \sum_{j=k+1}^{dmax} G_{t-j} + e_{1t} \\
 G_t &= \lambda_{1i} \sum_{i=1}^k G_{t-i} + \lambda_{2j} \sum_{j=k+1}^{dmax} G_{t-j} + \mu_{1i} \sum_{i=1}^k HEALTH_{t-i} \\
 &+ \mu_{2j} \sum_{j=k+1}^{dmax} HEALTH_{t-j} + e_{2t}
 \end{aligned}$$

HEALTH: Health Expenditure

G: Economic Growth Rate

The period of research has been dated from 1979 to 2016 annually. Data related to health expenditure from World Bank and data related to economic growth rate were collected from Central Bank.

The test statistic used is the Wald statistics, whose distribution of an asymptotic X2 has degrees of freedom equal to the number of zero constraints. The advantage of this method is that it will be saved from the necessity of knowing about the co-integration features of the system, and only the knowledge of the degree of the VAR model and the degree of convergence of the maximum variables is sufficient for conducting this test.

4.3 Auto Regressive Distributed Lag Model (ARDL)

Methods such as Granger-Parasite do not have necessary value due to not considering the short-run responses between

variables. Hence, those patterns are considered which have short-run dynamics in themselves and led to estimation of more accurate coefficients from the pattern. In general, the dynamic pattern is a pattern in which the interruptions of the variables are entered as follows:

$$Y_t = \alpha X_t + \beta X_{t-1} + \delta Y_{t-1} + u_t$$

In order to reduce bias related to estimation of pattern coefficients in small samples, it is better to use a pattern that considers the number of interruptions for variables.

$$\phi(L, P)Y_t = \sum_{i=1}^k b_i(L, q_i)X_{it} + c'w_t + u_t$$

The above pattern called ARDL pattern which here there is:

$$\phi(L, P) = 1 - \phi_1 L - \phi_2 L^2 - \dots - \alpha_p L^p$$

$$b_i(L, q_i) = b_{i0} + b_{i1}L + b_{i2}L^2 + \dots + b_{iq}L^q$$

L is the interrupt operator, w is a vector of constant variables, such as the width from origin, the virtual variables, the time trend or the exogenous variables with constant interruption. m is the maximum interrupt determined by the researcher and k is the number of explanatory variables.

In the next step, one of the equations is chosen using one of the Akaike (AIC), Schwarz Bayesian (SBC), Hannan - Quinn (HQC) criteria. Usually in samples less than 100, SBC criterion has been used to save freedom degree. To estimate the long-run coefficients of the model, the same dynamic model has been used. Long-run coefficients related to X variables will be obtained from this equation (Nkoro and Kelvin Uko):

$$\theta_i = \frac{\hat{b}_i(1, q_i)}{1 - \hat{\phi}(1, P)} = \frac{\hat{b}_{i0} + \hat{b}_{i1} + \hat{b}_{i2} + \dots + \hat{b}_{iq}}{1 - \hat{\alpha}_1 - \hat{\alpha}_2 - \hat{\alpha}_3 - \dots - \hat{\alpha}_p}$$

There are two methods in order to verify that the long-run relation from this method is not false:

$$H_0: \sum_{i=1}^p \phi_i - 1 \geq 0$$

$$H_a: \sum_{i=1}^p \phi_i - 1 < 0$$

The zero assumption indicates the lack of co-integration or a long-run relation, since the condition for tending the short-run dynamic relation towards long-run equilibrium is that the sum of the coefficients should be less than one. In order to perform the required test, the number one of the total coefficients is divided with the interruptions of dependent deductions variable and total deviation of coefficients.

$$t = \frac{\sum_{i=1}^p \hat{\phi}_i - 1}{\sum_{i=1}^p S_{\hat{\phi}_i}}$$

If the obtained absolute value of t from the absolute magnitude of the critical values represented by Benerjee, Dolado, and Mestre is larger, the zero assumption is rejected and the existence of a long-run relation is accepted. The second method is the use of bounds testing approach.

4.3.1 Bounds Testing Approach

If we suppose that β_i and μ are long-run coefficients, then its H_0 assumption of $H_0: \mu = \beta_1 = \dots = \beta_i = 0$ (the absence of a long-run relation) versus the hypothesis $H_1: \mu \neq \beta_1 \neq \dots \neq \beta_i \neq 0$ (with long-run relation). Bounds testing approach is a consolidated method to examine the existence of long-run relation between variables. This relatively new method has relatively high benefits than the other methods. In the first step, desired series is used regardless of whether they are I (0) or I (1). Secondly,

unlimited error correction method (UECM) can be created from the ARDL bounds testing approach with the use of a simple linear transformation. Third, the model indicates short-run and long-run dynamics. Fourth, experimental results show that this approach presents results for small samples (Belloumi, 2013).

4.3.2 Error Correction Method

ECM was first used by Phileps (1957) and then applied to correct the lack of balance by the parasite and Granger. Based on Phileps, ECM models are a policy modification method to bring the target variable closer to its optimal value. The main reason for using error correction patterns is the existence of co-integration between a set of economic variables (Tashkini, 2005).

The existence of co-integration between a set of economic variables provides a statistical basis for using ECMs patterns. These patterns have growing popularity in empirical work. The most important reason for these patterns is that the short-run fluctuations of the variables are associated with their long-run values. Actually these models are a kind of partial adjustment models in which, effective forces in the short-run and the speed of closing to the long-term equilibrium have been measured by introducing the stationary residue from a long-run relation. In other words, ECM states that the functional dependent variable changes from the deviation of the long-run equilibrium relation (which is expressed by the error correction component) and the changes of other explanatory variables (Tashkini, 2005).

An ECM that correlates short-run and long-run behavior of two variables consists of two steps:

The first step involves estimating a long-run relation and ensuring that it is not false. Therefore, the co-integration relationship should be evaluated as follows:

$$Y_t = \beta_0 + \sum_{j=1}^n \beta_j X_{jt} + \varepsilon_t$$

Then the error sentence of the following equation can be assessed as the equilibrium error:

$$\varepsilon_t = Y_t - \beta_0 - \sum_{j=1}^n \beta_j X_{jt}$$

In the second step, the residual interruption of the long-run relation is regarded as an error correction coefficient and is used to associate the short-run behavior of Y_t with its long-run equilibrium, then the following equation is estimated:

$$\Delta Y_t = \alpha + \sum_{i=1}^m \beta_{i0} \Delta Y_{t-1} + \sum_{i=1}^n \beta_{i1} \Delta X_{1t} + \dots + \sum_{i=1}^r \beta_{in} \Delta X_{nt-i} + \lambda \varepsilon_{t-1} + v_t$$

In the above equation $-1 < \lambda < 0$ is the regression estimated error statement of the long-term relationship with a time interruption. λ is the short-run adjustment coefficient in the above equation. This coefficient indicates that a few percent of deviation from the long-term relation is corrected in each short-term period. When X_t and Y_t , which are co-regretted from order of $I(1)$, are co-regretted, then ε_t Will be related to regression relation from the order $i(0)$, that is, stationary. ΔX_t and ΔY_t are also stationary, ECM variables are all $I(0)$. Consequently, this model can be assessed without any fear of obtaining false regression by OLS method, t and F statistics can be found in the testing pattern (Tashkini, 2005).

5. Methodological Outcomes

5.1 Generalized Dickey Fuller Test Results

As the results exhibit, variables are nonstationary which will be station with a differential load $I(1)$. So there exist a

condition for the use of Todayamamoto causality test and ARDL method.

Table 1. Generalized Dickey Fuller Test Result

Result	Obtained Probability	Variable
Nonstationary	.5021	g
Nonstationary	.9856	Health
Stationary	.0001	Dg
Stationary	.0000	Dhealth

Source: Research Results

5.2 The Results of Todayamamoto Causality Test

In order to perform a conventional Granger causality test, it is required to investigate the long-run and co-regression relation between variables. While in Todayamamoto causality test it is not necessary to know about the co-regression features of the system. With the purpose of examining the causality relation of Granger, Todayamamoto causality test has been used to investigate the causality relation between health expenditures and economic growth rate in Iran.

Table 2. The results of Wald Test

Results	P-Value	Wald Statistic X^2	Hypothesis H_0	Efficient variable	Dependent variable
There is causality	.0213	5.3	Non-causality	health	G
There is causality	.0213	5.3	Non-causality	G	Health

Source: Research Results.

As it is clear, the zero assumption based on non-causality is rejected for both variables, and 1 assumption based on the existence of the causality is accepted. So there is a mutual causality. It means that health expenditure is the cause of economic growth rate and economic growth rate is the cause of health expenditure.

5.3 Investigating the Assumption of the Long-Run Relation (Bounds testing approach)

According to this testing, If the value of the statistics F is greater than the I_0 Bound and I_1 Bound statistics, then the zero assumption based on the absence of a long-run relation will be rejected and so there will be a long-run relation. As the results indicate, this statistics which is obtained as 11.20 is higher than the I_0 Bound and I_1 Bound statistics at all levels of probability. Hence, the zero assumption will be rejected and the assumption based on the existence of a long-run relation will be accepted and there will be a condition for the use of ARDL testing.

Table 3. Bounds testing results

K	Value	Test Statistic
1	11.20	F-statistic
I1 Bound	I0 Bound	Significance
3.28	2.44	10%
4.11	3.15	5%
4.92	3.88	2.5%
6.02	4.81	1%

Source: Research results.

5.4 Investigating the Classic Assumptions

The normality test has been used for the following purposes: To analyze normalization assumption, to investigate the correlation assumption with the use of Breusch–Pagan test, to investigate the inconsistency of variance assumption with the use of Arch test and the true correction of the model with the use of coded test.

According to the obtained results, the zero assumption based on the lack of serial correlation, consistency of variance and normal distribution of residual sentences won't be rejected. It means that residual sentences are lack of

correlation serials but they have a consistency of variance and normal distribution and the model is quite corrected.

Table 4. Classic assumptions Results

Probability	Kind of test
.27	Normalization
.11	Serial correlation
.93	inconsistency of Variance
.20	true correction of the model

Source: Research results

5.5 Long-run Coefficients of ARDL Method

As it is understood from the results, the variable coefficient of health expenditure is significant and has an expected sign. If the health expenditure increases for one unit, the economic growth rate will increase .000101 units at that direction. The positive and significant coefficient of health expenditure illustrates that there is a positive and significant relation between health expenditures and economic growth in Iran.

Table 5. Long-run coefficients of ARDL method

Probability	Statistics t	Coefficient	Variable
.0238	2.369034	.000101	Health

Source: Research results

5.6 The Coefficient Related to the Error Correction Pattern.

Table 6. The coefficient related to the error correction pattern

Probability	Statistics t	Coefficient	Variable
.0001	-4.615087	-.725399	ECM(-1)

With regard to the obtained results, ECM (-1) coefficient is -.72. Since negative and absolute magnitude is smaller than unit, it is a confirmation of the existence of the long-run relation between the model variables. This value of the coefficient states that approximately .72 of the dependent variable is adjusted in each period.

6. Conclusion and Suggestions

This paper investigated that the relation between health expenditures and economic growth rate of Iran with making use of the Todayamamoto causality method and the impact on health expenditures on Iran's economic were with the use of the ARDL method for the period 1979-2016. The results of Todayamamoto causality method show us that there is a causality relation between health expenditure and Iran's economic growth rate. Also the results of ARDL indicate that the effect of health expenditures on Iran's economic growth rate is positive and significant but slight. With regard to research results it has been suggested that economic managers to consider health expenditures as an investment rather than a cost and take an effective action in growth by adopting appropriate policies and prioritizing investment in the health sector.

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