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## Original Article

# Health Care Cost Disease as a Threat to Iranian Aging Society

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## ABSTRACT

**Background:** Because of the rapid aging rate, the share of health expenditure in gross domestic product rises irreversibly and increases concern among politicians and the general public. The aim of this study was to examine the accuracy of the Baumol's model of unbalanced growth in Iran over the period 1981-2010.

**Methods:** This theoretical-analytical study was conducted in 2012 to investigate the various determinants of ongoing rise in the health expenditures. To this end, an Error Correction Model was derived from the long run cointegrating equation to inquire the veracity of Baumol's theory.

**Results:** Estimating the short run and long run equations by using time series data shows that the rate of increase in health expenditure is aligned with the difference between wage increases in and growth of productivity in the health sector. Besides, results show that both the per capita income and the inflation rate of health care had significant effects on raising the share of health sector in domestic economy.

**Conclusions:** According to rapid population aging and existence of Baumol's cost disease in Iranian health sector, we predict much more rise in health expenditure in a few decades.

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## Introduction

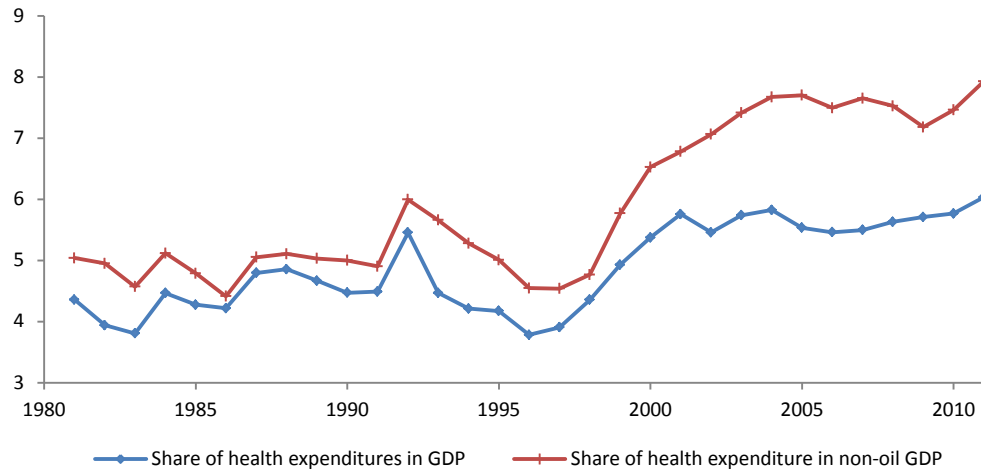
It is well known that development process raises services share in gross domestic product (GDP). In fact the sectoral share of service sector to GDP continually increases and reaches to 54 and 74 percent of domestic products in developing and developed countries, respectively<sup>1</sup>. It is obvious that the weight of service sector become ponderous alongside the growth in per capita income and economic development.

It is attributable that relatively small portion of income is allocated to the primary needs in developed countries; so welfare related spending has been evolved over the recent decades. Services in its all dimension have undeniable influence on welfare and they become even complicated with income growth<sup>2</sup>. Health and many of its ancillary activities should be considered as a service that plays a major role in the process of economic development. One of the most significant current discussions in health economics is the increasing share of health expenditures (HE) in GDP. In the new global economy, outspread of health sector has become the central issue for stability of this part of economy and causes growing concern among the policy makers.

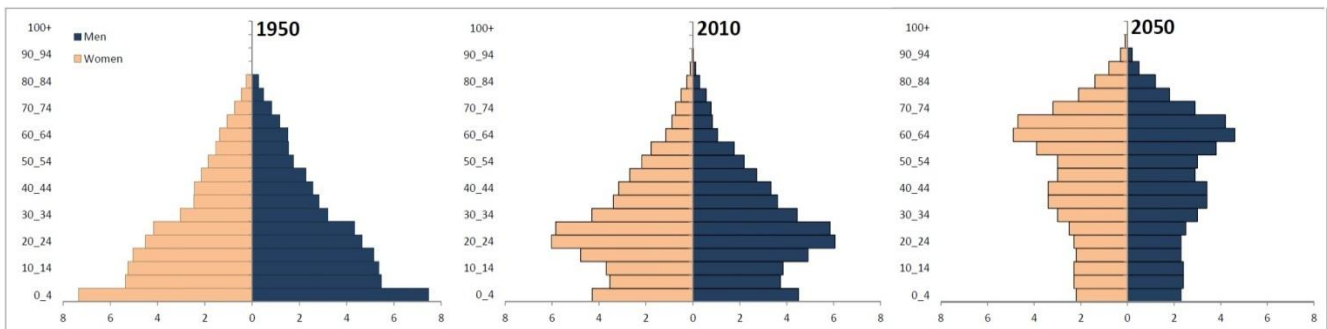
Young population and the level of per capita income in Iran necessitate a lower share of health in overall production, but Figure 1 shows that the share of health sector in its non-oil economy reaches over 8 percent in 2011. Iran is historically a young country, but recent studies show that advances

in medicine and public health have led a fewer portion of pregnant women, lower mortality rates and higher longevity, which in turn will lead to population aging in the near futures<sup>3</sup>. Population pyramids in different years are useful tool in revealing information about history and future of population. United Nations projection shows the 1970's baby boom in Iran boosts the aging process and older populations will continue to grow (Figure 2). According to United Nations report Iran will be the third fastest aging economy in the world after United Arab Emirates and Bahrain between 2010 and 2050<sup>4</sup> and it will foster an older population with potentially disastrous consequences for its workforce, public health and social security network. Therefore, public institutions need to prepare for the transition from younger to increasingly older populations. One of the most concerning issues in this regard certainly lies in the effects of population graying on health expenditures<sup>5</sup>; and in the face of such challenges, financing of welfare policies in Iran over the next few decades will become more and more unviable.

It is widely known that aging causes structural transformation in most economic markets<sup>6-8</sup>. In an economy with a large share of old population, public consumption alters to specific sectors like health, pension and insurance. The starting point for macroeconomic analysis of aging is the factor markets. Population aging will make the labor relatively scarce and capital to labor ratio is expected to increase over the time<sup>9,10</sup>.



**Figure 1:** Share of health expenditures in Iran as percent of GDP. Note: Based on Central Bank of Islamic Republic of Iran



**Figure 2:** Population pyramids in Iran. Note: Based on the United Nations population prospects data.

Given the importance of the issue addressed for Iran, this study analyzed the main economic causes of growth in Iranian health expenditure over two past decades. To this end, theory of “Baumol cost disease” as an appropriate economic framework was utilized to thinking about the causes of unbalanced growth and variation in Iranian health spending.

## Methods

This theoretical- analytical study was conducted in Tarbiat Modares University, Iran, in 2012. Testing for the existence of Baumol cost disease in Iran’s health care sector was performed by using macroeconomic data for Iran over the period 1981 to 2010. All data has been converted to logarithmic values and therefore we can explain the log deference of variables as theirs growth. The data fitting of the model were obtained from “Iranian Central Bank” and “Statistical Center of Iran” dataset.

Baumol<sup>11</sup> predicts that labor productivity and constant share at real output, would lead to increasing employment in the service sector. This theory has been used effectively to focus on health sector and its share on total production<sup>12, 13</sup>. Baumol divides the economy into two parts: a progressive and a non-progressive sector, then considers several assumptions. These assumptions state that: 1) regular growth in labor productivity can occur only in the progressive sector; 2) labor is the only factor of production; 3) nominal wages in both sectors are equal in the long run; and 4) nominal wages in progressive and non-progressive sectors rise to the same extent as labor productivity in the progressive sector. Based on these assumptions, if we keep the real output of a progressive and a non-progressive sector constant, more labor force will move to the non-progressive sector. So, non-

progressive sector will has even more share in the total output. This shift of expenditures into the non-progressive sector has been termed “Baumol’s cost disease”<sup>2</sup>.

In the recent years, there has been an increasing interest in determining the causes of rising in the health expenditures and theory of unbalanced growth provides a suit theoretical base for researcher to peruse existence of unbalanced growth in the health and other services. The findings of the more recent studies in this area indicate that per capita income, population growth, aging and changes in demographic indicators do correlate closely with HE growth<sup>14-16</sup>. Triplett and Bosworth<sup>17</sup> find that labor productivity growth in the services industries after 1995 has proceeded at about the United States economy wide rate. With respect to the sources of labor productivity improvement in the services industries, growth in multifactor productivity, IT capital deepening, and increased use of intermediate inputs played a role in control of service sector expansion in the U.S economy. Existence of Baumol’s disease approved for Netherlands nonmarket services; Brus<sup>18</sup> shows that the share of employment in services increased, while the share of service sector in total output remained constant. Hartwig<sup>2</sup> implies the Baumol’s model in a context that health care expenditure is driven by wage increases in excess of productivity growth. Testing empirically using data from a panel of 19 OECD countries approved Baumol’s theory of unbalanced growth. In some empirical contexts, high income elasticity of demand for services (Engel’s law) and relatively slow productivity growth in the service sectors (Baumol’s disease) have been viewed as key drivers of rising share of services in labor employment. Işcan<sup>19</sup> calibrates an economic model and shows that jointly Engel’s law and Baumol’s disease could explain about two thirds of the reallocation of labor into US

service sector. So far, however, there has been little discussion about specific countries like Iran that experience high level of inflation and a long run war that could be the potential causes of long run increasing share of health care in the economy.

Due to the equal increasing of wages in the economy and unbalanced growth in labor productivity, relative costs in non-progressive sector tended to rise. This situation will continue until the production of non-progressive has been eliminated or whole labor forces move to this sector in an extreme situation<sup>20</sup>. Using the literature review we could identify the key variables to frame a suitable model for our estimation. Then, we will consider the share of health expenditures in the GDP as a dependent variable to specify an econometrics model for Iran's economy. This model included per capita income, inflation in health sector, "war" dummy variable (value of 1 for years 1980-88 and 0 otherwise) and an error term that is assumed to follow an independent and identically distributed (i.i.d.) (0,  $\sigma^2$ ) process. In this study, we call the difference of the growth rates of nominal wages per employee and productivity as the "Baumol variable" as did some previous studies<sup>2</sup>. In other words, the difference between growth rates of nominal wages and labor productivity considered as a main factor to explain HE deviations. Awareness about main drivers of health expenditure will help us for managing the future health programs.

In order to find a long run relationship among variables, the number of unit roots should be identified for each individual time-series. The most common way to determine stationary of data is to use the "Dickey Fuller" and "Augmented Dickey Fuller" tests<sup>21</sup>. The results of Dickey Fuller test show that all variables have unit root. Augmented Dickey Fuller is repeated to determine the degree of variables integration and it shows that first differences of all variables are stationary. Based on these tests, all series are stationary in first difference level. Then it can be stated that all variables, integrated of first order, I (1), and are difference stationary I (0). Thus, the evidence suggests that first differencing of the variables appears to be sufficient to achieve stationarity. Specifying an economic model in terms of levels of the eco-

nomical variables often produces empirical results in which the R-squared is quite high, but the Durbin-Watson statistic is quite low. This happens because economic time series are prevailed by smooth, long term trends and the variables behave individually as nonstationary. A model which includes such variables tells little of the short run relationship between them. When multiple individual time-series variables are found to be integrated of order one, an additional test is required to determine whether long-term relationships exist among the variables or not. In fact, if the time series are both I (1) then we will often reject the hypothesis of no relationship between them even when none exists. For there to be a long run relationship between the variables they must be cointegrated.

The Johansen test<sup>22</sup> is a procedure for testing cointegration of several I (1) time series. This test permits more than one cointegrating relationship so is more generally applicable than the Engle-Granger test<sup>23</sup> which applied in a single estimated cointegrating relationship. Johansen shows that the hypothesis of cointegration can be formulated as the hypothesis of reduced rank of a regression coefficient matrix, which can be estimated consistently from vector regression equations. There are two statistics for testing in the Johansen<sup>24</sup>, which essentially test the rank of the variable matrix. The maximum eigenvalue statistic and the trace statistic test the number of cointegrating relations between variables. Trace test is a joint test where the null hypothesis is that the number of cointegrating vectors is less than or equal to  $r$ , against a general alternative that there are more than  $r$  vectors. Whereas the maximum Eigenvalue test conducts separate tests on the individual eigenvalues, where the null hypothesis is that the number of cointegrating vectors is  $r$ , against an alternative of  $(r+1)$ . The standard approach to the Johansen maximum likelihood procedure is to first calculate the trace and maximum eigenvalue statistics, then compare these to the appropriate critical values. Johansen's maximum eigenvalue and trace tests have been used to validate long run relationships among the variables. Table 1 contains the output from conducting a Johansen analysis of the study's variables.

**Table 1:** Johansen's trace test and maximum eigenvalue results

Rank		$\lambda_{\text{trace}}$		Rank		$\lambda_{\text{max}}$	
H <sub>0</sub>	H <sub>1</sub>	Statistic	Level 95%	H <sub>0</sub>	H <sub>1</sub>	Statistic	Level 95%
r=0	r ≥ 1	112.18 <sup>a</sup>	76.97 <sup>a</sup>	r=0	r=1	74.89 <sup>a</sup>	34.81
r ≤ 1	r ≥ 2	28.21	29.79	r ≤ 1	r=2	28.03	28.58
r ≤ 2	r ≥ 3	21.08	25.87	r ≤ 2	r=3	15.38	22.29
r ≤ 3	r ≥ 4	10.21	15.49	r ≤ 3	r=4	13.79	15.89

<sup>a</sup> Significance at the 0.05 level

## Results

Macroeconomists build time series models for testing economic theories, forecasting and policy analysis. So, we turn to an empirical interpretation where it can be argued that how the sluggish rate of growth in labor productivity, per capita income growth and increases in price of health care services can explain the health expenditure deviation in the Iran's economy.

First of all, the rank of variable matrix should be tested. For determining the number of cointegrating vectors the Johansen's reduced rank procedure was employed. Both the trace test and the eigenvalue test reject the null hypothesis of

no cointegration ( $r=0$ ) at the 5% level and it means that cointegration exists among the variables; while the null hypothesis ( $r \leq 1$ ) and ( $r \leq 2$ ) is not rejected against the alternative of the existence of 2 or 3 cointegrated vectors. From the results in Table 1 we can conclude that there exists one significant cointegrating vector that these variables are bound together by long run equilibrium relationship.

The long run coefficients are estimated and reported in Table 2 as a next. Results give highly significant coefficients with expected signs for three variables and the cointegration equation is adequate from the theoretical point of view. In the Johnson's long run estimation all variables are in the same (left) side of the equation and then the signs of all vari-

ables should be negatively explained. We find that Baumol's model of "unbalanced growth" is strongly supported by Iran's data. As predicted by Baumol's theory, the value of the coefficient is close to one. There is a strong relationship between nominal per capita GDP growth and health expenditure variations has been reported in the literature, as we mentioned before. Our results do not challenge the economic theories and support previous findings of others showing that, one percent growth in per capita income led to 0.51

percent growth in the share of HE in GDP. Inflation (a general rise in the price of goods and services) must be accounted for in model to examination of healthcare expenditure growth. More paying for health care induces inflation in the health sector which in turn leads to overspending on health care. Estimated coefficient confirms the positive influence of increase in the price of health care and says a one percent increase in prices leads to a 0.08 percent increase in the HE.

**Table 2:** Normalized Cointegrating Coefficients and Error Correction Model

Long run regression: Normalized Cointegrating Coefficients						
Variables	L(HE)	C	L (Baumol)	L (Gdpp)	L(Inf)	War
Coefficients	1.00	-0.04	-0.83	-0.51	-0.08	0.004
t-statistic	-	-21.9 <sup>c</sup>	-4.42 <sup>b</sup>	-3.94 <sup>b</sup>	-7.50 <sup>c</sup>	1.86 <sup>a</sup>
Short run regression: Error Correction Estimates (Dependent Variable $\Delta L(HE)$ )						
Variables	C	$\Delta$ (Baumol)	$\Delta L$ (Gdpp)	$\Delta L$ (Inf)	$\Delta$ (War)	ECM (-1)
Coefficients	0.21	0.39	0.51	0.11	0.20	-0.74
t-statistic	1.68	2.03 <sup>b</sup>	7.15 <sup>c</sup>	5.83 <sup>c</sup>	2.47 <sup>b</sup>	2.15 <sup>b</sup>
F statistic: 11.58		R <sup>2</sup> : 0.75		Log Likelihood: -874.3		

<sup>a, b, c</sup> denote significance at the 10%, 5% and 1% level, respectively.

Dummy variables are indicator variables and normally coded 0 or 1. In order to see the effects of Iran-Iraq war (1980-88) on the HE, we used a dummy variable in regression. Our result shows that the "War" is insignificant in this model and we can conclude that this event had not considerable effect on health spending in the long term. It might be happened due to structural changes in the public expenditure pattern during the war. Generally, Log Likelihood statistic cannot reject the appropriateness of specified model. Whenever the variables are co-integrated, there exist an error correction mechanism which incorporates long run information of the series relating the change in one variable to past equilibrium errors<sup>23</sup>. In this contest, an additional lag value of disequilibrium error retained from the static model has been used to gives information about the short run behavior of the variables. The coefficient on the error-correction term (ecm-1) measures the speed of adjustment of the endogenous variable towards the equilibrium. Effectively, ECM term in the model is significantly different from zero. The coefficient of ECM (-1) is equal to (-0.74) for short run and imply that deviation from the long run equilibrium level of HE is corrected by 74 percent over the each year; this is further proof of the existence of stable long run relationship. The lag length of short run model is selected on basis of Schwartz Bayesian Criteria (SBC). Furthermore, the coefficient of determination for short run model is 0.75 and meaning that 75 percent of variation in HE growth in the short run can be explained by the model. Baumol variable is statistically significant in short run, but its coefficient is smaller than the long run; then the effect of differences between wage and productivity in the long run is more explicit. As presented in Table 2, per capita income and health sector inflation have significant effect on short run HE growth; likewise, war in years 1980-88 increases the share of health spending in GDP at the same time.

## Discussion

To learn more about the true drivers of rising health care share in national economy, this paper represents both long run and short run effects of Baumol's cost disease on Iranian health sector. Rapid rise in share of health expenditure in

GDP has been considered as a negative phenomenon and encourage researchers to determine its drivers. The share of health expenditure had rapid growth in Iranian GDP despite any considerable increase in its income level or structural population changes. Taking into account the high percentage of young population in Iran and their lower health cost, policy makers are urged to be alert about the expansion of the health sector. This study, applies Baumol's unbalanced growth theory to cognizance of health expenditure growth in Iran. According to Baumol's theory regular growth in labor productivity can occur only in the progressive sector and he mentioned to health as a non-progressive sector.

Estimation of long run and short run equations by using Iran's data significantly confirms Baumol's explanation for HE growth. The Baumol's variable coefficient for Iran is less than developed countries<sup>2, 11, 19</sup>, but under the United Nations projection, the proportion of persons aged 60 or above is expected to reach 33 percent by 2050 and the importance of this issue will be intensify in next decade. As a result of this study, the authors conclude that one of the best preventive policies to tackle the growing consequences of health sector inflating is to increase productivity in the health sector and encouraging workforce to collaborate in this policy.

Although there is much remains to be done, our work generates important findings in the field of cost disease. One limitation of this study is that the sample used for this research may be small. The reason for this small sample is due to limited statistics about labor efficiency. Another limitation is that the "labor efficiency" used in the research may not be representative of the health sector labor efficiency and due to lack of detailed information about labor market, overall labor efficiency has been used as a proxy for efficiency of health care professions. Future research would have been more convincing if the researchers have more appropriate data in micro scale.

## Conclusions

Due to increasing share of the elderly in the population and existence of Baumol's cost disease, Iranian health care

expenditures will continue to grow relative to the economy in coming decades. Considering these issues, upgrading labor productivity is recommended as an effective strategy to deal with negative consequences of ageing and cost disease in health care sector.

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## Conflict of interest statement

The authors declare that they have no conflict of interest.

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