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# The effect of macroeconomic indicators on health-care expenditure in Iran

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## Abstract:

**INTRODUCTION:** A sharp increase in expenditure is one of the challenges of the health system in Iran. Every macroeconomic variable affects health, and if it is disregarded, it will lead to higher macrobudgets. Physical and mental health as well as the use of health services change according to the macroeconomic conditions and business cycles (boom and recession). The present study aimed to determine the effect of macroeconomic indicators on health expenditure.

**METHODS:** This study was descriptive analytical. The required data related to macroeconomic indicators and health expenditure in public and private sectors were collected during 1995–2014. The data were analyzed using the time series models in econometrics, Vector Auto Regression, and Granger causality technique.

**RESULTS:** The results of this study indicated that health expenditure has a positive bilateral relationship with gross domestic production (GDP), gross national production, national income, and national consumption. On the contrary, expenditure has a negative bilateral relationship with liquidity rate and inflation rate. In addition, budget deficit has a negative unilateral relationship with health expenditure while population rate has a positive unilateral relationship with health expenditure.

**CONCLUSION:** The results of this study indicated the increase of health expenditure in Iran that GDP is the most critical determining factor of health expenditure. In general, the total expenditure in the health sector in the world increases when the countries become richer. In line with the increase of resources, innovative financing methods and efficiency improvement are required for providing basic health services in low-income countries.

## Keywords:

Health, health expenditure, macroeconomic indicators

## Introduction

The World Health Organization (WHO) regards governments in charge of providing public health. Emphasizing the task of governments in providing public health, especially the vulnerable groups, is highly obvious. Health-care financing is regarded as a set of relevant and interconnected activities for providing health-care services.<sup>[1]</sup> Financing as one of the four main tasks of the health system considers three subtasks of income accumulation (establishing joint fund for

financing resources) and purchase.<sup>[2,3]</sup> Financing leaves a very significant effect on the efficiency of the health system.<sup>[4]</sup> State-owned resources in the health sector and the amount of resources allocated to this sector leave a positive direct effect on the output of the health sector.<sup>[5]</sup> Health is among the factors, which increases during the economic boom but decreases during the recession. Physical and mental health as well as the use of health services change according to the macroeconomic conditions and business cycles (boom and recession).<sup>[6]</sup> The mental health of individuals changes according to the business cycles.<sup>[7]</sup> Macroeconomic variables including national income, national

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expenditure, formation of national capital, general level of prices (inflation), employment rate, unemployment rates, budget deficits (BDs), foreign debt, boom, and recession affect health components.<sup>[5,6]</sup> The formation of uncertainty is one of the psychological costs of inflation. Severe inflation disrupts economic calculations. Unpredictable fluctuations in the decisions made by governments and inflation confuse the private agents with insufficient information about making a decision against the government, cause uncertainty among the agents in society, and reduce health.<sup>[8,9]</sup> The instability of macroeconomic policies in the economy of a country changes the balance of payments in that country. In other words, the balance of payments establishes an aligned relationship with health indicators because of the direct relationship with business cycles, boom, and recession.<sup>[7]</sup> Studying different countries indicated that foreign debt has direct and indirect effects on the mortality of children below 5 years old.<sup>[10]</sup> Reviewing the efficiency of the health sector in Iran indicated that, despite the made efforts to improve health, some problems in this area have not been solved yet.<sup>[11]</sup> A sharp increase in expenditure is one of the challenges of the health system in Iran. While the total expenditure index in Iran has become 30 times higher during the last 20 years, this growth was 71 times higher in the expenditure of the health sector.<sup>[12]</sup> The share of patients from paying health-care expenditure is so high that 3.5 million people have gone under the poverty line only due to health expenditure.<sup>[13]</sup> Insurance companies are behind their main role in protecting patients against unpredictable expenditure.<sup>[14,15]</sup> The status of macroeconomic indicators, health, and health expenditure in Iran is not well known because of the lack of access to accurate information for determining the national health accounts and the lack of transparency in the participation of the private and public sectors. This factor reduced the efficacy of the adopted policies and led to some problems for the realization of health goals. Each macroeconomic variable affects health, and if such variables are ignored, the result will be the allocation of macroeconomic budgets and nonrealized goals of the country. The policy-making of the economic sectors in society directly affects the limitation or development of national health.<sup>[5]</sup> Since the government is in charge of the final responsibility of the health system in a country, thus the accurate and responsible management of the public health in a country is the essence of a good and effective government.<sup>[16]</sup> The first step to achieve the desired status and realization of the health system is to recognize the current status of macroeconomic indicators and health expenditures. The awareness of health expenditure and different sources of resources in contributing the health system financing can provide useful information for planners to make policy in the health sector. The present study helped the health policy-makers by studying the changes of macroeconomic indicators and their effect on

health expenditures to appropriately control the health expenditure changes than the macroeconomic indicator changes and achieves better predictions of future health expenditure by macroeconomic decisions.

## Methods

The present study was descriptive analytical, and the data related to macroeconomic indicators and health expenditure in the public and private sectors during 1995–2014 were collected from the website of the Central Bank, Statistical Centre of Iran, the WHO, as well as other information resources. In order to ensure the accuracy of the collected data, they were matched to the data from other articles related to this subject.<sup>[17]</sup>

The data were analyzed using the time series models in econometrics, VAR, and Granger causality technique in stata13 software. Two tests of Granger causality (Dickey–Fuller, ordinary least squares [OLS] regression, residuals) and Johansen–Juselius (Dickey–Fuller, VAR, Trace matrix and eigenvalue [ $\chi^{\text{trace}}$  and  $\chi^{\text{max}}$ ], cointegration test of Granger causality) were used. Time series are a significant category of data in empirical analyses. These series are the sequences of data which are collected as discrete in equal time intervals.

### Unit root test

The most common method for measuring the variable stationary is Dickey–Fuller unit root test. In this study, the stationary of each variable in their logarithmic form was studied using Dickey–Fuller unit root test at data level and difference in mode of y-intercept and trend at 5% level.

### Ordinary least squares test

In order to estimate the parameters in the health expenditure equation being in form of a single equation regression model, the ordinary least squares (OLS) method was used as follows:

$$\text{LHCE} = \beta_0 + \beta_1 \text{LGDP} + \beta_2 \text{LGNP} + \beta_3 \text{LNI} + \beta_4 \text{Lc} + \beta_5 \text{LL} + \beta_6 \text{LBD} + \beta_7 \text{LIR} + \beta_8 \text{LGC} + \beta_9 \text{LUR} + \beta_{10} \text{LPR}$$

### VAR test

After conducting the stationary test of variables and their degree of reliability, the VAR model was used to recognize the mutual effect between variables and their causality using the stationary variables. Johansen cointegration analyses require the determination of optimal Lags in the VAR model.

### $\chi^{\text{trace}}$ and $\chi^{\text{max}}$ tests

After determining the number of optimal Lags in the VAR model, the number of cointegrated vectors should be determined. For this purpose, the Johansen–Juselius maximum likelihood was used. If the statistics of  $\chi^{\text{trace}}$  and

$\chi^{\max}$  tests are greater than the critical value presented by Johansen–Juselius at the desired level, the null hypothesis assuming the presence of no cointegrated vector will be rejected, and this test will be repeated until the null hypothesis is accepted. The number of cointegrated vectors together, with the pattern by which the number of cointegrated vectors was determined, was specified simultaneously.

### Granger causality test

Granger causality test is one of the most common and widely used methods for studying the causality relationship. The vector error correction model (VECM) was used to investigate the relationship between variables. Granger causality test in the framework of VECM was used as the final step to answer the causality direction or investigate the relationship of cause and effect among the variables.

## Results

The results of the unit root test were presented in Table 1 for the studied variables.

Optimal Lag: It is an lag where Akaike and Schwarz criteria have their minimum value. Thus, health expenditure at lag 5 was significant at 5% level while GDP, national income, GNP, Gini coefficient (GC), consumption (C) and population rate (PR) at lag8 were significant at 5% level. liquidity at lag 4, Budget deficit (BD) and Unemployment rate (UR) at lag 0, and inflation rate (IR) at lag 6 were significant at 5% level and were stationary having a unit root [Table 1].

Since it was Durbin-Watson (DW)  $> R^2$  in the regression, there was no fake regression. Y-intercept was significant at 5% level. The coefficients of gross domestic product (GDP), gross national production (GNP), consumption (C), BD, IR, NI, Liquidity (L) and PR were significant at 5% level [Table 2].

Based on the quantities of  $\chi^{\text{trace}}$  and  $\chi^{\max}$  tests and the critical values provided by Johansen–Juselius, the null hypothesis on the presence of two cointegrated vectors was accepted in the second model  $r = 2$  because the quantities of  $\chi^{\text{trace}}$  and  $\chi^{\max}$  tests related to this model were less than the critical value presented at 5% level. Thus, the second model was considered as an ideal model, and the number of cointegrated models was considered two  $r = 2$  [Table 3].

The variables of health expenditure, GDP, GNP, national income, consumption, liquidity, IR, BD, GC, and PR at lagt 1 were optimal, and in these lags, the criteria of Schwarz-Bayesian, Akaike, and Hannan Quinn had the lowest values [Table 4].

Based on the results obtained from Granger causality test, the PR was the causality of health expenditure

**Table 1: The stationary of variables by augmented Dickey-Fuller test with trend and y-intercept**

Row	Variables	MCV (5%)	ADF	Optimal Lag	Test result
1	Health expenditure	-3.600	3.738	5	Stationary
2	GNP	-3.600	-3.870	8	Stationary
3	National income	-3.600	-3.775	8	Stationary
4	GDP	-3.600	-3.654	8	Stationary
5	Consumption	-3.600	4.395	8	Stationary
6	Liquidity	-3.600	3.640	4	Stationary
7	Inflation rate	-3.600	-4.548	6	Stationary
8	Budget deficit	-3.600	-4.852	0	Stationary
9	Gini coefficient	-3.600	-3.672	8	Stationary
10	Unemployment rate	-3.600	-3.668	0	Stationary
11	Population rate	-3.600	-3.664	8	Stationary

MCV=Minimum critical value, ADF=Augmented Dickey-Fuller, GNP=Gross national production, GDP=Gross domestic production

**Table 2: The estimation of macroeconomic indicators on health expenditures**

Variables	Coefficients	T statistics	P
GDP	0.70	3.19	0.04
GNP	0.55	-2.52	0.043
NI	0.62	-3.28	0.04
Consumption (C)	0.74	6.65	0.007
LL	-0.17	1.92	0.031
BD	-0.07	1.98	0.009
IR	-0.78	-1.91	0.005
GC	-1.03	-1	0.391
UR	-0.31	0.30	0.785
PR	0.11	-4.51	0.020
Fixed coefficient	0.27	7.95	0.004

$F^2=0.999$ ,  $DW=2.763$ . GNP=Gross national production, GDP=Gross domestic production, NI=National income, LL=Liquidity, BD=Budget deficit, IR=Inflation rate, GC=Gini coefficient, UR=Unemployment rate, PR=Population rate

while health expenditure was not the causality of PR. Unemployment rate was not the Granger causality of health expenditure and health expenditure was not the Granger causality of unemployment rate. GC was not the Granger causality of health expenditure and health expenditure was not the Granger causality of GC. BD was the Granger causality of health expenditure while health expenditure was not the Granger causality of BD. GNP was the Granger causality of health expenditure, and health expenditure was the Granger causality of GNP. GDP was the Granger causality of health expenditure and health expenditure was the Granger causality of GDP. National income was the Granger causality of health expenditure, and health expenditure was the Granger causality of national income. Liquidity was the Granger causality of health expenditure, and health expenditure was the Granger causality of liquidity [Table 5].

## Discussion

The results of this study indicated that GDP is the most important determining factor of health expenditure.

**Table 3:  $\chi^{\text{trace}}$  and  $\chi^{\text{max}}$  tests**

Variable	Test	Null hypothesis (r)	Alternative hypothesis (r)	Test statistics	Critical value at 95% level	P
Health expenditures	$\chi^{\text{trace}}$	0	1	193.25	125.61	0.0000
		1	2	119.49	95.75	0.0005
		2	3	63.76	69.81	0.0234
		3	4	46.94	47.85	0.0608
		4	5	26.81	29.79	0.1063
		5	6	13.79	15.49	0.0886
	$\chi^{\text{max}}$	6	7	1.95	3.84	0.1623
		0	1	73.75	46.23	0.0000
		1	2	45.73	40.07	0.0104
		2	3	26.82	33.87	0.2727
		3	4	20.12	27.58	0.3325
		4	5	13.01	21.13	0.4508
		5	6	11.84	14.26	0.1166
	6	$\geq 7$	1.95	3.84	0.1623	

**Table 4: Optimal lags in the VAR model for variables**

Row	Variable name	Lag	LogL	FPE	AIC	HQC	SBC
1	Health expenditure	1*	-224.783	1.37e+10	23.871	23.888	23.971
2	GNP	1*	-277.114	3.37e+11	29.38	29.397	29.479
3	GDP	1*	-275.701	2.90e+11	29.231	29.248	29.331
4	National income	1*	-274.550	2.57e+11	29.110	29.127	29.210
5	Consumption	1*	-60.026	40.123	6.529	6.545	6.628
6	Liquidity	1*	-234.603	3.84e+09	24.905	24.922	25.005
7	Inflation rate	1*	-61.043	44.661	6.636	6.653	6.735
8	Budget deficit	1*	-205.93	2.46e+09	24.461	24.471	24.559
9	Gini coefficient	1*	62.693	0.000	-6.388	-6.372	-6.289
10	Unemployment rate	6*	-16.916	1.077	2.910	2.892	2.997
11	Population rate	1*	-106.506	5348.848	11.421	11.438	11.521

The SBC, AIC, and HQC in these lagshave the minimum value and these lags are optimal. \*=These lags are optimal, FPE=Final prediction error, LR=Likelihood ratio, SBC=Schwarz-Bayesian criteria, AIC=Akaike criteria, HQC=Hannan-Quinn criteria, GNP=Gross national production, GDP=Gross domestic production

**Table 5: Granger causality test for macroeconomic indicators and health expenditure**

Variable name	H <sub>0</sub>	P	F-statistic	lag	Test result
GNP	GNP is not the Granger causality of health expenditure	0.043	4.016	2	H <sub>0</sub> is rejected
	Health expenditure is not the Granger causality of GNP	0.025	6.064	1	H <sub>0</sub> is rejected
GDP	GDP is not the Granger causality of health expenditure	0.007	7.216	2	H <sub>0</sub> is rejected
	Health expenditure is not the Granger causality of GDP	0.028	5.797	1	H <sub>0</sub> is rejected
National income	National income is not the Granger causality of health expenditure	0.000	0.227	3	H <sub>0</sub> is rejected
	Health expenditure is not the Granger causality of national income	0.000	0.068	3	H <sub>0</sub> is rejected
Liquidity	Liquidity is not the Granger causality of health expenditure	0.037	4.155	3	H <sub>0</sub> is rejected
	Health expenditure is not the Granger causality of liquidity	0.000	49.394	1	H <sub>0</sub> is rejected
Budget deficit	Budget deficit is not the Granger causality of health expenditure	0.011	6.843	2	H <sub>0</sub> is rejected
	Health expenditure is not the Granger causality of budget deficit	0.799	0.404	4	H <sub>0</sub> is accepted
Gini coefficient	Gini coefficient is not the Granger causality of health expenditure	0.413	1.052	5	H <sub>0</sub> is accepted
	Health expenditure is not the Granger causality of Gini coefficient	0.071	3.254	2	H <sub>0</sub> is accepted
Unemployment rate	Unemployment rate is not the Granger causality of health expenditure	0.152	2.239	3	H <sub>0</sub> is accepted
	Health expenditure is not the Granger causality of unemployment rate	0.152	2.267	1	H <sub>0</sub> is accepted
Population rate	Population rate is not the Granger causality of health expenditure	0.044	4.758	1	H <sub>0</sub> is rejected
	Health expenditure rate is not the Granger causality of population rate	0.118	2.714	1	H <sub>0</sub> is accepted

GNP=Gross national production, GDP=Gross domestic production

The results indicated a positive bilateral relationship between GDP and health expenditure. GDP was the Granger causality of health expenditure, and health expenditure was the Granger causality of GDP. A study by Mehrara and Fazaeli in MENA countries indicated a

strong positive relationship between health expenditure and GDP per capita in these countries.<sup>[18]</sup> A study by Shah Bokharti and Basijoldin Bat in Pakistan in 2006 indicated that health expenditure increased more rapidly than GDP and the most significant factor changing the

health expenditure was the change in GDP.<sup>[19]</sup> The results of the present study showed that national income has a positive bilateral effect on health expenditure. However, Acemoglu *et al.* (2013) concluded that increased income plays a vital role in increasing the ratio of health expenditure to GDP.<sup>[20]</sup> In another study by Sen and Rout, it was found that income and education have a significant effect on family health expenditure. Family income has a significant effect on health expenditure while the effect of education is slight.<sup>[21]</sup> Moreover, the results of the present study indicated that the effect of liquidity rate and IR on health expenditure is negative and bilateral. The increase of inflation and unemployment has any social and economic expenditure for family and society. The effect of inflation on health expenditure is significant. The increasing rate of inflation from the channel of instability, class gap, reduced purchasing power, and reduced economic and social security will have a negative effect on health expenditure and economic growth. The volume of liquidity in an economy should be according to the production rate of goods and services; otherwise, it will undoubtedly lead to inflation with recession in production. In other words, the increased rate of liquidity to the real production growth rate will lead to the increase of inflation. GC and unemployment rate were not statistically significant in this study. However, the study by Ahmadi *et al.* (2009) indicated that unemployment, inflation, balance of payments, and GC had a reverse and significant relationship with health. The variables of health expenditure and government expenditure had a significant effect on the health outputs. The final result was that health is not independent from macroeconomic variables and each of these variables has a kind of effect on health.<sup>[5]</sup> Unemployment has a negative relationship with health expenditure. In unemployment conditions, the potential human resources that can play a significant role in productive occupations are useless leading to the reduction of individual and national income. The government requires financial resources for investment in various sectors including the health and health-care sector. Unemployment and the reduction of national income impede government investment in the health sector and public health expenditure. Since the basket of household expenditure involves different expenditures such as food, clothing, housing, education, and health, the available financial resources for health care are less than other basic needs such as food with the reduction of household income while out-of-pocket payments and private health expenditure also decrease.<sup>[22]</sup> The increased education leads to the better awareness of people on the use of health facilities and improvement of health status. Personal care is improved and health expenditure is reduced with an increase in educated population.<sup>[23]</sup> Sen and Root (2007) believed that an educated person spends a larger share of his income on health in comparison to an illiterate person. Sen and Root showed the significant

positive effect of income and education on household health expenditure.<sup>[21]</sup> On the other hand, Fattahi *et al.*, studied the significant negative effect of education on the public health expenditure of the studied countries.<sup>[17]</sup> The results of this study indicated a positive unilateral relationship between PR and health expenditure and also indicated that population structure affects health expenditure. The percentage of population over 60 years old and population below 5 or 15 years old is commonly used. Since the ratio of the population under 5 or above 60 is very high, the share of population over 60 is used more in studies because the effect of population aging on health expenditure is usually considered to a high extent. Shahabadi *et al.*, The elderly people require more health services leading to higher health expenditures. Based on the findings of the WHO, there is a positive correlation between the elderly and health expenditure, especially in high- and middle-income countries, where the population aging is increasing rapidly.<sup>[24]</sup> The results of this study indicated a negative unilateral relationship between BD and health expenditure.

## Conclusion

The present study examined the effect of macroeconomic variables on total health expenditure and showed that GDP had a significant, positive, and bilateral effect on health expenditure in Iran and is the most important determining factor of health expenditure. The results indicated that GDP, GNP, national income, and national consumption had a significant, positive, and bilateral effect on health expenditure, but their effect was not as much as GDP. Inflation and liquidity, as expected, had an adverse effect on health sector outputs and their effect was negative and bilateral. In addition, the present study indicated that BD had a negative unilateral effect on health expenditure while PR had a positive unilateral effect on health expenditure. The results for GC and unemployment rate are not statistically significant, and based on the results of the study, there was no causal relationship with health expenditure. In general, the total expenditure on the health sector in the world increases as the countries become richer. The significant question is whether the increased health expenditure aims to each the global health coverage and improves the public health? In this study and other similar studies, an increase was observed in health expenditure over the last few decades.<sup>[25]</sup> Along with increasing resources, the innovative financing methods and efficiency improvement are required to provide basic health services in low-income countries.

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### Conflicts of interest

There are no conflicts of interest.

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