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Original Article

Health Sector Inflation Rate and its Determinants in Iran: A Longitudinal Study (1995-2008)

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Abstract

Background: Health price inflation rate is different from increasing in health expenditures. Health expenditures contain both quantity and prices but inflation rate contains prices. This study aimed to determine the factors that affect the Inflation Rate for Health Care Services (IRCPIHC) in Iran.

Methods: We used Central Bank of Iran data. We estimated the relationship between the inflation rate and its determinants using dynamic factor variable approach. For this purpose, we used STATA software.

Results: The study results revealed a positive relationship between the overall inflation as well as the number of dentists and health inflation. However, number of beds and physicians per 1000 people had a negative relationship with health inflation.

Conclusion: When the number of hospital beds and doctors increased, the competition between them increased, as well, thereby decreasing the inflation rate. Moreover, dentists and drug stores had the conditions of monopoly markets; therefore, they could change the prices easier compared to other health sectors. Health inflation is the subset of growth in health expenditures and the determinants of health expenditures are not similar to health inflation.

Keywords: Health inflation rate, Dynamic factor models, Health expenditures, Iran

Introduction

Increase of health expenditures is a challenge for both families and governments in most of the countries around the world. Besides, raising the health services price and accessibility to purchasable coverage are important matters for healthcare providers and regulators (1).

According to most economic books, inflation increases in the general price level periodically. Economists usually use Consumer Price Index (CPI) for measuring the inflation rate. CPI in the health sector consists of physician, dentist and hospital room visit fees, inpatient and hospital equipment expenditures, etc. Studies have shown that many factors affect the Inflation Rate of the Consumer Price Index for Health Care Services (IRCPIHC) (2).

Health policy makers often mix health inflation rate with health expenditures. Health inflation involves changes in consumer price index (CPI) effected by the factors, which affect supply and demand of health services. These factors include overall inflation rate, number of doctors, hospital

beds, and pharmacies, existence of insurances, etc. The degree of competition between health service deliverers also affects the inflation rate. Health expenditures are the spending for health, including both the amount and price of services consumption. Health expenditures are the sum of public and private health expenditures. It contains the costs of health services (preventive and curative), nutrition activities, family planning activities and emergency aid designated for health. Growth in health expenditures is different from inflation rate, because this growth might occur due to the increase in the amount rather than the price of the services. This is affected by population's age, urbanization, education, level of development, etc. Thus, it could be presumed that health inflation is the subset of growth in health expenditures (1, 3).

According to the Central Bank of Islamic Republic of Iran data between 1995 and 2008, IRCPIHC was always higher than the general inflation. In 1995, general inflation was 23.81% and health inflation rate was 49.46%. In addition, general inflation rate was 18% and health inflation rate was 22% in 2006. Therefore, increase in health inflation rate can decrease the patients' purchasing power and enhance the catastrophic health expenditures. Ultimately, inflation in the health sector increases the general inflation and decreases the individuals' life conditions and human productivity (4).

The present study aimed to determine the factors, which affect the IRCPIHC in Iran.

Methods

This descriptive analytical study aimed to determine the relationship between health inflation and its determinants in Iran. For estimating the model, we used the data of Central Bank of Islamic Republic of Iran between 1983 and 2008. The data for earlier years were not available. The determinants of health inflation rate, which were used in this study, have been shown blew. The model used in this study was previously utilized by Cebula in the United States (5). HINF= f (INF, DOC, EDU, INSU, GDP, DOC, BED, DEN, PHARM)

Where:

HINF is the CPI in the health sector,

INF is the total inflation rate,

DOC is the number of physicians per 1000 people,

EDU is the individuals' mean years of education,

INSU is the percentage of the individuals covered by health insurance,

GDP is per capita Gross Domestic Product (GDP) at purchase price parity,

BED is the number of hospital beds per 1000 people,

DEN is the number of dentists per 1000 people, and

PHARM is the number of pharmacies per 1000 people.

The econometrics form of this model has been presented blew:

$HINF_t = \beta_0 . inf_t^{\beta 1} . INSU_t^{\beta 2} . GDP_t^{\beta 3} . LDOC_t^{\beta 4} . DEN_t^{\beta 5} . BED_t^{\beta 6} . pharm_t^{\beta 7} . edu_t^{\beta 8}$

Due to its Cobb-Dauglas form, estimating the model with general ordinary least square estimator was not possible. Thus, first we had to change the form of the model and make it linear. In doing so, we needed a log-log form model.

$LHINF_t = \beta_o + \beta_1 Linf_t + \beta_2 LINSU_t + \beta_3 L GDP_t + \beta_4 LDOC_t + \beta_5 LDEN_t + \beta_6 LBED_t + \beta_7 Lpharm_t + \beta_8 Ledu_t + U_t$

L shows the logarithm in the model.

For estimating the model, because of having long time series, we tested the unit root. When a variable is stationary, variance and covariance are constant over time. On the other hand, if a variable is non-stationary, the results of estimating the model may not be true and a bias called spurious regression will occur. Therefore, the validity of coefficients will be low and we cannot rely on the results. Hence, we used augmented Dickey-Fuller test and Philips Perron unit root test. After confirmation of having non-stationary variables, we had to find the lag order of the model. In this study, we used 3 tests to find the number of lags.

After that, we used dynamic factor estimator to find out the relationship between the variables. Dynamic factor estimator estimates the parameters of dynamic-factor models by using maximum likelihood. Dynamic-factor models are flexible models for multivariate time series. They could be used for unobserved factors, which have a vector autoregressive structure. Exogenous covariates are

permitted in both the latent factors and dependent variables. It represents also another advantage over time series estimator. It eliminates local shocks and measurement errors because of idiosyncratic movements (6). In our study, because of the lack of data, we could not estimate the model by cointegration approach and vector autoregressive estimator; therefore, we used dynamic factor estimator. In addition, the level of significance was 95%.

Results

Table 1 shows the results of augmented Dickey-Fuller and Philips Perron unit root tests. Null hypothesis of these two tests is having unit root in the time series.

As the table depicts, having unit roots was confirmed for lhinf, linf, and ledu and, consequently, the null hypothesis was confirmed. Considering Philips perron unit root test, the null hypothesis of having unit root was confirmed for lhinf, linf, ledu, and ldoc.

After confirmation of having unit root, the number of lags and the r static factors entering the equation were determined. As shown in Table 2, Akaike's Information Criterion (AIC), Schwarz's Bayesian Information Criterion (SBIC), and Hannan and Quinn Information Criterion (HQIC) with the maximum lags of 4 were used. The results of these tests confirmed having 3 lags.

Table 3 shows the results of estimating the model using factor variable estimator. According to the table, overall inflation and number of dentists per 1000 people had a positive significant relationship with health inflation. The results were also positive for the number of pharmacies per 1000 people, but at 10% rather than 5% significance level. However, per capita GDP (lgdp), number of doctors per 1000 people (ldoc), and number of beds per 1000 people (lbed) had a negative relationship with health inflation. This relationship was negative and significant at 10% level for the percentage of insured people (lins). Furthermore, the coefficients for lpharm and lden were larger compared to other variables. Thus, it could be indicated that these two variables were most effective in health inflation.

Table 1: The results of unit root tests for the study variables

Variable	Augmented Dickey Fuller test	Philips Perron test
Lhinf	0.000	0.000
Linf	0.0043	0.0080
Lgdp	0.9834	0.9321
Lins	0.6711	0.6722
Ledu	0.0018	0.0002
Lden	0.7886	0.6561
Ldoc	0.1257	0.0005
Lpharm	0.5139	0.4564
Lbed	0.0823	0.0900

Table 2: The results of determination of lag orders using AIC, SBIC, and HQIC

Lag	Df	*P*-value	AIC	SBIC	HQIC
0			-34.2937	-33.9074	-34.2739
1	64	0.000	-78.8862	-75.4096	-78.7082
2	64	0.000	-482.451	-476.27	-482.134
3	64	0.000	-495.103*	-488.923*	-494.787*
4	64		-488.651	-482.471	-488.335

Table 3: The results of estimating the model by dynamic factor estimator

Variable	Coefficients	Z	*P*-value
D1.hinf	-0.7797	-2.50	0.013
D2.hinf	-0.8655	-4.27	0.000
D3.hinf	-0.6680	-3.16	0.002
Linf	1.5616	13.05	0.000
Lgdp	-0.4179	-2.62	0.009
Lins	-0.1680	-1.84	0.063
Ledu	-2.5274	-1.40	0.163
Lden	5.9439	10.01	0.000
Ldoc	-1.4920	-3.94	0.000
Lpharm	4.5628	1.83	0.068
Lbed	-1.6098	-2.33	0.020
Constant variable	21.9736	5.01	0.000
Var(e.hlinf)	0.00035	-	-

Discussion

Dentists have the largest effect on the health inflation rate. Therefore, increase in the number of dentists will result in increase in the health inflation rate. Consequently, it could be concluded that dental services were not delivered in a competitive market. Because of having high demand price elasticity, insurers did not like to cover dental services. Therefore, dentists could easily change the prices with poor supervision (7). On the other hand, because of change in the consumption patterns, consumption of dental and oral care services has increased in developing countries, which could not be compensated even by increase in the number of dentists and dental care (8, 9). These changes have decreased in developed countries because of dental prevention programs (10). In general, demand price elasticity of dental care is higher than that of other healthcare services (11). Hence, due to rise in demand for dental services, the price of these services will increase more than that of other services and will be more effective in health inflation rate (9, 12). Because of having asymmetric information and high price elasticity, if the insurers cover dental services, they will be faced with high degrees of moral hazard and they will lose, so in many insurance programs there is the lack of covering oral care and there is high out of pocket payments for these services (11,12).

Similar to dentists, the number of pharmacies per 1000 people had a positive effect on health inflation rate. However, the relationship was significant at 10% significance level. The market of pharmacy is similar to a monopoly market, not a competitive market. This is due to the fact that: 1. the initial cost of a new drugstore is high and new stores cannot be added to the market easily, 2. there are some geographical regulations in drug markets that do not allow people to construct a drug store near another one (13), and 3. People do not know about the prices of drugs and cannot evaluate their quality (14). This asymmetric information about the prices and qualities exists in other health sectors, but it is more evident in drug market rather than dental and general physician markets. Therefore, we can conclude that drug market has the behavior of monopoly markets more than other health sectors. In comparison to other markets, raising the prices is easier in a monopoly market; thus, it has a larger effect on changing the health inflation rate (15, 16). The findings of the present study indicated no significant relationship between education and health inflation rate. When the level of education increased, health inflation rate decreased. This is due to the fact that educated people have more knowledge about personal care and have more willingness to keep themselves healthy (17, 18).

On the other hand, educated people are more concerned about their health and, as a result, use more health outcomes. The insignificant results obtained in this study might be due to these two contradictory behaviors (19).

In the present study, a negative relationship was found between GDP and health inflation rate. However, most of other studies have reported a positive relationship between GDP and healthcare expenditures (20). Thus, we must differ between growth in health expenditures and health inflation. When GDP increases, the level of development increases, too; therefore, people keep themselves healthier. Cebula also found a positive relationship between GDP and health inflation (5).

The findings of the current study showed a positive relationship between the number of hospital beds per 1000 people and the health inflation rate. Hospital beds contain both public and private ones. This results from the supply and demand equilibrium. In contrast to dental and oral care, no significant change has been observed for consumption. Efficiency of hospital services and reduction in the length of hospital stay increase the supply of hospital beds (21, 22). Additionally, when the number of hospital beds increases, the competition between inpatient suppliers will increase simultaneously. These results were consistent with those obtained by Cebula (5).

The results of this study showed a negative relationship between the number of doctors and health inflation rate. When the number of doctors increases, the competition between them increases, as well and they need to decrease their prices to attract more patients (5). According to the literature, the relationship between the number of doctors and healthcare expenditures may be positive or negative depending on the demand elasticity of the services, which the doctors deliver (20, 23-26). When the number of doctors increases, the number of cared people increases, too but the prices will decrease. If the services have low price elasticity, health expenditures will decrease and vice-versa (1, 27).

In this study, a negative relationship was observed between insurance coverage and health inflation rate at 10% significance level. Increase in insurance coverage empowers the insurance companies to control the prices and compel the health deliverers to stabilize the prices, eventually decreasing the health inflation rate (28, 29). Moreover, the overall inflation rate had a positive relationship with health inflation rate. This is due to the fact that when the prices increase, the willingness of health sector providers to increase their income for fixing their purchasing power will increase, as well (5). This study had some limitations. We only had the data for a few years and more recent data on the inflation rate in Iran were not available. Further studies can investigate the relationship between health inflation rate and some other variables, such as foreign exchange rate and urbanization.

Conclusion

Growth in CPI of health, which is known as health inflation, is different from growth in health expenditures. Determinants of health inflation are different from health expenditures, too. For instance, per capita GDP increased healthcare expenditures, but decreased the health inflation rate. Besides, growth in the number of hospital beds increased the health expenditures by using more beds, and increase health inflation by increasing the competition between inpatient care deliverers. Similar discussions are also obtained regarding physician supply. For controlling health inflation, rate governments need to notice issues above.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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