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RESEARCH ARTICLE

Analysis of the Relationships between Compulsory Health Spending, Doctors, Hospital Beds and Hospital Stays for Turkiye

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ABSTRACT
A significant part of health expenditures is allocated to hospitals, but whether the funds invested in resources are used successfully or not is determined by assessing factors such as the number of hospital beds and the number of doctors. Additionally, the length of hospital stay is a critical performance indicator. The objective of this paper is to investigate the mutual relationships between compulsory health spending, the number of doctors, the number of hospital beds, and hospital stays in the case of a developing country. We focus on Turkiye using the annual data on compulsory health spending (U.S dollars/capita), the number of doctors (per 1.000 inhabitants), the number of hospital beds (per 1.000 inhabitants), and the length of hospital stay (days) for the period of 1994-2020. In our analysis, following testing the stationary properties of the variables, we employ the Fourier causality tests proposed by Enders and Jones (2016) and Nazlioglu et al. (2016) to analyze the causality links between compulsory health spending, the number of doctors, the number of hospital beds and the length of hospital stay. Our findings confirm the evidence of causal runs from compulsory health spending to the number of hospital beds and from the number of doctors to compulsory health spending in the relevant period.

Keywords: compulsory health spending, hospital beds, number of doctors, hospital stay

JEL Kodu / JEL Code: I20, H51, C10

Introduction

Health services around the world are facing the severest global pandemic crisis of a century not only in China, where the virus spread from, but also in the United States, which has the highest coronavirus death toll in the world, and the United Kingdom, which recorded the highest numbers in Europe. The onset of the coronavirus led to high mortality rates in developed countries in Europe such as the United Kingdom, Italy, Spain, and France. North America was the worst affected, resulting in the mobilization of extraordinary healthcare resources and measures. As of March 2021, the total number of worldwide cases reached 117 million, with over 2.6 million deaths (Statista, 2020). During the pandemic, hospital treatment was used more widely, especially in the public sector, and several governments launched large-scale funding packages. The COVID-19 pandemic in all countries stimulated the utilization of physicians and health facilities as well as raised the number of hospital visits, creating a higher demand for medical devices and items (Fitch Solutions, 2020).

According to the data acquired from the European Centre for Disease Prevention and Control (2020) Italy, the country that suffered the most in the Euro-Area, reported nearly 29.350 deaths from March to May, while France and Spain, the other two worst affected countries, reported 25.540, and 25.860 deaths, respectively. The United Kingdom, with the number of deaths at nearly 29.500, and the USA with the number of deaths at 72.100, were also heavily affected, while China, the origin of the virus outbreak, recorded only 4.633 deaths overall. Given the low death rates when compared to advanced economies like the United States, the United Kingdom, Italy, Spain, and France, the Ministry of Health of Turkiye indicates that Turkiye performed well in the fight against the coronavirus pandemic. When confronted with the growing number of cases of COVID-19, Turkiye adopted a series of measures much like other countries. Some of these measures involved confining people over 65 and under 20 years of age at home, blocking road traffic in and out of certain provinces and major cities, suspending domestic and foreign flights, supplying free masks to citizens, building two emergency hospitals in Istanbul and enforcing a curfew for approximately two months (Carnegie, 2020). In addition to these measures, the Ministry of Health (MoH) outlines that Turkiye responded to the coronavirus outbreak with

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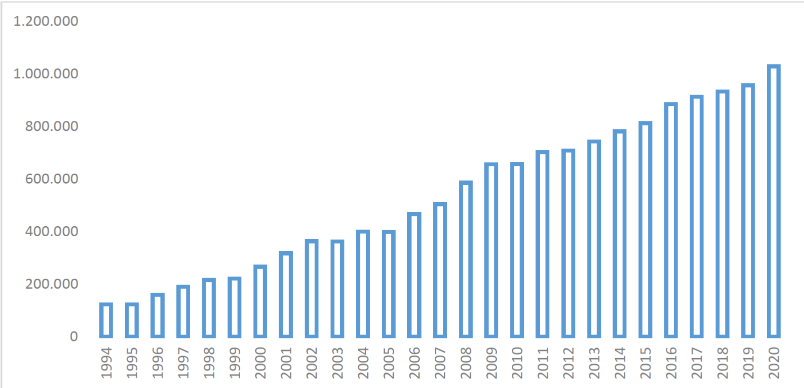
a comparatively strong public healthcare system. Accordingly, a strong infrastructure of public healthcare, advanced technology, and swift proactive steps helped Turkiye prevent the scenarios from happening in other countries that had very high death rates (TRT World, 2020).

Healthcare indicators in Turkiye showed that the Health Transformation Program, which began in 2003 to support the healthcare system, provide equity amongst people, increase healthcare efficiency, and improve healthcare quality, has been effective. Parallel to the HTP, health expenditures changed dramatically from 2003 to 2018. Access to healthcare services and social health status indicators improved with an increasing level of patient satisfaction after the HTP initiative was implemented. Investments in the health system led to an improvement in the healthcare indicators in Turkiye, so we aim to analyze the causality relationship between compulsory health spending and selected health indicators in this study. Graph 1 shows the upward trend in compulsory health spending (US dollars/ capita) from 1994 to 2020.



Source: OECD, World Bank

Figure 1. Compulsory Health Spending (US Dollars Capita): 1994-2020

Our study adds to academic literature in numerous ways. A large part of health expenditures is allocated to hospitals, but whether the funds allocated to resources are used effectively or not is measured by examining variables such as the number of hospital beds and the number of doctors. In addition, the length of a hospital stay is a key performance output. The resources used as inputs in performance evaluation studies such as health personnel, number of beds, and number of medical devices are compared with the outputs obtained including the number of examinations, number of inpatients, length of stay, number of surgeries, and number of births. Accordingly, hospitals can be characterized as effective or ineffective as emphasized by Boz et al. (2018). To the best of our knowledge, this study is one of very few in the academic literature that focuses on the mutual relationships between health spending and health indicators such as hospital beds, the number of doctors, and the length of hospital stays. Our study extends the literature by focusing on compulsory health spending and those health indicators of a developing country. Consistent increases in healthcare costs are a major issue for policymakers in every country, including Turkiye. We focus on answering the question of whether healthcare indicators improve when healthcare spending increases. This study critically assesses this idea by reviewing relevant literature, with the goal of providing a deeper and more nuanced look at the connections in question. Furthermore, our study contributes empirically. We use recently proposed causality tests which allow for structural breaks through the Fourier functions. When Fourier terms are utilized to include structural breaks, causality results differ from previously reached results, and stronger relationships are identified.

The remainder of the paper is organized as follows: the next section reviews the outlook of Turkiye's healthcare system before 2000 and in the post-2003 period with the implementation of the Health Transformation Program. The third section briefly discusses the relevant literature and the fourth section provides the methodology, presents the data, and reports empirical findings. Finally, the last section concludes by addressing some policy implications.

A Brief Review of the Turkish Health System: pre-2000 and post-2000

Many countries developed national programs to make sure their health systems were prepared to manage an outbreak like the COVID-19 pandemic. This policy change allowed public health authorities to respond effectively to reports of suspicious cases, identify contacts that were at risk, and manage these types of cases; while hospitals had the requisite resources and guidelines to maintain infection prevention protocols, secure healthcare workers, and mitigate risk to the general public (World Health Organization, 2020). The stronger a country's health system is, the greater its ability to fight and minimize the adverse effects of a pandemic. Today, Turkiye has a strong healthcare system when compared to twenty years ago, while struggling with the coronavirus pandemic. Therefore, the system performed well during the pandemic as stated by the Ministry of Health of Turkiye.

Turkiye's healthcare system underwent a major renovation with the Health Transformation Program in 2003. It was designed to address the fundamental weaknesses in the system by improving accessibility to healthcare services and care delivery quality, upgrading the old system, and strengthening the social security framework to cover the vast majority of the population (Kilci, 2021). Table 1 summarizes the major developments in the Turkish healthcare system in the period from 2003-2018.

Table 1. Major Developments in Turkish Healthcare System (2003-2018)

2003	• Acheived universal health coverage.
2004	• The family medicine model pilot legislation was implemented and the practice of this family model improved the access and equality of care. • Implemented a performance-based supplementary payment framework that linked healthcare payments to operational performance standards in MoH hospitals in order to provide greater independence for public hospitals over revolving fund management. • Established an international reference pricing system for drugs to pharmaceuticals. • Improved green card (GC) deployment coverage to ensure more effective implementation of this system. Implemented the "Reimbursement Commission," which abolished various social security agencies that operated separate reimbursement commissions, and the adoption of a joint model.
2005	• Transferred the Social Insurance Organization's healthcare facilities to the MoH, which reduced uncertainty in the provision of the public sector and separated the role of purchasing health services from the task of procurement. • Established a single social security organization. • Added a quality element to the performance-based supplementary payment system (PBSP) in MoH hospitals. • Launched the practice of "Family Medicine" within the framework of the HTP. • Formed a positive list for drugs.
2006	• Established the pharmaceutical expenditure tracking system within SSI Adopted the "Social Security and General Health Insurance Law". • United the public insurance schemes including "Government Employees Retirement Fund", "Social Security Institution" and "Bag-Kur" under the newly established Social Security Institution. • Consolidated healthcare financing institutions through the Health Transformation and Social Security Reform. • Introduced global budgets (hospital-level budget ceilings) for MoH hospitals to control overall public spending.
2007	• Presented proposed legislation on the pilot program of public hospital organizations. • Added new elements to the HTP following the formation of the new government in 2007, which involved health promotion for a safer future and healthier life schemes, that aimed at multi-dimensional health accountability for mobilizing citizens, cross-sectoral cooperation, and cross-border health services to improve the country's international strength. • Developed an institutional performance evaluation framework.
2008	• Brought the "Social Security and General Health Insurance Law" into effect and introduced the "General Health Insurance Program" to create a financially sustainable social security system covering the entire population.
2010	• Utilized global budgets (budget ceilings) for drugs. • Extended the family medicine model for all of Turkiye.
2011	• Reorganized MoH's stewardship role. • Formed public hospital unions to boost health service efficiency and quality. • Established the "Turkish Medicine and Medical Devices Agency".
2012	• Achieved full integration of health insurance by moving the GC system for the poor to SSI.
2014	• Introduced "Complementary Health Insurance".
2015	• Launched a Health System Strengthening and Support Program (USD 134.12 million) that was aimed at improving the primary and secondary prevention of identified NCDs, increasing the efficiency of public hospital management, and enhancing the ability of evidence-based policymaking at the MoH.
2017	• New drug investments implemented by the "Turkish Medicine and Medical Devices Agency". • Undertook investments for improving the "Health Tourism Department".
2018	• Established the model of "City Hospital" to enhance the health system and healthcare standards.

Source: OECD (2005), OECD (2014), OECD (2017), OECD (2019), Kilci (2021), Kilci (2022), Okem and Cakar (2015), Yasar (2010), World Bank (2018), World Bank (2019).

Major health status indicators improved dramatically as a result of the Health Transformation Program. Patient satisfaction and healthcare indices improved, leading to lower infant and maternal mortality and a longer life expectancy. The World Bank data showed that once HTP was implemented, life expectancy rose to 75 in 2012 from 71 in 2001, only a few years before the program began. There was a remarkable increase in the availability of hospital beds, medical professionals, and nursing staff. The program also contributed to quantifiable changes in healthcare, including an expansion in resources, personnel, and infrastructure, bringing greater patient satisfaction (Oxford Business Group Report, 2015).

Literature Review

In the academic literature, the causality from life expectancy and healthcare-related developments to economic growth has been widely studied since the 1950s. Accordingly, healthcare expenditures contributed to the productivity of human capital; as a result, positive developments in the healthcare area have had economic significance. In the studies that focused on the hypothesis of "health-oriented growth", the growth impacts of rising life expectancy as a summary measure of health status and the possible ways in which health might affect productivity were examined. Studies indicated that improved health status could potentially have positive growth impacts via the following channels: increasing the current value of schooling and, thereby, motivating young people to spend more in human capital, acquiring higher school and job participation rates thanks to fewer days of illness, enhancing the alertness and functioning performance of students at school and staff in the workforce, decreasing fertility rates, growing returns to investment in human capital and higher learning quality (Madsen, 2018).

The research in the literature supported stable trends for improving health conditions and rising health spending in developed countries. For example, the average rate of infant mortality decreased from 3.3 to 0.6 per 1000 live births; the average life expectancy at birth for females increased from 72.5 to 80 years; the average life expectancy at birth for males increased from 67.6 to 73.6 years while the total health expenditure to GDP ratio increased from 3.4 percent to 7.7 in countries across the European Union from 1960 to 1995 (Nixon and Ulmann, 2006). Nonetheless, the findings on the connection between health expenditure and health outcomes remained unclear because of the difficulties in separating the influence of the health service input as a determinant of health conditions outputs which therefore caused measurements to be ineffective. Focusing on the contribution of healthcare expenditure and health outcomes, Nixon and Ulmann (2006) carried out an analysis of the European Union during the period 1980-1995 by utilizing infant mortality and life expectancy as dependent variables and health expenditure as the independent variable and found that health expenditure was one of the major factors contributing to health performance quantitatively and qualitatively. Accordingly, they suggested that health expenditure was an important driver in reducing infant mortality, though it only contributed slightly to improving life expectancy for both men and women.

Jaba et al. (2014) investigated the impact of health resources on health outcomes for a group of countries identified by the level of income and geographical location. They sought to measure the influence of health expenditures per capita on life expectancy at birth and to see if health expenditures per capita increased significantly along with a rise in longevity for developed countries, particularly for European countries. Their findings indicated a strong correlation between healthcare expenditure and life expectancy. Moreover, country impacts were noteworthy and demonstrated the existence of notable variations between countries. While health expenditures are expected to impact health outcomes, it should be noted that the effectiveness of transmitting expenditures into improved health outcomes could vary considerably. In this sense, some countries obtain better health outcomes than others, even with lower health expenditures per capita. From this perspective, Ray and Liden (2020) attempted to address the question of whether private and public health expenditures were correlated with healthcare indicators such as infant mortality and life expectancy at birth for countries and whether higher private and public health expenditures in low-income countries would boost health conditions in comparison with high-income countries. With this in mind, they analyzed the influence of private and public health expenditures on infant mortality and life expectancy at birth for 195 countries throughout 1995-2014 by dividing the data set into groups based on life expectancy growth, infant mortality rate decreases, and gross national income per capita level. Their findings suggested that public health expenditures impacted healthcare indicators more than private health expenditures. The second question could not be answered positively which meant that although favorable public expenditure impacts were observed in poor countries, the effects of private health expenditures were either insignificant or equal to the impact of public health expenditure, which means that this result was partially sensitive to the methodology employed. In a recent study that focused on the South-East Asia Region, Behera and Dash (2020) analyzed the effectiveness of health expenditures on healthcare outcomes for the period from 2000 through 2014 by dividing health expenditures into four groups; government health expenditures from domestic sources, external assistance of health to the government, private out-of-pocket, and private not out-of-pocket expenditure. By employing such indices of health conditions such as infant mortality, life expectancy, index of universal health coverage, immunization coverage, and undernourishment prevalence, they found evidence of positive impacts from total health expenditures, particularly the public health expenditures on improving life expectancy and reducing infant mortality. They also noticed a strong positive relationship between health expenditures and the universal health coverage index. In another study, Othman-Abdullah (2022) examined the links between government health expenditures and a variety of health-related variables for Iraq between 2005 and 2020. They found that spending related to factors like the number of hospitals and beds as well as the total number of healthcare facilities. These findings, however, revealed that government health expenditures did not significantly relate to the number of doctors. Similarly, Tiehi and Coulibaly (2022) investigated the factors influencing government healthcare spending in Africa and they revealed that population growth, hospital beds, nurses-midwives, number of doctors, corruption scores, and political stability did have an impact on government spending. As a consequence of the COVID-19 pandemic, the quantity of research on the health system and health expenditures is likely to rise dramatically in the future.

Data and Econometric Methods

Data

This study evaluates the mutual links between compulsory health spending and selected health indicators. We use the annual data on compulsory health spending (US dollars/capita), hospital beds (per 1.000 habitants), the number of doctors (per 1.000 inhabitants), and length of hospital stay (days) for the period from 1994 to 2020 which covers the first wave of the COVID-19 pandemic and we aim to emphasize the importance of an investment in the healthcare sector through health spending particularly during the COVID-19 pandemic. We collect statistics from the OECD, World Bank, and Ministry of Health and use the logarithmic forms of the variables. Table 2 presents the variables which we use in our analysis.

Table 2. Definition of the variables

	Variables	Abbreviation	Type	Source
Independent Variable	Compulsory Health Spending	SPENDING	Annually	OECD, World Bank
Dependent Variable	Hospital Beds	BED	Annually	OECD, MoH
Dependent Variable	The Number of Doctors	DOCTOR	Annually	OECD, World Bank
Dependent Variable	Length of Hospital Stay	STAY	Annually	OECD, World Bank

Figure 1 shows the graphs of the logarithmic form of the variables.

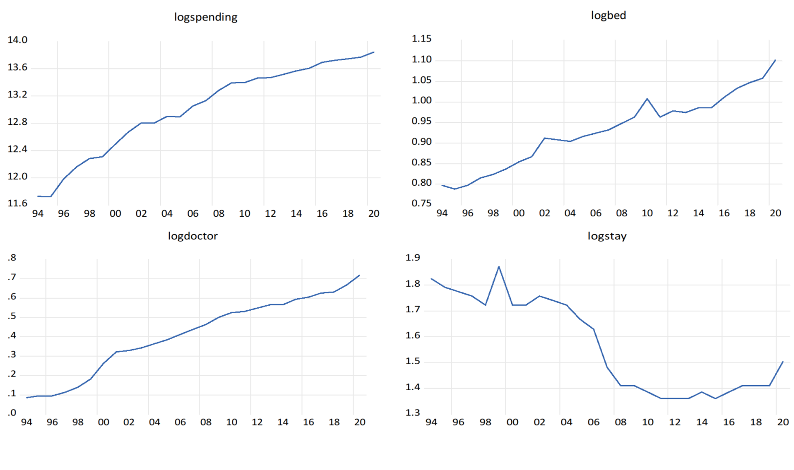


Figure 2. Graphs of the variables

Methods

In our analysis, we employ the Enders and Lee (2012) Fourier ADF unit root test to assess the stationary properties of the variables. Enders and Lee (2012) take into account the Dickey-Fuller test where the deterministic term is a function of time, denoted by α(t), as follows:

$$y_t = \alpha(t) + \rho y_{t\,1} + \gamma t + \varepsilon_t, \tag{1}$$

where α(t) is a deterministic function of t and ε t is a stationary disturbance with variance σ_{ε}^2. Enders and Lee (2012) seek evidence against the assumption that there is no unit root (i.e., $\rho = 1$). Once the form of α(t) is undefined, any test for $\rho = 1$ becomes difficult if α(t) is not given correctly. They use the Fourier expansion as an estimate for the form of the functional variable α(t), which remains unknown.

$$\alpha(t) = \alpha_0 + \Sigma_{k=1}^{n}\left(\alpha_k sin\frac{2\pi kt}{T} + \beta_k cos\frac{2\pi kt}{T}\right); n \leq T/2, \tag{2}$$

where n is the total number of frequencies used in the estimation, k represents a specific frequency, and T is the total number of observations.

If $\alpha_1 = \beta_1 = \ = \alpha_n = \beta_n = 0$, it is evident that the process is linear, and standard methods for checking for unit roots might be used. A break or nonlinear trend, in contrast, requires the presence of in the data-generating process, at least one Fourier frequency. One significant benefit of the Fourier approximation is that it is a global approximation rather of a local one. In a regression analysis, it is not practical to utilize a very big value of n. Overfitting is a potential issue when many frequency components are used. So instead of proposing the precise form of α(t), they attempt to choose appropriate frequencies to put in Equation (2). They only employ one frequency, k, and focus on the testing regression in this respect.

$$\Delta y_t = \rho y_{t-1} + c_1 + c_2 t + c_3 sin\frac{2\pi kt}{T} + c_4 cos\frac{2\pi kt}{T} + e_t. \tag{3}$$

In Equation (3), Enders and Lee (2012) allow τDF_t represents the t-statistic for the null hypothesis $\rho = 0$. After determining that the asymptotic properties of the DF version of the test are identical to those of the LM version of the test, they prefer not to provide the asymptotic distribution. As with the other alternative tests, it is crucial to note that the critical values for the null hypothesis of a unit root will depend entirely on the frequency k and the sample size T. However, they are independent of the coefficients of the Fourier terms and other deterministic terms. Hence, simulations allow Enders and Lee (2012) to systematize critical values. The study's critical values for τDF_t are documented in Tables 1a and 1b. The following is a possible implementation of the break test if the value of k is estimated. Initially, they make an approximation of Equation (3) for all integer values of k as $1 \leq k \leq 5$. Specifically, it is observed that is the result of the regression with the smallest sum of squared residuals (SSR). Assuming serial correlation in the residuals, more lagged values of Δyt could be added to Equation (3). Second, they provide evidence supporting the feasibility of conducting pretests for nonlinearities. In order to do so, they do the standard F-test for the null hypothesis implying c3 =c4 =0. The F-statistic distribution becomes non-standard if the unit-root null is placed on the data-generating process (DGP). In case the value of F in the sample is smaller than the critical value specified in the study, the null hypothesis of a linear trend could not be rejected. They recommend using the standard linear Augmented Dickey-Fuller test instead.

Next, we analyze the causality links between the variables using the Fourier Granger causality test developed by Enders and Jones (2016) and the Fourier Toda Yamamoto test proposed by Nazlioglu et al. (2016). Due to the gradual changes in the interconnections between the variables and the inadequacy of linear specifications in capturing the connections, the econometric analyses are often not clear and straightforward. Since several smooth mean shifts are prevalent in the VAR system, Enders and Jones (2016) allow the adaptable Fourier form to detect them and to address the Granger-causality tests with short-term dynamics. Enders and Jones (2016) verify the non-stationarity of the variables and then, after using the Flexible Fourier Form to account for breaks, they examine the linear VAR as follows:

$$z_t = \delta + \Sigma_{i=1}^{11} A_i z_{t-i} + e_t \tag{4}$$

where δ denotes a (4x1) vector of intercepts, A_i represents (4×4) coefficient vector and e_t shows the vector of innovations. Here, there are two major issues. To begin with, there are unaccounted-for structural fractures in the system defined by Equation (4). Further, since an unrestricted VAR is likely to be overparameterized, the confidence intervals shown in the depiction may be too wide. To demonstrate how ignored breaks might confound Granger causality tests, they implement a common approach and place constraints on the VAR that are suggested by the Granger causality tests. Their findings point to a lack of interaction between the variables. Because of the strong reactions, the series tends to respond solely to its own shocks. Then, instead of the VAR provided by Equation (5), Enders and Jones (2016) let the deterministic regressors be as follows:

$$z_t = \delta(t) + \Sigma_{i=1}^{11} A_i z_{t-i} + e_t \tag{5}$$

$$\delta(t) = [\delta_1(t), \delta_2(t), \delta_3(t), \delta_4(t)]' \tag{6}$$

and each intercept δ_{it} is affected by n Fourier frequencies in such a way that:

$$\delta_i(t) = \alpha_i + \beta_i t \Sigma_{k=1}^{n} \alpha_i k sin\left(\frac{2\pi kt}{T}\right) + \beta_{ik} cos\left(\frac{2\pi kt}{T}\right) \tag{7}$$

Finally, Enders and Jones (2016) acquire the equation below to employ the Fourier Granger causality test.

$$y_t = \alpha_0 + \gamma_1 sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 cos\left(\frac{2\pi kt}{T}\right)\beta_1 y_{t-1} + \ldots + \beta_u y_{t-u} \tag{8}$$

Results for the Granger causality vary significantly from those previously acquired when the Fourier terms are employed to adjust for breaks. When Enders and Jones (2016) include trigonometric functions in the model, they find stronger linkages and more complex interactions between the variables than the Granger-causality findings provided by the linear VAR. Furthermore, since taking the difference of variables might lead to a loss of information, Nazlioğlu et al. (2016) extend the Fourier causality test proposed by Enders and Jones (2016). In the Fourier Toda Yamamoto causality test, Nazlioğlu et al. (2016) use the following equation.

$$y_t = \alpha_0 + \gamma_1 sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 cos\left(\frac{2\pi kt}{T}\right)\beta_1 y_{t-1} + \ldots + \beta_{p+d} Y_{t-p+d} + e_t \tag{9}$$

Here, the Granger causality is tested utilizing the terms of Wald statistics and the Fourier. In case the Fourier terms are utilized to include structural breaks, the results of causality differ from previously reached results, similar to the test proposed by Enders and Jones (2016), and stronger relationships can be identified.

Analysis Findings

To evaluate the stationary characteristics, we apply the Fourier ADF unit root test in the first part of our analysis. The results of the unit root test are shown in Table 3.

Table 3. The findings of the Fourier ADF unit root test

Variables	Frequency(k)	MinSSR	FADF Test-statistic	F-Statistic
SPENDING	1	0.073118	-5.724808***	14.05772***
BED	1	0.004385	-2.484142	3.738887
DOCTOR	1	0.004779	-3.793270	8.037419*
STAY	1	0.040787	-5.883179***	18.228570***

Note: Critical values for FADF t-statistic for k=1 and T=27 are -4.95, -4,35, and -4.05 at 1%, 5%, and 10%. In addition, critical values for F-statistic are 12.21, 9.14 and 7.78 at 1%, 5%, 10%, respectively. A linear trend is employed in the model.

When we examine the Fourier ADF unit root test, we notice that the “SPENDING” and “STAY” variables are stationary since both the FADF T-statistic and F-statistic are bigger than the critical values specified in the study of Enders and Lee (2012). The “DOCTOR” variable has a unit root since the FADF T-statistic is less than the critical values stated despite the fact that the F-statistic is greater than the critical values stated. On the other hand, for the “BED” variable since the F-statistic is less than the critical values specified in the study of Enders and Lee (2012) we need to use the standard ADF unit root test. The ADF test also confirms that the “BED” variable does have unit root since prob. value 0,2951 is greater than 0.05. In the following stage, we examine the causal links between variables, and we employ the Fourier Granger causality test for the variables that were I(0) and the Fourier Toda Yamamoto causality test for the variables that become stationary at different levels. Table 4 presents the findings.

According to Table 4, there are causality runs from the “SPENDING” variable to “BED” and from “DOCTOR” to “SPENDING” since the bootstrap p-value is less than 0.01 while there are no causality runs from “BED” to “SPENDING”, from “SPENDING” to “DOCTOR”, from “SPENDING” to “STAY”, and from “STAY” to “SPENDING”. These findings mean that compulsory health spending does have an impact on hospital beds and the number of doctors does have an impact on compulsory health spending

Table 4. The findings of the Fourier Granger and Fourier Toda-Yamamoto test

Relationship	Wald-test	asymptotic p-value	bootstrap p-value	Optimal p	Optimal k
SPENDING→ BED	16.046135	0.000327***	0.000530***	2	1
BED → SPENDING	0.219219	0.896183	0.892600	2	1
SPENDING→ DOCTOR	0.912966	0.633507	0.645500	2	1
DOCTOR→ SPENDING	14.92427	0.000574***	0.005600***	2	1
SPENDING→ STAY	2.741721	0.253888	0.280500	2	1
STAY→ SPENDING	3.132469	0.208830	0.232300	2	1
BED→ STAY	1.679782	0.431757	0.445500	2	1
STAY→ BED	6.512072	0.038540**	0.071300*	2	1
DOCTOR→ STAY	1.289550	0.256130	0.270900	1	1
STAY→ DOCTOR	0.000232	0.98782722	0.985700	1	1

Note: ***, **, and * show the statistical significance level at 1%, 5%, and 10%. The findings are acquired by using Akaike criteria and 10.000 bootstrap value. Since n is less than 50, we use the bootstrap p-value.

Table 5. Caption

Variables	Frequency(k)	MinSSR	FADF Test-statistic	F-Statistic
SPENDING	1	0.073118	-5.724808***	14.05772***
BED	1	0.004385	-2.484142	3.738887
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Note: Critical values for FADF t-statistic for k=1 and T=27 are -4.95, -4,35, and -4.05 at 1%, 5%, and 10%. In addition, critical values for

in the analysis period. It is an expected result since investment in healthcare system can lead to improvement in the healthcare equipment such as hospital beds. In addition, the increase in the number of doctors might lead to an increase in compulsory spending.

Conclusion and Policy Implications

In this paper, we review the evolution of the health system in Turkiye in the post-crisis period in which the Health Transformation Program has been implemented and analyze the mutual causality links between compulsory health spending and health indicators including hospital beds, the number of doctors and hospital stay from 19994 through 2020. In our analysis, we utilize the Fourier causality test proposed by Enders and Jones (2016) and the Fourier Toda Yamamoto causality test proposed by Nazlioglu et al. (2016). The findings of the causality test show that there is a short-run relationship between compulsory health spending and hospital beds and between the number of doctors and compulsory health spending. The evidence of a causality relationship between compulsory healthcare spending and hospital beds is an expected result. Since 2003, public healthcare spending in Turkiye has grown under the HTP framework, leading to a modest rise in the number of available hospital beds. Of course, it is not very easy to say whether healthcare expenditures improve the healthcare system. It is crucial to quantify the worth of healthcare production and to find out how well it is doing. Generally, an increase in health expenditures must result in an increase in the healthcare being provided if the health of a population improves in response to the rise in spending. In this sense, the capacity of hospital beds is an important indicator of healthcare resources. Reduced availability of beds is likely to have a negative effect on treatment and add to long queues. Higher spending on healthcare means more healthcare resources in general and more beds in supply in particular. Our findings also support the evidence of a causality relationship between the number of doctors and compulsory healthcare spending. Although we expect that compulsory healthcare spending will increase as the number of doctors rises, it seems unclear how the medical staff affects the growth of healthcare spending. For instance, Chernew et al. (2009) studied the link between primary care doctors and health spending growth in the period from 1995-2005 and argued that the share of primary care doctors is uncorrelated with healthcare spending. In this context, they emphasized that more study was required before a primary care doctor's possible causative influence could be evaluated. In another study, Othman-Abdullah (2022) found that government health expenditures did not correlate with the number of doctors while there was a causality link between government health spending and hospital beds. Our findings are partly in line with Othman-Abdullah (2022) since our findings support the evidence of a causality relationship between these two variables. This finding is also in line with Tiehi and Coulibaly (2012) in which a relationship was found between the number of doctors and government health spending.

We could not find any causality link between compulsory health spending and the length of a hospital stay in our analysis. Indeed, the length of time a patient is hospitalized is often used as a measurement of how well treatment is being delivered. The fewer days a patient spends in the hospital the less money and time will be spent on their care. A shorter patient stay might be a valuable efficiency indicator if it is assumed that care quality has not decreased. Walsh et al. (2022) indicated that healthcare systems might react to resource shifts and one way to do this is to raise the occupancy rate, shorten the average duration of stay, and cut down on the number of new patients admitted. Although the length of stay is a major indicator of efficiency in the healthcare industry, changes in the length of stay without knowing the context might be unproductive. In addition, the results make one wonder whether it's fair to use length of stay as an efficiency measure, especially when the reasons for changes in length of stay are analyzed in isolation from other indicators.

We also have some limitations in our study. For instance, we could not find data regarding the variables after 2020. In addition, when we checked the subcategories under hospital bed, we could not reach sufficient data. In response to the COVID-19 pandemic, Turkiye took measures to control the transmission of the epidemic, in addition to providing economic support to that impacted several groups in the community. However, the effects of the COVID-19 pandemic are estimated to have a significant adverse impact on Turkiye, further weakening macroeconomic fundamentals such as economic growth, industrial production, and unemployment rate. Therefore, the macroeconomic variables should be included with a larger data set in an analysis in the future.

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