Estimating of Health Services Expenditures within the Framework of Public Financial Management Using ARIMA Method

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ABSTRACT

This study aims to estimate and evaluate the trends in public health expenditures and total expenditures within the scope of public financial management. The study employs the ARIMA model, a time series method, using monthly data spanning 202 periods from January 2006 to October 2022. The estimated period extends from November 2022 to December 2024. The findings reveal a notable upward trend in both public health expenditures and total expenditures. Projections indicate that public health services expenditures are estimated to be approximately TL 251 billion in 2024, with total expenditures reaching approximately TL 3.98 trillion. By emphasizing a strong linkage between policy, planning, and budgeting, the study draws inferences to enhance the potential for effective and efficient resource utilization. In this context, the study underscores the importance of a strategic framework for the effective utilization of public resources. The results of this study, shedding light on decision-makers in public expenditure management, can provide valuable insights for future planning and policy considerations.

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1. INTRODUCTION

The share allocated to healthcare services from the national income has been steadily increasing. This trend exerts continuous pressure on public budgets and poses a significant challenge for policymakers (Braendle and Colombier, 2016:1051). Public expenditures allocated to healthcare services from public budgets contribute to increasing the efficiency of healthcare services and enhancing health outcomes. Therefore, planning and establishing a robust health budget and financing system have become a priority among many countries worldwide (Nolte and McKee, 2004:58). Due to the variability in the public policy-making process, the importance of budget systems that encompass planning and programming has increased. A well-designed and planned system that operates effectively can ensure rational allocation of resources.

Establishing a structure that embraces transparent and accountable principles, facilitating access to information and reporting processes, is crucial for monitoring the progression of the process (Yılmaz and Akdeniz, 2020:89). Public sector planning is a crucial tool for translating the government's intentions and policies into on-the-ground activities. In the public sector, planning is viewed as a continuation of the policy-making process. It is considered as a daily management tool for operationalizing policies through long-term strategic vision and short-term operational plans (Tsofa et al., 2016:261). It is asserted that the aim of rationalizing and prioritizing the use of limited available resources through public sector planning and budgeting is not sufficient. Simultaneously, there is an emphasis on the inevitability of responding to internal and external environmental factors such as political interests, institutional arrangements in planning and budgeting, and societal values (Green and Mirzoev, 2008:40). Within the framework of public financial management, evaluating public budgets as both a planning tool and, beyond planning, as a fiscal policy tool in economic interventions highlights the necessity for detailed consideration and planning of public expenditure programs (Ergen, 2021:283). A significant portion of the world's economic output is allocated to healthcare systems. Therefore, making decisions to optimize the performance of healthcare systems is crucial (Fekri et al., 2018:1). It is emphasized that in addition to stronger institutional integration for planning and budgeting processes, there is a need for evidence-based approaches and realistic goal-setting with improved data for top-level health policymakers and decision-makers (Tsofa et al., 2016:271).

Indicators of healthcare system performance are not considered separately from their ultimate goals and measurement subjects. Governments need studies that routinely monitor and evaluate the functioning of the system, employing scientific methods and techniques to make more informed decisions about healthcare expenditures, financing, organization, and policies (Kruk and Freedman, 2008: 264). The inclusion of budgeting in future planning increases the importance of planning and programming. Therefore, it is emphasized that statistical and mathematical methods should be utilized more during the planning process (Bektaş and Çetinkaya, 2021:250; Yılmaz and Akdeniz, 2020:105).

In this context, the aim of the study is to provide evidence to policymakers and decision-makers in the context of the planning-budget relationship by predicting future expenditures under the functional classification within the scope of public financial management. This will be achieved by examining the trends of healthcare service expenditures and total expenditures. The goal is to make forecasts for the future, offering insights into the relationship between planning and budgeting within the realm of public financial management.

To achieve the goal of health planning, the planning process needs to be conducted with a flexible and participatory understanding, and coordination with other decision-making mechanisms must be structured (Huzaifaf et al., 2014:30). In other words, health planning is evaluated as a process within the policy-making where actors make rational and realistic decisions among alternatives (Tosun, 2022:111).

Health planning is of critical importance in developing and underdeveloped countries due to the scarcity of resources, aiming to meet the expectations of individuals in terms of healthcare services. In many countries, a lack of understanding of budgeting issues results in disjointed processes such as disjointed health policy-making, planning, costing, and budgeting. This situation can lead to misguided planning between the health sector priorities stated in general strategic plans and policies and the funds allocated to the health sector through the budgeting process (WHO, 2016:397).

A sound health planning, by establishing partnerships and collaborative relationships to reduce inequalities and disparities among populations, groups, and especially geographical areas, allows for effective and efficient use of resources. This can bring about changes in agencies, professionals, and individuals to enhance the quality of healthcare services and positively impact the relationship between healthcare expenditures and economic growth (Keleher, 2011:330). Countries can improve the quality of healthcare service delivery and positively influence the relationship between healthcare expenditures and economic growth by utilizing their resources more effectively and efficiently (Yıldız and Yıldız, 2018:214). Kıran et al. (2023) state

the importance of countries taking necessary measures to maintain a balance between economic growth and healthcare expenditures. They emphasize the significance of controlling the increasing costs in healthcare expenditures for the efficient and effective utilization of resources.

Focusing on differences across cultures, history, economics, and sociopolitical contexts is crucial. This understanding isn't just vital for policymakers shaping healthcare delivery and financing worldwide; it's also essential for health economists and policymakers measuring national health expenditures effectively (WHO, 2003:5).

Public sector performance management implementation is stated to enhance performance through the effective operation of transparency and accountability principles. Additionally, the importance of utilizing various factors such as different budget proposal scenarios, different budgeting techniques and practices, and involving stakeholders in the performance evaluation process has been emphasized (Çiçek and Şahin İpek, 2013:93).

The necessity of addressing the health sector in conjunction with the social and demographic characteristics of the economy is emphasized. Therefore, national health and healthcare expenditure decisions are not only influenced by biological and environmental factors but also by economic, social, and demographic changes (Abbes and Hiemenz, 2011:1). Measures such as increasing healthcare revenues, adopting scientific approaches in resource allocation, tax exemptions in medical technology, and strengthening public-private partnerships enable the efficient use of the budget (Braithwaite et al., 2017). Poverty, inequality, market failures, and other negative externalities underscore the need for government intervention, especially in significant public service sectors, particularly in healthcare services, especially in developing countries (World Bank, 1993:286).

2. MATERIALS AND METHOD

The aim of the study is to predict future trends by using functional classification, which indicates the type of government activities according to budget classification, through healthcare expenditure and total expenditure trends. Additionally, the study aims to evaluate the level of health expenditures within the overall budget expenditures in comparison to the current implemented policies. The ARIMA (AutoRegressive Integrated Moving Average) method, one of the time series-based future forecasting methods, has been utilized for data analysis. In order to make predictions for the future using the dataset, the autoregressive (AR) model defined by Yule in 1926 and the moving averages (MA) model introduced by Slutzky in 1937 have been employed together. The EViews 12 software package was used to implement the method. In the study, a monthly dataset comprising 202 periods from January 2006 to October 2022 was utilized (Figure 1 and Figure 2). The data was obtained from the General Directorate of Accounting of the Ministry of Treasury and Finance of the Republic of Turkey, Central Government Budget Statistics. The conducted forecast covers the period from November 2022 to December 2024, encompassing a two-year period.

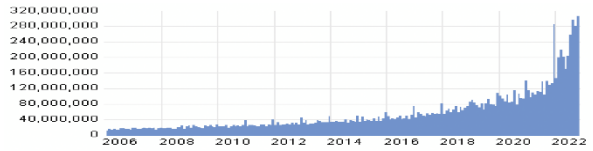

Figure 1: Total Expenditure (2006-2022) (Thousand TL)

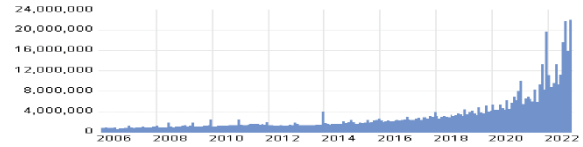

Figure 2: Total Health Expenditure (2006-2022) (Thousand TL)

ARIMA Method

ARIMA models, commonly known as the Box-Jenkins method in the literature, are frequently used in forecasting economic variables (Dritsakis and Klazoglou, 2019:80; Ramezanian et al., 2019:2). In addition to forecasting economic variables, the ARIMA method is employed for predictions in various fields (Alghamdi et al., 2019; Singh et al., 2020; Schaffer et al., 2021). In forecasts related to the health sector, it is often observed that income (Andellini et al., 2021; Jiao et al., 2020) and healthcare expenditures (Jakovljevic et al., 2022; Klazoglou and Dritsakis, 2019; Oshinubi et al., 2019; Zheng et al., 2020; Kıran et al., 2022) data are commonly used.

The ARIMA model can be composed of autoregressive (AR), moving average (MA), and integration (I) functions based on the stationarity degree of the time series (Fattah et al., 2018:3). The application of the method takes place through specific steps. The first step is the selection of the model. In this step, appropriate values for p, d, and q are determined to define the ARIMA (p, d, q) model. Initially, the value of d is determined by transforming non-stationary time series into stationary series. The Augmented Dickey-Fuller (ADF) unit root test helps determine whether the time series is stationary or not. Logarithmic transformations and differencing are preferred approaches for stabilizing the time series in non-stationary series (Cao et al., 2013:3; Cheung and Lai, 1995:277). The

stationarity status of the variables used in the research may vary according to the selected ARIMA model (Ramezanian et al., 2019:2; Zheng et al., 2020:2). In the next step, an attempt is made to determine the order of p for the autoregressive process (AR) and the order of q for the moving average (MA). In this step, the autoregressive process model is typically expressed with a p-order model and is represented as in Equation 1 (Ramezanian et al., 2019:2).

$$y_t = c + \sum_{i=1}^{p} \alpha y_{t-1} + \varepsilon_t \qquad (1)$$

In Equation 1, p represents the parameter of the model; c is the constant term, and ε denotes the error term. The process function for the moving average is represented with a q-order model, as shown in Equation 2.

$$y_t = \mu + \varepsilon_t + \sum_{i=1}^{q} \theta_i y \varepsilon_{t-1} \qquad (2)$$

ARMA model prediction method is commonly applied based on time series data, providing the ability to forecast future changes and values in time series. The model takes its final form by combining the p and q models and is represented as in Equation 3.

$$y = c + \sum_{i=1}^{p} \alpha y_{t-1} + \varepsilon_t + \sum_{i=1}^{q} \theta_i y \varepsilon_{t-1} \qquad (3)$$

The model suitable for the purpose of the study is determined based on certain parameters. In the subsequent step, to ensure the verification of the results, the forecast coefficients are examined, including "R2" for goodness of fit, "p value" for significance level, and the significance of residual values. The most suitable model is decided by considering Akaike or Schwarz criteria values in the case of having multiple optimal AR and MA models. It is desired that these values have the smallest value, and the decision for the optimal model can be made accordingly (Klazoglou and Dritsakis, 2018:461; Ramezanian et al., 2019:2).

3. RESULTS

Data analysis followed the steps of the Box-Jenkins approach, including selecting the model, estimating parameters, reviewing alternative models, and selecting the most suitable model to obtain forecast data. To achieve accurate results in the model selection step, the data should be stationary. According to the functional classification table of general budget expenditures, Table 1 provides the data covering the periods 200601-202210 for healthcare expenditures. To test stationarity, the Augmented Dickey-Fuller (ADF) unit root test was applied. In cases where time series data is non-stationary, a logarithmic transformation followed by differencing was performed. As a result of the differencing process, stationarity was observed at the 1% significance level at the level. The data regarding the results of the unit root test are provided in Table 1.

Table 1. Augmented Dickey-Fuller (ADF) Unit Root Test Results

Variable	Level	t-Statistic	Prob.
Healthcare Expenditures	%1(-3.46) %5(-2,87) %10(-2,57)	-3,60**	0,0065
Total Expenditure	%1(-3.46) %5(-2,87) %10(-2,57)	-3,931**	0,0022

t-statistic values are labeled as ***, **, and * when the p-value is less than 0.01, between 0.01 and 0.05, and between 0.05 and 0.1, respectively.

In ARIMA modeling, the values for p (autoregressive order) for AR and q (moving average order) for MA are determined by examining the ACF (autocorrelation function) and PACF (partial autocorrelation function), establishing the suitability of the model. When selecting appropriate values for p, d, and q in the models, it is essential to consider certain criteria. These criteria can be listed as follows: the estimated parameters being statistically significant, the F-statistic value being significant, and the AIC and SIC values being smaller among alternative models. In this context, the values related to the selection of the most suitable model for income and expenditure balance according to AIC (Akaike Information Criterion) and SIC (Schwarz Criterion), Hannan-Quinn criteria are provided in Table 2. The Durbin-Watson statistic is employed to test for the presence of autocorrelation. As stated in the literature, the Durbin-Watson statistic must fall within the range of 0 to 4, and in the absence of autocorrelation, it is expected to be approximately 2 (Gujarati, 2001:423). Therefore, if the calculated Durbin-Watson statistic is around 2, it can be inferred that there is no autocorrelation in the model.

Table 2. Determining the Most Suitable ARIMA Model for the Developed Forecast Models

Variable	Model	AIC	SIC	Hannan-Quinn
Healthcare Expenditures	ARIMA (1, 1, 1)	-0,2996	-0,2501	-0,2796
	ARIMA (2, 1, 2)	-0,2805	-0,1978	-0,2470
	ARIMA (2, 1, 1)	-0,2877	-0,2215	-0,2609
	ARIMA (2, 1, 3)*	**-0,3570**	**-0,2577**	**-0,3168**
Total Expenditure	ARIMA (1, 1, 1)	-0,9946	-0,9492	-0,9763
	ARIMA (2, 1, 2)	-0,9772	-0,9013	-0,9466
	ARIMA (2, 1, 1)	-0,9838	-0,9231	-0,9593
	ARIMA (2, 1, 3)*	**-1,0866**	**-0,9955**	**-1,0498**

To determine the appropriate model for predicting healthcare expenditures and total expenditures, multiple models were tested. After these trials, it was decided that the most suitable models for both variables were ARIMA (2,1,3). The Table 3 provides the values related to the parameter estimation results of the identified optimal models.

Table 3. Values Related to the Prepared Optimal Models for Variables

Variable	**Model**	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Healthcare Expenditures	C	0,015729	0,003739	4,207170	**0,0000***
	AR(1)	-1,079887	0,018055	-59,81197	**0,0000***
	AR(2)	-0,975040	0,017746	-54,94353	**0,0000***
	MA(1)	0,397996	0,051568	7,7717839	**0,0000***
	MA(2)	0,126554	0,058420	2,166269	**0,0315***
	MA(3)	-0,726986	0,050069	-14,51973	**0,0000***
	Value				
	R-squared	0.378965	Theil's U		**0.473610**
	Prob(F-statistic)	0.000000	Hannan-Quinn		-0,3168
	Akaike info criterion	-0,357038	Schwarz criterion		-0,257742
			Durbin-Watson		1,871282
Total Expenditure	**Model**	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
	C	0,015043	0,002458	6,120454	0,0000
	AR(1)	-1,726453	0,005663	-304,8408	0,0000
	AR(2)	-0,995767	0,003812	-261,2442	0,0000
	MA(1)	0,999053	0,048614	20,55080	0,0000
	MA(2)	-0,280321	0,079728	-3,515967	0,0005
	MA(3)	-0,736627	0,045730	-16,10803	0,0000
	R-squared	0,502635	Theil's U		0,19
	Prob(F-statistic)	0,0000	Hannan-Quinn		-1,0498
	Akaike info criterion	-1,086619	Schwarz criterion		-0,995523
			Durbin-Watson		2,046206

When Table 3 is examined, it is observed that the values required for the parameters to perform the prediction modeling are met, and the F-statistic is significant ($p<0.05$). According to the analysis results, Theil-U values for the income variable are found to be 0.47 and 0.19. The fact that the data is within acceptable ranges indicates that the model is predictable. Based on the created models, the forecast for healthcare expenditures in the general budget covering the period from November 2022 to December 2024 has been made. The values related to the results are provided in Table 4.

Table 4. Healthcare Expenditure Predictions for the Period November 2022 to December 2024

Monthly Period	**Healthcare Expenditures**	**Monthly Period**	**Healthcare Expenditures**
202211	₺ 15.005.386,25	**202312**	₺ 22.597.927,99
202212	₺ 18.101.362,65	**202401**	₺ 20.582.788,57
202301	₺ 18.255.277,57	**202402**	₺ 19.908.309,75
202302	₺ 15.807.179,26	**202403**	₺ 23.718.094,08
202303	₺ 19.216.133,64	**202404**	₺ 21.278.245,66
202304	₺ 18.789.688,21	**202405**	₺ 21.162.467,68
202305	₺ 16.696.184,50	**202406**	₺ 24.829.047,06
202306	₺ 20.341.766,19	**202407**	₺ 22.039.432,16
202307	₺ 19.348.815,83	**202408**	₺ 22.506.118,83
202308	₺ 17.675.106,20	**202409**	₺ 19.534.071,94
202309	₺ 21.471.022,17	**202410**	₺ 17.233.190,77
202310	₺ 19.943.060,14	**202411**	₺ 18.031.662,13
202311	₺ 18.745.621,78	**202412**	₺ 20.357.781,46

When examining Table 4, it is anticipated that expenses will be approximately 15 billion TL in November 2022 and 18 billion TL in December 2022. Looking at January 2024, health service expenditures expected to be around 20.5 billion TL, while in December 2024, it is observed that the health service expenses were 20.3 billion TL.

Table 5. Total Expenditure Estimates for the Period 2022:11-2024:12

Monthly Period	Total Expenditure	Monthly Period	Total Expenditure
202211	₺ 253.302.329,50	**202312**	₺ 276.943.566,27
202212	₺ 285.694.127,31	**202401**	₺ 311.855.753,87
202301	₺ 261.784.528,10	**202402**	₺ 286.876.197,06
202302	₺ 239.875.911,35	**202403**	₺ 310.922.210,40
202303	₺ 261.322.101,96	**202404**	₺ 310.625.421,43
202304	₺ 259.778.086,62	**202405**	₺ 342.176.181,01
202305	₺ 254.546.811,33	**202406**	₺ 313.214.341,59
202306	₺ 280.118.227,07	**202407**	₺ 349.959.961,97
202307	₺ 255.973.456,50	**202408**	₺ 333.380.591,10
202308	₺ 287.132.491,92	**202409**	₺ 342.832.419,05
202309	₺ 272.137.581,72	**202410**	₺ 362.162.408,53
202310	₺ 281.221.257,73	**202411**	₺ 338.443.699,01
202311	₺ 296.089.198,01	**202412**	₺ 380.428.691,95

Examining Table 5, it is projected that the total expenditures will be approximately 253 billion TL in November 2022 and 285 billion TL in December 2022. Looking ahead to January 2024, the estimated total expenditures are expected to be around 312 billion TL, while the actual total expenditures for December are observed to be 380 billion TL. Referring to Table 6, the estimated total health service expenditures for November and December 2022 are approximately 173 billion TL, with total expenditures reaching 2,823 billion TL. The forecast for health service expenditures in 2023 is about 229 billion TL, and for 2024, it is anticipated to be 251 billion TL. Total expenditures are expected to be around 3,227 billion TL in 2023 and 4,000 billion TL in 2024.

Table 6. Annual Total Estimated Amounts of Monthly Health Expenditure and Total Expenditures for General Budget for the Years 2022:11-2024:12 (Thousand TL)

Years	2022	2023	2024
Healthcare Expenditures	173.495.907	228.887.783	251.181.210
Total Expenditure	2.822.857.858	3.226.923.219	3.982.877.877

4. DISCUSSION

In public financial management, functional classification plays a crucial role in the preparation, allocation, and monitoring of budgets. Each function in the functional classification encompasses various sub-level activities. It is emphasized that the numerical measurement of program objectives determined for these functions through econometric methods has positive contributions to the rational decision-making process (Ergen, 2021:288). It is well known that conducting the budget creation process rationally and making decisions accordingly will enhance policy-making capacity. Monitoring the relationship between planning and budgeting and ensuring managerial control over the process can increase the potential for effective and efficient use of resources (Yılmaz and Akdeniz, 2020:107). The Ministry of Treasury and Finance's 2019-2023 Strategic Plan emphasizes the goal of determining fiscal policies to achieve economic balance, budget discipline, sustainable growth, and equitable distribution. In this context, the plan sets the objective of developing participatory, collaborative, and cooperative methods in fiscal decision-making and practices (Ministry of Treasury and Finance, 2019:10). In this context, the study, by predicting future expenditures of health services and total expenditures-one of the functions of the state-holds evidential value for policymakers in the decision-making process of public financial management.

Public financial management is concerned with how budgets are prepared, resources are allocated, and expenditures are monitored. In this study, within the scope of public financial management, the trend of health service expenditures and total expenditures according to functional classification, indicating the type of state activities, has been predicted. It was found that the best forecasting models for both variables were ARIMA (2,1,3). These models were applied separately for each variable, and predictions were made for the period from November 2022 to December 2024. The findings obtained indicate an increasing trend in health expenditures and total expenditures. According to the predictions, health service expenditures are estimated to be approximately 251 billion TL, and total expenditures are expected to be around 4,000 billion TL

in the year 2024. In line with the literature and the findings obtained, it can be stated that promoting evidence-based management in the context of health and economic policies will contribute to the control of healthcare expenditures. The health expenditure budget serves as a significant indicator in achieving a country's fundamental financial objectives, implementing and evaluating health policies and strategies. In this context, when evaluated, the findings of the study can potentially guide policymakers in developing new policies and feasible strategies. Health authorities are emphasized to aim for effective engagement with budget authorities to promote reliable, priority-focused health budgets, ultimately strengthening accountability in budget execution (WHO, 2016:399).

5. CONCLUSION

The forecasts for healthcare expenditure may exhibit temporal variations depending on the specific problem they intend to address. While it may focus on a very short period to manage current resources, forecasts regarding how the demographic and epidemiological transition processes of the country will affect expenditures can encompass longer periods. In light of this information, taking measures for the reforms aimed at implementing a strong correlation between policy, planning, and budgeting can be facilitated based on the findings of the study. Anticipating future healthcare expenditures and total expenditures can contribute to the determination of programs and plans associated with this function. Consequently, the boundaries and scope of the budget allocated to healthcare services will be defined, and policies and strategies can be shaped within these limits. This can potentially enhance the potential for effective and efficient use of resources by ensuring proper allocation of resources.

The study has certain limitations and strengths. The dataset used for the variables in the study covers a specific period, limiting the forecast period to a constrained timeframe. Upon reviewing the literature, the uniqueness and strength of the study emerge from the absence of similar econometric studies, particularly focusing on healthcare, within the field of public financial management. The literature emphasizes the need for such studies. Future research expanding the variables and time dimension may reveal new findings. Lastly, it should be noted that the obtained results may be influenced by changes both in the timeframe and the sample data dimensions. The limitation arises from the presentation of estimates in nominal figures without accounting for inflation. This signifies a constraint in the study as it disregards the potential impact of inflation on the real value of healthcare expenditures over time, thus rendering the estimates potentially unable to adapt to such changes. Therefore, it is crucial to consider this limitation when interpreting the findings.

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Conflict of Interest:
The authors declare that they have no conflict of interest.
Ethical Approval:
This study is based on the analysis of existing publicly available secondary data. The data has been previously collected and sourced from public channels, tailored to align with the objectives of this study. The dataset has been obtained in accordance with the purpose of this research. Given that the study's data is derived from existing publicly available sources, we believe it is ethically sound, and no ethical review board approval is deemed necessary.
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REFERENCES

Abbas, F., & Hiemenz, U. (2011), Determinants of public health expenditures in Pakistan. ZEF-Discussion Papers on Development Policy, (158).

Alghamdi, T., Elgazzar, K., Bayoumi, M., Sharaf, T., & Shah, S. (2019, June). Forecasting traffic congestion using ARIMA modeling. In 2019 15th international wireless communications & mobile computing conference (IWCMC) (pp. 1227-1232). IEEE.

Andellini, M., Bassanelli, E., Faggiano, F., Esposito, M. T., Marino, S., & Ritrovato, M. (2021, June). Forecasting hospital performances using a hybrid ETS-ARIMA algorithm. In 2021 IEEE International Workshop on Metrology for Industry 4.0 & IoT (MetroInd4. 0&IoT) (pp. 42-47). IEEE.

Bektaş, N.B. & Çetinkaya, Ö. (2021). Bütçe Yönetimi Kavramı ve Türkiye'de Bütçe Yönetiminin Başarısının Değerlendirilmesi. International Journal of Public Finance, 6(2), 233-262.

Braendle, T., & Colombier, C. (2016). What drives public health care expenditure growth? Evidence from Swiss cantons. 1970-2012. Health policy (Amsterdam, Netherlands), 120(9), 1051–1060. https://doi.org/10.1016/j.healthpol.2016.07.009

Braithwaite, J., Matsuyama, Y., & Johnson, J. (2017). Healthcare reform, quality and safety: perspectives, participants, partnerships and prospects in 30 countries. CRC Press.

Cao, S., Wang, F., Tam, W., Tse, L. A., Kim, J. H., Liu, J., & Lu, Z. (2013). A hybrid seasonal prediction model for tuberculosis incidence in China. BMC medical informatics and decision making, 13(1), 1-7.

Cheung, Y. W., & Lai, K. S. (1995). Lag order and critical values of the augmented Dickey–Fuller test. Journal of Business & Economic Statistics, 13(3), 277-280.

Çiçek, H. G., & İpek, E. A. Ş. (2013). Performans Yönetiminin Amaç-Araç Uyumu Tartışması ve Performans Esaslı Bütçeleme Sistemi. Maliye Dergisi, 165, 80-96.

Dritsakis, Nikolaos & Klazoglou, Paraskevi, (2019). Time Series Analysis using ARIMA Models: An Approach to Forecasting Health Expenditure in USA. Economia Internazionale / International Economics, Camera di Commercio Industria Artigianato Agricoltura di Genova, vol. 72(1), pages 77-106.

Ergen, Z. (2021). Performans esaslı bütçe sisteminden program bazlı performans bütçe sistemine geçiş: yeni bütçe sistemi ile hedeflenenler. Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 14(1), 280-302. http://doi.org/10.25287/ohuiibf.778740.1

Fattah, J., Ezzine, L., Aman, Z., El Moussami, H., & Lachhab, A. (2018). Forecasting of demand using ARIMA model. International Journal of Engineering Business Management, 10, 1847979018808673.

Fekri O, Macarayan ER, Klazinga N. (2018). Health system performance assessment in the WHO European Region: which domains and indicators have been used by Member States for its measurement? Copenhagen: WHO Regional Office for Europe. (Health Evidence Network (HEN) synthesis report 55).

Green, A. T., & Mirzoev, T. N. (2008). Planning for public health policy. International Encyclopedia for Public Health, Heggenhougen K, Quah S.

Gujarati, D. N. (2001). Basic econometrics. 1995.

Hazine ve Maliye Bakanlığı (2019). T.C. Hazine ve Maliye Bakanlığı 2019-2023 Stratejik Plan. https://ms.hmb.gov.tr/uploads/2020/03/2019-2023-Maliye-Bakanl%C4%B1%C4%9F%C4%B1-Stratejik-Plan%C4%B1_Bas%C4%B1lacak-Versiyon.28.02.2020.pdf

Huzaifah, H., Tariq, M., Lai, W. K., Nur Adnin, A. Z., Dika, J., Juni, M. H., & Faisal, I. (2018). Theory of health planning: Case study for development of national health plan in Asean countries. International Journal of Public Health and Clinical Sciences, 5(4), 29-42.

Jakovljevic, M., Lamnisos, D., Westerman, R., Chattu, V. K., & Cerda, A. (2022). Future health spending forecast in leading emerging BRICS markets in 2030: health policy implications. Health research policy and systems, 20(1), 1-14.

Jiao, R., Zhang, Y., Di, C., Wu, B., Shu, J., Liu, Y., & Kuang, S. (2020). Prediction of the income and expenditure risk of social medical insurance fund based on ARIMA model. In 2020 Conference on Social Science and Modern Science (SSMS2020). DOI: 10.38007/Proceedings (Vol. 698).

Jira, C., Feleke, A., & Mitike, G. (2004). Health planning and management for health extension workers. Ethiopia Public Health Training Initiative.

Keleher, H. (2011). Population health planning for health equity. Australian Journal of Primary Health, 17(4), 327-333.

Kıran, Ş. Akbolat, M. ve Sevim F. (2022). Health System Financial Sustainability- The 2030 Projection For 23 OECD Countries. In book: International Research in Health Sciences V: Eğitim Yayınevi.

Kıran, Ş., Sevim, F., & Şenol, O. (2023). Gelir Gruplarına Göre Sağlığın Gelir Üzerindeki Etkisi: Bir Panel Veri Analizi. Sosyoekonomi, 31(57), 401-417. https://doi.org/10.17233/sosyoekonomi.2023.03.19

Kruk, M. E., & Freedman, L. P. (2008). Assessing health system performance in developing countries: a review of the literatüre. Health policy, 85(3), 263-276.

Nolte, E., & McKee, M. (2004). Does health care save lives? Avoidable mortality revisited. The Nuffield Trust.

Oshinubi, K., Rachdi, M., & Demongeot, J. (2021, September). Analysis of reproduction number R0 of COVID-19 using current health expenditure as gross domestic product percentage (CHE/GDP) across countries. In Healthcare (Vol. 9, No. 10, p. 1247). MDPI.

Ramezanian, M., Haghdoost, A. A., Mehrolhassani, M. H., Abolhallaje, M., Dehnavieh, R., Najafi, B., & Fazaeli, A. A. (2019). Forecasting health expenditures in Iran using the ARIMA model (2016-2020). Medical journal of the Islamic Republic of Iran, 33, 25.

Schaffer, A. L., Dobbins, T. A., & Pearson, S. A. (2021). Interrupted time series analysis using autoregressive integrated moving average (ARIMA) models: a guide for evaluating large-scale health interventions. BMC medical research methodology, 21(1), 1-12.

Singh, S., Parmar, K. S., Kumar, J., & Makkhan, S. J. S. (2020). Development of new hybrid model of discrete wavelet decomposition and autoregressive integrated moving average (ARIMA) models in application to one month forecast the casualties cases of COVID-19. Chaos, Solitons & Fractals, 135, 109866.

Tosun, N. (2022). Sağlıkta planlama üzerine kavramsal bir değerlendirme. Turkish Studies - Social, 17(1), 97-115. https://dx.doi.org/10.7827/TurkishStudies.52414

Tsofa, B., Molyneux, S., & Goodman, C. (2016). Health sector operational planning and budgeting processes in Kenya—"never the twain shall meet. The International journal of health planning and management, 31(3), 260-276.

World Bank (1993). World Development Report 1993, Investing in Health. Washington D.C: World Bank.

World Health Organization. (2003). Guide to producing national health accounts: with special applications for low-income and middle-income countries. World Health Organization.

World Health Organization. (2016). Strategizing national health in the 21st century: a handbook", World Health Organization. https://apps.who.int/iris/handle/10665/250221

Yıldız, B., & Yıldız, G. (2018). Sağlık Harcamalarının Ekonomik Büyüme Üzerindeki Etkisi: Avrupa ve Merkez Asya Ülkeleri Örneği. Maliye Dergisi, 174, 203-218.

Yılmaz, H. H., & Akdeniz, İ. (2020). Cumhurbaşkanlığı Hükümet Sistemi ile Değişen Kamu Mali Yönetim Sisteminde Program Bazlı Bütçe Sistemine Yönelik Bir Yapılandırma Önerisi. Sayıştay Dergisi, (117), 87-114.

Zheng, A., Fang, Q., Zhu, Y., Jiang, C., Jin, F., & Wang, X. (2020). An application of ARIMA model for predicting total health expenditure in China from 1978-2022. Journal of global health, 10(1).