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Asymmetric Effect of Income on the Healthcare Expenditure in Türkiye

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Abstract

This paper examines the dynamics between income and health spending in Türkiye from 1988 to 2020, employing autoregressive distributed lag (ARDL) and nonlinear ARDL (NARDL) methodologies. One of the key findings of this study is the presence of an asymmetric relationship between variations in income and overall healthcare expenditure. This means that changes in income levels do not have uniform effects on health expenditure, and the direction of these effects depends on whether income is rising or falling. Interestingly, the research reveals that both increases and decreases in income lead to a rise in total health expenditure. However, the impact of income declines on health expenditure is more pronounced. In other words, when people experience a decrease in income, they tend to allocate a larger portion of their reduced resources to health-related expenses. This highlights the significant financial strain that income reductions can place on individuals and households when it comes to healthcare costs. This pattern of asymmetric effects also extends to government or compulsory health expenditures. When income falls, the government's role in funding health expenses becomes more prominent, as individuals rely more on public healthcare services during economic downturns. Furthermore, the study sheds light on the intriguing relationship between income shifts and voluntary or out-of-pocket health expenses. Positive income shifts are found to be associated with a reduction in voluntary health expenditure. This suggests that as people experience an improvement in their financial situation, they may opt for less costly or more efficient healthcare services, leading to a decrease in out-of-pocket expenses. Conversely, when income levels decrease, individuals may find themselves with limited options, potentially resorting to more expensive private healthcare services or bearing a greater burden of out-of-pocket expenses. This finding underscores the financial vulnerability that can accompany negative income shifts.

Keywords: Health Expenditure, Asymmetric Effect, NARDL.

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1. INTRODUCTION

The relationship between income and health expenditure is a highly debated and heated topic in the literature, and yet, the extent to which income impacts health expenditure remains to be determined. Income is considered to be a significant determinant of healthcare expenditure, as it affects an individual's ability to afford healthcare services and insurance coverage (Moore et al., 1992; Samadi & Rad, 2013; Nghiem & Connelly, 2017; Barati & Fariditavana, 2020). Individuals tend to spend more on healthcare, both in absolute terms and as a proportion of their income, as income levels rise. This is due to the fact that households with higher incomes spend more on health insurance premiums, co-payments, and out-of-pocket expenses than households with lower incomes and, therefore, are more likely to afford more comprehensive insurance coverage, enabling them to have greater access to health insurance and better healthcare facilities. Moreover, people with higher incomes are more likely to prioritize their health and wellness and to engage in preventive health behaviors such as exercising regularly, maintaining a healthy diet, and seeking regular check-ups, which can reduce the need for costly medical interventions in the future (Pampel et al., 2010). On the other hand, people with lower incomes may struggle to afford health insurance premiums and out-of-pocket expenses, which can limit their access to healthcare services. They may also be more likely to have poor diets and delay seeking medical attention until their health conditions become more severe, which can result in higher healthcare costs in the long run. However, it should be noted that these behaviors are often influenced by factors such as education level, cultural background, and social status, all of which are closely linked to income.

Although the positive effect of income on health expenditure is very well documented in the empirical literature, there has been an ongoing debate regarding the size of the income elasticity of healthcare due to the mixed findings in the literature (Barati & Fariditavana, 2020). Some studies find that healthcare is a luxury good, estimating that income elasticity exceeds unity (Newhouse, 1977; Moore et al., 1992; Gerdtham et al., 1992; Roberts, 1999; Okunade & Murthy, 2002; Freeman, 2003; Hall & Jones, 2007) while some others estimate that health care is a necessity rather than a luxury (Wang, 2009; Moscone & Tosetti, 2010; Baltagi & Moscone, 2010; Chakroun, 2010; Baltagi et al., 2017; Rana et al., 2020; Apergis et al., 2020; Dubey, 2020; Casas et al., 2021).

On the other hand, another important extent of the link between income and health expenditure is the nature of this relationship, as it can be asymmetric too, related to the behavior of healthcare expenditures in response to changes in income. From the theoretical perspective, higher-income individuals may have greater access to healthcare services and be more likely to use healthcare services when their incomes increase. On the other hand, healthcare prices may be sticky and not respond to decreases in demand in a symmetric manner, which can lead to higher healthcare expenditures even when incomes decrease.

In sum, from the theoretical perspective, the nature of the association between income and health expenditure is complex, and the asymmetric pass-through from income to health expenditure should be considered to uncover the true relationship between the two. Therefore, this paper aims to investigate both the linear and nonlinear relationship between income and health expenditure in Türkiye. Türkiye is a proper study area within this context, as the country has made progress in improving healthcare access and utilization in recent years, yet there remain challenges in ensuring equitable access to healthcare services across different income levels and regions. According to the World Health Organization (WHO), in 2019, Türkiye spent 5.5% of its Gross Domestic Product (GDP) and $965 per capita on healthcare. Healthcare is financed through a mix of public and private sources in Türkiye, and public healthcare spending in Türkiye accounted for 73.3% of total healthcare expenditure in 2019, while private healthcare spending accounted for 26.7%. Out-of-pocket payments accounted for 18.5% of total healthcare expenditure in 2019. In terms of healthcare utilization, Türkiye had 2.6 hospital beds per 1,000 population and 1.4 physicians per 1,000 in 2019. The utilization of healthcare services in Türkiye has been increasing in recent years, with a growing demand for hospital care and outpatient services. There are also disparities in healthcare access and utilization across different income levels and regions in the country. Higher-income individuals and those living in urban areas have greater access to healthcare services compared to lower-income individuals and those living in rural areas (WHO, 2021).

Our motivation stems from the observation that while the relationship between income and healthcare expenditure is well-explored, the specific dynamics within Türkiye, especially under the asymmetric effects model, remain underexamined. This gap is significant given Türkiye's unique economic and healthcare landscape, which includes rapid modernization, integration with global markets, and substantial health sector reforms. The choice of Türkiye as a case study is motivated by its distinctive context, which includes fluctuations in economic growth, periods of political stability and unrest, and ambitious healthcare reforms aiming towards universal health coverage. This context presents an ideal scenario to explore the nuanced impacts of income fluctuations on healthcare spending, offering insights that are both regionally specific and potentially generalizable to other emerging economies undergoing similar transitions.

Our study contributes to the literature by providing empirical evidence on the asymmetric responses of healthcare spending to income variations in a developing country context, highlighting the importance of economic conditions in shaping health expenditure patterns. This is particularly relevant given the current global economic uncertainties and their implications for healthcare financing and access.

2. LITERATURE REVIEW

Although the debate on the relationship between income and health expenditure is extensive in the theoretical and empirical literature, most of the studies examine the linear relationship between the two, and though there has been an ongoing debate on whether healthcare is a necessity or luxury good, mostly find empirical evidence supporting the hypothesis that the effect of income on healthcare spending is positive. Some of the studies that can be considered in this context are summarized in Table 1 below.

Table 1. Literature Summary

Study (Year)	Country/Region	Period	Method	Results
Moore et al. (1992)	24 OECD countries	1972-1987	OLS	Healthcare is a luxury good.
Baltagi et al. (2017)	167 countries	1995-2012	Panel ARDL (MG and CCEMG Estimators)	At the global level, health care is a necessity rather than a luxury. The degree of income elasticity varies based on where countries stand in the global income hierarchy, with lower-income nations exhibiting greater elasticity.
Acemoglu et al. (2013)	US	1970-1990	OLS and IV Estimation	An increase in income is unlikely to be a significant factor behind the growing share of GDP allocated to healthcare expenditure.
Moscone & Tosetti (2010)	49 US states	1980-2004	Panel ARDL (FE, CCEMG, CCEP Estimators)	Healthcare is an essential need, not a luxury.
Parker & Wong (1997)	Mexico	1989	Probit and 2sls	Healthcare expenses in Mexican households vary based on shifts in household income, and the segment most responsive to income fluctuations is the uninsured population with lower incomes.
Caporale et al. (2018)	50 US states	1966-2009	OLS and Fractional Cointegration Techniques	In the short term, healthcare is a necessity, but in the long term, it can be considered a luxury.
Kim et al. (2017)	28 countries	2011	Multilevel Logit	Individuals with lower incomes are more prone to skip necessary medical treatment
Chen & Escarce (2914)	US	1996-1998	OLS	High-income Americans utilize more healthcare services than those with lower incomes, regardless of their actual medical requirements.
Rana et al. (2020)	161 countries	1995-2014	CCEMG	Healthcare is a necessity for all income levels.
Farag et al. (2012)	173 countries	1995-2006	OLS and FE	Healthcare is a necessity, and in low-income countries, changes in income have the smallest impact on healthcare spending.
Zare et al. (2013)	30 Iranian provinces	1984-2008	OLS	While the findings indicate that healthcare is a necessity across all income groups, the income elasticity is least pronounced among the poorest residents of both urban and rural areas in Iran.

Dubey (2020)	India	2014-2018	Quantile Regression	In all instances, healthcare is a necessary commodity, and its income elasticity decreases notably over time. The lowest income group exhibits a higher income elasticity compared to other income brackets for all types of healthcare spending in rural areas and for outpatient and non-medical expenses in urban areas.
Baltagi & Moscone (2010)	20OECD Countries	1971-2004	FE, Spatial MLE, and CCEP	Healthcare is a necessity.
Freeman (2003)	51 US states	1966-1998	DOLS	Healthcare expenditure, even at the aggregate level, is a necessity good.
Musgrove et al. (2002)	191 WHO member states	1997	OLS	National health spending rises from around 2-3% of GDP at low incomes to 8-9% at high incomes.
Bilgel & Tran (2013)	10 Canada provinces	1975-2002	GIV and GMM	Healthcare is far from being a luxury.

Assessing the true effect of income on healthcare spending is of obvious importance due to the fact that this task has significant policy implications. Even though that is the case, few studies have focused on a potential asymmetric relationship between income and health expenditure. However, mentioning a few recent studies in this context would be suitable.

Barati and Fariditavana (2020), unlike previous literature, investigate income – healthcare expenditure nexus in the USA, considering asymmetric interaction between the two. Specifically, they estimate the income elasticity of healthcare expenditure for each type of service by decomposing aggregate healthcare expenditure into twelve different types of services (Hospital care, home health care, residential and personal care, dental services, physicians and clinical services, prescription drugs, other professional services, administration and net cost of health insurance, nursing care facilities and continuing care retirement communities, durable and non-durable medical equipment, public health activity). For this purpose, they employ the linear and nonlinear ARDL approaches developed by Pesaran et al. (2001) and Shin et al. (2014), respectively. The empirical evidence obtained from the linear model provides a significant positive elasticity (below unity) for aggregate expenditure. However, the findings suggest that the magnitude of elasticity differs among various categories of healthcare services. Income elasticity is less than one for some health services, while other expenditures tend to grow faster than the GDP. In addition, income does not seem to have a significant effect on the expenditures for many health services. On the other hand, estimates from the nonlinear model indicate that the effect of income variation on healthcare spending is asymmetric for the aggregate and most of the associated health services. In other words, higher income leads to higher healthcare expenditure, but a lower income level does not necessarily result in an equal decline in expenditures.

Wu et al. (2014) examine the relationship between health expenditure and its determinants in 16 OECD countries over the period 1975-2009, focusing on the nonlinear dynamics of healthcare expenditure. To do so, they estimate panel smooth transition regression (PSTR) models. To explain

the heterogeneity between the variables in time and by country and control for the factors associated with health spending, the study considers the lagged ratio of public expenditures on health as the transition variable. The empirical evidence implies a nonlinear association between health spending and its determinants; this relationship varies with time and across countries. Specifically, the results suggest that the time (trend) variable, a proxy for technical progress in health care has a nonlinear effect on health expenditure and ignoring the other variables results in overestimating the income elasticity of health expenditure. In addition, healthcare expenditure appears to be an essential requirement, and the income elasticity increases as the lagged ratio of public health spending over five periods grows. Moreover, income elasticities are weakened once the age structure variables are included in the model as explanatory variables and the ratios of public health spending exhibit a nonlinear Granger-causal relationship with fluctuations in healthcare expenditure.

Within the context of Türkiye, a limited number of studies have been conducted to investigate the impact of income on healthcare expenditure. For instance, Kilci (2022) examines the effect of economic performance on per capita health expenditure in Türkiye over the period 1999-2018. Employing Residual Augmented Least Squares (RALS) Engle-Granger and traditional Engle-Granger cointegration tests, the study confirms the presence of a long-run effect of economic growth on healthcare spending per capita over the specified time period. Similarly, Ilgun et al. (2023) investigates the effects of income, inflation, and the Health Transformation Program on the total health expenditure per capita in Türkiye for the period 1985-2016. The findings from the ARDL analysis indicates that per capita health expenditure increases as income does. In micro context, Ozer (2023) examines the socio-economic determinants of out-of-pocket healthcare spending in Türkiye. Using data from three waves (2006, 2010, and 2016) of Life in Transition Survey (LITS) and employing OLS and logistic regressions, he finds that income growth increases out-of-pocket healthcare expenditures.

Clearly apparent, while a few studies have explored this relationship in the Turkish context, they predominantly focus on a linear framework. Our research addresses a notable gap in the existing literature regarding the relationship between income and healthcare expenditure in the Turkish context. Importantly, our study distinctively categorizes healthcare expenditure into total, government/compulsory, and voluntary/out-of-pocket spending. Furthermore, our study distinguishes itself by not only contributing to this limited pool of research but also by challenging the conventional linear perspective. We employ ARDL and NARDL methodologies to uncover the asymmetric effects, thereby providing a deeper understanding of this relationship in Türkiye. This approach not only enriches the existing literature but also offers valuable insights for policy formulation in an emerging economy.

To sum up, it is clear from the literature that the nature of the relationship between income and health expenditure and to what extent income can affect health spending is still an open question.

Therefore, the efforts are worthwhile to identify the true relationship between income and health spending as this task would have significant health policy implications.

3. DATA AND METHODOLOGY

This study attempts to reveal the dynamic relationships between income and health expenditure in Türkiye over 1988-2020. For this purpose, we adopt the following multivariate model in which the age structure of the population and risk factors for lifestyle-related diseases are employed as control variables:

$$h_t = \alpha + \beta_1 y_t + \beta_2 65_t + \beta_3 r1_t + \beta_4 r2_t + \varepsilon_t$$

where h_t represents the health expenditure per capita; y_t denotes income per capita; r_t represents the risk factors for lifestyle-related diseases; 65_t represents the proportion of the population aged 65 years and older; and ε_t is an i.i.d. stochastic error term. The subscript t denotes the time period, 1970-2018. All the variables are in their natural logarithmic form. The summary information regarding the variables subject to the empirical analysis is provided in Table 2, while Table 3 presents the descriptive statistics for the variables used in the analysis.

Table 2. Summary of the Variables

Target Variable	Proxy Variable	Symbol	Description	Source
Health Expenditure	(Total) Health Spending	$h1$	(Total) health expenditure, per capita, current prices, current PPPs (US dollar)	OECD Data
	(Government/ compulsory) Health Spending	$h2$	Healthcare financed through government spending and compulsory health insurance (per capita, current prices, current PPPs (US dollar))	OECD Data
	(Voluntary/ out-of-pocket) Health Spending	$h3$	Healthcare financed through voluntary health insurance and private funds such as households' out-of-pocket payments, NGOs, and private corporations (per capita, current prices, current PPPs (US dollar))	OECD Data
Income	GDP per capita	y	GDP per capita, current prices, current PPPs (US dollar)	OECD Data
Age Structure	Population ages 65 and above	65	Population ages 65 and above (% of total population)	OECD Data
Risk Factors for Lifestyle-Related Diseases	Tobacco Consumption	$r1$	Annual consumption of tobacco items (e.g., cigarettes, cigars) in grams per person aged 15 years old or more.	OECD Data
	Alcohol Consumption	$r2$	Annual consumption of pure alcohol in liters per person aged 15 or older	OECD Data

Table 3. Descriptive Statistics

Variables	Mean	St. Dev.	Min.	Max.	Skewness	Kurtosis
h_1	613.93	381.91	119.79	1304.71	0.25	1.72
h_2	456.64	310.45	59.09	1028.70	0.33	1.71
h_3	157.29	75.65	52.08	276.01	-0.06	1.68
y	15164.92	7400.35	7260.90	28680.09	0.75	2.03
65	6.36	1.46	4.2	9.1	0.04	1.84
r_1	1475.29	275.62	1021	1901.4	-0.35	1.72
r_2	1.45	0.13	1.2	1.7	-0.11	2.33
lnh_1	6.18	0.77	4.79	7.17	-0.40	1.74
lnh_2	5.82	0.86	4.08	6.94	-0.42	1.89
lnh_3	4.92	0.58	3.95	5.62	-0.49	1.65
lny	9.52	0.46	8.89	10.26	0.42	1.69
ln65	1.82	0.24	1.44	2.21	-0.23	1.75
lnr_1	7.28	0.20	6.93	7.55	-0.51	1.76
lnr_2	0.37	0.09	0.18	0.53	-0.28	2.44

Source: Author's Calculations

To begin with, to determine both the short-run and the cointegrating (long-run) relationship between the variables, the ARDL specification of the model can be conducted as follows:

$$\Delta h_t = \alpha + \beta_1 h_{t-1} + \beta_2 y_{t-1} + \beta_3 65_{t-1} + \beta_4 r_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta h_{t-i} + \sum_{i=0}^{p} \delta_i \Delta y_{t-i} + \sum_{i=0}^{p} \theta_i \Delta 65_{t-i} + \sum_{i=0}^{p} \varphi_i \Delta r_{t-i} + \mu_t$$

where β_1 - β_4 are the long run and δ, θ, and φ are the short run parameters. The null hypothesis of no cointegration ($\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$), following Paseran et al. (2001), can be tested simply using a standard F-test. If a cointegrating relationship exists among the variables, Eq. 2 is then estimated based on the Akaike information criterion (AIC) or the Schwarz information criterion (SIC). The short-run coefficients and error correction term (ECT), on the other hand, are estimated using an error correction model (ECM), which can be specified as follows:

$$\Delta h_t = c + \sum_{i=1}^{p} c_{1i} \Delta h_{t-i} + \sum_{i=0}^{p} c_{2i} \Delta y_{t-i} + \sum_{i=0}^{p} c_{3i} \Delta 65_{t-i} + \sum_{i=0}^{p} c_{4i} \Delta r_{t-i} + \vartheta ECT_{t-1} + e_t$$

where ECT_{t-1} is the one-lagged value of the residuals obtained from the cointegration model, and ϑ is the speed of adjustment, showing how much of a short-term shock would disappear in the long run.

However, as mentioned earlier, we are primarily interested in the possibility that the effect of income on health expenditure is asymmetric. Since the ARDL model is based on the assumption that the relationship between the variables is linear, it is insufficient for our analysis if the relationship between the variables is asymmetrical. Fortunately, the nonlinear ARDL (NARDL) method developed

by Shin et al. (2014) estimates the relationship between the related variables in a nonlinear fashion, allowing to decompose the movement of the relevant variable into its positive and negative partial sums. In our context, this corresponds to:

$$y_t = y_0 + y_t^+ + y_t^-$$

where $y_t^+ = \sum_{i=1}^{t} \Delta y_i^+ = \sum_{i}^{t} \max(\Delta y_i^+, 0)$ ve $y_t^- = \sum_{i=1}^{t} \Delta y_i^- = \sum_{i}^{t} \min(\Delta y_i^-, 0)$

Thus, the final NARDL model, which is known as the asymmetric error correction model can be derived as follows (Shin et al., 2014):

$$\Delta h_t = \alpha + \beta_1 h_{t-1} + \beta_2 65_{t-1} + \beta_3 r_{t-1} + \beta^+ y_{t-1}^+ + \beta^- y_{t-1}^- + \sum_{i=1}^{p} \gamma_i \Delta h_{t-i} + \sum_{i=0}^{p} \theta_i \Delta 65_{t-i} + \sum_{i=0}^{p} \varphi_i \Delta r_{t-i} + \sum_{i=0}^{p} \pi_i^+ \Delta y_{t-i}^+ + \sum_{i=0}^{p} \pi_i^- \Delta y_{t-i}^- + \mu_t$$

where the long-run effect of positive and negative changes in income on health expenditure is captured by β^+ and β^-, respectively, whereas the short-run effects are given by $\sum_{i=0}^{p} \pi_i^+$ and $\sum_{i=0}^{p} \pi_i^-$, respectively.

4. EMPIRICAL FINDINGS

The ARDL bounds testing approach to cointegration allows using variables with different degrees of integration in the relevant model. However, it is based on the assumption that the variables under examination are either stationary (I(0)) or integrated of order 1 (I(1)).Thus, in order to eliminate the possibility of spurious regression, it is first necessary to test whether the variables in the model have a higher degree of integration. Hence, this section commences by conducting the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests to confirm that none of the variables possess I(2) characteristics, thus mitigating the risk of spurious regression. The results of these tests can be found in Table 3 and the findings confirm that none of the variables are I(2).

Table 3. ADF and PP Unit Root Tests

	ADF		PP	
Variable	**Constant**	**Constant/Trend**	**Constant**	**Constant/Trend**
$h1_t$	-0.537(0)	-2.014(0)	-0.526(2)	-2.120(3)
$\Delta h1_t$	-7.562(0)***	-7.484(0)***	-7.525(2)***	-7.450(2)***
$h2_t$	-1.345(0)	-2.159(0)	-2.392(15)	-1.877(17)
$\Delta h2_t$	-9.746(0)***	-9.825(0)***	-9.994(11)***	-21.499(40)***
$h3_t$	-0.609(0)	-2.626(0)	-0.609(0)	-2.656(1)
$\Delta h3_t$	-6.812(0)***	-6.749(0)***	-6.858(2)***	-6.797(2)***
y_t	-0.886(0)	-1.833(0)	-0.873(2)	-2.009(3)
Δy_t	-5.517(0)***	-5.485(0)***	-5.521(1)***	-5.492(1)***

$r1_t$	-1.539(0)	-1.525(0)	-1.564(2)	-1.485(1)
$\Delta r1_t$	-6.880(0)***	-6.916(0)***	-6.878(1)***	-6.916(0)***
$r2_t$	-4.162(0)***	-4.377(0)***	-4.178(1)***	-4.380(2)***
$\Delta r2_t$	-6.936(0)***	-6.876(0)***	-10.424(15)***	-10.126(14)***
65_t	1.027(0)	-2.634(0)	0.927(1)	-2.621(5)
$\Delta 65_t$	-5.344(0)***	-5.751(0)***	-5.352(1)***	-5.736(2)***

Note: ***, **,* Statistical significance at the 1%, 5%, and 10% levels, respectively.

In Table 4, we present the results of the bounds test, and it is notable that we observe no evidence of cointegration in the linear models, while the long-run relation exists when the nonlinear forms are specified for each case. In other words, we can evaluate the healthcare spending dynamics and its relation to other variables. Therefore, it can be argued that any wrong specification may result in a misleading conclusion concerning the cointegration between the specified variables.

Table 4. Bounds Test Results

Model	Optimal Lagged Length	F-stat
F($h1_t$/ y_t,$r1_t$, $r2_t$,65_t)	(2, 0, 0, 0, 0)	2.295
F($h2_t$/ y_t,$r1_t$, $r2_t$,65_t)	(2, 0, 2, 2, 1)	3.255
F($h3_t$/ y_t,$r1_t$, $r2_t$,65_t)	(1, 2, 0, 2, 0)	2.352
F($h1_t$/ y_t^+,y_t^-, $r1_t$, $r2_t$,65_t)	(1, 1, 1, 1, 1, 0)	6.962***
F($h2_t$/y_t^+,y_t^-, $r1_t$, $r2_t$,65_t)	(1, 2, 0, 2, 2, 2)	14.360***
F($h3_t$/ y_t^+,y_t^-, $r1_t$, $r2_t$,65_t)	(2, 0, 1, 0, 1, 0)	10.019***
	Critical Values	
Significance Level	**Lower Bound**	**Upper Bound**
%1	4.394 (4.030[a])	5.914 (5.598[a])
%5	3.178 (2.922[a])	4.450 (4.268[a])
%10	2.638 (2.458[a])	3.772 (3.647[a])

Note: The optimal lagged length is determined using the Akaike Information Criterion (AIC). *** indicates the existence of cointegration with a significance level of %1. Given the small sample size, the critical values are from Narayan (2005) Case III. [a] denotes the critical values for the asymmetric model.

Now that we have confirmed a statistically significant cointegration relationship among the variables, we can move forward to analyze both short-term and long-term dynamics. The results for each type of health expenditure are provided in Tables 5-7.

Table 5. ARLD and NARDL Results (Total Health Expenditure)

Part I: Linear ARDL						
	0	1	2	3	4	5
Column A: Short-run Estimates						
Ln (h1)		0.509***	0.283			
		(0.181)	(0.185)			
Ln (y)	0.095					
	(0.071)					
Ln (r1)	0.263***					
	(0.081)					
Ln (r2)	-0.020					
	(0.185)					
Ln (65)	0.501					
	(0.313)					
Column B: Long-run Estimates						
Intercept	Ln (y)	Ln (r1)	Ln (r2)	Ln (65)	ECM (t-1)	
-1.093	0.456	1.264**	-0.098	2.409***	-0.208***	
(0.758)	(0.276)	(0.549)	(0.903)	(0.793)	(0.058)	
Column C: Diagnostics						
F test	LM Test	RESET	R2	CUSUM(CUSUMSQ)		
2.295	1.061	0.086	0.992	S(U)		
	(0.588)	(0.771)				
Part II: Nonlinear ARDL						
	0	1	2	3	4	5
Column A: Short-run Estimates						
Ln (h1)		0.211				
		(0.133)				
POS	1.035***	-0.548*				
	(0.312)	(0.301)				
NEG	-0.693*	-0.422				
	(0.363)	(0.378)				
Ln (r1)	0.053	0.314**				
	(0.123)	(0.132)				
Ln (r2)	0.134	-0.228				
	(0.142)	(0.137)				
Ln (65)	0.665***					
	(0.244)					
Column B: Long-run Estimates						
Intercept	POS	NEG	Ln (r1)	Ln (r2)	Ln (65)	ECM (t-1)
-0.199***	0.618***	-1.414***	0.465***	-0.120	0.844***	-0.789***
(0.041)	(0.062)	(0.270)	(0.083)	(0.201)	(0.280)	(0.113)
Column C: Diagnostics						
F test	LM Test	RESET	R2	CUSUM(CUSUMSQ)		
6.962	2.017	0.000	0.606	S(S)		
	(0.365)	(0.986)				
Wald-Short	Wald-Long					
9.660	19.844					
(0.004)	(0.000)					

Note: ***, **,* Statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6. ARLD and NARDL Results (Government/Compulsory Health Expenditure)

Part I: Linear ARDL						
	0	1	2	3	4	5
Column A: Short-run Estimates						
Ln (h2)		0.468***	0.376**			
		(0.149)	(0.152)			
Ln (y)	0.181					
	(0.207)					
Ln (r1)	-0.302	0.955**	-0.535*			
	(0.281)	(0.362)	(0.310)			
Ln (r2)	0.105	-0.074		-1.183***		
	(0.351)	(0.375)	(0.302)			
Ln (65)	1.016	-1.145				
	(0.787)	(0.761)				
Column B: Long-run Estimates						
Intercept	Ln (y)	Ln (r1)	Ln (r2)	Ln (65)	ECM (t-1)	
1.502	1.158	0.750	-7.374	-0.821	-0.156	
(1.544)	(0.700)	(1.121)	(8.160)	(3.223)	(0.036)	
Column C: Diagnostics						
F test	LM Test	RESET	R2	CUSUM(CUSUMSQ)		
3.255	9.440***	10.934***	0.989	S(S)		
	(0.009)	(0.003)				
Part II: Nonlinear ARDL						
	0	1	2	3	4	5
Column A: Short-run Estimates						
Ln (h2)		0.427***				
		(0.081)				
POS	1.320***	-0.140	-0.550			
	(0.360)	(0.473)	(0.330)			
NEG	-0.687**					
	(0.256)					
Ln (r1)	-0.272*	1.213***	-0.436**			
	(0.146)	(0.174)	(0.166)			
Ln (r2)	0.187	0.419**		-0.936***		
	(0.181)	(0.176)	(0.162)			
Ln (65)	0.751*	0.574		-1.260***		
	(0.426)	(0.537)	(0.413)			
Column B: Long-run Estimates						
Intercept	POS	NEG	Ln (r1)	Ln (r2)	Ln (65)	ECM (t-1)
-1.791*	1.099***	-1.200***	0.881***	-0.577	0.113	-0.573***
(1.029)	(0.126)	(0.424)	(0.150)	(0.432)	(0.530)	(0.056)
Column C: Diagnostics						
F test	LM Test	RESET	R2	CUSUM(CUSUMSQ)		
14.360	2.843	15.686	0.997	S(S)		
	(0.241)	(0.001)				
Wald-Short	Wald-Long					
14.660	15.840					
(0.001)	(0.000)					

Note: ***, **,* As described earlier.

Table 7. ARLD and NARDL Results (Voluntary/Out-of-Pocket Health Expenditure)

Part I: Linear ARDL						
	0	1	2	3	4	5
Column A: Short-run Estimates						
Ln (h3)		0.590***				
		(0.167)				
Ln (y)	0.588	-1.442***	0.838**			
	(0.388)	(0.536)	(0.387)			
Ln (r1)	0.135					
	(0.121)					
Ln (r2)	0.031	-0.385	0.586*			
	(0.327)	(0.317)	(0.310)			
Ln (65)	1.040**					
	(0.508)					
Column B: Long-run Estimates						
Intercept	Ln (y)	Ln (r1)	Ln (r2)	Ln (65)	ECM (t-1)	
-0.968	-0.038	0.329	0.567	2.538***	-0.410***	
(1.337)	(0.247)	(0.331)	(1.249)	(0.658)	(0.112)	
Column C: Diagnostics						
F test	LM Test	RESET	R2	CUSUM(CUSUMSQ)		
2.352	1.100	0.000	0.954	S(U)		
	(0.577)	(0.992)				
Part II: Nonlinear ARDL						
	0	1	2	3	4	5
Column A: Short-run Estimates						
Ln (h2)		0.162	-0.642***			
		(0.159)	(0.171)			
POS	-0.048					
	(0.081)					
NEG	-0.901	-1.837***				
	(0.563)	(0.592)				
Ln (r1)	-0.259**					
	(0.114)					
Ln (r2)	-0.035	-1.062***				
	(0.276)	(0.297)				
Ln (65)	1.687***					
	(0.440)					
Column B: Long-run Estimates						
Intercept	POS	NEG	Ln (r1)	Ln (r2)	Ln (65)	ECM (t-1)
5.904***	-0.032	-1.849***	-0.175**	-0.741***	1.140***	-1.481
(1.398)	(0.055)	(0.231)	(0.068)	(0.184)	(0.246)	(0.177)
Column C: Diagnostics						
F test	LM Test	RESET	R2	CUSUM(CUSUMSQ)		
10.019***	0.440	0.563	0.971	U(S)		
	(0.803)	(0.459)				
Wald-Short	Wald-Long					
2.558	30.643					
(0.120)	(0.000)					

Note: ***, **,* As described earlier.

The results from the analysis reveal that there exists an asymmetric relationship between income fluctuations and total health expenditure. Specifically, both increments and decrements in

income are associated with an escalation in total health expenditure, with the impact of income reductions manifesting more robustly. This observation is consistent when isolating for government or compulsory health expenditures. Additionally, it was discerned that positive income variations correlate with a decline in voluntary or out-of-pocket health expenditure, whereas negative income variations amplify such expenses. The former effect is statistically significant.

Regarding total health expenditure, an understanding that both positive and negative shifts in income lead to a rise in total health expenditure presents a complex scenario, indicating that different mechanisms might be at play for each effect. First, people with higher incomes generally have better access to healthcare. This can lead to a consumption of more, often preventive, health services which could drive up total expenditure. Higher income also often correlates with increased demand for better quality and sometimes more expensive healthcare services. Furthermore, with more disposable income, individuals might be willing to invest more in their health, considering health as a form of human capital. On the other hand, if people delay or forego essential health services during the initial phases of financial stress, it can lead to complications that are more expensive to treat later on. Moreover, if public health subsidies or insurance don't provide adequate coverage during economic downturns, households might have to allocate a larger proportion of their diminished income to health, thereby paradoxically increasing health expenditure even when income decreases.

The replication of the above pattern in government or compulsory health expenditure points towards systemic factors and policies that might be driving these trends. Elevated government revenues during prosperous economic times could lead to an expansion of public health programs or better funding of existing ones. On the other hand, governments might prioritize essential health services during economic downturns. However, if the rise in expenditure is disproportional to the decrease in income, it might suggest that more citizens are relying on public health services due to reduced personal incomes.

The case of voluntary/out-of-pocket health expenditure showcases an opposite trend compared to the total health expenditure, emphasizing the intricate relationship between income and health spending mechanisms. Individuals might opt for comprehensive health insurance policies as their income increases, reducing direct out-of-pocket expenses. Also, with a booming economy, governments might roll out incentives or subsidies, reducing the out-of-pocket expenses for individuals. However, in tougher times, individuals might either forgo insurance or opt for plans with lower premiums but higher deductibles and co-pays. This can lead to higher out-of-pocket expenses when they access healthcare services. Moreover, economic downturns might force governments to make budget cuts, and if health subsidies are affected, this could lead to an increased out-of-pocket burden on individuals.

Overall, the asymmetric relationship between income changes and health expenditure is emblematic of the multifaceted ways in which macroeconomic trends intersect with health systems and individual health behaviors. The stronger negative effect when income decreases suggests that during economic downturns, vulnerabilities in the healthcare system become more pronounced, potentially leading to challenges in healthcare access and financial burdens for individuals.

These findings underscore the importance of robust health safety nets and policies that can adapt to economic fluctuations, ensuring that the health needs of the population are met consistently, irrespective of macroeconomic trends. It might also suggest the value of policy interventions that buffer against the more severe impacts of income declines on health expenditure.

We acknowledge the challenge posed by the limited number of studies directly exploring the nuanced relationship between income levels and healthcare expenditure. However, these results, which indicate that higher income levels lead to increased healthcare expenditure, while a decrease in income does not necessarily result in a proportional reduction in healthcare spending, align with the findings of Barati and Fariditavana (2020). This similarity underscores the robustness of our findings and contributes to a growing body of evidence suggesting a nonlinear relationship between income and healthcare expenditure."

5. CONCLUSION

This study investigates the relationship between income and health expenditure in Türkiye from 1988 to 2020, using ARDL and NARDL methodologies. An important finding of the study is the asymmetric pass-through of changes in income to the total healthcare expenditure. Changes in income levels have heterogeneous impacts on health expenditure, with the direction of these impacts contingent upon whether income is increasing or decreasing. The results indicate that both income increases and decreases result in an increase in total health expenditure. Nevertheless, the effect of reduced income on healthcare spending is stronger. Put simply, individuals tend to dedicate a greater proportion of their diminished financial resources towards healthcare costs when their income decreases. This underscores the considerable economic burden that decreases in income can impose on individuals and households in terms of healthcare expenses. The phenomenon of asymmetric effects also applies to government or mandatory health expenditures. During periods of economic recession, the government's responsibility for financing healthcare costs becomes more significant, as individuals increasingly depend on public healthcare services. Moreover, the study sheds light on the intriguing relationship between income shifts and voluntary or out-of-pocket health expenses. Positive changes in income are linked to a decrease in voluntary spending on healthcare. This implies that as individuals experience an enhancement in their economic circumstances, they might choose healthcare services that are less expensive or more effective, resulting in a reduction in personal expenditures. In contrast, in situations where income levels decline, individuals may face restricted choices and may be

compelled to turn to costlier private healthcare services or assume a larger share of out-of-pocket expenses. This discovery highlights the susceptibility to financial instability that can occur as a result of negative changes in income.

Türkiye's recent history has been characterized by a push towards modernization and integration with global markets. The country has seen fluctuations in economic growth, periods of political stability and unrest, and a significant drive toward reforms in various sectors, especially health. The positive relationship between both increased and decreased income with health expenditure highlights that Türkiye's health expenditure is highly sensitive to economic fluctuations. This could mean that during prosperous times, the government and individuals invest more in health. However, during downturns, there might be a surge in demand for health services, perhaps due to stress-related illnesses or deferred healthcare needs coming to the fore. If health expenditure is rising irrespective of economic conditions, it may suggest continuous investments in infrastructure, human resources, and capacity-building in the health sector.

The government's health expenditure mirroring total health expenditure suggests a proactive role played by the Turkish government in ensuring health service accessibility. This is aligned with Türkiye's push for universal health coverage. The stronger increase in health expenditure during income downturns might indicate potential strains on the public health budget during economic recessions. Policymakers need to ensure fiscal sustainability while maintaining health service quality and access.

The decrease in out-of-pocket expenditure with increased income might suggest better insurance coverage, possibly because more people can afford private health insurance or there is better utilization of public health insurance. The increase in out-of-pocket expenses during downturns is worrisome. During economic challenges, people might be exposed to catastrophic health expenditures, which can further impoverish families.

As deduced from our results, the asymmetric relationship between income fluctuations and health expenditure provides important insights for policymakers. First, it should be considered setting up health sector-specific stabilization funds during periods of economic growth. These funds can be used to counterbalance increased health expenditures during downturns, ensuring sustainability. To mitigate the impact of out-of-pocket expenditures, the government should further strive for universal health coverage, ensuring that even the most vulnerable populations have access to essential health services without financial hardships. Furthermore, the economic sensitivity of health expenditure must be regularly monitored and evaluated. Understanding the precise factors driving expenditure changes can help in formulating targeted policy interventions. Given the intertwined nature of economic fluctuations and health expenditure, there is a need for integrated health-economic policies that consider the broader economic context while shaping health strategies. Furthermore, during economic

downturns, people might not be aware of the full range of services covered by the public health system. Awareness campaigns can guide them towards cost-effective, state-covered services, reducing out-of-pocket expenditures. Collaboration with private sector stakeholders, NGOs, and international organizations is also critical. These collaborations can bring in additional resources, expertise, and innovative solutions to address health expenditure challenges. Moreover, it must be ensured that there are safety nets for vulnerable groups, such as the elderly, children, and the unemployed, especially during economic downturns. This can include targeted subsidies, free health check-ups, or expanded insurance coverage.

In essence, while Türkiye's commitment to healthcare is evident, the country's health expenditure's sensitivity to economic fluctuations underscores the need for resilient, adaptable, and forward-thinking health policies. By preemptively addressing potential vulnerabilities and harnessing opportunities during periods of economic growth, Türkiye can ensure a sustainable and accessible health system for all its citizens.

Our study uses macro-level data from Türkiye, which, while providing valuable insights, may not capture micro-level variations and individual behaviors. Furthermore, the ARDL and NARDL models employed are robust for our analysis purpose, yet they have inherent limitations in capturing some nonlinear relationships and interactions between variables. While our model includes key control variables like tobacco and alcohol consumption, the exclusion of other potential lifestyle-related variables could limit the breadth of our findings. Lastly, our findings are specific to the Turkish context and may not be directly applicable to other countries with different economic and healthcare systems.

Based on the limitations of this study, future research could employ micro-level data, including individual and household surveys, to validate and extend our findings. Moreover, investigating the relationship using different econometric models or machine learning approaches could provide additional insights. Incorporating a wider range of control variables, especially those reflecting broader socio-economic factors, could also enhance the understanding of the dynamics at play. Lastly, comparative studies involving multiple countries could help understand how income influences healthcare expenditure in various socio-economic and healthcare contexts.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The author declares that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article.

The entire work of the study was carried out by its only, stated author.

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