

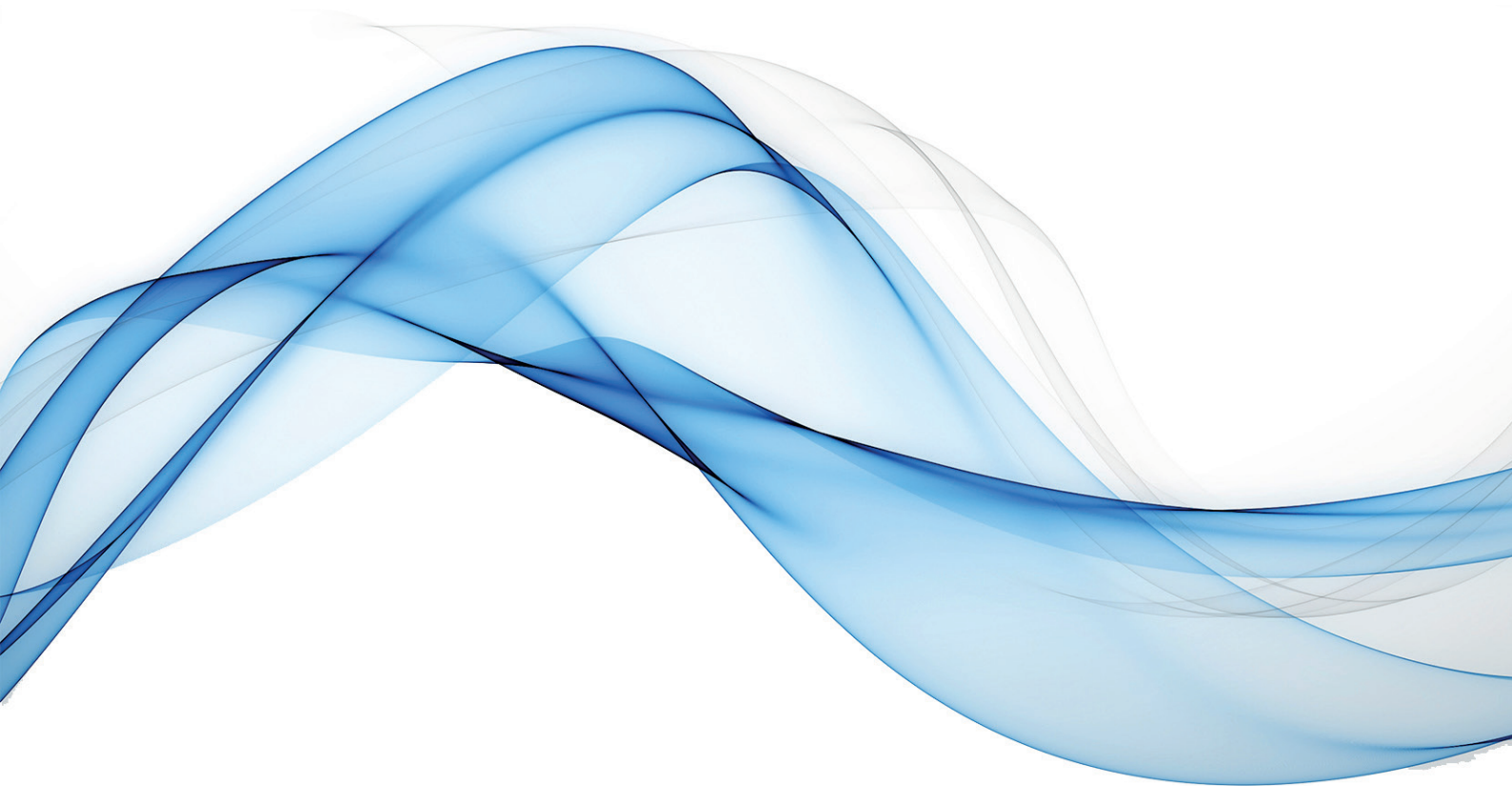


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ABOUT THE JOURNAL

The Journal of Applied Microeconometrics (JAME) is an internationally peer reviewed and periodical open access e-journal covering any issues in theoretical and applied microeconometrics. The journal also covers quantitative research in microeconomics. The main topics subject areas of the journal are as follows:

- Estimation and Testing
- Robust Regression
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JAME aims to serve as a platform for high quality research in applied microeconometrics. The scope of the Journal includes any papers dealing with identification, modelling, estimation, testing and prediction issues encountered in the analysis of individual-level data on the economic behavior of individuals or firms using regression methods for microeconomic data i.e. cross sectional data, repeated cross-sectional data, pool data, cohort and panel data etc. The journal also accepts case study articles written for both developing and developed countries.

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CONTENTS

	BOOK REVIEW	
Applied Microeconometrics with Health Data		37
	Selahattin Güriş	
	RESEARCH ARTICLE	
Are household members in Türkiye happy or not?: The generalized ordered logit model		41
	Bensu Timur Erden	
	RESEARCH ARTICLE	
Suicide trends in Türkiye by gender and suicide methods (2003-2022): A joinpoint regression analysis		53
	Nefise Ladikli & İtir Tarı Cömert	

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Applied Microeconometrics with Health Data

Selahattin Güriş¹ 

¹ Prof. Dr., Marmara University, Faculty of Economics, Department of Econometrics, Türkiye, email: sguris@marmara.edu.tr

Book title: Applied Microeconometrics with Health Data

Book editors: Prof. Dr. Ebru Çağlayan Akay and Assoc. Prof. Dr. Özge Korkmaz

Publication date of the book: 2021

Number of pages: 492

Publisher: Der Publications, İstanbul/TÜRKİYE

In this book review, I would like to introduce the book titled “Applied Microeconometrics with Health Data”.

As this book is an econometrics book, first of all, it would be more suitable to discuss and provide information about econometrics. Econometrics is one of the branches of economics. Therefore, the methods used specifically in the analysis of any topics regarding economics are covered by econometrics. Nevertheless, econometric methods could be utilized in many branches of science including Health Sciences. As a result, we might assert that econometrics could be used in the economic analysis of events encountered in different branches of science. Besides, in order to analyze specific subjects of various branches of science, econometric methods could be employed.

Various methods collected under the name of microeconometrics in the literature are used in special cases that would result from the characteristics of the science to be considered. Microeconometrics could be categorized as different methods in the econometrics literature. A special field of microeconometrics known as “Health Econometrics” employs health data that need to be analyzed via the methods in the econometrics literature, which is the subject of this book titled “Applied Microeconometrics with Health Data”.

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The book is written for those individuals (researchers, students or other people) who would like to conduct econometric analyzes with the use of health data. In the book, microeconometrics topics in Health Econometrics are explained with a clear and simple language. The chapters are structured at a level that would benefit anyone who are interested in the application of microeconometrics with health data. The book would not only be informative and useful to people who are interested in econometrics, but also to anyone who are specifically interested in health sciences.

These days, once econometric analysis is considered, it is taken into account together with computer package programs. For this particular reason, the Stata package program is utilized to facilitate the work of researchers in the book. Thus, while making applications easier, researchers would not require any search for package programs and their studies would be completed in a shorter time. The book is a resource that supports both implementation, reporting and interpretation of econometric results.

The book consists of twelve chapters arranged in accordance with the development stages of the research. Each of the chapters has a basic structure in which the theory of the method, predictions and tests, and the use of Stata program commands related to the topics covered are explained. The chapters commence with the discussion of health econometrics and health data. Then, the data arrangement in the statistical literature is described. This section is especially important for those who would like to conduct research in fields other than any science related to the analysis of data such as statistics and econometrics. The explanations then continue with the microeconometrics chapters after explaining the linear and nonlinear models that form the basis of the basic microeconometrics chapters. In the general framework of the book, the order of the chapters are as follows: Health Econometrics and Health Data, Data Editing, Tables and Graphs, Linear Regression Models, Generalized Linear Models, Non-Linear Models, Conditional and Unconditional Quantile Regression, Binary Preference Models, Multinomial Logit and Probit Models, Ordered Logit and Probit Models, Counting Data Models, Duration Models, Panel Regression Models.

The book is edited by Ebru Çağlayan Akay and Özge Korkmaz. The total number of authors in the book is twelve and all are academics. In addition, the editors are also chapter authors. I know most of the authors well along with their academic works, as they are all successful, ethical and disciplined academics. The authors, in order of title, without specifying the title, are Ebru Çağlayan Akay, Sibel Selim, Ferda Yerdelen Tatoğlu, Filiz Çakır Zeytinoğlu, Nebile Korucu Gümüšoğlu, Özge Korkmaz, Hatice Hicret Özkoç, Sinem Güler Kangallı Uyar, Melek Astar, Özlem Gökteş, Merve Ertok Onurlu and Nazan Şak.

I would like to congratulate my academic colleagues who contributed, especially the editors. I am looking forward to their continued successful work. Thank you for your efforts. There are English written microeconometrics books in the literature (i.e. Blundell 1992; Cameron and Trivedi 2005; 2010; Lee 2005). However, there had been an extensive gap for a Turkish written microeconometrics book for long times. Therefore, as the book fills a big gap in the Turkish literature of microeconometrics, I recommend the book to anyone seeking information on this specific subject.

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Submission Declaration Statement: I confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

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Are household members in Türkiye happy or not?: The generalized ordered logit model

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Abstract

The goal of individuals is to achieve happiness and live a happy life in general. However, there are many economic and socio-demographic factors that affect their happiness. This paper examines the happiness of household members from the perspective of socio-demographic and economic factors via 2009 and 2015 Turkish Statistical Institute's (TURKSTAT) Life Satisfaction Survey data. The econometric method employed is the generalized ordered logit model. The findings suggest that economic factors have a significant impact on individuals' happiness. For household members, while getting a job, owning a car, and saving money increase the happiness of individuals, being in debt, being married or single, and paying debts decrease happiness. These results are aimed to contribute to policy makers' practices in order to increase the happiness of individuals in the country.

Keywords: Happiness Economics, Economics, Household, Life Satisfaction, Generalized Ordered Logit Model,

JEL Codes: I31, G51, D63, D1

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1. INTRODUCTION

The economics of happiness has entered the field of interest of economists in recent years. While psychologists in the literature examine the economics of happiness using well-being surveys, various new methods are developed by economists to this field. Economists have examined the concept of happiness by relating it to income in their studies. This situation might cause individuals to miss the basic elements that ensure their happiness. Individuals may prefer a personally rewarding but low-paying job over a well-paid job in the classical Walrasian sense. (Graham 2005: 41-42).

The concept of utility has entered the economic literature as a concept close to happiness. Although the two concepts are separated from each other, in recent years, the concept of benefit has begun to be included in happiness studies (Lane 2017: 62). Happiness economics is based on the concepts of utility and welfare, which also include the utility functions of factors that are effective in determining economic behavior. Richard Easterlin, who first examined the concept of happiness economy in 1974, defined the interaction between income and happiness with the Easterlin Paradox in his study titled "Does Economic Growth Improve Human Fortune? Some Empirical Evidence". Easterlin examined the interaction between happiness and income in three ways: differences between countries' happiness levels and gross domestic product; differences between income groups and happiness levels; and differences between income and happiness within countries in different time periods (Easterlin 1974: 100-111). Determining the economic and social factors that affect the happiness of individuals and measuring the direction of influence and economic values of these factors are also considered within the concept of happiness economics.

According to Perio (2006), research conducted in economics does not have sufficient knowledge of the concept of happiness and has not been given as much importance. As happiness begins to be measurable, over time happiness researchers have become interested in this subject. Nevertheless, there are different opinions about the methods used in measurement and this issue might lead to controversy. Especially in economic science, the fact that objective measurement methods are at the forefront has caused the findings to be obtained from these methods to be questioned (Veenhoven and Dumludağ 2015: 206). Laboratory experiments and field studies are the preferred methods to measure happiness. Additionally, phone software has been developed to facilitate happiness data analysis (Rutledge et.al. 2014: 12252). In Easterlin's paper, the happiness question is "In general, how happy would you say you are? Very happy, fairly happy, not very happy" (Easterlin 1974: 89-125). The happiness data of the countries are collected from General Social Studies (General Social Survey, GSS), Eurobarometer Survey (Eurobarometer Survey), and Russian Panel Observation Study (The Russian Longitudinal Monitoring Survey) and the happiness levels of countries are measured. In surveys, to measure the happiness levels of countries, individuals are asked a question scored from 1 to 4 or 1 to 10 about their happiness in life. A score from 1 to 10 is generally used, with 1 being very dissatisfied and 10 being very satisfied (Veenhoven and Dumludağ 2015: 206).

The aim of this paper is to examine the economic and socio-demographic factors affecting the happiness of Turkish households using the Life Satisfaction Survey data from 2009 and 2015. While examining these factors in this study, Life Satisfaction Surveys from 2009 and 2015 were used, and both years were combined and included in the model as a year variable. Recent years were not included in the analysis because the economic difficulties experienced in Türkiye, especially in 2015 and after, affected every individual greatly, the concept of happiness was mostly linked to the economic situation, and the importance of other factors decreased. In studies conducted with cross-sectional data, the causal relationship between variables might only provide information about that period and not about the general situation. Therefore, two different years were considered, and the causal relationships between the variables were compared. Happiness level was categorized as the dependent variable, and independent variables were categorized as socio-demographic and economic. The happiness economics literature was examined, and it was seen that in some of the studies, the ordered logit model was generally used, but the parallel regression assumption was violated. In this study, estimation is proceeded with the generalized ordered logit model, which does not require the parallel regression assumption. This model is more advantageous such that it provides detailed information about each category of the dependent variable and is a less restricted model compared to the ordered logit model (Akay and Timur 2017). Due to these advantages, it is expected that the use of this model in happiness studies would become widespread.

The first part of the article provides an introduction. The literature on happiness economics studies is mentioned in Section 2. Section 3 gives information about the data and the generalized ordered logit model. The findings and conclusion are reported in Sections 4 and 5, respectively.

2. LITERATURE

The concepts of life satisfaction and happiness have been examined by social scientists since the 1940s through survey studies, the most common of which are the “General Social Survey” in the USA and the “Euro-barometer” survey in the European Union.

The Easterlin paradox by Richard Easterlin, who introduced the concept of happiness to literature, suggested that governments should focus on gross happiness products. Because after the point where basic needs are met, governments’ focus on gross domestic product would not increase the happiness of individuals. Following Easterlin’s study, many studies have been conducted in the literature on the economics of happiness. The previous literature examining happiness economics is summarized in Table 1.

Table 1. Happiness Economics Literature

Authors	Data	Results
Easterlin (1974)	AIPO (American Institute of Public Opinion) 1946-1970. 19 Countries from Asia, Africa and Latin America (England, USA, India, Dominican Republic, Thailand, Japan, Philippines, Malaysia, France, Italy, Cuba, Egypt, Israel, Yugoslavia, Panama, Nigeria, Brazil, Poland, West Germany)	Income increases do not affect happiness after a specific point.
Veenhoven (1994)	India, Greece, Belarus, Portugal, South Korea, Italy, Philippines, Hungary, Spain, Japan, West Germany, Switzerland, South Africa, Luxembourg, Singapore Brazil, France, Finland, Norway, USA, Belgium, Sweden, Netherlands, Denmark, N. (South), England, Australia, Canada, Ireland, Iceland, Mexico	Increasing income does not increase happiness at the same rate.
Winkelmann and Winkelmann (1998)	GSOEP (German Socio-Economic Panel Study) Germany data from 1984-1989	Unemployment negatively affects life satisfaction.
Carbonell (2005)	GSOEP Germany Data	Increasing income does not increase the happiness of the rich. Low incomes of poor people cause unhappiness.
Boes and Winkelmann (2006)	GSOEP Germany Data from 1992 and 1997	Happiness buys money.
Peiro (2006)	World Values Survey (1995-1996)	Single (-), Married (+), Age (+), Income (+), Unemployment (-)

Şeker (2009)	Life Satisfaction Survey Türkiye data from 2003-2007	TURKSTAT's Life Satisfaction Survey data is presented with explanations, and it is stated in the study that there is insufficient research on happiness.
Bülbül ve Giray (2012)	Life Satisfaction Survey Türkiye data 2008	There is a stronger relationship between married people's private life satisfaction and work life. Income (+), Education (+)
Atay (2012)	World Values Survey (1994-1999) Türkiye (1996), Bulgaria (1997), Czech Republic (1998), Hungary (1998), Poland (1997), Romania (1998), Slovakia (1998), Slovenia (1995).	Age (-), Woman (+), Economic Freedom Index (+), Religious (+), Married (+), Unemployment (-), Urban (+), Education (+), HDI (+)
Caner (2014)	Life Satisfaction Survey Türkiye data from 2003-2011	In years of crisis, earning a high absolute income is more important for happiness. Being Unemployed (-), Male (-), Age (u)
Dumludağ et al. (2015)	Life Satisfaction Survey Türkiye data 2011	Increased income increases happiness. Education level has no significant effect on happiness. Age (u), Rural (+), Marriage (+)
Eren ve Aşıcı (2015)	Life Satisfaction Survey Türkiye data from 2004-2013	The rating of hope is the strongest determinant of happiness. Female (+), Education (?), Hope Level (+), Health (+), Income Ranking (+), Age (u)
Akay ve Timur (2017)	Life Satisfaction Survey Türkiye data from 2009 and 2015	The factors of well-being were examined separately for men and women, and as a result, it was revealed that economic well-being and meeting basic problems were important factors in happiness.

Note: (-) opposite direction relationship. (+) same direction relationship u) Happiness first decreases, then remains unchanged for a while, then increases. (?) a meaningless relationship.

3. DATA and METHODOLOGY

This section provides information concerning the data and econometric methodology employed in the study.

3.1. Data and Variables

In the happiness economics studies, many factors other than income affect happiness, such as the individual's quality of life, status, age, goals, hopes, expectations, and living standards (Eren ve Aşıcı 2015:8; Caner 2014:1331). While examining these factors in this study, Life Satisfaction Surveys from 2009 and 2015 were used, and both years were combined and included in the model as a year variable. The Life Satisfaction Survey is TURKSTAT's first survey with subjective elements and social content. In the research, individuals' expectations, happiness, satisfaction with living conditions, and satisfaction with public services related to basic living areas have been measured. In the study, in which TURKSTAT's Life Satisfaction Surveys from 2009 and 2015 were used, economic factors such as individuals' income, indebtedness, car ownership and employment opportunities as well as gender, age, education and marital status were examined. In the 2009 and 2015 Life Satisfaction Surveys, individual happiness levels were evaluated as follows: "How happy are you when you think of your life as a whole?" The question was answered by ticking one of the options given on a 5-point Likert scale (very unhappy, unhappy, fairly happy, happy, and very happy). The variables found to be significant in the estimated models and their definitions are given in Table 2.

Marital status, education and income group variables are created by the author. Education level options are as follows: 0. Did not finish a school, 1. Primary school, 2. Secondary school, 3. Vocational or technical secondary school, 4. High school, 5. Vocational or technical high schools, 6. Colleges, 7. Faculty 8. Master's/PhD (including 5 or 6-year faculties). However, it was used in the study by creating it as follows: 1. Primary school (Primary school-Secondary school-Vocational or technical secondary school) 2. High school (High school-Vocational or technical high schools), 3. Bachelor degree (Colleges-Faculty), 4. Postgraduate (Master's-PhD). Marital status options are as follows in the Life Satisfaction Survey; 1. Single 2. Married 3. Divorced 4. Spouse died 5. Separated. However, it is used in the study by creating it as follows: 1. Single, 2. Married, 3. Divorced - Spouse died -Separated. In the Life Satisfaction Survey, the options for the income group variable are created as very low, low, middle, and high income groups according to the hunger line, poverty line, and high income line. According to the data obtained from TURKSTAT, hunger and poverty limits are as follows: Hunger line is 287 TL and 1329 TL for 2009 and 2015 respectively. Poverty line is 825 TL and 4329 TL for 2009 and 2015 respectively. High-income limit is 2440 TL and 10100 TL for 2009 and 2015 respectively. According to the data obtained from the TURKSTAT, the high-income limit was calculated as 8.5 times the poverty line in 2009 and 7.6 times the poverty line in 2015 (Kolukısa, Sağbaş 2020: 212). Accordingly, income group options have been created for very low, low, middle, and high-income groups¹. In addition, interaction terms related to education level, employment, or marriage variables are examined but not included in the study as they are not statistically significant.

Table 2. Variables and Descriptions

Variables	Descriptions	
Happiness	How happy are you when you think of your life as a whole? 1. Very Happy 2. Happy 3. Fairly Happy 4. Unhappy 5. Very Unhappy	
Year	1. 2015 0. 2009	
Age	Individual's age (18 years+)	
Gender	1. Male 0. Female	
Marital Status	What is your marital status? 1. Single 2. Married 3. Divorced - Spouse died - Separated	
Education Level	What level of education did you last complete? 1. Primary school 2. High school 3. Bachelor degree 4. Postgraduate	
Saving money	I started saving last year. 1. Yes 0. No	
Owning a car	I bought a car last year. 1. Yes 0. No	
Get a job	I got a job last year (for job seekers) 1. Yes 0. No	
Borrowing	I got into a debt last year. 1. Yes 0. No	
Servicing Debt	I paid off my debts last year. 1. Yes 0. No	
Income Group	2009	2015
	1.0-630 TL (Very low-income group) 2.631-990 TL (Low-income group) 3.991-2 750 TL (Middle income Group) 4.2 751-3 851+ TL (High-income Group)	1. 0-1 264 TL (Very low-income group) 2. 1 265-2 540 (Low-income group) 3. 2 541 – 3 721 TL (Middle income Group) 4. 3 722+ TL (High-income Group)

3.2. Generalized Ordered Logit Model

Ordered qualitative choice models are employed when the dependent variable has an ordinal structure with two or more categories. The ordered logit model is one of the most used ordered qualitative preference models. However, it has been seen in the literature that the parallel regression assumption of this model could be violated (Long 1997:116-118; Borooah 2002: 7-8).

This assumption assumes that the regression functions for different options are parallel to the logit scale. To examine the validity of the assumption, Wald Test (Brant, 1990) is used. The parallel regression assumption, which explains that the relationship between the independent variables and the dependent variable does not change according to the categories of the dependent variable, is important for the reliability of the results obtained from ordered logit models. If the assumption does not hold, then the alternative models should be utilized (Amemiya 1985: 293).

The generalized ordered logit model is a less restrictive model that does not require the parallel regression assumption (Williams 2006a: 1). This model is used as an alternative to the ordered logit model. The generalized ordered logit model estimates a set of coefficients and a constant for each of $m-1$ points at which the dependent variable Y , which takes the values $0, 1, 2, \dots, m$, can be divided into two. These sets of β_k coefficients correspond to a set of cumulative distribution functions. For the probability of any category (m) in the generalized ordinal model is shown as follows (Williams 2005: 2):

$$P(Y_i < k) = F(-X\beta_k) \quad k = 1, \dots, m \tag{1}$$

$$Pr(y = m|x) = \begin{cases} F(\tau_1 - x\beta_1) & m = 1 \\ F(\tau_m - x\beta_m) - F(\tau_{m-1} - x\beta_{m-1}) & 1 < m \leq M - 1 \\ 1 - F(\tau_{M-1} - x\beta_{M-1}) & m = M \end{cases} \tag{2}$$

F is defined as the logistic cumulative distribution function. β is a vector of logit coefficients; m is the logit equation and τ is the cut point and x is a vector of independent variables. In addition, for the category (m) of the generalized ordered logit model cumulative probability value is shown in Equation (3) and $F(\tau_m - \sum_{k=1}^K \beta_{mk} - x_k)$ refers to the distribution function (Fullerton 2009: 315):

$$Pr(y \leq m) = F(\tau_m - \sum_{k=1}^K \beta_{mk} - x_k) \quad m = 1, 2, \dots, M - 1 \tag{3}$$

Model interpretation is as follows: Option 1 compares with options 2, 3, 4, and 5; Options 1 and 2 are compared with options 3, 4, and 5. Options 1, 2, 3, and options 1, 2, 3, 4 are compared with options 4,5 and 5 in a similar way, respectively (Williams 2006b: 63).

4. FINDINGS

This section provides information concerning the initial and empirical results employed in the study.

4.1. Initial Findings

In this section, some statistics and tables are included, using the Life Satisfaction Survey that has been conducted regularly since 2004. The rates of values that are a source of happiness for the period from 2009 to 2015 are given in Table 3, and the level of happiness by gender, age group, and marital status is given in Table 4.

According to the results of the Table 3, health ranks first among the values that are the source of happiness, while love and success are ranked second and third, respectively.

Table 3. Values as Source of Happiness

Years	Values as source of happiness (%)					
	Health	Love	Success	Money	Job	Other
2009	70.7	13.2	6.6	5.2	3.5	0.8
2010	71.2	13.0	6.9	4.6	3.5	0.9
2011	72.8	13.1	6.9	4.3	2.4	0.5
2012	70.8	13.8	6.7	5.1	3.1	0.6
2013	68.0	15.2	8.6	4.1	2.3	1.8
2014	68.8	15.4	8.5	4.2	2.2	0.9
2015	68.8	15.8	8.6	3.9	2.0	1.0

Source: TURKSTAT Life Satisfaction Survey, 2009-2015.

Table 4 shows the level of happiness by gender, age group, and marital status for 2015. According to the results of Table 4, while 59.6% of married individuals are happy, this rate is 49.5% for single individuals. According to age groups, the lowest happiness rate was in the 45–54 age group with 51.7%, while the highest happiness rate was seen in the 18–24 age group with 63.8%. Finally, the rate of individuals who stated that they were happy is 56.6%.

Table 4. Level of Happiness by Gender, Age Group and Marital Status (2015)

	Happy	Fairly Happy	Unhappy
Total	56.6	32.0	11.4
Male	52.9	34.3	12.8
Female	60.2	29.8	10.0
Age group			
18-24	63.8	28.4	7.8
25-34	58.6	31.9	9.5
35-44	54.2	34.0	11.8
45-54	51.7	34.7	13.7
55-64	55.1	30.7	14.2
65+	56.8	30.7	12.4
Marital Status			
Married	59.6	30.9	9.5
Single	49.5	34.6	15.9

Source: TURKSTAT Life Satisfaction Survey, 2015

4.2. Empirical Findings

This paper aims to determine factors affecting the happiness of household members with a generalized ordered logit model using the Life Satisfaction Survey data. Table 5 shows the model estimations and report that the coefficients of the generalized ordered logit models are statistically significant. According to LR test result, it is seen that the hypothesis that explanatory variables do not affect the dependent variable is rejected. To interpret the coefficient estimates of generalized ordered logit models, odds ratios are calculated, and the direction of the effects of explanatory variables on individual happiness levels is determined by looking at the signs of β coefficients.

Table 5. Generalized Ordered Logit Estimation Results

Dependent Variable:

Happiness (1. Very Happy 2. Happy 3. Fairly Happy 4. Unhappy 5. Very Unhappy)

Variables	1. Very Happy			2. Happy			3. Fairly Happy			4. Unhappy		
	Coefficient	Odds Ratio	P-Value	Coefficient	Odds Ratio	P-Value	Coefficient	Odds Ratio	P-Value	Coefficient	Odds Ratio	P-Value
Year	0.027	1.027	0.649	-0.082**	0.920	0.012	-0.356*	0.699	0.000	-0.290*	0.747	0.003
Age	0.014*	1.014	0.000	0.004 *	1.004	0.001	0.011 *	1.011	0.000	0.008**	1.008	0.022
Gender	-0.315*	0.729	0.000	-0.215*	0.806	0.000	-0.240*	0.785	0.000	0.012	1.012	0.898
Marital Status (Married)	-0.707*	0.492	0.000	-0.684*	0.504	0.000	-0.887*	0.411	0.000	-0.974*	0.377	0.000
Marital Status (Single)	-0.249	0.779	0.151	-0.294*	0.745	0.000	-0.300*	0.740	0.003	-0.408**	0.664	0.030
Education Level (Bachelor degree)	-0.267*	0.765	0.001	-0.285*	0.751	0.000	-0.510*	0.600	0.000	-0.809*	0.445	0.000
Saving Money	0.270*	1.310	0.000	0.221*	1.248	0.000	0.296*	1.345	0.000	0.175	1.191	0.200
Owning a car	0.651*	1.919	0.000	0.358*	1.431	0.000	0.757*	2.131	0.000	0.626**	1.870	0.020
Get a job	0.079	1.082	0.531	0.184*	1.203	0.007	0.285*	1.330	0.003	0.298	1.348	0.101
Borrowing	-0.438*	0.644	0.000	-0.647*	0.523	0.000	-0.914*	0.400	0.000	-1.278*	0.278	0.000
Servicing Debt	-0.344*	0.708	0.000	-0.177*	0.837	0.000	-0.432*	0.648	0.000	-0.457*	0.632	0.000
Income Group (Low-income)	-0.048	0.952	0.435	-0.017	0.982	0.602	-0.107**	0.897	0.038	-0.162	0.849	0.119

Number of obs=16,943
 LR chi2(48) = 1189.39
 Prob>chi2= 0.0000
 Log Likelihood= -20481.831
 Pseudo R2= 0.0282

Note: *Significant at 1% level, **Significant at 5% level.

Demographic and economic factors used in the analysis are reported to be affecting happiness. The odds of reporting levels of happy are 0.92 times lower for 2015 compared to 2009. Economic reasons such as increases in exchange rates, increasing inflation, and unemployment may have negatively affected the happiness of individuals. The odds of reporting very happy level are 1.01 times higher with an increase in age. It is thought that the increase in the possibility of being happy as you get older is due to reasons such as increasing experiences, gaining different perspectives on life, and learning to cope with stress. The odds levels of happy are 0.80 times lower for men compared to women. In Turkish society, men are defined as the breadwinners of the house who must provide a good life for their spouses and children. This responsibility can sometimes make men be more unhappy compared to women.

Being married reduces the odds of happiness by 0.50 times compared to other categories (single, divorced-spouse, widowed-separated), while being single decreases it by 0.74 times. Being a university graduate reduces the odds of happiness by 0.75 times compared to other situations (primary school, high school, postgraduate). In Turkish society, the dominant view of marriage is that the woman is responsible for cleaning the house, and the man is responsible for providing for the household. Individuals with a high level of education may also feel inadequate and unhappy in the face of such responsibilities. The reason why singles are not happy may be that they feel spiritually lonely and want someone to share life with. In addition, economic, social, and environmental pressures can also negatively affect the happiness of single people.

Saving money, which is one of the economic factors, increases the odds of happiness by 1.24 times, and owning a car increases it by 1.43 times. Having a job increases the odds of happiness by 1.20. Borrowing and servicing debt reduce the odds of very happy by 0.64 and 0.70 times, respectively. The low-income groups reduce the odds of fairly happy by 0.90 times compared to other income groups. Economic factors always affect the happiness of individuals, positively or negatively. As can be seen here, while saving money, having a job, and owning a car increase the happiness of individuals whereas borrowing and servicing debt decrease their happiness as it would put more economic pressure on them.

5. CONCLUSION

Individuals would like to live a happy life throughout their lives, from the past to the present. There are many factors affecting a happy life. In this study, social, demographic, and economic factors affecting individuals' happiness are examined. The 2009 and 2015 data from the Life Satisfaction Surveys conducted by TURKSTAT every year are utilized to estimate the generalized ordered logit model.

While some of the findings are in line with the studies in the literature, some of them are different from the results obtained in the literature. For example, while married individuals were happy in the studies of Perio (2006) and Dumludağ et al. (2015), this study shows that married individuals are not happy. The effect of the age variable on happiness is the same as in the study of Perio (2006). In addition, the results obtained in this study, which examined income-related variables (such as owning a car and saving) report a positive effect on happiness and these are in line with the findings of the Easterlin et al. (2010). Easterlin (2010) states in his study that more income also allows people to live fuller and happier lives compared to the poor. To summarize the results mentioned in the findings section; while age, get a job, owning a car and saving money increase the happiness of individuals, education level, being in debt, paying debts and being married or single decrease happiness.

Several suggestions could be made to the policymakers to increase the happiness of individuals. New policies might be developed to ensure that the income distribution is equal and fair, and the diversity and effectiveness of support programs for individuals in low-income groups can be increased. Thus, the happiness of individuals in low-income groups can be increased. Offering new business opportunities can increase economic freedom for individuals and thus make them happier. Rather than increasing the incomes of individuals, increasing their purchasing power at a level that meets their basic needs would make them even happier. It is worthwhile to replan and revise banking arrangements so that borrowing or paying debt does not prevent individuals from becoming happy. For married people to be as happy as other individuals, development policies that will enhance the importance of family relationships and allow for the children to be raised as qualified, happy, and healthy individuals should be created. Social support programs for families, children, and couples should be increased, and everyone should benefit from these programs. Instead of focusing only on a high level of education, efforts should be made to raise strong individuals who are well-educated, happy, and self-confident. In order to make the mentioned improvements at

national and international levels, contracted development, improvement, education and socialization programs could be developed with countries in similar situations.

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Submission Declaration Statement

I confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

Endnotes

¹Very low-income group: Income is below the hunger line.

Low-income group: Income is between the hunger line and poverty line.

Middle income Group: Income is between poverty line and high-income line.

High-income Group: Income is above the high-income line.

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Suicide trends in Türkiye by gender and suicide methods (2003-2022): A joinpoint regression analysis*

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Abstract

Suicide, which broadly signifies “the act of intentionally causing one’s own death,” necessitates analysis within socio-psychological cause-and-effect relationships. Suicide is a multidimensional public health issue that needs to be addressed at both individual and societal levels. Approaching suicide as a public health problem requires the continuous and systematic collection, analysis, and dissemination of accurate information about the counts, crude and standardized rates, incidence, prevalence, and characteristics of fatal and non-fatal suicidal behaviors. In this ongoing and systematic process, the examination of the changing trend of suicide cases holds a significant place. This research utilizes joinpoint regression analysis (JRA) to examine the crude rate focusing on overall and gender-specific; and annual percent change of suicide methods in Türkiye, recorded between 2003 and 2022. The findings indicate that the crude suicide rate has increased over a 20-year period, with 2018 being a noteworthy point in the upward trend. While males have shown a consistent increase over the years, females exhibited a decreasing trend until 2017, after which they started to rise. The study also reveals diverse trends in suicide methods over the years. The obtained findings are interpreted in the context of the current situation, and limitations and recommendations are considered.

Keywords: Suicide, Epidemiology, Trend Analysis, Joinpoint Regression, Mental Health

JEL Codes: C46, C88, I18, J11, J19

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1. INTRODUCTION

According to the World Health Organization (WHO) (2021) data, approximately 703,000 individuals die by suicide each year. Based on the 2020 data, around 1.5% of global deaths occurred due to suicide. When examining global causes of death, suicide appears to rank higher than causes such as malaria, HIV-AIDS, various cancer types, and war. In Türkiye, according to the mortality statistics for the year 2022, deaths resulting from suicide constitute less than 1% among the general causes of death. In the data on causes of death in Türkiye, suicide is ranked lower compared to all other causes (Turkish Statistical Institute 2023a). In suicidology research, suicide is emphasized as one of the leading causes of death worldwide. While the rates in Türkiye appear relatively low, the fact that suicide has an impact across all sociodemographic levels indicates that it is a multidimensional public health issue. From this perspective, analyzing the phenomenon of suicide in socio-psychological terms and in terms of cause-and-effect relationships, both individually and collectively, and determining its trajectory over time to make future projections is a necessity.

When global data are examined based on sociodemographic variables, it is observed that males worldwide have a suicide rate 2.3 times higher than females. 58% of suicides occur in age groups under 50, and the highest age-standardized suicide rate is recorded in the group aged 70 and above. According to global data, hanging is the most frequently used method of suicide, followed by self-poisoning and the use of firearms (World Health Organization 2021).

In terms of economic classifications, approximately 77% of deaths are recorded in low- and middle-income countries. Regarding age-standardized suicide rates, high-income countries rank highest at 10.9 per 100,000. Across WHO regions, the highest age-standardized suicide rate is recorded in Africa at 11.2 per 100,000, while the lowest rate is in the Eastern Mediterranean region at 6.4. On a country-specific level, Lesotho ranks highest with 72.4 per 100,000. According to an assessment by the Organization for Economic Co-operation and Development (OECD) (2023) in 2020, South Korea had the highest suicide rate at 24.1 per 100,000. In an epidemiological study conducted in 17 countries, the prevalence of suicidal ideation was found to be 9.2%, suicide plan prevalence was 3.1%, and nonfatal suicide attempt prevalence was 2.7% (Nock et al. 2009: 9-10). While prevalence estimates can vary significantly between countries, it is known that certain characteristics, such as the age of onset of suicide cases and the rate at which suicidal thoughts turn into attempts, overlap across countries.

According to the WHO rankings encompassing data from 179 countries, Türkiye ranks 169th with a suicide rate of 2.4 per 100,000. Among the 42 OECD countries, Türkiye is placed 40th (OECD 2023, World Population Review 2023). In Turkish Statistical Institute (TURKSTAT) suicide database, there were 4,146 recorded suicide cases in 2022 and crude suicide rate is 4.88 per 100,000. Among provinces, Tunceli has the highest crude suicide rate (14.28 per 100,000), while Gümüşhane has the lowest (0.68 per 100,000). It is observed that most suicide cases occur in metropolitan areas. Istanbul having the highest number at 508, followed by Ankara with 277 and İzmir with 206 recorded suicides (Turkish Statistical Institute 2023b).

According to TURKSTAT (Turkish Statistical Institute) data (2023b), 75% of those who die by suicide are male (3,111 individuals), and 25% are female (1,035 individuals). Male suicides occurred most frequently in the 25-29 age group, both in terms of numbers and crude rates, while female suicides were most prevalent in the 15-19 age group. Unlike the global gender trend in suicide cases, in Türkiye, men have a suicide rate three times higher. The age-specific suicide rate, calculated by gender in 2022, is higher in men at 7.31 per 100,000. When examining marital status, 44% of suicide cases were married, 41.2% were never married, 10.2% were divorced, and 4.4% were widowed. In terms of education, the highest suicide rate is observed in the group with a high school diploma or equivalent at 27.8%. For 58% of suicide cases, the reason is recorded as unknown or other. Another significant percentage of suicide cases is recorded due to illness (Turkish Statistical Institute 2023b).

The TURKSTAT data (2023c) indicates that there has been an overall population increase of approximately 11% during the decade from 2013 to 2022. In the same ten-year period, there is a 27.5% increase in the number of suicide cases, with a 19% increase in female suicides and a 31% increase in male suicides. It is known that the main contributing factors to suicide rates include mental health disorders, macroeconomic conditions, economic insecurity and crisis, seasonality, employment and living conditions, isolation, and various social issues such as discrimination (Mann et al. 2005: 2064-2065; Blüml et al. 2013: 4-5; Turecki and Brent 2016: 8-9).

When unusual conditions such as war, pandemics, and economic crises are excluded, societal suicide rates tend to follow a stable trajectory over extended periods. It is accepted that proportional stability facilitates the explanation and comparison of differences between countries and societies. Additionally, suicide rates can vary regionally and between countries by up to tenfold. While regional and country-level variability is partly assumed to be associated with economic and sociocultural differences, it is also thought to stem from the detection and recording of suicide cases in terms of reliability, transparency, ease, or content (Zalsman et al. 2016: 648-650). Examining the data trend, there are independent fluctuations in regions and countries. For example, a decreasing trend in suicide-related deaths has been observed in many European countries and the United States after 1990 (Thomas and Gunnell 2010: 1472-1473; Puzo et al. 2016: 7-9). This decreasing trend has been confirmed for the last two decades, particularly concerning adolescents considered a high-risk group (Kölves and De Leo 2016: 76). In the middle-aged and older age groups, however, an upward trend in suicide-related deaths has been predominantly identified among men after 1990 (Fond et al. 2016: 3-4; Brazinova et al. 2017: 165-166).

In the Turkish literature, numerous studies conducted in various scientific disciplines on the phenomenon of suicide with different samples can be observed. However, research using comprehensive suicide data is relatively less common. In a study analyzing the trend of suicide cases by age, gender, and method between the years 2002 and 2015 using joinpoint regression analysis, it was found that there was a 2.3% increase in men and a 3.1% decrease in women during the specified years. An increasing trend was observed in all age groups except for the male group aged 65 and over. This study also reveals the method and age groups that show both increasing and decreasing trends over time (Göktaş and Metintaş 2019: 198-202). In another research covering the period between 2002-2015, statistically significant correlations and differences were found between various sociodemographic variables and suicide. Research findings show that men and the urban population had a higher tendency to suicide during the relevant years. It has been revealed that the number of suicides varies according to age and education level (Özcan et al. 2018: 17-32). In a research examining the count and characteristics of suicides between 1974-2013, regional distribution rates were examined using correlation and variance analysis and the findings were shown with thematic maps (Yakar et al. 2017). In another study examining the same dates, time series analysis, unit root and stationarity tests were used. Findings have shown that shocks resulting from economic problems lead to permanent and long-lasting effects on female suicide rates (Akyuz et al. 2020: 1188-1190).

In the relevant literature, there are articles focusing on different year ranges such as 1987-2011, 2007-2019, 2015-2019, 1983-2013, and 1995-2019. Doğan and Toprak (2019) examined the potential effects of age, period and cohort on the trend of suicide between 1983-2013 using a nonlinear regression model and natural spline smoothing functions. In another research covering the years 1987-2011, Doğan et al. (2015: 360-361) used joinpoint regression analysis to examine the change trend over time, the decreases and increases in suicide mortality, and the distribution of suicide methods and age ranges by gender. It was found that the age-standardized suicide rate of men was higher than that of women in the relevant year range. A significant increase was observed in men in all age groups. It has been determined that the most commonly used suicide methods are hanging, poisoning, firearms and jumping. Kartal et al. (2022: 1859-1860) examined suicides between 1995-2019 to identify at-risk populations; comparisons between groups were made using two proportions Z test. An increase in the suicide rate of men was detected between the relevant years, and the most important risk factor was seen to be illness. In an observational-analytical study covering the years 2015-2019, nonparametric comparisons between groups were made based on sociodemographic variables. It has been observed that the suicide rate and rate are higher in men (Emiral et al. 2022: 3-5). Teker (2011: 190) examined suicide mortality rates between 2007-2019 using joinpoint regression analysis. Suicide mortality rate increased in men during this year; decreases in women; observed that there was no statistically significant change in the total rate. However, no research covering the years 2020, 2021, and 2022 could be found.

Suicide is largely a preventable action and a crisis that can be managed with strategic planning. Therefore, effective suicide prevention strategies should be an integral part of public health policies. The precursor to prevention strategies is understanding the current and evolving situation over time. In this study, joinpoint regression analysis (JRA) is used to examine the changes in suicide-related deaths in Türkiye over the decade from 2003 to 2022, focusing on crude suicide rates by gender and the percentage of suicides by method. In the first section, global and Türkiye-specific suicide statistics and current research are included. The second section contains information and descriptive statistics, tables and figures regarding the TURKSTAT data used in the research. Subsequently, the methodology is explained in detail, theoretical information about the joinpoint model is given, and the equations for the APC and AAPC values included in the research are presented. The findings obtained as a result of the JRA were explained with tables and figures and discussed.

2. DATA AND METHOD

2.1. Data

The research utilizes the TURKSTAT suicide statistics database for the years 2003-2022. The selected data year range includes economic crisis and pandemic periods. Since the impact of these phenomena already exists, the last 20 years were examined, considering the sufficient number of observations, in order to exclude the impact of the 2001 crisis. Data on “suicide incidents resulting in death” are sourced from records of the Ministry of Interior General Directorate of Security, Gendarmerie General Command, Ministry of Justice General Directorate of Prisons and Detention Houses, and the General Staff of the Turkish Armed Forces. Additionally, TURKSTAT cause of death data is consulted. The scope of suicide statistics has expanded over time. Data were obtained from records kept by the General Directorate of Security and the Gendarmerie General Command until 2012. From 2012 onwards, records obtained from death certificates, along with those from the Ministry of Justice General Directorate of Prisons and Detention Houses and the General Staff, are included in the database. The database provides access to statistical tables on suicide counts, crude rates, and specific suicide rates based on gender, legal marital status, age group, cause and method, administrative regions, provinces, residence, and educational status.

The suicide statistics are annually published according to the TURKSTAT data publishing calendar. Since the data are publicly available via the TURKSTAT official website¹, it is not required to provide an official permission. As the mass dataset does not contain direct personal content, and there is no researcher-participant contact, such as experimental methods or data collection from samples, ethical committee approval has not been necessary.

The data obtained from TURKSTAT were organized by years, gender, method, number, percentage, total suicide count, and population, making it ready for analysis. Both female and male gender groups, along with various methods such as hanging, taking chemicals, throwing from a high place, drowning, firearms, burning, using a sharp instrument, using natural gas or LPG etc., throwing off a train or another motorized vehicle, and other methods were included in the analysis.

Descriptive statistics of crude suicide rate by gender and percentage by suicide method are presented (Tables 1 and 2). According to the descriptive statistics, the overall crude suicide rate in the general population ranges from 3.58 to 4.95 (‰). The lowest crude suicide rate was observed in 2011, while the highest crude suicide rate was identified in 2021. The crude suicide rate observed in women ranges from 0.89 to 1.72 (‰). The lowest crude suicide rate in women was recorded in 2017, whereas the highest was observed in 2003. In men, the crude suicide rate ranges from 2.39 to 3.85 (‰). The lowest crude suicide rate in men occurred in 2003, and the highest was recorded in 2021. The average crude suicide rate for men is approximately 2.5 times higher than that of women (Figure 1).

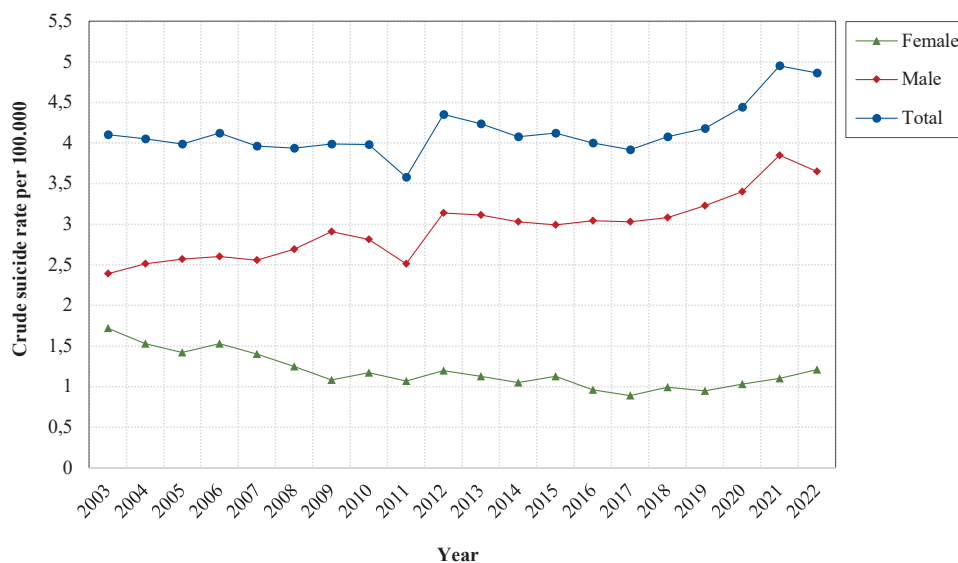


Figure 1. Crude Suicide Rate, 2003-2022

Table 1. Descriptive Statistics of Crude Suicide Rate by Gender, 2003-2022

2003-2022				
Group	Min.	Max.	\bar{x}	SD
Female	0.89	1.72	1.19	0.22
Male	2.39	3.85	2.95	0.39
Total	3.58	4.95	4.14	0.31

Note: \bar{x} : Mean; SD: Standard deviation.

According to the descriptive statistics of suicide methods, it is evident that hanging has the highest percentile value average, while gas or LPG etc. has the lowest average . Hanging has consistently been the most frequently used method throughout the relevant years, followed by firearms. In the third position, taking chemicals was prevalent until 2009, after which it was replaced by throwing from a high place . Upon comprehensive examination across all year range, the highest percentile averages were identified sequentially for hanging, firearms, and throwing from a high place. Other methods tend to have relatively lower percentages (Table 2, Figure 2).

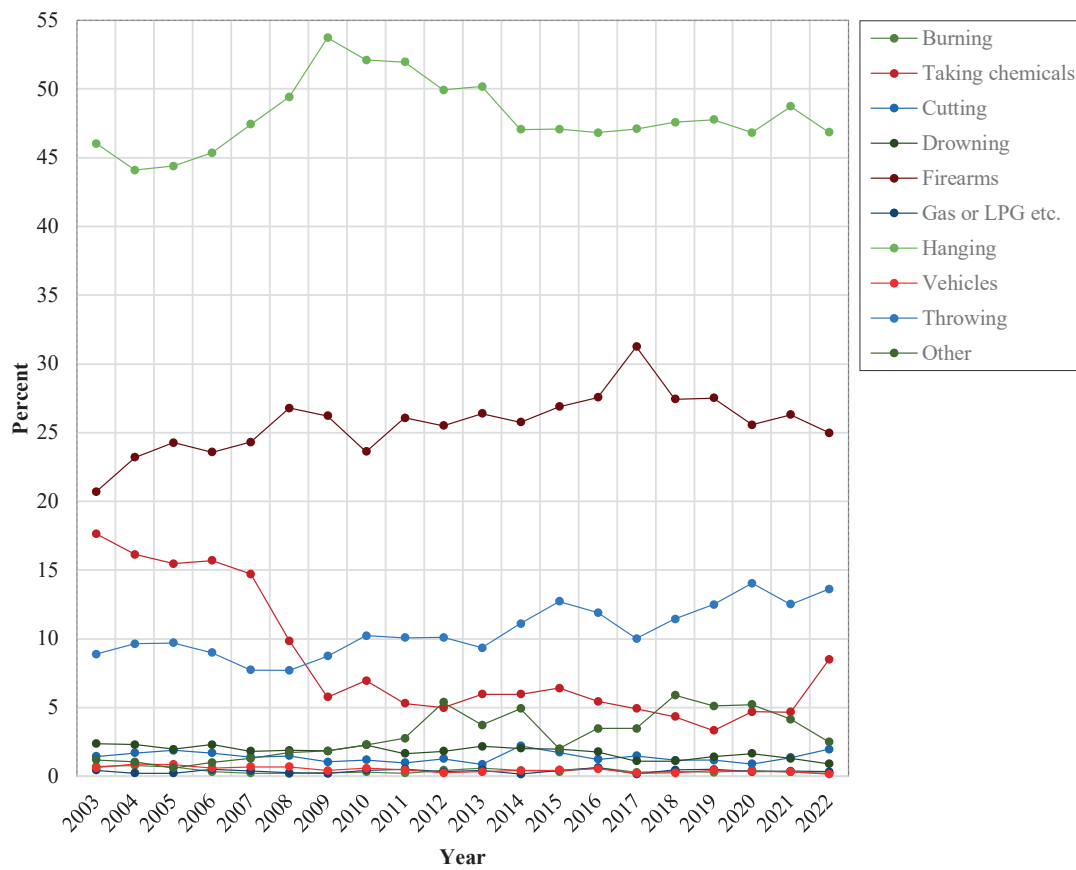


Figure 2. Suicide Method Percentage, 2003-2022

Table 2. Descriptive Statistics of Suicide Method Percentage, 2003-2022

Suicide method	2003-2022			
	Min.	Max.	\bar{x}	SD
Burning	0.21	0.77	0.39	0.17
Taking chemicals	3.31	17.63	8.33	4.74
Cutting	0.86	2.20	1.40	0.36
Drowning	0,89	2.36	1.78	0.43
Firearms	20,70	31.25	25.69	2.16
Gas or LPG etc.	0.15	0.62	0.36	0.13
Hanging	44.10	53.72	48.02	2.54
Throwing from a high place	7.70	14.04	10.54	1.85
Throwing off a train or motorized vehicle	0.14	0.88	0.47	0.20
Other	0.59	5.89	2.97	1.68

Note: \bar{x} : Mean; SD: Standard deviation.

2.2. Method

The data have been analyzed using joinpoint regression analysis (JRA), a technique particularly useful for modeling time trends in incidence, prevalence, percentage, mortality, and survival statistics etc. JRA used in the analysis of significant changes in various indicators over time due to situations such as health policies, social regulations, crisis situations and states of emergency. In this examination, JRA was conducted using the Joinpoint Regression Software, version 5.0.2, developed by the Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute. Starting from the assumption that there is no statistically significant joinpoint in the trend over time, the software tests the possibilities of one or more breakpoints and incorporates them into the model. Additionally, Statistical Package for the Social Sciences (SPSS) version 25 was used for descriptive statistical analysis of the data. Time series are examined with the assumption that the trend for a certain period will be constant on an annual basis. In social changes, a single model is not sufficient as structural breaks will be seen in the trend. Structural breaks are called piecewise regression, broken line regression, and joinpoint regression.

The theoretical foundations of JRA have been compiled into articles by Kim et al. (2020). JRA is a statistical modeling approach that elucidates the correlation between two variables through a segmented linear regression, which is constrained to maintain continuity throughout, especially at points where the slope of the regression function undergoes changes. Joinpoint regression model fits a series of straight lines to the crude rate, percentage, or values, determining the joinpoints where the trend changes substantially. The joinpoints and location of these are decided by the model and data. Suppose that the data observe $(x_1, y_1), \dots, (x_n, y_n)$ is crude suicide rate at time x_i and $y_i = \log(y_i)$. The joinpoint model proposed by Kim et al. (2000: 336) assumes:

$$y_i = \log(y_i) = \alpha_1 + \beta_1 x_i + \delta_1 (x_i - \tau_1)^+ + \dots + \delta_k (x_i - \tau_k)^+ + \epsilon_i, i = 1, \dots, n, \quad (1)$$

where are independent errors, the notation $\alpha^+ = \alpha$ if $\alpha > 0$, and $\alpha^+ = 0$ otherwise. The mean function of y_i is linear segments connected at change-points $\tau_1 < \dots < \tau_k$ in the model. The undetermined positions of change-points, denoted as τ_1 , and the unspecified quantity of change-points, denoted as k , necessitate estimation based on the available data. In the event that the number of change-points is presumed to be a known value, denoted as $\kappa = K$, the determination of the locations of K joinpoints, represented as τ_1, \dots, τ_k , is accomplished through either the grid search approach elucidated by Lerman (1980).

The joinpoints are tested using a series of Monte Carlo permutation tests and Bonferroni correction in multiple comparisons. Operation starts from $k_0 = 0$ (or the minimum value) and continues until the maximum point of k_1 . The comprehensive least squares estimations of the regression coefficients are subsequently computed utilizing the determined joinpoints. Following the acquisition of the least squares fit for a model with $\kappa = K$, an iterative process is implemented to ascertain whether the inclusion of joinpoints significantly diminishes the residual sum of squares. The iterative procedure scrutinizes the null hypothesis positing K_0 joinpoints against the

alternative hypothesis proposing K_l joinpoints, where $K_l > K_o$. Typically, the iteration commences with K_o and K_l being the predefined minimum and maximum number of allowable joinpoints.

In consideration of the non-applicability of classical asymptotic theory in this context, a Monte Carlo permutation test is employed to establish the p -value of the test. The initial step involves permuting the residuals derived from fitting the model under the null hypothesis. Subsequently, for each permutation, the permuted residuals are reintegrated into the fitted values, and the permuted data are refitted under the alternative hypothesis. F -statistics are then obtained as a measure of goodness-of-fit. The p -value for the test is computed based on the distribution of the goodness-of-fit statistics.

Should the null hypothesis be rejected, the test scenario compares $H_o: \kappa = K_o = k_a + 1$ versus $H_l: \kappa = K_l = k_b$; otherwise, it compares $H_o: \kappa = K_o = k_a$ versus $H_l: \kappa = K_l = k_b - 1$. The testing process is reiterated until, for a certain K , the examination of $H_o: \kappa = K$ versus $H_l: \kappa = K + 1$ is executed. Given the multiple testing nature of the procedure, the significance level for each test is adjusted to uphold the overall level under α , representing the probability of overfitting the model. In lieu of the permutation test, model selection methodologies grounded in the Bayes Information Criterion (BIC) or a modified BIC are considered expedient alternatives. Significance level is,

$$\alpha(k_a; k_b) = a / (MAX - k_a) \tag{2}$$

In the final, addressing autocorrelation and heteroscedasticity issues, a series of linked log-linear segments is found between significant joinpoint locations, each segment indicating a short-term trend (APC). A negative APC indicates a decreasing trend, while a positive APC indicates an increasing trend. APC serves as a method for delineating trends in rates over temporal sequences. In this context, the assumption is made that suicide rates undergo alteration at a consistent percentage of the rate observed in the preceding year. Rates exhibiting a uniform percentage change annually manifest linear changes on a logarithmic scale. Hence, to ascertain the APC for a given data series, $\log(Ry) = b_0 + b_1y$; $\log(Ry)$ is the natural log of the rate in year y , the following regression model is employed:

$$\begin{aligned} \text{From year } y \text{ to year } y + 1 &= \left[\frac{R_{y+1} - R_y}{R_y} \right] \times 100 \\ &= \frac{\{e^{b_0 + b_1(y+1)} - e^{b_0 + b_1(y)}\}}{e^{b_0 + b_1(y)}} \times 100 \\ &= (e^{b_1} - 1) \times 100 \end{aligned} \tag{3}$$

Additionally, the long-term trend (AAPC) and confidence intervals for these trends are calculated. AAPC is computed through an initial estimation of the optimal underlying joinpoint model tailored to suit the data. The AAPC over a designated fixed interval is then determined through a weighted average of the slope coefficients derived from the underlying joinpoint regression model. The weights assigned to each slope coefficient correspond to the length of the respective segment within the specified interval. The conclusive phase of the computation involves transforming this weighted average of slope coefficients into an annual percent change. If we denote as the slope coefficient for the i th segment, with the index i referencing the segments within the desired range of years, and ω_i as the length of each segment in the range of years, the calculation is expressed as follows:

$$\left\{ \exp \left(\frac{\sum \omega_i b_i}{\sum \omega_i} \right) - 1 \right\} \times 100 \tag{4}$$

At the first analysis, the calculated crude suicide rate, as the dependent variable, was evaluated with specific to gender over a decade-long period using the total count of suicides and the population of Türkiye as references. Secondly, official rates of suicide methods, as the dependent variable, were assessed over a decade, considering both overall trend and specific to genders. Gender groups were compared by crude rate and methods.

At the analysis process, the grid search method was utilized. Logarithmic transformation was applied to the data. Weighted Bayesian Information Criterion (WBIC), one of the data driven BIC methods, was used in model selection. While the internal application of data dependent selection (DDS) relies on either BIC or BIC3 determined by empirically established cut-off values for the selection statistics, the weighted BIC integrates BIC and BIC3 through a weighted penalty term determined by the data characteristics. Hereby, WBIC was intended to prevent the risk of overfitting. Based on the data points, a minimum of 0 and a maximum of 3 joinpoints were determined.

3. RESULTS

According to the JRA results, a statistically significant AAPC in the crude suicide rate in Türkiye between 2003 and 2022 was identified (AAPC = 1.13, $p < 0.01$). There was an AAP increase of 1.13% over the 20-year period (Table 3). A joinpoint was observed in the year 2018 during this period (Figure 3). The change in the first segment covering the years 2003-2018 was not statistically significant. However, the change in the second segment covering the years 2018-2022 was statistically significant (APC = 5.39, $p < 0.01$). This suggests that the crude suicide rate increased by 5.39% annually between 2018 and 2022 (Table 4).

Table 3. AAPC in Crude Suicide Rate, 20-Years Period Between 2003-2022

Endpoints	AAPC	Lower CI	Upper CI	Test Statistic	p-value
2003-2022	1.1367	0.2980	1.9824	2.6602***	0.0078

Note: *: 10%; **: 5%; ***: 1%.

Table 4. APC in Crude Suicide Rate Segments

Segment	APC	Lower CI	Upper CI	Test Statistic	p-value
2003-2018	0.0306	-0.5354	0.5998	0.1150	0.9099
2018-2022	5.3946	1.5271	9.4093	2.9955***	0.0090

Note: *: 10%; **: 5%; ***: 1%.

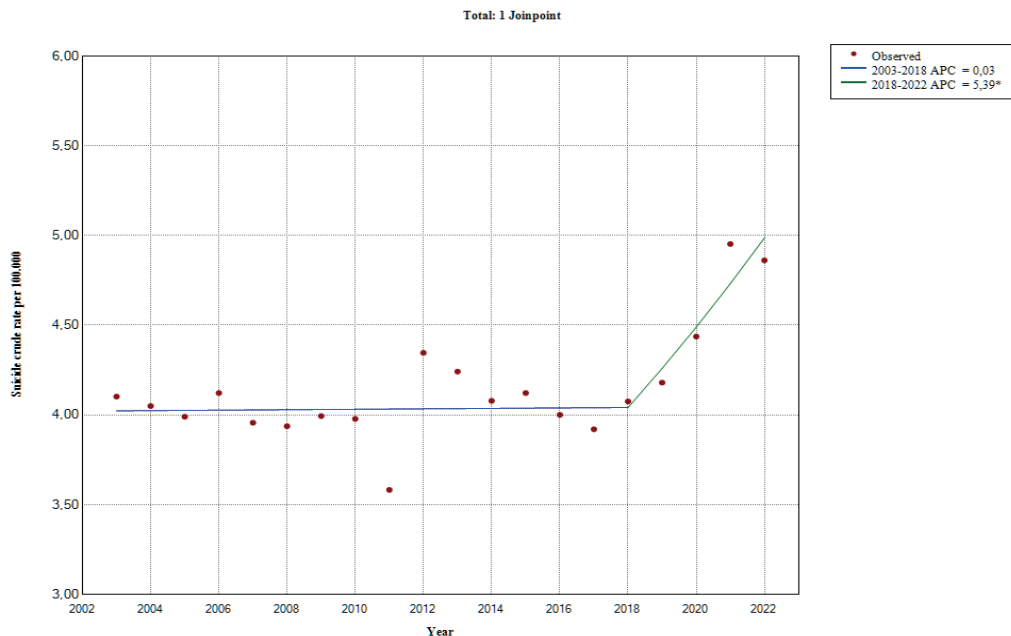


Figure 3. Crude Suicide Rate by Year

As stated in the results obtained from the JRA conducted to determine the changes in crude suicide rates over a 20-year period by gender groups, statistically significant changing in the AAP was identified for females (AAPC = -1.66, $p < 0.05$) and males (AAPC = 2.07, $p < 0.001$). It was observed that the crude suicide rate for females experienced a decline of 1.66% in the AAP over the 20-year period. Conversely, for males, there was an increase of 2.07% in the AAP of crude suicide rates over the same timeframe (Table 5).

Table 5. AAPC in Crude Suicide Rate By Gender, 20-Years Period Between 2003-2022

Gender	Endpoints	AAPC	Lower CI	Upper CI	Test Statistic	p-value
Female	2003-2022	-1.6654	-2.9346	-0.3796	-2.5337**	0.0112
Male	2003-2022	2.0703	1.6115	2.5311	9.5561***	<0.0001

Note: *: 10%; **: 5%; ***: 1%.

In the JRA graph, a joinpoint in the crude suicide rate for females was observed in 2017 (Graph 3). The APC between 2003-2017, constituting the first segment of the line, and 2017-2022, forming the second segment, are statistically significant. According to the slope of the first segment, the crude suicide rate decreased annually by 3.87% between 2003-2017 (APC = -3.87, $p < 0,001$) (Table 6). In contrast, the slope of the second segment indicates that the crude suicide rate increased by 4.78% annually between 2017-2022 (APC = 4.78, $p < 0,001$). No joinpoint has been observed in the crude suicide rate for males (Figure 4). According to the results, there has been an annual increase of 2.07% in the crude suicide rate for males between 2003 and 2022 (APC = 2.07, $p < 0,001$) (Table 6).

Table 6. APC in Crude Suicide Rate Segments by Gender

Gender	Segment	APC	Lower CI	Upper CI	Test statistic	p-value
Female	2003-2017	-3.8701	-4.7883	-2.9431	-8.7657***	< 0.0001
	2017-2022	4.7804	0.0221	9.7652	2.1416**	0.049
Male	2003-2022	2.0703	1.6115	2.5311	9.5561***	< 0.0001

Note: *: 10%; **: 5%; ***: 1%.

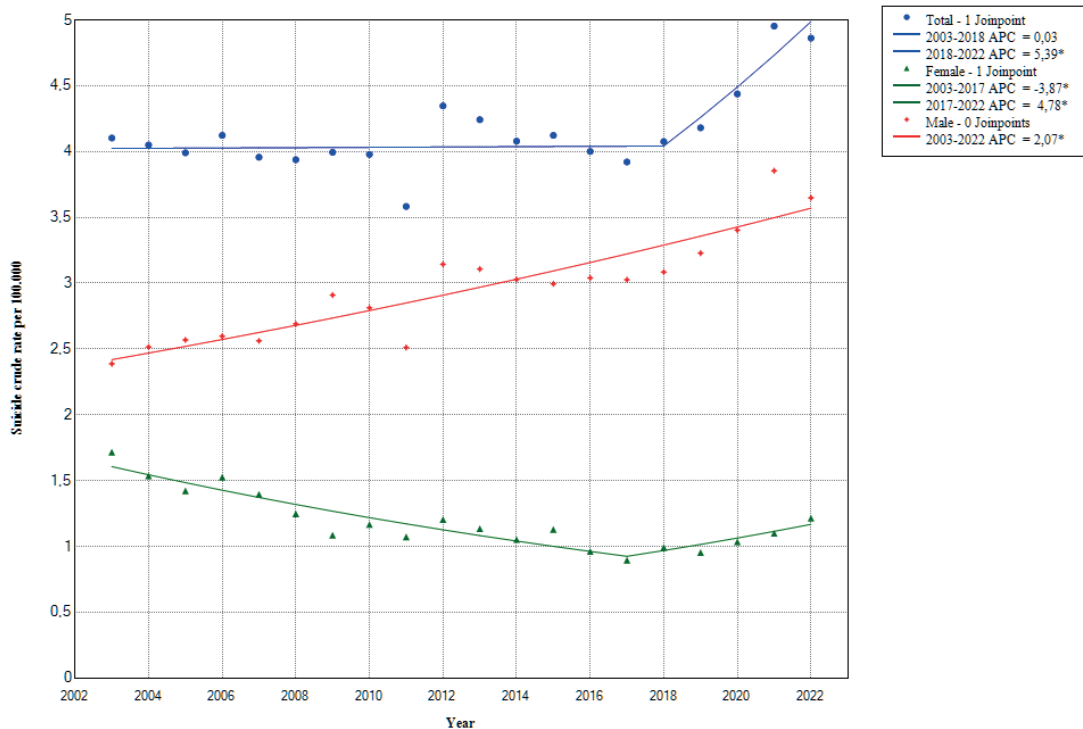


Figure 4. Crude Suicide Rate by Gender

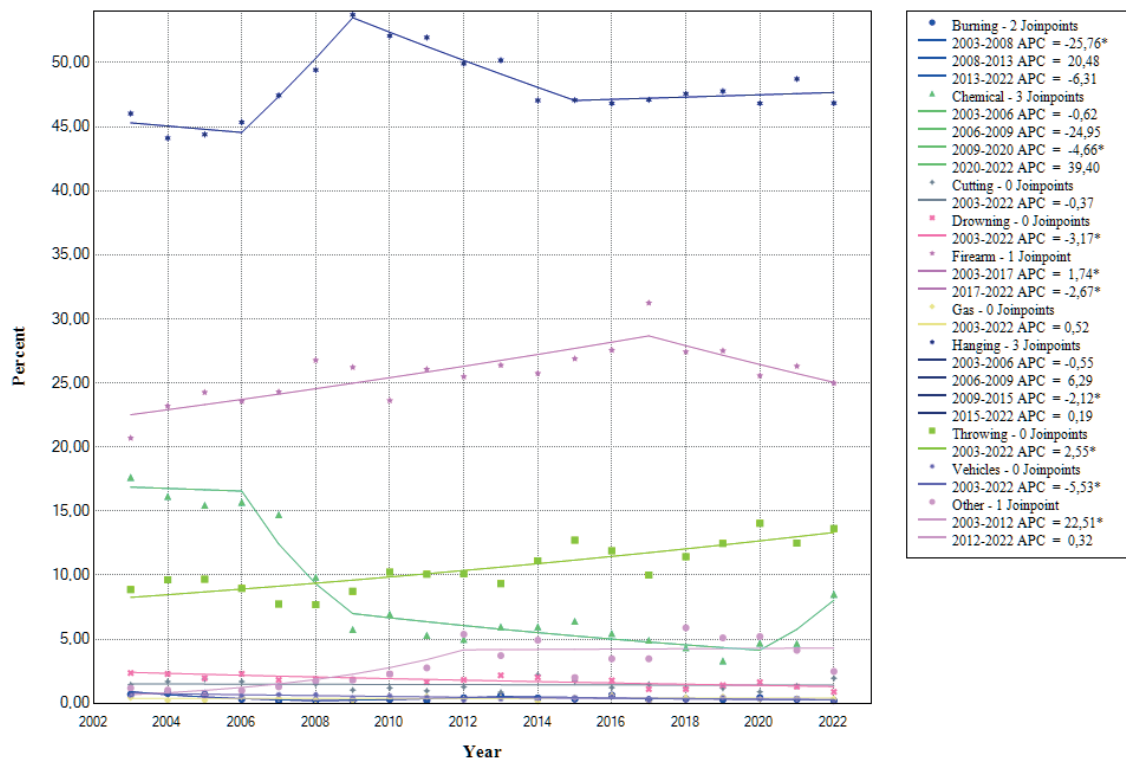
JRA findings indicate statistically significant in AAPC of suicide methods, including drowning (AAPC = -3.16, $p < 0.001$), throwing from a high place (AAPC = 2.54, $p < 0.001$), and throwing off a train or another motorized vehicle (AAPC = -5.53, $p < 0.001$), during the period from 2002 to 2023. Over the 20-year period, there was a 3.16% decrease in the AAP of drowning, a 5.53% decrease in the AAP of throwing off a train or another motorized vehicle, and a 2.54% increase in the AAP of throwing from a high place. The AAPC in the other methods is also statistically significant, with a found increase of 10.28% (AAPC = 10.28, $p < 0.01$) (Table 7).

Table 7. AAPC of Suicide Method Percentage, 20-Years Period Between 2003-2022

Method	Endpoints	AAPC	Lower CI	Upper CI	Test Statistic	<i>p</i> -value
Burning	2003-2022	-5.8447	-14.5056	3.6936	-1.2233	0.2212
Taking chemicals	2003-2022	-3.8208	-9.4730	2.1843	-1.2607	0.2074
Cutting	2003-2022	-0.3728	-2.4242	1.7216	-0.3772	0.7104
Drowning	2003-2022	-3.1685	-4.5212	-1.7966	-4.8085***	0.0001
Firearms	2003-2022	0.5613	-0.1716	1.2996	1.4997	0.1336
Gas or LPG etc.	2003-2022	0.5174	-2.3151	3.4321	0.3793	0.7088
Hanging	2003-2022	0.2685	-0.7734	1.3213	0.5032	0.6148
Throwing from a high place	2003-2022	2.5477	1.7693	3.3321	6.9365***	< 0.0001
Throwing off a train or motorized vehicle	2003-2022	-5.5300	-7.5305	-3.4862	-5.5840***	< 0.0001
Other	2003-2022	10.2832	3.6732	17.3145	3.1039***	0.0019

Note: *: 10%; **: 5%; ***: 1%.

In the JRA graph, joinpoints for burning are observed in 2008 and 2013, with 2 joinpoints; for taking chemicals, in 2006, 2009, and 2020, with 3 joinpoints; for firearms, in 2017, with 1 joinpoint; for hanging, in 2006, 2009 and 2015, with 3 joinpoints; and for other methods, in 2012, with 1 joinpoint (Figure 5).



In burning, the APC during the first segment of the line, covering the years 2003 to 2008, is statistically significant (APC = -25.76, $p < 0.01$). According to the slope value of the first segment, the percentage of burning decreased annually by 25.76% from 2003 to 2008. The APCs for the second segment (2008-2013) (APC = 20.48, $p > 0.05$) and the third segment (2013-2022) (APC = -6.30, $p > 0.05$) were not statistically significant. For taking chemicals, based on the slope value of the third segment, there was a statistically significant annual decrease of 4.66% from 2009 to 2020 (APC = -4.66, $p < 0.05$). The APCs for the first (2003-2006) (APC = -0.61, $p > 0.05$), second (2006-2009) (APC = -24.94, $p > 0.05$), and fourth (2020-2022) (APC = 39.39, $p > 0.05$) segments were not statistically significant. For firearms, the APCs for the first (2003-2017) (APC = 1.74, $p < 0.001$) and second (2017-2022) (APC = -2.66, $p < 0.05$) segments were statistically significant. In the first segment (2003-2017), there was an annual increase of 1.74%, while in the second segment, there was an annual decrease of 2.66%. For hanging, the APCs for the first (2003-2006) (APC = -0.55, $p > 0.05$), second (2006-2009) (APC = 6.29, $p > 0.05$), and fourth (2015-2022) (APC = 0.18, $p > 0.05$) segments were not statistically significant. In the third segment (2009-2015) (APC = -2.12, $p < 0.001$), there was a statistically significant annual decrease of 2.12%. For other methods, the APC for the first segment (2003-2012) (APC = 22.51, $p < 0.01$) was statistically significant, indicating an annual increase of 22.51%. In the second segment (2012-2022), there was no statistically significant change (APC = 0.32, $p > 0.05$) (Table 8).

There is no joinpoint found in drowning, throwing from a high place, and throwing off a train or motorized vehicle methods (Graph 5). Between 2003 and 2022, there was an annual decrease of 3.16% in drowning (APC = -3.16, $p < 0.001$), 5.53% in throwing off a train or motorized vehicle (APC = -5.53, $p < 0.01$), and an increase of 2.54% in throwing from a high place (APC = 2.54, $p < 0.01$). All three APC values are statistically significant (Table 8).

Table 8. APC in Suicide Method Segments

Method	Segment	APC	Lower CI	Upper CI	Test Statistic	p-value
Burning	2003-2008	-25.7626	-39.8463	-8.3814	-3.0855***	0.0094
	2008-2013	20.4829	-12.2066	65.3443	1.2827	0.2238
	2013-2022	-6.3083	-13.6732	1.6850	-1.7341	0.1084
Taking chemicals	2004-2006	-0.6165	-12.8631	13.3514	-0.1064	0.9176
	2006-2009	-24.9494	-45.1698	2.7278	-2.0682	0.0685
	2009-2020	-4.6603	-8.1304	-1.0590	-2.9117**	0.0172
	2020-2022	39.3997	-3.9545	102.3235	2.0171	0.0744
Cutting	2003-2022	-0.3728	-2.4242	1.7216	-0.3772	0.7104
Drowning	2003-2022	-3.1685	-4.5212	-1.7966	-4.8085***	0.0001
Firearms	2003-2017	1.7403	1.1188	2.3656	6.0019***	< 0.0001
	2017-2022	-2.6677	-5.0602	-0.2149	-2.3157**	0.0351
Gas or LPG etc.	2003-2022	0.5174	-2.3151	3.4321	0.3793	0.7088
	2003-2006	-0.5543	-3.8134	2.8154	-0.3773	0.7146
	2006-2009	6.2944	-0.0315	13.0206	2.2505	0.0509
Hanging	2009-2015	-2.1214	-3.3673	-0.8595	-3.7864***	0.0043
	2015-2022	0.1880	-0.5507	0.9322	0.5742	0.5799
Throwing from a high place	2003-2022	2.5477	1.7693	3.3321	6.9365***	< 0.0001
Throwing off a train or motorized vehicle	2003-2022	-5.5300	-7.5305	-3.4862	-5.5840***	< 0.0001
Other	2003-2012	22.5140	8.0914	38.8609	3.4556***	0.0035
	2012-2022	0.3230	-5.5218	6.5294	0.1145	0.9103

Note: *: 10%; **: 5%; ***: 1%.

4. CONCLUSION

The aim of the study, which examines suicide cases in Türkiye over the last 20 years in the context of gender and method, is statistically elucidate potential trend changes between 2003 and 2022. No research based on official data for the specified years was found in the literature. Therefore, it is believed that the findings will give rise to new research questions.

Upon examining the results, it can be observed that the crude suicide rate has followed an increasing trend over the 20-year period. The year 2018 particularly stands out with a dramatic rise in the crude suicide rate within this 20-year timeframe. The ongoing economic crisis, initiated in 2018 and compounded by the subsequent pandemic, has been a prominent feature in this 20-year period. The economic crisis that commenced in 2018 was characterized by the rapid depreciation of the Turkish lira (TRY), high inflation, an excessive current account deficit, substantial foreign currency-denominated debt, escalating borrowing costs, and the consequent increase in credit defaults.

When examining global suicide rates and Turkish statistics, it is imperative to additionally consider the pandemic process. COVID-19, declared a pandemic by the WHO in March 2020, starting in China at the end of 2019, rapidly spread to more than 200 countries. As of April 2023, it has been recognized as one of the deadliest pandemics in human history, with approximately 762 million confirmed cases and over 6.5 million deaths (World Health Organization 2023). The intensity and duration of the pandemic varied, but almost all countries implemented measures such as international and/or domestic travel restrictions, temporary closure of educational institutions at all levels with a transition to remote learning, limiting or blocking social and physical interactions, temporary closure of workplaces by transitioning almost all professional groups, implementation of home quarantine and isolation, testing, and mandatory vaccination.

During economic downturns, job loss, economic contraction, and financial difficulties are known to contribute to 13% of suicide-related deaths (Coope et al. 2015: 102-103). Comparable to the COVID-19 pandemic, the past pandemic of the Spanish flu has been associated with an increase in epidemic suicide-related deaths. The fear of illness, coupled with a decrease in social interaction and integration during the disease period, has resulted in an elevation of suicide rates (Wasserman 1992: 250-252; Centers for Disease Control and Prevention 2020; Ornell et al. 2020: 232-235). Research on the COVID-19 pandemic, dominated by social isolation and fear of illness similarly to the Spanish flu period, indicates that the disease significantly affects not only the physical health but also the mental health of individuals and society. Numerous studies have reported an increase in lower psychological well-being, higher anxiety and depression scores, prevalence of anxiety and depression, loneliness, despair, alcohol and substance use, rise in indicators of family conflict and violence, exacerbation of pre-existing psychiatric disorders, self-harm behavior, and an increase in suicide cases (Cullen et al. 2020: 311-312; Asahi et al. 2021: 8-9; Breslau et al. 2021: 2-3; Kumar and Nayyar 2021: 1-2). COVID-19-related suicide cases have been reported in various countries, including the United States, the United Kingdom, Italy, Germany, Bangladesh, India (Sher 2020: 708-709).

In Türkiye, the first COVID-19 case was announced on March 11, 2020, with the number of cases rising to 191 within a week. The first death due to COVID-19 occurred on March 17, 2020. A month after the initial announcement, the number of cases rose to 947, with 21 deaths. After one year, 2,835,989 cases and 29,290 deaths were recorded. During this period, nationwide lockdowns were implemented, and the controlled normalization process was initiated. According to the TURKSTAT data, the crude suicide rate, which was 4.21 in 2019, increased to 4.45 in 2020, and in 2021, it reached 4.98, the highest level in the last 20 years. The highest number of suicides recorded between 2001 and 2021, 4194 cases, also coincided with the pandemic period in 2021.

The crude suicide rate for males has consistently followed an upward trend between 2003 and 2022. On the other hand, the crude suicide rate for females declined between 2003 to 2017 but started to rise in 2017. In any case, the crude rate for males is higher than that for females. The higher suicide rate for males compared to female is consistent with global suicide-gender trend and current research findings.

The average annual percentage change in burning, taking chemical, cutting, and firearms methods has shown a statistically significant negative trend. Drowning (with a decreasing trend), throwing off a train or motorized vehicle (with a low trend), and throwing from a high place (with an increasing trend) have undergone changes

in the 20-year average percentage. Other methods not classified in the categories also show a dramatic increase. It is observed that the joinpoints of methods are not clustered in a specific year. The highest percentage is in hanging, followed by firearms. Taking chemical were the third-largest percentage among methods until 2006, after which they declined. Throwing from a high place took its place after 2006 when it began to show an upward trend. Although taking chemical have started to rise again as of 2020, still rank fourth. Across the globe, the most common suicide methods are hanging, poisoning, and firearms. In Türkiye's data, hanging and firearms differ from global methods as throwing from a high place is also prominent. All subsequent methods have smaller percentages and have shown minimal changes.

The research has certain limitations, particularly challenges in accessing historical data, the absence of age-specific standardized rates, and issues encountered in establishing a compatible database system for the Joinpoint Regression Software. Another limitation can be attributed to the quality of TURKSTAT data. WHO (2020) reports highlight that out of 183 member states for which estimates were made between 2000-2019; approximately 60% have high-quality vital data records. It is emphasized that especially low and some middle-income countries have low data quality, sparse data, or distortions, misinterpretations, or careless coding of suicide incidents due to reasons such as stigma, illegality, and the level of development of government services. For countries with low-quality vital data, modeling methods are employed in making estimates. However, the type, complexity, group criteria, and applications of models can lead to significant differences and inconsistencies. Consistent results can be obtained from high-quality vital data. For instance, it is known that suicide incidents in Belgium, ranked 11th with a rate of 18.3 per 100,000, include legally sanctioned euthanasia procedures in the country. On the other hand, countries experiencing internal conflicts and civil war such as Afghanistan (4.1), Iraq (3.6), and Syria (2) have significantly lower suicide rates compared to other countries. The nature of suicide incidents underlying these rates (such as sociopolitical conflicts, terminal illnesses, mental health issues, suicide attacks) is uncertain. In the WHO database, Türkiye is classified as a source of moderately high-quality vital data with a note of insufficient trend data (World Health Organization 2020). Specifically for Türkiye, there is inconsistency between suicide data reported by the TURKSTAT and WHO data.

Another limitation arises from suicides categorized as unknown cause or coded as other in terms of method. The prevalence of suicides labeled as unknown or other among various causes and methods can be attributed to the inability to interview the families and close associates of the deceased, relying on contradictory suicides. Official suicide rates and related statistics disclosed in Türkiye and other countries are calculated based on events documented in administrative records. Factors such as age and method constitute the objective components of the suicide incident: "However, the manner in which suicide is carried out and the choice of suicide methods are only the external and superficial aspects of the event, perhaps the most objectively and concretely graspable in suicide. When the tableau of reasons is presented to us, we may suspect that we are faced with the interpretation of observers or witnesses; however, there is no doubt about the statistics of the methods chosen for committing suicide. At least, we cannot be mistaken about the manner in which the suicide chooses to kill oneself." (Durkheim, 2022: XXXIII-XXXIV; Halbwachs, 2002: 31-32). The reason for suicide is often based on post-mortem data, frequently relying on subjective information. Especially, the tendency of the deceased's close associates to conceal the incident and its reasons for various motives complicates obtaining the data on the cause and method of suicide.

Furthermore, the consideration of variables such as age, income, poverty, economic confidence, and others by the TURKSTAT in the context of suicide (e.g., cause) will provide important findings. We would like to suggest that exploring the media-highlighted suicides in recent years through a thorough examination of statistical trends could provide clear insights. This approach offers the opportunity to assess risk factors, protective factors, establish cause-and-effect relationships, measure suicide risk, predict suicide probability, and gain significant insights into historically recurring patterns.

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We declare that all ethical rules were followed during the study's preparation processes. In the event that a contrary situation is discovered, Journal of Applied Microeconometrics accepts no responsibility, and all responsibility rests with the study's author(s).

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Endnotes

¹ data.tuik.gov.tr

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