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# Affective Socioeconomic Factors on Suicide in Turkey: An Econometric Analysis

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## Abstract

Although it is generally accepted that the cultures, religious beliefs, traditions, welfare levels and social structures of the countries may have an impact on suicidal tendencies, the increasing number of suicide cases worldwide and the epidemiological structure of suicide phenomenon reveals the necessity to accept suicide as a public health problem and importance of determining the factors leading to suicide in terms of finding urgent and effective solutions.

The aim of this study was to investigate whether there is a relationship between suicides and various socio-economic factors in the case of Turkey. By doing this, it has tried to fill a certain extent the existing gap in terms of both methodological and empirical evaluation of suicide cases in Turkey. In this respect, the effects of per capita income, unemployment, divorce, alcohol consumption, labor force participation, inflation and urbanization on suicide have been tried to be determined by using modern time series analysis methods.

## Keywords

Suicide
Socioeconomic factors
Time series analysis
Count data regression analysis

## About Article

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# Türkiye'de İntihar Üzerinde Etkili Olan Sosyoekonomik Faktörler: Ekonometrik Bir Analiz

## Özet

Ülkelerin kültürleri, dini inançları, gelenekleri, refah düzeyleri ve toplumsal yapılarının intihar eğilimleri üzerinde etkili olabildiği genel kabul görmekle birlikte intihar vakalarının dünya genelinde artış göstermesi ve intiharın epidemiyolojik yapısı intihar konusuna bir halk sağlığı sorunu olarak yaklaşılmasının ve bireyleri intihara götüren faktörlerin belirlenmesinin acil ve etkili çözümler üretilmesi açısından önemini ortaya koymaktadır.

Bu çalışmanın amacı, çeşitli sosyo-ekonomik faktörler ile intihar olgusu arasında bir ilişki olup olmadığını Türkiye örneğinde araştırmaktır. Böylece hem yöntemsel açıdan hem de Türkiye'de intihar olgusunun ampirik olarak değerlendirilmesi açısından var olan boşluk bir ölçüde doldurulmaya çalışılmaktır. Bu doğrultuda, veri derleme imkânları ve ilgili ampirik literatür çerçevesinde kişi başına gelir, işsizlik, boşanma, alkol tüketimi, iş gücüne katılım, enflasyon ve kentleşmenin intihar üzerindeki etkileri modern zaman serisi analiz yöntemleri kullanılarak belirlenmeye çalışılmıştır.

## Anahtar Kelimeler

İntihar
Sosyoekonomik faktörler
Zaman serileri analizi
Sayma veri regresyon analizi

## Makale Hakkında

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## Introduction

According to the World Health Organization (WHO), more than 800,000 people commit suicide each year, and millions attempt suicide worldwide. As of 2016, suicide is the second most common cause of death in the 15-29 age group in which suicide tendency is most common. When international statistics are examined, it is seen that the rate of suicide has an increasing tendency in the world although it varies from country to country. Crude suicide rate in Turkey is 4.11 / 100,000 (TURKSTAT). Compared with other countries in terms of crude suicide rate, Turkey can be counted among the countries with the lowest suicide rate.

The phenomenon of suicide which is regarded as a bad behavior and even cursed in almost all religions and cultures has existed in every society throughout history and has become quite frequent from time to time [§]. Inherently there is a desire to live a long and comfortable life in human nature, but it is always unintelligible and creepy to end a person's life by his/her own will. Even today, in many societies, suicide is seen as a taboo and stigma that should not be discussed. This situation is reflected in the suicide statistics as well. In many countries suicide cases are either not reported or reported differently as the cause of death. Therefore, it is accepted that the suicide rates are slightly higher than the official values.

Suicide is a tragic and preventable health problem. In the previous ages while this "deviation" was tried to be prevented by the rules of morality and religious beliefs, with the development of modern science and research techniques, it was aimed primarily to understand the personal, environmental and social causes of suicide and to prevent suicides as much as possible through the policies to be developed accordingly. In this context, within the framework of the Mental Health Action Plan 2013-2020 initiated by the World Health Organization, it aims to reduce the rate of suicide by 10% in its member countries. In another program launched by the WHO in 2008, suicide is considered as one of the priority health problems and it is accepted to provide technical support to the member countries (WHO, 2014).

It is generally accepted that the cultures, religious beliefs, traditions, prosperity and social structures of the countries can have an effect on the suicidal tendency. However, due to the increasing number of suicide cases worldwide and the epidemiological nature of suicidal behavior, by seeing suicide as a public health problem, it is necessary to determine the factors that lead to suicide and to take urgent and effective steps. Sweden offers a remarkable example. While it had a very high rate of suicide in the 1960s, as a result of effective measures taken in the 1980s, it started to decline. Currently, Sweden is below the European average of 12 / 100,000.

Suicide can be dealt with in various aspects as a research topic. Since the schools of ancient Greek philosophy, the dynamics and ethics of suicide have been pondered, and whether life is really worth living is considered a serious problem of philosophy. Cultural historians and anthropologists have investigated societies' attitudes toward suicide, sometimes approving, but more often disparaging. Sociologist Emile Durkheim (1897), by considering suicide as a phenomenon that concerns individuals as well as society, chose suicide as the subject of a monograph, a work which remains seminal today. Psychological theories related to the causes of suicide have been proposed, at least since Freud, to find more effective ways to

[§] See Evans and Farberow (2003: xv-xxxi) for a brief history of suicide. A more detailed historical narration can be found in Barbagli (2015).

explain suicide as a clinical and public health problem. Today, science branches such as neurobiology and genetics help other branches in their efforts to understand suicidal behavior (Soper, 2018: 1).

In the light of the above evaluations, in this study we investigated whether there is a relationship between various socio-economic factors and suicide phenomenon in the case of Turkey. By doing this, the existing gaps both in terms of the methodological aspect and the empirical evaluation of suicide phenomenon in Turkey were attempted to fill in a certain extent. In this respect, the effects of per capita income, unemployment, divorce, alcohol consumption, labor force participation, inflation and urbanization on suicide have been tried to be determined by using modern time series analysis methods.

## Suicide: Definitions and Motives

The word *intihar* in Turkish derived from the Arabic word *nahr* which means *chest*, *hitting the chest*, *cutting the throat with a knife*. The word *intihar* was used in the translations made from Arabic during the Tanzimat period in order to correspond the act of self-killing (Yılmaz, 2003: 8). In Latin, suicide is derived from *sui* (myself) and *cedere* (killing, chopping). In English, this word was transferred as *suicide* (Eskin, 2003: 3). The first use of *suicide* in English goes back to 1662 (Uçan, 2006: 5).

The Turkish Language Association defines suicide as "to end to him/her own life by himself/herself due to social or psychological reasons" (www.tdk.gov.tr). The famous French sociologist Emile Durkheim, who carried out the first academic study on the phenomenon of suicide, in his book *Le Suicide* (1897), applies the term suicide to "any death which is the direct or indirect result of a positive or negative act accomplished by the victim himself" (Durkheim, 2002: xi). In his definition, Durkheim explained the reason for his emphasis on indirect and direct action, that one can kill himself not only with a knife or a gun, but also by refusing to feed.

Freud proposed two theses for suicide. According to the first thesis, suicide is the way that the person chooses to get rid of the hated or beloved object with the progression of distress in the case of depression. In the second thesis, as a result of increased depression, the person punishes himself by committing suicide (Harmancı, 2015: 3). Shneidman (1985) defined suicide as "voluntary self-destruction". According to Shneidman, suicide has logic in itself and it is an undecisive behavior which has hidden aim.

As Barzilay and Apter (2014) have stressed, many studies have been conducted on suicidal behavior and related factors, but few attempts have been made to establish a coherent, consistent and inclusive theory with the available data. Suicidal behaviors are not simple events, but a range of activities associated with a range of risk factors.

Research on suicide has a long history going back centuries. The first authors interested in the subject focused on the moral aspect of suicide. However, towards the end of the 18th century, when the incidence of suicide was increasing rapidly in Europe, attention was directed to the causes of suicide. Although it is widely accepted that there is a close relationship between suicide and mental disorder, the interest has been spent on explaining the differences in suicide rates from a racial and climatic point of view. Durkheim's 1897 *Le Suicide* (Suicide) is a turning point in this regard. This study not only informed that a sociologically different approach to suicide would develop in the following years, but also

became a milestone in the development of sociology. (Fincham *et al*., 2011: 8). Many researchers from different schools of thought that followed the path opened by Durkheim have also produced important studies.

In fact, Durkheim's work can be seen as a reflection of a general trend in the social sciences. The advances made in the natural sciences in the 17th and 18th centuries were aimed at revealing that everything has been going on within the universe and that the metaphysical explanations were unnecessary. Some social scientists have tried to treat social phenomena as a set of definite relationships as in the case of rules of physics (Taylor, 1982; 3). According to this approach, suicide is not a "devil-work activity" rather it is a phenomenon that personal and environmental reasons of which can be scientifically investigated and prevented.

It can be said that studies on the causes of suicide have changed over time in terms of handling the problem. While the first studies approach the issue as a problem of morality and belief, it is observed that the efforts to explain the suicide phenomenon in psychological and sociological terms intensified later. While the disciplines such as psychology and psychiatry try to determine the causes of suicide based on individual characteristics, sociology approaches the issue through a more holistic perspective. This sociological point of view follows the view of Durkheim (2002, [1897]) that "sociological phenomena should be examined as objects that is realities outside the individual".

The factors cause to suicide can be handled in two dimensions as micro and macro. All of the clinical studies and many of the field studies approach the issue at the micro level, addressing the factors that may be effective in suicide cases that have been completed or remained at the attempt stage in terms of personal and environmental characteristics. Mental disorder (depression, stress, anxiety, etc.), alcohol addiction, income and educational level, age, gender, disease and the environment, such as family, work environment, geography are the most important factors in this context.

On the other hand, from a more general and social point of view, it is possible to consider the factors that may affect the suicidal tendency in terms of macro factors at national or international level. At the national level, the analysis can be carried out considering the effects of fluctuations in economic structure and especially the loss of income and unemployment increases caused by the crisis periods, social changes reflected by the rates of migration and divorce, general alcohol consumption and changes in education level. It is also possible to deepen the analysis based on regional data. An international analysis with an extended set of variables with religious, racial and geographical factors can allow make comparisons between countries.

Social isolation, exclusion, loss of status and individualization tendencies created by social changes in individuals in big cities can lead to an increase in suicidal action (Meder and Gültekin, 2012:140). Urban living conditions pave the way for illness, crime and mental illness, as well as suicide events. Social isolation tendency of the individuals living in the city may result in suicidal action with the feeling of insecurity, unrecognition, uneasiness and loneliness. (Douglas, 1967: 96).

Regarding the idea that the economic crisis triggered suicides, Durkheim stated that the increase in suicides experienced in economic crises was also experienced in welfare crises, as a result, he argued that the increase in suicides by financial crises was not solely caused by

impoverishment. He stated that the reason for this was a sudden disorder in the social order when the crisis took place and that this confusion could push people to suicide, even due to comfort. He underlined that increasing the level of income in society will increase suicide at the same rate as in the case of a disaster (Durkheim, 2002: 203).

## Suicide in the World and Turkey

### *World*

Suicide is a phenomenon that the whole world faces in general. When the worldwide distribution of suicide cases is examined, it is seen that all countries are shaken by suicides, regardless of their level of development, geographical location and cultural characteristics (see Figure 1).

When the global distribution of suicide rates is examined, it is seen that suicide rates are very high (more than 15/100 thousand) in former Soviet Union member countries and some sub-Saharan African countries. India, the second highest populated country in the world, has a similar rate. This can be attributed to the social pressure caused by the caste system in India. The high level of suicide rates in countries such as the USA, Australia and Western Europe, which are at the top in terms of income level and development, are remarkable. However, many middle and lower income countries in South America and Africa also have high suicide rates. It is noteworthy that suicide rates are low in many Muslim-dominated countries in North Africa, the Middle East and the Pacific.

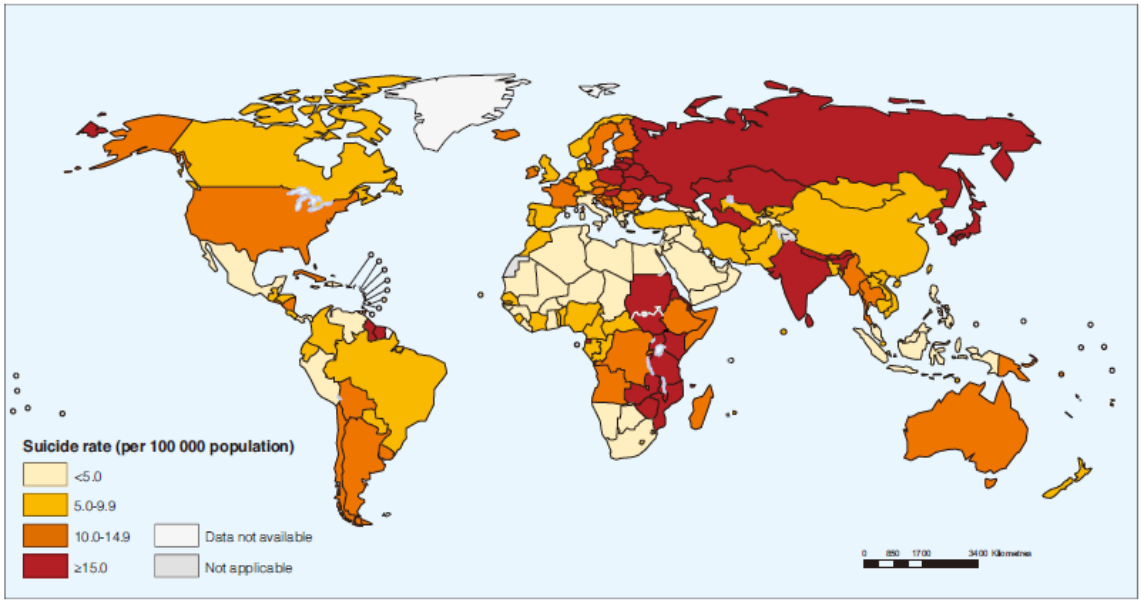


**Figure 1.** Distribution of suicide rates worldwide (as of 2012).
Source: WHO (2014)

On the other side, when suicide age and national income level are taken into consideration, it is seen that suicides are concentrated in the 15-30 age range in middle and low income countries and the suicide rate decreases with age. In high-income countries, the rate of suicide rises to the peak in the 40-60 age range and decreases to lower and higher ages

(WHO, 2014: 18). Accordingly, it can be said that suicides are more common among young people in poor and middle income countries and middle age suicides in high income countries. Worldwide, with a few exceptions, such as China, the male suicide rate is higher than the female suicide rate.

The World Health Organization divides the countries into five groups according to the suicide rate (the number of suicides per 100 thousand people). Among these five groups, that partitioned as very low (less than 2), low (2 to 5), medium (5 to 10), high (10 to 20) and very high (more than 20), the most populous group is the group that has medium suicide rate. As moving up and down, the number of members in the groups decreases. According to this situation, it can be said that the countries have a nearly normal distribution in terms of suicide. On the other hand, when the groups are taken into consideration as a whole, it is seen that there are countries with different levels of development, culture, and geography in each group (Atasoy and Kösle, 2019). For example, in the lowest (Malaysia, Jordan, Bolivia, Morocco, Qatar, Peru, Haiti, Jamaica) and the highest rate group (Japan, Ukraine, China, South Korea, Namibia, Swaziland), this diversity stands out.

***Turkey***

In Turkey, the suicide data obtained from legal sources began to be published in the *Yearbook of Justice Statistics* since 1963. Since 1974, official data on suicides have been published under the title of *Suicide Statistics*.

When the latest suicide statistics for 2015 released by the Turkey Statistical Institute examined, it is seen that the number of fatal suicidal acts was increased by 1.3% compared to 2014 (3211 people). So, in Turkey, a people committed suicide every 2.5 hours on average in 2015 (www.tuik.gov.tr).


**Figure 2.** Female and male suicide rates in Turkey (1975-2016)
Source: TURKSTAT (2014)

Boran (2009), points that the lower the suicide rate in Turkey compared with other countries and suggests that the religious beliefs of Turkish society is one of the reasons for it.

It is known that economic crises have an aggravating effect on people with suicidal tendencies. In Turkey, a significant increase in suicide rates seen in the years following the 1994 and 2001 economic crises. The economic crises stemming from the critical deficits of public deficits in 1994 and the financial markets of November 2000 and February 2001 have caused great turmoil in economic and social life. Increases in male and female suicide rates have been observed over the next few years. Especially in the years following the 2001 crisis, male suicides jumped.

Although there is a widespread belief that marriage has a protective effect across the suicidal idea, the opposite situation is observed in Turkey. When the suicide statistics of the last 10 years are examined, it is seen that married individuals commit suicide more. The share of married individuals who committed suicide in 2015 was 50.5%. Those who never married are in second place with 37.7%. Although the percentage of individuals whose spouses are died or divorced is very low, it does not seem to have much effect on suicide.

Official statistics reveal that primary school graduates committed suicide more than others in Turkey in the last 10 years. Although it widely accepted that there is a negative relationship between suicide rates and the level of education, it is seen that suicide rate has increased in college graduates in Turkey during the last decade.

When suicides in Turkey analyzed in terms of gender, it appears that men commit suicide more than women. Turkey is not an exception in this regard among the rest of the world. In the countries such as Turkey where fewer women participate in working life and take lesser responsibility for livelihood, the fact that economic and work related problems, which are among the main stress factors, are more common in men supports this result (Ekici *et al.*, 2001: 210).

In Turkey and the world, suicide is seen mostly in 15-24 age groups. Women constitute the majority in the ages below 15 and 15-24 age interval whereas men take the majority in the age group 25 and over (Atasoy *et al.*, 2002: 7). According to statistics released by the 2015, highest completed suicide rate were seen in 15-19 age group for women and in 20-24 age group for men. Looking at the overall intensity, most suicide is observed between the ages of 15-24. The rate is decreasing in following ages groups and then increasing gradually over 75 years old. This fact can be explained by the increase in average life expectancy (Uçan, 2006: 8) and increasing responsibilities in proportionate to age.

When the suicide density is analyzed according to statistical region units, it is seen that suicide is recorded most in the Aegean region, followed by the Mediterranean and Marmara regions. The regions where the least suicide occurred were Northeast Anatolia, Eastern Black Sea and Central Anatolia respectively. In the Aegean region, the rate of suicide decreases as moved towards the inner parts. The reasons for this are that urbanization in the coastal areas is higher, the economy is based on industry and tourism, whereas the life is dominated by agriculture at inner parts. (Boran, 2009: 6). The high rate of suicide in the Marmara region can be attributed to the high immigration of Istanbul. Suicide rates differ between regions across Turkey and throughout moving from the eastern part towards the western part, particularly in big cities, increasing rates come to seem (Yüksel and Ceyhun, 1994: 126).

## Related Empirical Literature

Researches on the causes of suicide show variety in terms of methodology. Although suicide is a subject frequently studied by various disciplines, especially psychology and sociology, macro-level analyses have a very low share among the studies as to the factors leading to suicide. One of the main reasons for this is that researches on suicide are carried out by science branches such as psychiatry, psychology and sociology that heavily focus on individual (micro) level research. Another reason is the difficulty in finding detailed and reliable macro (aggregated) data on suicide. It can also be said that modern time series analysis methods are not well known by the mentioned disciplines and the difficulty of reaching micro level time series is effective. As a result of this situation, it is seen that there are few studies in the empirical literature about the causes of suicide in which time series analysis methods used.

In one of these few studies, Rodriguez-Andres *et al.* (2011) investigated the socio-economic factors that affect suicide in Japan separately for men, women and total suicide cases, using data belongs the 1957-2009 period and the ARDL bounds test co-integration approach. As a result of the analysis, it was concluded that the most important cause of suicide in men was divorce whereas fertility rate in women. On the other hand, labor force participation rate and economic difficulties affect both genders at a similar rate. The authors conclude that sociological factors are more effective on suicide in Japan than economic factors.

Ample of theoretical and empirical arguments reveal that economic condition plays a significant role on the suicidal behavior. Departing from this idea, Ruiz-Perez *et al.* (2017) investigated the impact of economic deterioration on suicide rates in Spain. The results found suggest that the Spanish economic crises have been associated with suicide rates in 2008, 2009 and 2012.

Using data from 2002-2011, Aktaş (2014) investigated the relationship between net migration rate, socioeconomic development level, population density, number of single households and unemployment level, and the mean of male and female suicide with multivariate cross-sectional regression analysis. As a result of the analysis, it was concluded that there was a significant relationship between male suicides and socioeconomic development level, population density, number of single households and unemployment level, variables other than population density had a positive effect and migration rate did not have a significant effect. In females, only population density and number of single households had a significant effect, whereas net migration rate, socioeconomic development level and the coefficients of unemployment variables were not significant at 5% level.

Altınanahtar and Halıcıoğlu (2009) conducted a time series analysis based on ARDL models by which they tried to determine the socio-economic factors affecting the suicides in Turkey. According to the results they achieved, urbanization is the most effective factors on suicide during the period of 1974-2007. As slum-intensive, unplanned and rapid urbanization increases, the number of suicides seems to be increasing. The other significant variable is the economic crisis, which was represented by the number of liquidated companies. The periods of economic depression are periods in which mental problems related to stress and depression increase both for the business world and the employees. This pressure can be expected to increase suicidal tendency. According to the findings, income level and divorce rate do not seem to affect suicide.

## Econometric Analysis

In this section, socio-economic factors affecting suicide are analyzed adopting two different approaches. Firstly, classical time series analysis was carried out by taking the suicide rate which is defined as the ratio of suicides number to the total population, as dependent variable. As the variable defined in this way is not count data, the possibility of encountering deviant and inconsistent estimates in the estimation of the regression equation as a condition arising from the structure of the variable is eliminated. In the second approach, the number of suicide cases was taken as dependent variable and count data regression analysis was applied. Thus, it will be possible to monitor the change in the estimation of the relationship between the variables depending on different indicators of suicide on the one hand and the different estimation method on the other.

### *Variables, Models and Data*

The theories on general socioeconomic factors that affect suicide are predominantly based on Durkheim's views (Jalles and Andresen, 2015). Accordingly, deterioration in social and economic structure and regressions lead to various anomalies both at the society and at the individual level, which reduces the life satisfaction of individuals and reinforces suicidal ideation.

Dependent variables of female suicide rate ($Y_1$) and male suicide rate ($Y_2$) indicate the number of female and male suicide cases per 100 thousand people. In many studies investigating socioeconomic factors affecting suicide, suicide rate is used as dependent variable (e. g, Rodriguez-Andres, 2005; Fischer and Rodriguez-Andres, 2008; İnelmen *et al.*, 2010; Rodriguez-Andres *et al.*, 2011; Antonakakis and Gupta, 2017).

Alcohol consumption ($X_1$): It has been shown in many micro-level studies that persons who uses addictive substances such as alcohol and drugs are more prone to suicide (İnelmen *et al.*, 2010). Drunkenness caused by excessive alcohol use can lead to conflict and violence with one's environment and family, and alcohol dependence can lead to material and spiritual losses, leading to depression, anxiety and depression. Accordingly, at the macro level, increasing the consumption of alcoholic beverages in a society can be expected to increase the number of alcoholic individuals and suicidal tendency. In the data collection stage, it has not been possible to reach sufficiently long and comprehensive data related to alcoholic beverage consumption in Turkey. Therefore, instead of consumption of alcoholic beverages, domestic alcoholic beverage production data is used as a proxy variable. When it is considered that the majority of domestically produced alcoholic drinks consumed in Turkey and that this production is almost totally consumed in the short term (*i.e.* within a year), this proximity can be said to be high.

Number of Divorces ($X_2$): Domestic problems and incompatibility between spouses are one of the major sources of stress. Such conflicts, which often result in divorce, can lead to psychological problems or further deepen the discomfort that already exists in individuals. Therefore, increasing the number of divorces in a society can be expected to strengthen the suicidal tendency.

Inflation rate ($X_3$): Inflation is a variable used in most empirical studies as an indicator of macroeconomic instability. Periods where high inflation observed in Turkey (before 2002), corresponds to the periods of rising macroeconomic stress, increasing complains about the

high cost of living, harden financial and commercial life, increased unemployment and economic uncertainty. In case of excess instability, financial collapse may trigger psychological traumas and increase the suicide rate significantly. It is possible that male individuals, especially those responsible for the livelihood of a household, tend to commit suicide in the face of aggravating living conditions. Antonakakis and Gupta (2017) show that macroeconomic uncertainties increase suicidal tendency among young and old men and that women are more resistant to such negativities.

Per capita GDP ($X_4$): It is appropriate to expect that the increase in income will have a positive effect on financial problems and indirectly on some other problems (health, career, social environment, etc.). However, it is also possible that the skewed income distribution may prevent the expected impact of this indicator. On the other hand, suicides due to feelings of dissatisfaction are common among high-income individuals. Barstad (2008) found a positive relationship between high income level and suicidal tendency in the case of Norway. Suzuki (2008) argues that uncertainties regarding the income level strengthen the suicidal tendency. In addition, among the countries with the highest suicide rate in the world, there are many high income countries such as South Korea, Japan and Finland.

Urbanization rate ($X_5$): Although urban life promises higher living standards, it contains stress factors in many ways. On the other hand, there are also opinions that better health, education, entertainment and social activities offered by urban life will make individuals more resilient to emotional problems that feed the idea of suicide.

Overall unemployment rate ($X_6$): The relationship between unemployment and suicide is one of the most widely researched topics in the literature. The stress experienced by unemployed individuals due to loss of income and status, uncertainty about the future and anxiety may improve suicidal ideation. In addition, the problems that unemployed people will have with their close environment and the anxiety of working people losing their jobs during periods of increasing unemployment have the potential to increase the overall suicide rate.

Female and male unemployment rates ($X_7$, $X_8$): Similar to the change in the overall unemployment rate, it is possible that male and female unemployment rates may have a more specific impact on individual male and female suicide rates.

Labor force participation rates of women and men ($X_9$, $X_{10}$): Working, occupying the mind and body with a subject, providing material strength, increasing social integration, achieving personal satisfaction can increase the resistance of individuals against psychological problems that feed the idea of suicide. However, on the contrary, stress and anxiety arising from work and working conditions may cause serious problems in relations with the work environment and the immediate environment. Therefore, both positive and negative effects are possible.

The relationship between suicide rates and the aforementioned socioeconomic factors will be analyzed separately for women and men. Thus, it will be possible to determine whether the nature of the relationships differ according to gender. The models to be estimated are as follows:

*Female*:

Model 1: $Y_{1t} = \beta_{10} + \sum_{j=1}^{5} \beta_{1j} X_{jt} + \beta_{16} X_{6t} + \varepsilon_{1t}$

Model 2: $Y_{1t} = \beta_{20} + \sum_{j=1}^{5} \beta_{2j} X_{jt} + \beta_{26} X_{7t} + \varepsilon_{2t}$

Model 3: $Y_{1t} = \beta_{30} + \sum_{j=1}^{5} \beta_{3j} X_{jt} + \beta_{36} X_{9t} + \varepsilon_{3t}$

*Male*:

Model 4: $Y_{2t} = \beta_{40} + \sum_{j=1}^{5} \beta_{4j} X_{jt} + \beta_{46} X_{6t} + \varepsilon_{4t}$

Model 5: $Y_{2t} = \beta_{50} + \sum_{j=1}^{5} \beta_{5j} X_{jt} + \beta_{56} X_{8t} + \varepsilon_{5t}$

Model 6: $Y_{2t} = \beta_{60} + \sum_{j=1}^{5} \beta_{6j} X_{jt} + \beta_{66} X_{10t} + \varepsilon_{6t}$

Here, $\varepsilon_{.t}$ is an independently and identically distributed (*i. i. d.*) white noise error term. The data related to the series used in the analyses covers the period of 1974-2017 and has been compiled by using TURKSTAT (2014) and TURKSTAT's online database. For the sake of saving the space, any information was not given about the empirical methods used in the analyses. Ample information can be found easily in the related literature and at least in Varol (2019), if required.

***Classical Time Series Analysis***

In this subsection, socio-economic factors affecting male and female suicide rate in Turkey is examined in the framework of classical time series analysis. In this direction, the stationarity characteristics of the series were investigated in the first stage of the analysis, and then the co-integration test was conducted depending on the results of the stationarity analysis.

***Findings of Stationarity Analysis***

As it is well known, a regression relationship between non-stationary time series has the risk of giving misleading (spurious) estimates. Therefore, stationarity analysis was performed based on ADF and PP unit-root tests to determine whether a regression between the level values of the series would yield false results. The results obtained are given in Table 1 below. The tests were conducted for two different specifications in the series, which included only the intercept term and both the intercept term and the time trend.

**Table 1.** Unit-root test results for series.

| Variable | ADF Test | | PP Test | | Structural Break Test | |
|---|---|---|---|---|---|---|
| | *Intercept* | *Intercept and trend* | *Intercept* | *Intercept and trend* | *Intercept* | *Intercept and trend* |
| $Y_1$ | -2,4000 (0,1477) | -2,1414 (0,5089) | -2,3317 (0,1670) | -2,0491 (0,5585) | -2,9933 (0,6898) | -3,5258 (0,6775) |
| $Y_2$ | -0,7570 (0,8207) | **-3,5865 (0,0429)** | -0,9473 (0,7632) | **-3,5179 (0,0500)** | -4,2716 (0,0797) | **-5,7357 (< 0,01)** |
| $X_1$ | 0,0328 (0,9563) | **-3,6760 (0,0358)** | -0,0131 (0,9520) | -2,1934 (0,4810) | -2,2199 (0,9603) | -4,5027 (0,1297) |
| $X_2$ | -0,0152 (0,9518) | -2,0646 (0,5502) | 0,1050 (0,9625) | -2,0412 (0,5627) | **-12,2191 (< 0,01)** | **-13,4658 (< 0,01)** |
| $X_3$ | -1,9780 (0,2951) | -2,5599 (0,2996) | -1,8949 (0,3315) | -2,4087 (0,3701) | -3,6815 (0,2916) | -4,1381 (0,2935) |
| $X_4$ | 2,4694 (1,0000) | -0,1347 (0,9926) | 4,6598 (1,0000) | 0,2148 (0,9974) | -3,8430 (0,2172) | **-6,5143 (< 0,01)** |

| | | | | | | |
|---|---|---|---|---|---|---|
| $X_5$ | -2,2580 (0,1900) | -2,7257 (0,2321) | -1,7763 (0,3869) | -0,8428 (0,9532) | **-11,0123 (< 0,01)** | **-9,7837 (< 0,01)** |
| $X_6$ | -2,1083 (0,2425) | -2,4801 (0,3359) | -2,1554 (0,2250) | -2,5499 (0,3041) | **-5,7668 (< 0,01)** | **-5,9485 (< 0,01)** |
| $X_7$ | -1,3137 (0,6147) | -1,2848 (0,8785) | -1,3478 (0,5986) | -1,1136 (0,9148) | -2,1872 (0,9644) | -2,8215 (0,9511) |
| $X_8$ | -1,9805 (0,2940) | -2,4698 (0,3407) | -2,0198 (0,2776) | -2,6078 (0,2790) | **-4,4662 (0,0473)** | -4,2426 (0,2347) |
| $X_9$ | -1,5524 (0,4978) | 0,4097 (0,9986) | -1,5485 (0,4998) | 0,8356 (0,9997) | -3,3203 (0,4922) | -2,4520 (0,9863) |
| $X_{10}$ | -1,1727 (0,6776) | -0,1480 (0,9923) | -1,1294 (0,6955) | -0,6924 (0,9673) | -2,5986 (0,8693) | **-5,9366 (< 0,01)** |
| $\Delta Y_1$ | **-8,2077 (< 0,01)** | **-8,1949 (< 0,01)** | **-8,2746 (< 0,01)** | **-8,3243 (0,0000)** | **-8,7691 (< 0,01)** | **-8,8156 (< 0,01)** |
| $\Delta Y_2$ | **-8,9293 (< 0,01)** | **-8,8200 (< 0,01)** | **-11,5988 (< 0,01)** | **-11,7007 (0,0000)** | **-10,6189 (< 0,01)** | **-10,4548 (< 0,01)** |
| $\Delta X_1$ | **-4,2665 (< 0,01)** | **-4,2586 (< 0,01)** | **-4,3563 (< 0,01)** | **-4,3449 (< 0,01)** | **-5,1955 (< 0,01)** | **-5,2761 (0,0137))** |
| $\Delta X_2$ | **-5,9618 (< 0,01)** | **-5,9786 (< 0,01)** | **-5,9650 (< 0,01)** | **-6,1180 (< 0,01)** | **-6,1990 (< 0,01)** | **-6,3140 (< 0,01)** |
| $\Delta X_3$ | **-7,6852 (< 0,01)** | **-7,7325 (< 0,01)** | **-7,8870 (< 0,01)** | **-8,3071 (< 0,01)** | **-9,3867 (< 0,01)** | **-9,2737 (< 0,01)** |
| $\Delta X_4$ | **-5,2871 (< 0,01)** | **-6,1550 (< 0,01)** | **-5,3188 (< 0,01)** | **-6,3159 (< 0,01)** | **-6,7426 (< 0,01)** | **-7,4203 (< 0,01)** |
| $\Delta X_5$ | -1,3899 (0,5781) | -1,7991 (0,6874) | -1,7434 (0,4027) | -2,1038 (0,5287) | **-18,8579 (< 0,01)** | **-12,4811 (< 0,01)** |
| $\Delta X_6$ | **-5,4169 (< 0,01)** | **-5,3476 (< 0,01)** | **-6,3991 (< 0,01)** | **-6,1942 (< 0,01)** | **-6,6040 (< 0,01)** | **-6,7610 (< 0,01)** |
| $\Delta X_7$ | **-6,0572 (< 0,01)** | **-6,2459 (< 0,01)** | **-6,0530 (< 0,01)** | **-6,9859 (< 0,01)** | **-6,6898 (< 0,01)** | **-6,7444 (< 0,01)** |
| $\Delta X_8$ | **-5,6570 (< 0,01)** | **-5,5989 (< 0,01)** | **-5,7827 (< 0,01)** | **-5,7151 (< 0,01)** | **-6,8035 (< 0,01)** | **-6,2435 (< 0,01)** |
| $\Delta X_9$ | **-6,5095 (< 0,01)** | **-7,3012 (< 0,01)** | **-6,6406 (< 0,01)** | **-7,2716 (< 0,01)** | **-9,1772 (< 0,01)** | **-9,0212 (< 0,01)** |
| $\Delta X_{10}$ | **-5,6445 (< 0,01)** | **-5,8550 (< 0,01)** | **-5,8119 (< 0,01)** | **-5,9627 (< 0,01)** | **-7,3047 (< 0,01)** | **-7,7977 (< 0,01)** |

Notes: *i*. Δ denotes the first difference of the series. *ii*. Figures in parentheses are the p-values that show the absolute significance level. *iii*. The cases where the null hypothesis can be rejected with a 5% significance level are highlighted in bold.

ADF and PP unit-root tests generally yielded similar results. Accordingly, the female suicide rate is stationary at the level for the trend-containing specification and all other variables are difference stationary. However, the urbanization rate series does not seem stationary even when the first difference is taken.

Conventional tests, such as ADF and PP, may prove that the series is not stationary in case of structural break. Therefore, another unit-root test was applied to the series considering the structural break. As a result of this test, it was concluded that most of the variables were stationary at different specifications. This finding reinforces the fact that ADF and PP tests are suffered by lack of power and the variables are integrated in different degrees.

In the next step, the existence of a long-term relationship between the variables will be examined by the ARDL bounds test approach, which allows different degrees of integration.

***Findings of Co-integration Analysis***

Before proceeding to the co-integration test, the appropriate specification for the ARDL (*p*, *q*) model was determined by automatic selection, taking into account the Schwarz Information Criteria for each model (Table 2). Since the sample volume was not very large (44 observations), a maximum of 4 delays were allowed.

**Table 2.** Appropriate ARDL specifications.

| Specification | Appropriate Model |
|---|---|
| *Model 1* | ARDL (1, 2, 4, 1, 2, 4, 1) |
| *Model 2* | ARDL (1, 2, 4, 4, 4, 4, 3) |
| *Model 3* | ARDL (3, 2, 4, 3, 4, 3, 3) |
| *Model 4* | ARDL (1, 1, 1, 4, 0, 3, 3) |
| *Model 5* | ARDL (1, 1, 1, 4, 3, 3, 0) |
| *Model 6* | ARDL (4, 1, 4, 4, 4, 4, 4) |

Bounds tests were carried out after determining the appropriate specification for each model. All calculated F statistic values are high enough to reject even at 1% significance level the null hypothesis which asserts that there is no co-integration relationship between the variables (Table 3).

**Table 3.** ARDL Bounds test results.

| Specification | F statistics | $\alpha$ | I (0) | I (1) |
|---|---|---|---|---|
| *Model 1* | 12,5764 | | | |
| *Model 2* | 18,8921 | % 10 | 2,218 | 3,314 |
| *Model 3* | 12,7786 | % 5 | 2,618 | 3,863 |
| *Model 4* | 26,6601 | % 1 | 3,505 | 5,121 |
| *Model 5* | 26,7217 | | | |
| *Model 6* | 13,3811 | | | |

***Estimating Long-run Relationships***

After having realized the existence of a significant long-term relationship between the variables, long-term equations have been estimated (Table 4). When the estimations obtained

are examined, alcohol consumption is the only factor affecting suicide rate in all specifications. The increase in alcohol consumption increases the suicide rate in both men and women. Another common effect variable is GDP per capita. In five of the six models, the increase in the income level significantly reduced the suicide rate for men and women at the significant level of 5%. Additionally, the increase in urbanization rate seems to have a dampening effect on suicidal tendency in four out of the six models.

The negative effect of divorce on suicidal tendency only applies to men. Macroeconomic uncertainty, represented by inflation, has no significant effect on suicidal tendency. Likewise, it can be said that unemployment and labor force participation rates do not affect suicidal tendency among men and women.

**Table 4.** Estimation of long-run relationships.

| Coefficient | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|---|---|---|---|---|---|---|
| $\beta_0$ | **5,2298** **(< 0,01)** | **2,2323** **(0,0181)** | 1,8147 (0,6227) | **3,7428** **(< 0,01)** | **4,1653** **(< 0,01)** | -21,7330 (0,1044) |
| $\beta_1$ | **6,34e-06** **(< 0,01)** | **1,88e-06** **(< 0,01)** | **1,39e-05** **(0,0133)** | **6,86e-06** **(< 0,01)** | **7,03e-06** **(< 0,01)** | **1,37e-05** **(< 0,01)** |
| $\beta_2$ | 7,49e-06 (0,0787) | 1,20e-05 (0,0529) | -9,83e-06 (0,4146) | **2,99e-05** **(< 0,01)** | **2,99e-05** **(< 0,01)** | 8,15e-06 (0,4348) |
| $\beta_3$ | -0,0037 (0,4067) | 0,0026 (0,3607) | 0,0023 (0,8347) | 0,0064 (0,2212) | 0,0046 (0,3238) | **-0,0327** **(0,0477)** |
| $\beta_4$ | **-0,0003** **(< 0,01)** | **-0,0004** **(< 0,01)** | **-0,0004** **(< 0,01)** | -0,0001 (0,0622) | **-0,0001** **(0,0447)** | **-0,0005** **(0,0196)** |
| $\beta_5$ | **-0,0722** **(< 0,01)** | **-0,0351** **(< 0,01)** | -0,1701 (0,1048) | **-0,0935** **(< 0,01)** | **-0,0983** **(< 0,01)** | -0,0291 (0,6103) |
| $\beta_6$ | **-0,1881** **(< 0,01)** | 0,0099 (0,8232) | 0,0653 (0,1939) | 0,0589 (0,1515) | 0,0470 (0,1586) | 0,2796 (0,0556) |
| $\chi^2_{SC}$ | **8,5182** **(0,0141)** | 4,8841 (0,0870) | **8,1533** **(0,0170)** | **6,6264** **(0,0364)** | 5,4817 (0,0645) | **22,2111** **(< 0,01)** |
| $\chi^2_H$ | 25,5762 (0,5963) | 26,1704 (0,2000) | 27,4119 (0,4959) | 19,7692 (0,4086) | 19,0051 (0,4565) | 29,2893 (0,5542) |

Notes: *i.* The figures in parentheses are the p-values. *ii.* $\chi^2_{SC}$ denotes Breusch – Godfrey LM test statistics for autocorrelation, $\chi^2_H$ denotes Breusch – Pagan – Godfrey LM test statistics for heteroscedasticity. *iii.* The cases where the null hypothesis can be rejected with a 5% significance level are highlighted in bold.

In general, if an assessment is made; alcohol consumption, income level and urbanization rate has a significant and meaningful impact on the male and female suicide rates in Turkey. When considering the increase of consumption of alcoholic beverages in Turkey over time (Buzrul, 2016), it can be expected that increasing alcohol consumption may feed development of suicidal thoughts in individuals who take alcohol.

Although it is possible increase of suicide tendency at high income levels, this phenomenon is unlikely to be observed in the middle income group. The prominence of the middle and lower income groups in developing countries such as Turkey, makes it plausible that a rise in

income level cause a decline in the suicide rate. This and the results related to divorce rate coincide with the findings of Altınanahtar and Halıcıoğlu (2009). However, the negative result on the effect of urbanization on suicide rate conflicts with the findings of them. At this point, it should be taken into consideration that Altınanahtar and Halıcıoğlu (2009) used the suicide number of men and women as dependent variables and applied a time series analysis based on ARDL model.

***Causality Analysis***

When mitigating suicide cases and suicide rates adopted as a goal, the question arises as to what tools can be used for this purpose. A forecast of the level of the suicide rate (the dependent variable used in this part of the analysis) over the coming years will provide valuable information on this. With the help of Granger causality analysis, it is possible to determine which variables provide information in order to estimate the values that the suicide rate will take in the following years. For this purpose, Granger causality tests for male and female suicide rates were conducted separately in this part of the analysis and their findings are presented in Tables 5 and 6 respectively.

**Table 5.** Granger causality test for female suicide rate.

| Lag length → | 1 | 2 | 3 |
|---|---|---|---|
| Hypothesis | F-statistics | F-statistics | F-statistics |
| $X_1 \rightarrow Y_1$ | **14,0016 (0,0006)** | **5,2231 (0,0100)** | **3,1735 (0,0365)** |
| $Y_1 \rightarrow X_1$ | 1,5795 (0,2161) | 0,0281 (0,9723) | 0,1223 (0,9463) |
| $X_2 \rightarrow Y_1$ | **5,4512 (0,0247)** | 1,8096 (0,1779) | 0,8489 (0,4769) |
| $Y_1 \rightarrow X_2$ | 0,8722 (0,3559) | 0,5550 (0,5788) | 0,5854 (0,6287) |
| $X_3 \rightarrow Y_1$ | 0,0983 (0,7609) | 1,3669 (0,2675) | 1,1504 (0,3429) |
| $Y_1 \rightarrow X_3$ | **5,8820 (0,0199)** | **3,4180 (0,0434)** | **3,2494 (0,0337)** |
| $X_4 \rightarrow Y_1$ | **8,2223 (0,0066)** | 1,9210 (0,1608) | 0,9550 (0,4251) |
| $Y_1 \rightarrow X_4$ | **8,8570 (0,0049)** | **5,2369 (0,0099)** | **3,6281 (0,0225)** |
| $X_5 \rightarrow Y_1$ | **4,4708 (0,0408)** | 1,3496 (0,2718) | **4,4041 (0,0101)** |
| $Y_1 \rightarrow X_5$ | 0,3356 (0,5657) | 0,2014 (0,8185) | 0,1286 (0,9425) |
| $X_7 \rightarrow Y_1$ | 1,0494 (0,3118) | 1,3104 (0,2819) | 1,0448 (0,3853) |
| $Y_1 \rightarrow X_7$ | 4,0614 (0,0506) | 3,2310 (0,0509) | **2,9650 (0,0457)** |

**Table 6.** Granger causality test for male suicide rate.

| Lag length → | 1 lag | 2 lags | 3 lags |
|---|---|---|---|
| Hypothesis | F-statistics | F-statistics | F-statistics |
| $X_1 \rightarrow Y_2$ | **14,0016 (0,0006)** | **5,2231 (0,0100)** | **3,1735 (0,0365)** |
| $Y_2 \rightarrow X_1$ | 1,5795 (0,2161) | 0,0281 (0,9723) | 0,1223 (0,9463) |

| | | | |
|---|---|---|---|
| $X_2 \rightarrow Y_2$ | **5,4512 (0,0247)** | 1,8096 (0,1779) | 0,8489 (0,4769) |
| $Y_2 \rightarrow X_2$ | 0,8722 (0,3559) | 0,5550 (0,5788) | 0,5854 (0,6287) |
| $X_3 \rightarrow Y_2$ | 0,0938 (0,7609) | 1,3669 (0,2675) | 1,1504 (0,3429) |
| $Y_2 \rightarrow X_3$ | **5,8820 (0,0199)** | **3,4180 (0,0434)** | **3,2494 (0,0337)** |
| $X_4 \rightarrow Y_2$ | **8,2223 (0,0066)** | 1,9210 (0,1608) | 0,9550 (0,4251) |
| $Y_2 \rightarrow X_4$ | **8,8570 (0,0049)** | **5,2369 (0,0099)** | **3,6281 (0,0225)** |
| $X_5 \rightarrow Y_2$ | **4,4708 (0,0408)** | 1,3496 (0,2718) | **4,4041 (0,0101)** |
| $Y_2 \rightarrow X_5$ | 0,3356 (0,5657) | 0,2014 (0,8185) | 0,1286 (0,9425) |
| $X_7 \rightarrow Y_2$ | 0,0849 (0,7723) | 1,5409 (0,2276) | 1,5765 (0,2130) |
| $Y_2 \rightarrow X_7$ | 2,6370 (0,1123) | 1,7029 (0,1961) | 0,9854 (0,4112) |

***Count Data Regression Analysis***

In some studies in the literature (*e. g.* Altınanahtar and Halıcıoğlu, 2009) the number of suicides was taken as the indicator of suicide. However, in this case, the use of the classical linear regression model will lead to biased and inconsistent estimates. In this part of the study, regression analysis for count data is carried out by taking the annual suicide numbers for male and female as dependent variables. In addition, both Poisson regression and Negative Binomial model were used as the model format.

Poisson regression model is the most commonly used format in counting data regression models (PRM). Theoretically, although the mean and variance in PRM are equal (equi-dispersion), in most cases this equality deteriorates (either under- or over-dispersion) in which case PRM-based estimates are inefficient (Eryavuz *et al.*, 2016). This is due to the heterogeneity of the data and / or the existence of large number of zero values. To remove the drawback of Poisson distribution, researchers have shown great interest to introduce mixed-Poisson distributions for modeling the over-dispersed or under-dispersed count data sets (Altun, 2019). One way to eliminate this problem is to use the negative binomial regression model (NBRM) which takes into account the unobservable heterogeneity in the data by adding an error term to the conditional mean of the Poisson distribution (Eryavuz *et al.*, 2016).

The same specifications used in the classic time series for men and women were used. Thus, it will be possible to compare the results to a certain extent with those obtained from classical time series analysis. However, since the number of suicide cases could be affected by the increase in the male and female population over time, the population variable was added to the equation.

As $Y_{3t}$ is female suicide numbers, $Y_{4t}$ is male suicide numbers, $X_{11t}$ is female population, $X_{12t}$ female population, equations to be estimated are as follows:

*Female*:

Model 7: $Y_{3t} = \alpha_{10} + \sum_{j=1}^{5} \alpha_{1j} X_{jt} + \alpha_{16} X_{6t} + \alpha_{17} X_{11t} + u_{1t}$

Model 8: $Y_{3t} = \alpha_{20} + \sum_{j=1}^{5} \alpha_{2j} X_{jt} + \alpha_{26} X_{7t} + \alpha_{27} X_{11t} + u_{2t}$

Model 9: $Y_{3t} = \alpha_{30} + \sum_{j=1}^{5} \alpha_{3j} X_{jt} + \alpha_{36} X_{9t} + \alpha_{37} X_{11t} + u_{3t}$

*Male*:

Model 10: $Y_{4t} = \alpha_{40} + \sum_{j=1}^{5} \alpha_{4j} X_{jt} + \alpha_{46} X_{6t} + \alpha_{47} X_{12t} + u_{4t}$

Model 11: $Y_{4t} = \alpha_{50} + \sum_{j=1}^{5} \alpha_{5j} X_{jt} + \alpha_{56} X_{8t} + \alpha_{67} X_{12t} + u_{5t}$

Model 12: $Y_{4t} = \alpha_{60} + \sum_{j=1}^{5} \alpha_{6j} X_{jt} + \alpha_{66} X_{10t} + \alpha_{67} X_{12t} + u_{6t}$

According to the Poisson model estimates, the number of men and women committing suicide increases due to alcohol use and population growth. Unlike women, increasing number of divorces increases male suicide. The effect of divorce in women is negative and insignificant. Another common result for men and women is that inflation and the increase in per capita income reduce the number of suicides. The effect of unemployment and labor force participation on suicides is generally negative for both groups. On the other hand, while the increase in urbanization rate is not effective on male suicides, it is seen that it reduces the number of suicides in women. When the results are considered as a whole, it can be said that socioeconomic risk factors have a similar effect on the suicide rates of men and women.

**Table 7.** Estimates of the Poisson regression model.

| Coefficient | Model 7 | Model 8 | Model 9 | Model 10 | Model 11 | Model 12 |
|---|---|---|---|---|---|---|
| $\alpha_0$ | **5,0245 (< 0,01)** | **4,7647 (< 0,01)** | **5,7685 (< 0,01)** | **5,0512 (< 0,01)** | **5,0213 (< 0,01)** | **4,3374 (< 0,01)** |
| $\alpha_1$ | **6,39e-07 (< 0,01)** | **6,35e-07 (< 0,01)** | **3,43e-07 (0,0314)** | **3,22e-07 (< 0,01)** | **4,41e-07 (< 0,01)** | **3,30e-07 (< 0,01)** |
| $\alpha_2$ | -4,45e-07 (0,5489) | **-1,62e-06 (0,0207)** | -1,05e-06 (0,1057) | **2,69e-06 (< 0,01)** | **3,25e-06 (< 0,01)** | **1,89e-06 (< 0,01)** |
| $\alpha_3$ | **-0,0036 (< 0,01)** | **-0,0032 (< 0,01)** | **-0,0027 (< 0,01)** | **-0,0024 (< 0,01)** | **-0,0025 (< 0,01)** | **-0,0024 (< 0,01)** |
| $\alpha_4$ | **-0,0001 (< 0,01)** | **-0,0001 (< 0,01)** | **-9,00e-05 (< 0,01)** | **-3,13e-05 (< 0,01)** | **-3,42e-05 (< 0,01)** | **-3,70e-05 (< 0,01)** |
| $\alpha_5$ | **-0,0154 (0,0350)** | **-0,0198 (< 0,01)** | **-0,0316 (< 0,01)** | 0,0081 (0,1603) | **0,0149 (0,0144)** | 0,0034 (0,5356) |
| $\alpha_6$ | **-0,0141 (0,0224)** | 0,0079 (0,1988) | **-0,0107 (< 0,01)** | **-0,0137 (< 0,01)** | **-0,0196 (< 0,01)** | 0,0061 (0,1484) |
| $\alpha_7$ | **1,44e-07 (< 0,01)** | **1,65e-07 (< 0,01)** | **1,76e-07 (< 0,01)** | **7,91e-08 (< 0,01)** | **5,51e-08 (0,0264)** | **1,05e-07 (< 0,01)** |
| $R^2$ | 0,9185 | 0,9152 | 0,9236 | 0,9742 | 0,9738 | 0,9741 |
| LR | 3867,96 (< 0,01) | 3864,37 (< 0,01) | 3878,19 (< 0,01) | 11906,28 (< 0,01) | 11918,04 (< 0,01) | 11899,27 (< 0,01) |
| AIC | 16,3396 | 16,4293 | 16,0836 | 17,0674 | 16,7732 | 17,2425 |
| SBC | 16,6774 | 16,7671 | 16,4214 | 17,4052 | 17,1110 | 17,5803 |

Notes: *i.* Figures in parentheses are the p-values. *ii*. LR: likelihood ratio value, AIC: Akaike Information Criterion, SBC: Schwarz Bayesian Information Criterion. *iii.* The cases where the null hypothesis can be rejected with a 5% significance level are highlighted in bold.

According to the results obtained from the negative binomial model, alcohol consumption, divorce, urbanization and unemployment variables do not seem to have a significant effect on suicide numbers. On the other hand, the effect of inflation and income level is significant and negative for both sex groups.

Comparing the results obtained from the Poisson and Negative Binomial models, it is noticed that there is more factor with significant effect in Poisson regression. In addition, inflation and income level variables which have a significant effect in both approaches are the most resistant factors. Considering the AIC and SBC criteria, it can be said that NBRM is superior and therefore the results of these models should be respected.

**Table 8.** Estimates of the Negative Binomial regression model.

| Coefficient | Model 7 | Model 8 | Model 9 | Model 10 | Model 11 | Model 12 |
|---|---|---|---|---|---|---|
| $\alpha_0$ | **5,0325 (< 0,01)** | **4,4849 (< 0,01)** | **5,3796 (< 0,01)** | **5,0601 (< 0,01)** | **5,0494 (< 0,01)** | **2,9355 (0,0317)** |
| $\alpha_1$ | 4,47e-07 (0,2463) | 5,64e-07 (0,1559) | 2,90e-07 (0,4938) | 2,45e-07 (0,4221) | 4,87e-07 (0,1271) | 3,47e-07 (0,2988) |
| $\alpha_2$ | -2,86e-07 (0,9038) | -2,04e-06 (0,3362) | -1,23e-06 (0,5437) | 2,74e-06 (0,1634) | **4,08e-06 (0,0358)** | 1,65e-06 (0,3383) |
| $\alpha_3$ | **-0,0028 (< 0,01)** | **-0,0023 (0,0469)** | **-0,0026 (0,0214)** | **-0,0027 (< 0,01)** | **-0,0028 (< 0,01)** | **0,0031 (< 0,01)** |
| $\alpha_4$ | **-9,74e-05 (< 0,01))** | **-0,0001 (< 0,01)** | **-9,35e-05 (< 0,01)** | **-3,26e-05 (0,0155)** | **-3,87e-05 (< 0,01)** | **-5,21e-06 (< 0,01)** |
| $\alpha_5$ | -0,0220 (0,2697) | -0,0229 (0,2348) | -0,0314 (0,1339) | 0,0070 (0,6745) | 0,0199 (0,2379) | -0,0002 (0,9893) |
| $\alpha_6$ | -0,0145 (0,4507) | 0,0221 (0,2249) | -0,0062 (0,4250) | -0,0238 (0,1142) | **-0,0364 (< 0,01)** | 0,0199 (0,1626) |
| $\alpha_7$ | 1,69e-07 (0,3065) | **1,84e-07 (0,0139)** | **1,92e-07 (0,0123)** | 9,19e-08 (0,1961) | 4,20e-08 (0,5578) | **1,43e-07 (0,0408)** |
| $R^2$ | 0,9150 | 0,9088 | 0,9201 | 0,9720 | 0,9689 | 0,9706 |
| LR | 4057,38 (< 0,01) | 4058,27 (< 0,01) | 4057,44 (< 0,01) | 12099,99 (< 0,01) | 12104,08 (< 0,01) | 12099,49 (< 0,01) |
| AIC | 11,6541 | 11,6318 | 11,6525 | 12,2745 | 12,1723 | 12,2870 |
| SBC | 12,0341 | 12,0118 | 12,0325 | 12,6545 | 12,5523 | 12,6670 |

Notes: *i.* Figures in parentheses are the p-values. *ii*. LR: likelihood ratio value, AIC: Akaike Information Criterion, SBC: Schwarz Bayesian Information Criterion. *iii.* The cases where the null hypothesis can be rejected with a 5% significance level are highlighted in bold.

Evaluating together the time series analysis and count data regression model findings, it can be seen that the most resistant factors in terms of method and specification are inflation and income level, followed by alcohol use and divorce rate factors. Thus, suicide decision of individuals in Turkey to be more sensitive to economic factors, while the familial troubles can be said to take second place. As emphasized previously, considering that alcohol use can

cause problems in the family, it can be considered that alcohol and divorce cases are closely related.

## Conclusion

In this study, we aimed to investigate whether there is a relationship between selected socio-economic factors and suicide phenomenon in Turkey. By doing this, existing gaps both in terms of the methodological aspect and the empirical evaluation of suicide phenomenon in Turkey could be filled in a certain extent. To this end, per capita income, unemployment, divorce, alcohol consumption, labor force participation, inflation and urbanization have been selected as explanatory factors and their impact on suicide have been tried to determine by using modern time series analysis methods.

According to co-integration analysis alcohol consumption, income level and urbanization rate has a significant and meaningful impact on the male and female suicide rates in Turkey. Considering the increase of consumption of alcoholic beverages in Turkey over time, it can be expected that increasing alcohol consumption may feed development of suicidal thoughts in individuals who take alcohol. The prominence of the middle and lower income groups in developing countries such as Turkey, makes it plausible that a rise in income level cause a decline in the suicide rate.

In this study, estimation with count data regression models was also applied. In this context, Poisson and negative binomial regression models are included. Poisson model estimates reveal that almost all included factors have significant impact on both male and female suicide rates. Specifically, the number of men and women committing suicide increases due to alcohol use and population growth. Another common result for men and women is that increase in purchasing power and income reduce the number of suicides. The effect of unemployment and labor force participation on suicides is generally negative for both groups. On the other hand, while the increase in urbanization rate is not effective on male suicides, it is seen that it reduces the number of suicides in women. When the results are considered as a whole, it can be said that socioeconomic risk factors have a similar effect on the suicide rates of men and women. According to the results obtained from the negative binomial model alcohol consumption, divorce, unemployment and urbanization do not seem to have a significant effect on suicide numbers. On the other hand, the effect of inflation and income level is significant and negative for both sex groups.

If the results obtained from the Poisson and Negative Binomial models are compared, it is noticed that there is more factor with significant effect in Poisson regression. In addition, inflation and income level variables, which have a significant effect in both approaches, are the most resistant factors.

Evaluating overall findings, it can be seen that the most resistant factors in terms of method and specification are inflation and income level, followed by alcohol use and divorce rate factors. Thus, suicide decision of individuals in Turkey to be more sensitive to economic factors, while the familial troubles can be said to take second place. As emphasized previously, considering that alcohol use can cause problems in the family, it can be considered that alcohol and divorce cases are closely related. The findings obtained from the causality analysis support the findings of the regression analysis on the one hand and provide important clues about the available tools for estimating and reducing suicide rates.

Considering the overall findings of the analyses it can be said that a two-dimensional strategy should be adopted for suicide mitigating programs by the related official authorities and NGOs as well. In the first dimension high-risk groups such as alcohol-addicted, poor, urbanized individuals should be targeted. In the second dimension whole population should be targeted by relevant country-wide social programs.

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