HARMONIC REGRESSION ANALYSIS OF TERROR EVENTS IN TURKEY: PERIODICITIES AND FORECASTING

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Abstract

In the study, the number of terrorist incidents occurred during 2001/01-2012/11 periods in Turkey's Southeast region are studied. Since Southeast region has the highest number of terrorist incidents in Turkey, Southeast region is selected. The data used in the study is obtained by special permission from official institutions. In this study, the periodicities observed during the period are examined and it is tried to obtain a meaningful predictive model by using harmonic regression and classical time series techniques. Harmonic regression and classical time series techniques have been shown to give better predictions in the application of periodic series. According to the results, predictions obtained by harmonic regression model are closer to the real values. However, it is determined that the acts of terrorism in Turkey show an increase in every 72 months-6 years period, and the observed periodicities are interpreted. So, it is important not to allow terrorist organizations to recover in the fight against terrorism. Considering such periodicities, it is important to share the results with the relevant units dealing with terrorism globally.

Keywords: Harmonic Regression, Periodicities, Time Series, Terror Events

TÜRKİYE'DE TERÖR OLAYLARININ HARMONİK REGRESYON ANALİZİ: PERİYODİKLİKLER VE ÖNGÖRÜ

Öz

Çalışmada, Türkiye'nin Güneydoğu bölgesindeki 2001/01-2012/11 dönemlerinde meydana gelen terör olaylarının sayısı incelenmiştir. Çalışma için Türkiye'de terör olaylarının yoğun olarak yaşandığı Güneydoğu Anadolu bölgesi seçilmiştir. Araştırmada kullanılan veriler resmi kurumlardan özel izinlerle alınmıştır. Bu çalışmada, dönem boyunca gözlenen periyodiklikler incelenerek harmonik regresyon ve klasik zaman serisi teknikleri kullanılarak anlamlı bir öngörü modeli elde edilmeye çalışılmıştır. Harmonik regresyon ve klasik zaman serileri tekniklerinin periyodik serilerin uygulanmasında daha iyi tahminler verdiği gösterilmiştir. Elde edilen sonuçlara göre, harmonik regresyon modeliyle elde edilen tahminler gerçek değerlere yakındır. Bununla birlikte, Türkiye'de terör eylemlerinin her 72 ayda (6 yıl) bir artış gösterdiği tespit edilmiş ve gözlemlenen süreklilikler yorumlanmıştır. Bu nedenle, terör örgütlerinin terörle mücadelede toparlanmalarına izin vermemek önemlidir. Bu periyodiklikleri göz önünde bulundurarak, sonuçları dünya çapında terörle ilgili birimlerle paylaşmak önemlidir.

Anahtar Kelimeler: Harmonik Regresyon, Periyodiklik, Zaman Serileri, Terör Olayları.

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INTRODUCTION

Terror can be perceived as pressure by spreading "fear and horror". However, it is a product of the modern age in terms of strategies. Terror is murder of civilians or security officials in order to achieve any purpose (this is mostly political) by means of voice-raising actions against propaganda. (Bal, 2003).

Terror is a long-standing war. However, it has become a common concern for the developed countries in the West after the attacks in the USA 2001 and Spain 2004 (Keefer-Loayza, 2008).

Over 30 years, Turkey combats and struggles against terrorism and terrorist organizations. So far, the economic cost of terrorism to Turkey is around 350 billion dollars. Although this figure is quite eerie, today is about twice that of Turkey's total exports (KCC1, 2015). Turkey continues to fight against terrorism, and in this fight, about 8,000 government officials and more than 1,700 citizens lost their lives (TGNA2 Human Rights Investigation Commission, 2013).

The whole world is engaged in fighting against the threat of terrorism with global perspective. Winning the global dimension of terrorism in particular, is a problem that only a few countries engaged in terrorism. In this process, Turkey has been fighting against the terrorist organizations for many years and this struggle caused both material and spiritual losses for the country. Unfortunately, the military and civilian casualties have reached at important levels. Therefore, the analysis of the data related with the terrorist events and dealing with terrorist activites is important in terms of the fight against terrorism.

Globally, all of the countries are devoted to combating with terrorism and terrorist organizations. Terrorist acts harm both human life and bring financial burdens on countries. The main aim in the fight against terrorism is to make terrorist organizations unable to take any actions. Acts of terrorism in Turkey show an increase in certain periods and continue for years. It continues to increase its effect with different methods and tactics. Although their names are different and change from time to time, the terrorist organizations with the same aims continue their activities.

Instead of using slogans in the fight against terrorism, it is important that studies based on statistics and conceptual analyzes should appear. Making analyzes

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[1] Konya Chamber of Commerce.
[2] Turkey Grand National Assembly.

based on scientific methods will make the coordinates of counter-terrorism more understandable and stronger. As a result, the future of the struggle against this global threat will become more predictable. (Bal, 2003).

Terrorist organizations are organized by defining ideology according to the subject they are exploiting. Although the loss of life, logistic and financing problems of organizations that define rural areas as stages for their activities, this large area constitutes the living space of the organization. In this context, Turkey's Eastern and Southeastern regions have been a geography that are suitable and give life to the terrorist organization. Since terrorist events mostly occurred in the Southeastern Anatolia Region of Turkey, in period 2001: 01-2012: 11 (*n:143*) the terrorist acts occurred are examined in this study.

The data used in the study was obtained from official institutions3 with special permission. The secret periodicities observed in terms of terrorist events are examined. The periodicity is taken into consideration and it has been tried to obtain a meaningful predictive model by using harmonic regression and classical time series techniques. The predictive values obtained by classical time series models and the predictive values obtained by harmonic regression are tried to be compared.

Since Turkey's fight against terrorism continues over 30 years, it is important to answer the questions that "do these terrorist acts have a periodicity?" and "why this kind of periodicity occur?" Interpretation of observed periodicities in terrorist events is examined.

Periodicities and their reasons are important in the fight against terrorism. In the long-term struggle, it is important that international/national security organizations should not allow the recovery processes of terrorist organizations, if the terrorist organizations are to be destroyed completely. Therefore, periodicities examined in the selected period should be taken into account. It is important to share the results with the relevant security units who deal and combat with terrorism globally or locally. With the help of examining such processes and periodicities, the security units will gain another perspectival and scientific view while combatting with terrorism and terrorist organizations.

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[3] The data used in the study are confidential. The data used in the study were taken from the Turkish Gendarmerie General Command with special permission and must only be used for this study.

1. LITERATURE

It is difficult to obtain data due to the fact that much of the data on terrorist incidents are confidential. Although obtaining this kind of data is quite difficult, the studies based on the data of terror events continue to increase. In addition, there are many studies using harmonic regression and classical time series techniques.

Weimann (1988), examined the predictability of international terrorism in terms of the existence of trends, seasonality, and periodicity of terrorist events. The data base used was the RAND Corporation's Chronology of International Terrorism. It contained the attributes of every case of international terrorism from 1968 to 1986.

Enders et al. (1992), applied spectral analysis to transnational terrorist time series involving all incidents, hostage incidents, bombings, assassinations, and threats and hoaxes during 1970–1989.

Rusnak (2010), made a spatial analysis of terror events. In study, Rusnak said that the advancement of understanding of the pathways and context would require more comprehensive and reliable approach to terrorism research; one such approach incorporated the use of spatial analysis combined with reliable and valid risk assessment modeling.

Katos et al. (2012), explicitly addressed the heterogeneity of terror by classifying groups according to their ideologies. They showed that the pattern of terror events and its determinants differ strongly for different types of terror events. They analyzed determinants of domestic and international terrorism for target and origin using the Global Terrorism Database and showed that there have been major shifts in terror activity and composition overtime.

Sarı and Gerdan (2013), determined the terrorist groups according to different criteria and determined the terrorist groups that should be rendered ineffective. In that way, primarily trained intelligence sources, such as unity, materials, allowances, etc. resources could be used more effectively to combat terrorist groups. In that way, efficient resource utilization would be provided and groups would be neutralized by starting from terrorist group in A class.

Karamanoğlu (2016), examined Turkey's terrorist incidents occurred in the five provinces and has obtained time-series models for terror events for each selected provinces. With the help of the obtained models, the predictions about the number of terrorist incidents in the regions studied were revealed.

Bowie (2017), in his research note presented 60 key databases, data sets and chronologies on terrorism events data developed since 1968. He described design characteristics of these quantitative data collections and pointed to their usefulness for research on terrorism and counter-terrorism.

Cordesman (2017), prepared a report to provide a graphic overview of the trends from 1970 to the end of 2016. Each section first traced the patterns since 1970, and then focused on the period from 2011-2016. In the study, he covered global, regional, and key national trends and compared different estimates and sources for 2015 and 2016.

2. METHODS AND FINDINGS

Many time series occurring in different fields such as economics, oceanography, astronomy, medicine, acoustics etc. strongly have periodic behavior.

The occurrence of periodicities is a characteristic feature of time series in natural and social studies. Unraveling such periodic features from observed records is a difficult task. There have emerged in the statistical literature various approaches to deal with this problem, both in the time and frequency domains. One of the important methods is harmonic regression (Artis et al., 2007).

Harmonic regressions are useful when time series have multiple seasonal patterns. The periodicities observed during the period (2001:01-2012:11) are examined and by using harmonic regression and classical time series techniques, a meaningful predictive model is tried to obtain.

Figure-1 presents the time series plots of terror events in 2001:01-2012:11 (n:143) period in Turkey's Southeastern Anatolia region.

Since the autocorrelation functions of data are rapidly decreasing, it can be said intuitively that the data is stationary. However, the stability of the series is also tested by standard Dickey-Fuller unit root tests and the series was stable at 5% meaning.
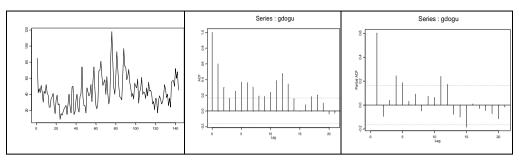
Figure-1. Terrorist Incidents in the Period 2001:01-2012:11 in Southeastern Anatolia

Table-1 presents the ADF unit root test statistics results. Based on the data, we observe that the series is stationary and it means that it is predictable.

Table-1. Dickey-Fuller Test Results

Null Hypothesis: Y has a unit root Exogenous: Constant Lag Length: 0 (Automatic - based on SIC, maxlag=13)		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		**-6.071017**	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

First of all, a time series model which is suitable for the data is tried to be obtained. For this reason, considering the partial autocorrelation function of the series, different time series models are considered and the model which gives the smallest AIC statistics is considered as the most suitable model. Table-2 presents the values of AIC statistics for different time series models.

Table-2. Values of AIC Statistics

p	1	2	3	4	6	12
AIC	1181.422	1182.116	1183.875	1176.416	1174.59	1169.542
p	(4)	(6)	(12)	(1,12)	(1,12,13)	(1,6,12,13)
AIC	1236.056	1225.011	1206.096	**1165.353**	1165.680	1165.599

Considering the table values, $e_t \sim WN(0, \sigma^2)$ it can be said that

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_{12} Y_{t-12} + e_t, \, t = 1, 2, ..., 143 \qquad \textbf{Model A}$$

Model A is the most appropriate model for the data.

Parameter estimates and last 100 estimation values for this model are given in Table-3 and Figure-2 below. As seen from the values in Table-3, all parameters are significant.

Parameters are observed as $\hat{\alpha}_0 = 9.53$ and $\hat{\sigma}_n^2 = 198.48$.

Table-3. Parameter Estimates for Model A

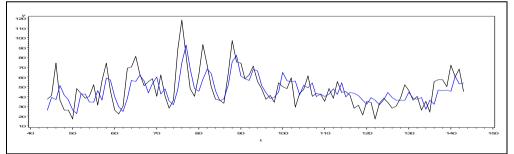|	Conditional Least Squares Estimation					
Parameter	**Estimate**	Standard **Error**	Approx **t Value**	**Pr > |t|**	**Lag**
MU	46.58073	4.71635	9.88	<.0001	0
AR1,1	0.48746	0.06913	7.05	<.0001	1
AR1,2	0.31178	0.07120	4.38	<.0001	12
	Constant Estimate	9.351865			
	Variance Estimate	198.4806			
	Std Error Estimate	14.08831			
	AIC	1165.353			
	SBC	1174.242			
	Number of Residuals	143			
	* AIC and SBC do not include log determinant.				

Figure-2. Estimation Values According to Model A (Black, Observation Values; Blue, Estimation Values)

According to Model A, considering 100 observation values, the estimation values are calculated by $\hat{y}_{i,a}$. Sum of error squares is obtained as

$$\sum_{i=44}^{143} (y_i - \hat{y}_{i,a})^2 = 20080.7973 \cdot$$

Periodograms are generally used as a tool for investigating possible cycles in the series. (Wei, 2006, Fuller 1996, Brockwell and Davis 1987).

Trigonometric functions come to mind in terms of periodic functions. Therefore, if any time series is given, such as $\{Y_1, Y_2, ..., Y_n\}$, for testing whether the series contains a periodic component or not, for these series it is assumed that a model in the form of model given below

$$Y_t = \mu + R\cos(wt + \phi) + e_t, t = 1, 2, ..., n$$

is suitable. Here the terms μ, R, ϕ and w are, in the same order, the expected value (average), width (amplitude), phase (phase) and frequency (frequency). These are model parameters and should be estimated. If they are selected as $w_k = 2\pi k/n$ than w_k's are Fourier frequencies. From the properties of cosine function $\alpha = R\cos(\phi)$ and $\beta = R\sin(\phi)$ the model can be written as

$$Y_t = \mu + \alpha\cos(w_k t) + \beta\cos(w_k t) + e_t, t = 1, 2, ..., n$$

According to this model, $H_0 = \alpha = \beta = 0$ if the hypothesis of rejection is rejected, there is periodic component (loop) in the data. The standard F test can be used to test this hypothesis. But because w_k frequecies are not known, the using of F test is not significant (Wei, 2006).

According to this model, the least squares estimators of the parameters μ, α and β are $\hat{\mu}$, a_k and b_k

$$\hat{\mu} = \bar{Y}_n = \frac{1}{n}\sum_{t=1}^{n} Y_t \;, \; a_k = \frac{2}{n}\sum_{t=1}^{n}(Y_t - \bar{Y}_n)\cos(w_k t) \;\; \text{and} \;\; b_k = \frac{2}{n}\sum_{t=1}^{n}(Y_t - \bar{Y}_n)\sin(w_k t)$$

The calculated values of a_k and b_k are called Fourier coefficients. Again, from the properties of trigonometric functions it can be written as

$$\sum_{t=1}^{n}\cos(w_k t) = \sum_{t=1}^{n}\sin(w_k t) = 0$$

and Fourier frequencies do not change according to average (invariant). With the help of Fourier coefficients obtained, it is calculated as the periodogram in the frequency of time series. (periodogram ordinate),

$$I_n(w_k) = \frac{n}{2}\left(a_k^2 + b_k^2\right)$$

The autocorrelation function of a time series is an important and the most common tool in the visual determination of seasonal and periodic components in the series with the stability of the series. The autocorrelation of a time series given as $\{Y_1, Y_2, ..., Y_n\}$ is ($\gamma(h) = Cov(Y_t, Y_{t+h})$) and can be calculated as

$$\hat{\gamma}_n(h) = \frac{1}{n}\sum_{t=1}^{n-h}(Y_t - \bar{Y}_n)(Y_{t+h} - \bar{Y}_n) \ .$$

The spectral density function of the series is also calculated as given below

$$\hat{f}_n(w_k) = \frac{1}{2\pi}\left(\hat{\gamma}_n(0) + 2\sum_{k=-(n-1)}^{n-1}\hat{\gamma}_n(h)\cos(w_k)\right) = \frac{1}{4\pi}I_n(w_k), k = 1, 2, ..., [n/2]\cdot$$

Also, it is $\lim_{n \to \infty} E(\hat{f}_n(w_k)) = f(w_k)$ and the periodogram of the series is asymptotic neutral for spectral density function (Wei, 2006). Therefore, periodograms can be used to estimate the spectral density function of the series. In addition, periodograms are an estimator of the spectral density function of any time series and are used in the investigation of probable periodicities (test of hypothesis).

For any stationary time series, in each frequency k, the periodogram values $I_n(w_k)$ are calculated. Let's show with the largest of these periodograms with $I_n(w_{(1)})$. Also, m is the number of full part of $n/2$ ($m = [n/2]$),

$$V = I_n(w_{(1)})\left[\sum_{k=1}^{m} I_n(w_k)\right]^{-1}$$

the value of the statistic is calculated. If there is no periodic component ($H_0: \alpha = \beta = 0$ under hypothesis) for the possibility of $P(V > c_\alpha)$

$$P(V > c_\alpha) = \alpha \cong m(1 - c_\alpha)^{m-1}$$

approach is used (Wei, 2006). From here, the critical value for c_α for any selected α level of meaning can be calculated as

$$c_\alpha = 1 - (\alpha / m)^{1/(m-1)}.$$

Accordingly, if $V > c_\alpha$ and the $H_0 : \alpha = \beta = 0$ hypothesis is rejected and it is concluded that there are periodic components in the series (Wei, 2006). In addition, periodograms are also used to investigate the presence of other periodicities. For this, $I_n(w_{(i)})$ is the ith the biggest periodogram value,

$$V_i = I_n(w_{(i)}) \left[\sum_{k=1}^{m} I_n(w_k) - \sum_{s=1}^{i-1} I_n(w_{(s)}) \right]^{-1}$$

and the value of the statistic is calculated. If $V_i > c_\alpha$ then the ith period that corresponds to the largest periodography is significant. The biggest periodogram values related with the data and the periods corresponding to them and statistical values of V_i are given in Table-4. Also the critical values are calculated and given below.

$$c_{0.01} = 0.11899 \ , \ \ c_{0.05} = 0.09849 \ , \ \ c_{0.10} = 0.08952$$

When Table-4 is examined, although the values are $V_1 > c_\alpha$, $V_2 > c_\alpha$ and $V_3 > c_\alpha$, the other values are $V_4 < c_\alpha$ and $V_5 < c_\alpha$. It can be said that the periodogram values corresponding to fourth and fifth periodogram values are not meaningful. But the periods corresponding to the V_5 value and V_3 value are same, the periods corresponding to V_4 value is very close to the critical value. For this reason, it can be observed and said that there are periods in every 143, 72, 12 and 6 months in terror events occurred in Turkey. Here the period value 143 is the length of the data and for this reason this value has no meaning and is omitted. Finally, in the series the period of every 6 months and 12 months (these can be seen as seasonal loops) and 72 months (6 years) loop are obtained.

Table-4. Periodic Components

i	1	2	3	4	5
$I_n(w_{(i)})$	9589.91	8049.56	5300.95	2225.06	2053.50
Period	143.00	71.50	5.958	11.917	6.217
V_i	0.19386	0.20185	0.16654	0.08387	0.08449

Using the above period values,

$$Y_t = \mu + A_1 \cos\left(\frac{2\pi t}{143}\right) + B_1 \sin\left(\frac{2\pi t}{143}\right) + A_2 \cos\left(\frac{2\pi t}{72}\right) + B_2 \sin\left(\frac{2\pi t}{72}\right)$$
$$+ A_3 \cos\left(\frac{2\pi t}{12}\right) + B_3 \sin\left(\frac{2\pi t}{12}\right) + A_4 \cos\left(\frac{2\pi t}{6}\right) + B_4 \sin\left(\frac{2\pi t}{6}\right) + e_t \ \ t = 1, 2, ..., n$$

let us assume that a harmonic regression model is suitable. Parameter estimates are given in Table-5a when this regression model is run.

Table-5a. Harmonic Regression Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	43.27174	1.12125	38.59	<.0001
a1	1	-8.31936	1.58606	-5.25	<.0001
b1	1	-7.97887	1.58552	-5.03	<.0001
a2	1	10.35335	1.59172	6.50	<.0001
b2	1	2.20637	1.58001	1.40	**0.1649**
a3	1	-4.42190	1.59160	-2.78	0.0062
b3	1	-7.48562	1.57994	-4.74	<.0001
a4	1	-5.07297	1.59160	-3.19	0.0018
b4	1	-2.44979	1.57994	-1.55	**0.1234**

When the results given in Table-5a are examined, the parameters B_2 and B_4 have no meaning (the p values are high). For this reason,

$$Y_t = \mu + A_1 \cos\left(\frac{2\pi t}{143}\right) + B_1 \sin\left(\frac{2\pi t}{143}\right) + A_2 \cos\left(\frac{2\pi t}{72}\right) + A_3 \cos\left(\frac{2\pi t}{12}\right)$$
$$+ B_3 \sin\left(\frac{2\pi t}{12}\right) + A_4 \cos\left(\frac{2\pi t}{6}\right) + e_t \ \ t = 1, 2, ..., n$$

Model B

we assume that a harmonic regression model (Model B) is suitable for the data, and the estimated parameter values are given in Table-5b. As seen from the values in the Table-5b, all of the parameter values are meaningful. The last 100 estimated values obtained from this model (Model B) are given in Figure-3.

Table-5b. Harmonic Regression Parameter Estimates

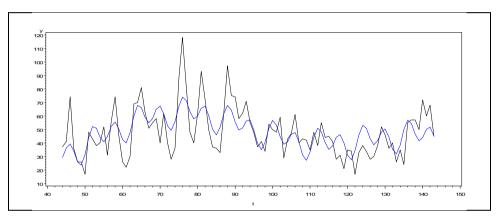|		Parameter Estimates			
		Parameter	Standard		
Variable	DF	Estimate	Error	t Value	Pr > |t|
Intercept	1	43.27174	1.13092	38.26	<.0001
c1	1	-8.31897	1.59973	-5.20	<.0001
s1	1	-7.99683	1.59912	-5.00	<.0001
c2	1	10.35335	1.60544	6.45	<.0001
c3	1	-4.42190	1.60531	-2.75	0.0067
s3	1	-7.48563	1.59355	-4.70	<.0001
c4	1	-5.07297	1.60531	-3.16	0.0019

Figure-3. Estimation Values According to Model B (Black, Observation Values; Blue, Estimation Values)

The estimation values according to Model B are $\hat{y}_{i,b}$ and when we consider the last 100 observed values and the sum of squared roots of error of the prediction values; sum of squared roots of error is

$$\sum_{i=44}^{143} (y_i - \hat{y}_{i,b})^2 = 17523.515 \cdot$$

When these values are considered,

$$\sum_{i=44}^{143} (y_i - \hat{y}_{i,b})^2 = 17523.515 < 20080.7973 = \sum_{i=44}^{143} (y_i - \hat{y}_{i,a})^2$$

since it has smaller than the other value obtained with Model-A, harmonic regression model can be seen more meaningful.

Prediction Values

Considering the models obtained above, predicted values for December 2012 and 2013 are calculated. (The data for December 2012 and 2013 is obtained by special permission after the study is completed.) Table-6 presents the predicted values.

Table-6. Realized Values and Predictions

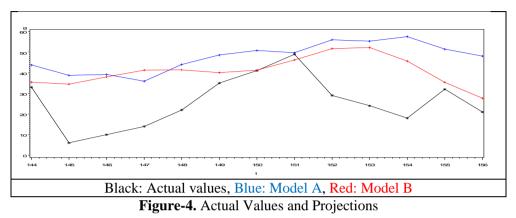| Month/Year	Actual Value	Prediction (**Model A**)	Prediction (**Model B**)
December 2012	33	43.7585	35.4680
January 2013	6	38.7884	34.4882
February 2013	10	39.1717	38.0127
March 2013	14	35.9290	41.2706
April 2013	22	44.0134	41.4036
May 2013	35	48.5778	40.0898
June 2013	41	50.8027	41.2374
July 2013	49	49.7048	46.2248
August 2013	29	56.0287	51.6756
September 2013	24	55.3700	52.2208
October2013	18	57.5432	45.6526
November 2013	32	51.4316	35.3741
December 2013	21	48.0654	27.6318

Here, $\hat{y}_{i,a}$ is the estimation value obtained by Model A; $\hat{y}_{i,b}$ is the estimation value obtained by Model-B. Estimations' sum of squared roots of error are found as

$$\sum_{i=144}^{156} (y_i - \hat{y}_{i,a})^2 = 7676.64487 \quad \text{and} \quad \sum_{i=144}^{156} (y_i - \hat{y}_{i,b})^2 = 4886.8574 \cdot$$

When the calculated sum of error squared roots are compared and the inequalities are considered,

$$\sum_{i=144}^{156} (y_i - \hat{y}_{i,b})^2 = 4886.8574 < 7676.64487 = \sum_{i=144}^{156} (y_i - \hat{y}_{i,a})^2$$

the results obtained by harmonic regression model are more meaningful than the other results obtained by Model A. As a result, the comparisons of the real values (terror events occurred in year 2013) with the estimated values obtained from two models are given in Figure-4.

Black: Actual values, Blue: Model A, Red: Model B
Figure-4. Actual Values and Projections

When the estimation values are taken into consideration, it is observed that the estimation values are very close to each other. As a result, the results obtained with Model B are more meaningful than the results obtained with Model A.

In 2013, the interpretation of the reduction in terrorist incidents can be done as follows. In 2012, Turkey tried to find a suitable solution to the terrorism problem using political stability of the democratic process and political negotiations. For this reason, a new era for the fight against terrorism began in Turkey. In this process, terrorist organizations seem to have reduced their actions. The decrease in 2013 can be explained in this way. However, after 2014, conflicts increased rapidly. The terrorist organization has never given up its real goals and achieving them by means of terrorist acts. The terrorist organization from time to time decided to ceasefire or did not operate for a certain period of time. As a matter of fact, terrorist organization has trained and prepared its personnel in the background of these periods. These decisions are purely tactical. When the process of preparation and recovery is over, it starts its activities again. In these periods, the terrorist organization makes preparation for the future activities. In this context, it tries to smuggle weapons and ammunition to Turkey for terrorist actions.

RESULTS AND COMMENTS

Performing studies on the analysis of terrorist events cannot be done due to lack of data and inability to access the information. However, statistical analysis of terrorism, which is the biggest problem of the recent years, is important for the strategies to be followed in the future periods. With this study, it is aimed to contribute to the literature in this direction, to examine the terrorist events more scientifically and to shed light on the new working areas.

Counter-terrorism requires a series of actions that require continuity. When the results obtained in the study are evaluated, the lack of continuity in the struggle with the organization saves time for the terrorist organizations to recover. For this reason, the struggle should not be interrupted and the security units should provide continuity in this struggle.

In the analysis, it is determined that the acts of the terrorist organization show periodicities. The results of the study can be viewed from two different aspects. From first aspect, harmonic regression models are compared with conventional time series models. The results obtained with harmonic regression model are more meaningful.

From second aspect, the fight against terrorism is a long-term struggle. The results also show that the activities of the terrorist organization in Turkey are periodically decreasing in every 6 years (72 months). Considering the actual values of the events, because of negotiations with the terrorist organization in Turkey in 2013, the number of events has decreased. However, the increase in the number of terrorist incidents in 2014 and in following years shows that this process has been abused by the terrorist organization. Despite the positive attitude taken by the state against the terrorist organization, it can be understood from the increase in the number of events that the terrorists have been hypocritical in this process.

Considering the number of terrorist acts and the number of people who lost their lives in terrorism, it is clear that international terrorist acts are designed to be more lethal each year. The precondition for a successful anti-terrorism policy is to understand the nature, structure and effects of terror. It is also important to understand the economic effects as well as other effects of terrorism. With its economic and social consequences, terrorism undermines the functioning of the international financial system and causes serious damage to the national economy (Alp, 2013).

The prevention of terrorism only depends on the development of a definition of terrorism accepted internationally and the development of anti-terrorism policies. In particular, some countries that support terrorism movements due to their specific economic or political interests need to cooperate in the international arena in order to give up this support and to continue the initiatives (Yılmaz and Yılmaz, 2005).

What can be said as the last word is that the most important and greatest loss given to terrorism is human life. From a global point of view, the spiritual weight of the situation of the families who lost their lives due to terrorism is much more than the weight of all the economic effects written above.

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