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The relationship between foreign exchange rate and femicide in Turkey: evidence from the cointegration tests based on nonlinear and Fourier functions

A relação entre taxa de câmbio e femicídio na Turquia: evidências dos testes de cointegração baseados em funções não lineares e de Fourier

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Abstract *This study aimed to review femicide, which is a result of violence against women and a serious public health problem, from a different perspective. Accordingly, it analyzed the presence of a relationship between foreign exchange, which was an essential trigger of the crises and unemployment, and femicide, which was the result of violence against women different from the act of murder. In the light of this aim, the data were obtained from the We Will Stop Femicide Platform, and the Central Bank of the Republic of Turkey. These data were examined through various analyses. According to the analysis results, a long-term cointegrating relationship was found between the foreign exchange rate and femicide in Turkey. The findings have demonstrated that the deviation caused by a 1% shock in the exchange rate could be balanced after 22.6 days. This study, which is significant in terms of questioning femicide from a neglected economic perspective, contributes to the literature by revealing that current and advanced empirical analyses and exchange rate fluctuations are "vital" in terms of non-economic facts and public health as well.*

Key words *Femicide, Foreign exchange rates, Cointegration, Fourier function, Nonlinearity*

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Introduction

Femicide is the result of a violent interaction that involves the death of a woman or a girl and the extreme and direct form of an interpersonal process. Researchers have suggested that *femicide* should be considered a specific case of violent phenomena, which can be interpreted in a comprehensive and theoretical framework. *Femicide* was first used as a concept in 1801, referring to "the murder of a woman"[1]. It was legally recognized in 1848 and published in the Wharton Legal Dictionary, thereby appearing in the English legal terminology. Radford (1992)[2] made a special emphasis by saying, "You cannot mobilize against something with no name." The fact that the violent deaths of individuals belonging to gender have reached non-negligible systematic dimensions has drawn all disciplines' attention. Hence, studies have been initiated to establish a conceptual framework. The word *femicide* was introduced to the literature when Diana Russel first used it at the International Tribunal for Crimes Against Women in March 1976. Later, femicide was defined by Radford & Russell (1992)[3] as "the misogynistic killing of women by men." In addition to this, Radford emphasized that a femicide is a form of sexual violence. The word *Homicide*, which refers to the murder of a human being, has been restricted with the word *femicide*[4], a theoretical concept referring to the murder of a woman[5]. Due to the increasing number of cases, this phenomenon has started to be included in other languages. It has been referred to as feminicide in Spanish and kadın cinayetleri in Turkish. In 1985, the term *gendercide* emerged to express the deliberate extermination of individuals of a particular gender[6].

Femicide is a sociological effort of apprehension that has been successful in transforming traditional perception, public awareness, scientific research, and policymaking. Femicide is a sociological effort of apprehension that has been successful in transforming traditional perception, public awareness, scientific research, and policymaking. This new word is used in the political context to understand women's violent deaths and create changes in the social order. It aims to prevent the confusion of women's violent deaths with the concept of murder, which does not discriminate between genders, draw attention that it is a crime in itself, and raise awareness[7]. Thanks to Radford & Russell (1992)[8] and Russell & Harmes (2001)[9], the word femicide evolved as a theoretical concept aimed at reversing the structuring forms of patriarchal power.

According to Ertürk (2015)[10], the female body is subjected to social control for the social groups to reproduce generations according to specific criteria. Violence against women has been normalized throughout the historical process and has become an *"ordinary tool"* used to maintain labor division between the genders. The data have demonstrated that this tool has been used all over the world. In particular, women are more vulnerable to the inevitable violence and death in societies where women are of less value and provided fewer rights than men. Inequalities in the gender ratio and the relatively high number of males have potentially devastating consequences for society[11].

Figure 1 presents the global scale of femicides. There is a great difficulty in accessing data on this sensitive matter, which requires a multidimensional approach. It necessary and of public interest to store the data and make it available to scientists. On the other hand, the available data belonging to the period after 1990 does not include some of the countries' annual data or some of the data of many countries at all. According to available data, the number of women murdered in 2018 in the world is 82,227. Figure 2, which has been created based on the available data, presents the total global values revealing how the femicides have been deliberately and systematically committed.

The increasing violence, were associated with the destruction and dissolution resulting from globalization by Friedman (2003)[12]. And female movements against the increasing violence have become global and attracted attention. It is clear that this multifaceted phenomenon requires multidisciplinary studies. According to the literature review, femicide has been studied regarding *i.* feminist, *ii.* sociological, *iii.* criminological iv. human rights and v. decolonial paradigms; however, it is observed that the investigation of the issue in terms of the economy has been neglected. However, economic conditions affect the psychology and behavior of individuals. Therefore, it is important to investigate femicide from a perspective based

on the economy. In order to prevent future murders, it is vital to determine the causes of genecide from different perspectives, take the necessary measures, and put the necessary policies into practice.

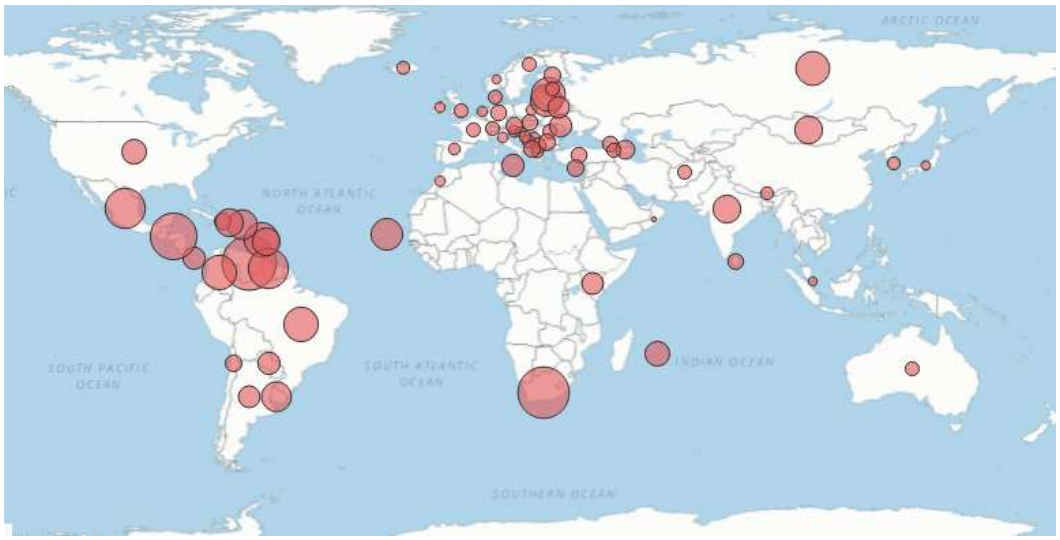

Figure 1. Femicide Around the World (2018).
Source: United Nations Office on Drugs and Crime (UNODC).

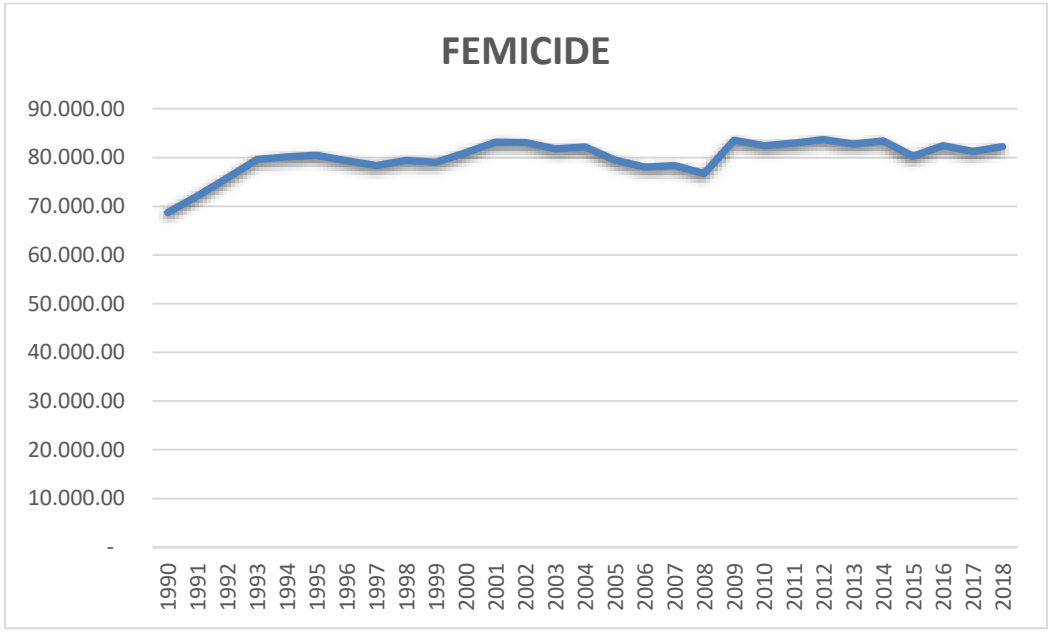

Figure 2. Global Femicide Rate Around the World (2018).
Source: Created by the Author.

This study investigates the presence of a relationship between the foreign exchange rate, which has devastating effects when not taken under control, and femicide in Turkey, which has a chronic current account deficit and is dependent on short-term foreign capital. Current and advanced empirical analysis will be used in the study. Before investigating femicide in terms of economy, it would be appropriate to explain why the foreign exchange rate was selected by describing its effects on individuals. A foreign exchange rate is a crucial tool applied in Orthodox anti-inflationary stabilization programs. Its effects are not limited to international trade and capital flows. The policies implemented by the central banks and political authorities, whose primary purpose is to protect the national currency's value, affect all areas of life, starting with the economy. The foreign exchange rate policies implemented in Turkey are observed to be a significant cause of economic crises. There is a linear relationship between the exchange rate, foreign trade, and unemployment[13]. Besides, the foreign exchange rate affects the labor market through imports and exports[14]. An increase in imports can affect the relationship between the employer and employee, thereby leading to the termination or change of various rights and regulations regarding wages, labor and working conditions against the employees. Studies reveal that a 10% increase in competition between imported and domestic goods leads to a 1.6% decrease in wages and increases the unemployment rate[15]. In addition, it is clear that currency crises have a significant impact on the unemployment phenomenon. For instance, both the foreign exchange rate and unemployment level increased in Mexico during the 1994 Crisis. In the 1997 Asian Crisis, the currency crisis in South Korea led to both unemployment and inflation[16]. Turkey experienced a process starting with the 1978 crisis, and particularly with the crisis created by the threat of unemployment after 1990. Since the establishment of the Republic, there have been five serious crises (1929-32, 1958-61, 1978-83, 1998-2001, and 2008). Before the crises, there have been increases in current account deficits. In 1977, 1987, 1990, 1993, 1997, 2000, and 2008, despite the fact that the external value of the national currency should have been corrected against the ongoing inflation problem, it was not reduced. Or, the external value of the national currency was increased. All these were the factors that increased the current account deficit. Currency explosions constituted the main factor that triggered the crises. In addition to inflation, the current account deficit is the leading cause of crises. Unemployment replaced inflation in the 2008 Global Financial Crisis[17]. The fluctuations of the foreign exchange rate were empirically presented in the study conducted for Turkey by Demir (2009)[18] regarding its negative effect on employment.

Recession, unemployment, and poverty caused by the crises adversely affect human psychology. In a report published by the World Health Organization (WHO)[19] during the days of the COVID-19 pandemic when the risk of violence against women increased, it is observed that the reasons for the increase of violence against women include unemployment, economic problems, prolonged staying at home and stress. The main reason for the increasing domestic violence is the predominant patriarchal order and gender inequality. The long-term presence of the potential aggressor and victim in a certain socio-geographic location prepares the ground for violence, conforming with the many theories of criminology[20]. Unemployment has been proven to be associated with family breakdowns, alcohol addiction, crime, and violence, based on a relationship found between the increase in the unemployment rate by 1% and the death of 37 thousand individuals, 920 cases of suicide, 650 cases of murders, 4 thousand hospitalizations in the mental hospital and the imprisonment of 3.3 thousand individual, over a six-year period[21]. Empirical studies have demonstrated that the increase in unemployment[22,23,24,25,26,27,28,29,30] and income inequality[31,32] increases crime rates. Nikolaos & Alexandros (2009)[33] found a negative relationship between wage and crime rate in the short term. According to Lombardo & Falcone (2011)[34], the highest crime rates are observed in regions with high divorce rates, youth unemployment, and female employment. Andresen (2012)[35] determined that the income had a significant and positive coefficient in the crimes of violence and mentioned that the unemployment rate had a significant and positive coefficient in the crimes of violence in the long run. Taş et al. (2014)[36] determined a similar relationship between the rates of unemployment and divorce. Kavaklı (2020)[37] found that femicide was committed mostly in economically less developed locations. Economic development reduces the negative impact of the risk factor.

There is a clear loop among crisis, unemployment, violence, and murder in light of all this information. Is there a relationship between systematically committed femicide and the foreign exchange rate as an

important trigger of crises? In this study, which sought an answer to this question, firstly the methods and data sets used will be presented, and the findings will be explained. Next, inferences will be made based on these findings.

Methodology and Data

In order to investigate the existence of the relationship between the foreign exchange rate and femicide n Turkey, the daily femicide data belonging to the period between 01 January 2019 and 29 September 2020 were obtained from the We Will Stop Femicide Platform, and the data regarding the daily buying rates of US Dollar in the same period were obtained from the Central Bank of the Republic of Turkey (CBTR) Electronic Data Delivery System (EDDS) (Table 1). These data were examined through various analyses. The analyses consisted of 373 observations. Figures 3 and 4 present the distribution of variables over the period of analysis. While an increase was observed in the foreign exchange rate during this process, a systematic "gendercide" was also prominent.

Table 1. Data Used in Analysis

Variables	**Abbreviation**	**Source**
Femicide	Femicide	We Will Stop Femicide Platform
American Dollar, Buying Rate	Rate	CBTR

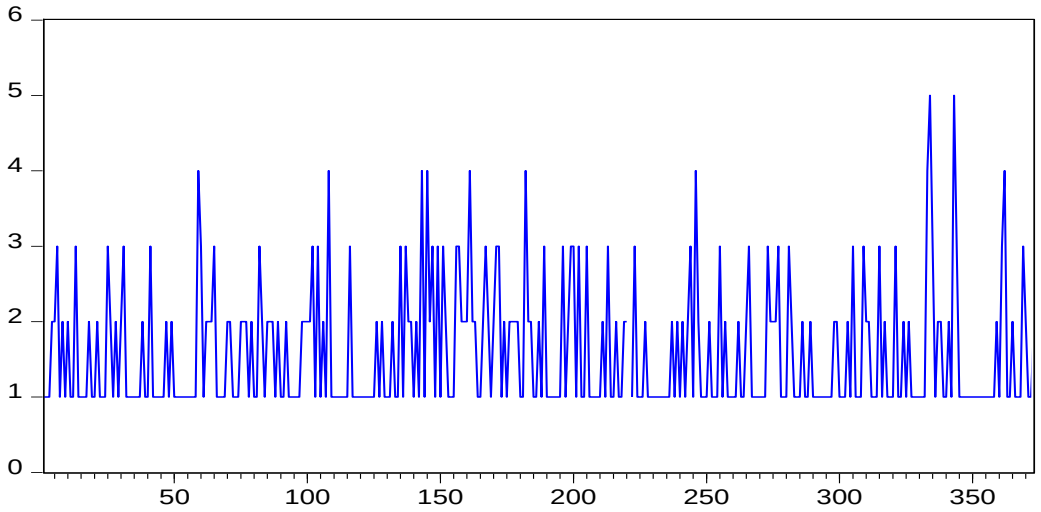

Figure 3. Femicide in Turkey (01.01.2019-29.09.2020).
Source: Created by the Author.

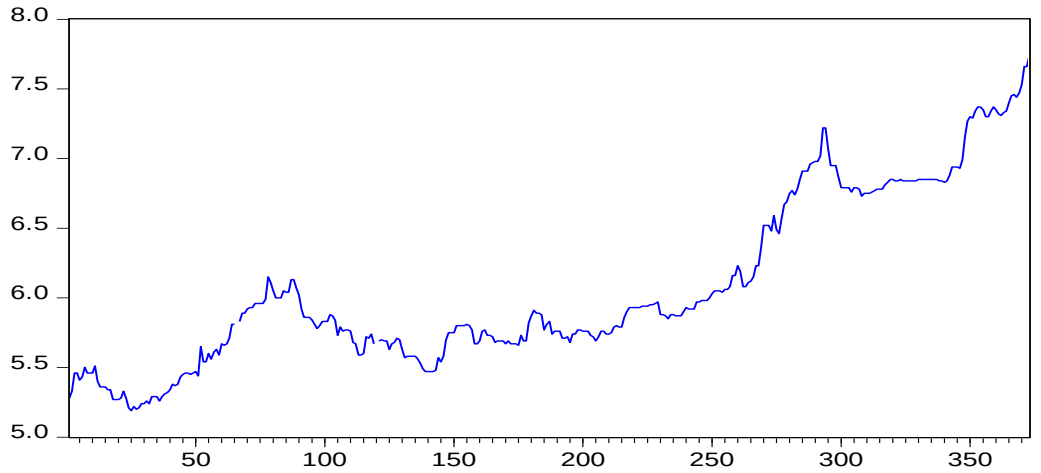

Figure 4. USD/TRY Buying Rate (01.01.2019-29.09.2020).
Source: Created by the Author.

Is there a relationship between the depreciation of the national currency and femicide? Before starting to search for the answer to this question, firstly the series's linearity tests were carried out using Harvey & Leybourne (2007)[38] and Harvey, Leybourne & Xiao (2008)[39] Tests. Next, the stationary tests were performed.

Tests for Linearity

Linearity tests of the series should be performed first since the linear analysis of the series exhibiting nonlinear behaviors would lead to the establishment of false models.

Linearity Tests are structured upon the models based on smooth transitions typed the STAR (Smooth Transition Autoregressive). These tests are a priori test for the transition to the STAR type test. Unlike other tests, these tests, which were introduced to the literature by Harvey, do not have any prerequisites. Considering the main advantage of not being affected by stationarity levels, Harvey & Leybourne (2007) and Harvey, Leybourne & Xiao (2008) Tests were administered for testing the linearity.

i. Harvey & Leybourne (2007) Test

This test, which introduced to the literature by Harvey & Leybourne (2007), does not make any assumptions, I_1 and I_2 it allows the coexistence of processes. This test has a structure with four degrees of freedom, where the following equation is used (1):

$$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-1}^2 + \beta_3 y_{t-1}^3 + \beta_4 \Delta y_{t-1} + \beta_5 (\Delta y_{t-1})^2 + \beta_5 (\Delta y_{t-1})^3 + \varepsilon_t \quad (1)$$

The null hypothesis indicating the linearity and the alternative hypothesis indicating the nonlinearity is presented in Equation 2 and Equation 3;

$$H_0 : \beta_2 = \beta_3 = \beta_5 = \beta_6 = 0 \quad (2)$$
$$H_1 : \beta_2 \neq \beta_3 \neq \beta_5 \neq \beta_6 \neq 0 \quad (3)$$

Test statistics of Harvey & Leybourne (2007) are presented in Equation 4;

$$W_T = \frac{RSS_1 - RSS_0}{RSS_0/T}$$
$$W_T^* = \exp(-b|DF_T|^{-1}) W_T \quad (4)$$

In this equation (Equation 4), b indicates the non-zero constant, DF_T indicates the standard ADF t statistics derived from the restricted regression, T indicates the number of observations, RSS_1, indicates sum of squares of the error term for the H_1 hypothesis. The Harvey & Leybourne (2007) test statistics are suitable for the distribution of x_4^2.

ii.Harvey, Leybourne & Xiao (2008) Test

The Harvey, Leybourne & Xiao (2008) Linearity Test, which was developed by enhancing and strengthening the Harvey & Leybourne (2007) Test, reviews the state of stationarity and I_1 separately. It has a structure with two degrees of freedom.

In order to analyze the basic hypothesis of linearity (Equation4) compared to the alternative hypothesis indicating the nonlinearity (Equation5), it is suggested to use the Equation 6;

$$H_0 : \beta_2 = \beta_3 = \beta_5 = \beta_6 = 0 \quad (4)$$
$$H_1 : \beta_2 \neq \beta_3 \neq \beta_5 \neq \beta_6 \neq 0 \quad (5)$$

$$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-1}^2 + \beta_3 y_{t-1}^3 + \sum_{j=1}^{p} \beta_{4,j} \Delta y_{t-j} + \varepsilon_t \quad (6)$$

Equation 6 can be reorganized using the first-order Taylor expansion, and it can be written as Equation7;

$$\Delta y_t = \lambda_1 \Delta y_{t-1} + \lambda_2 (\Delta y_{t-1})^2 + \lambda_3 (\Delta y_{t-1})^3 + \sum_{j=1}^{p} \lambda_{4,j} \Delta y_{t-j} + \varepsilon_t \quad (7)$$

In Equation 7, p indicates the number of delays, and Δ indicates the difference operator. The (W_0) test statistics, which are calculated for stationarity, and the (W_1) test statistics, which are calculated for nonstationarity, are calculated by using the Harvey et al. (2008) W_λ test statistics. They conform with the distribution of W_λ x_2^2.

Nonlinear Unit Root Tests

Following the determination of the nonlinearity, the unit root tests produced from nonlinear models were performed.

i.Leybourne, Newbold & Vougas (LNV) (1998) Unit Root Test

Leybourne, Newbold & Vougas (LNV) (1998)[40], who suggested gradual integration of structural changes to the model with a smooth transition instead of instantaneous integration, developed a unit root test as an alternative to the unit root tests with structural breaks. This test, in which structural breakage is taken into account with a logistic function, allows smooth structural transitions and constitutes the beginning of nonlinear tests. Logistic soft

transition regressions were created by defining three models;

Model A

$$y_t = \alpha_1 + \alpha_2 S_t(\lambda,\tau) + v_t \quad (8)$$

Model B

$$y_t = \alpha_1 + \beta_1 t + \alpha_2 S_t(\lambda,\tau) + v_t \quad (9)$$

Model C

$$y_t = \alpha_1 + \beta_1 t + \alpha_2 S_t(\lambda,\tau) + \beta_2 t S_t(\lambda,\tau) + v_t \quad (10)$$

In the models, the $S_t(\lambda,\tau)$, indicates the logistic smooth transition, which is presented in Equation 11. In this logistic function, τ determines the midpoint of the transition process, and γ determines the transition speed. Where $\gamma>0$, $S_{-\infty}(\gamma\ \tau)=0$, $S_{+\infty}(\gamma\ \tau)=1$ and $S_{\tau T}(\gamma\tau)=0{,}5$. If γ is smaller, it would take longer for the logistic smooth transition of $S_\tau(\gamma\tau)$ to exceed the interval (0,1). If γ= 0, $S_\tau(\gamma\tau)=0{,}5$ at all t moments. If γ is greater, $S_\tau(\gamma\tau)$ would exceed the (0,1) interval rapidly. If γ converges to $+\infty$, the value of the function changes from 0 to 1 momentarily at $t=\tau T$.

$$S_t(\gamma,\tau) = \left[1+\exp\left\{-\lambda\left(t-\tau T\right)\right\}\right]^{-1} \quad (11)$$

v_t is the expression of the stationary process with a mean of zero. Hence, the Y initial value for Model A is stationary around a mean that gradually changes between α_1 and $\alpha_1+\alpha_2$. Similar to Model A, there is also a mean gradual change in Model B between α_1 and α_1 and $\alpha_1+\alpha_2$; however, unlike Model A, there is a constant trend term in Model B. In Model C, the constant ranges from α_1 to $\alpha_1+\alpha_2$, and the trend ranges from β_1 to $\beta_1+\beta_2$ gradually, only once, and at the same speed and time. In this test, there is a constraint that the constant and trend transitions occur at the same time and at the same speed.

There are two phases for calculating the test statistics. In the first step, using the Nonlinear Least Squares (NLS), the appropriate model is estimated only with deterministic components, and the residuals are obtained;

Model A

$$\hat{v}_t = y_t - \hat{\alpha}_1 - \hat{\alpha}_2 S_t\left(\hat{\lambda},\hat{\tau}\right) \quad (12)$$

Model B

$$\hat{v}_t = y_t - \hat{\alpha}_1 - \hat{\beta}_1 t - \hat{\alpha}_2 S_t\left(\hat{\lambda},\hat{\tau}\right) \quad (13)$$

Model C

$$\hat{v}_t = y_t - \hat{\alpha}_1 - \hat{\beta}_1 t - \hat{\alpha}_2 S_t\left(\hat{\lambda},\hat{\tau}\right) - \hat{\beta}_2 t S_t\left(\hat{\lambda},\hat{\tau}\right) \quad (14)$$

After the residuals are obtained, the ADF regression is established in the second phase, and the unit root test is performed over this regression (Equation 15).

$$\Delta\hat{v}_t = \delta\hat{v}_{t-1} + \sum_{i=1}^{p}\psi_i\Delta\hat{v}_{t-i} + \varepsilon_t \quad (15)$$

$$H_0 : \delta = 0 \quad (16)$$

$$H_1 : \delta < 0 \quad (17)$$

The hypotheses to be established in the analysis of the unit root are presented in Equation16 and Equation17. This test is performed by testing the statistical significance of $\rho\hat{}$ using the t test.

ii.Harvey & Mills (HM) Unit Root Test (2002)

The unit root test based on soft transition, created by Leybourne, Newbold & Vougas (1998), was extended to two soft transitions and introduced to the literature by Harvey & Mills (2002)[41]. Three models were also created for this test;

Model A

$$y_t = \alpha_1 + \alpha_2 S_{1t}(\lambda_1,\tau_1) + \alpha_3 S_{2t}(\lambda_2,\tau_2) + v_t \quad (18)$$

Model B

$$y_t = \alpha_1 + \beta_1 t + \alpha_2 S_{1t}(\lambda_1,\tau_1) + \alpha_3 S_{2t}(\lambda_2,\tau_2) + v_t \quad (19)$$

Model C

$$y_t = \alpha_1 + \beta_1 t + \alpha_2 S_{1t}(\lambda_1,\tau_1) + \beta_2 t S_{1t}(\lambda_1,\tau_1) + \cdot\alpha_3 S_{2t}(\lambda_2,\tau_2) + \beta_3 t S_{2t}(\lambda_2,\tau_2) + v_t \quad (20)$$

While there are two transitions for mean in Model A and Model B, unlike Model A, there is a fixed trend in Model B. Model C allows two transitions in both mean and trend.

In the models, $S_{it}(\lambda_1,\tau_1)$ indicates the logistic smooth transition, which is presented in Equation 21. The error term, v_t is the expression of the stationary process with a mean of zero.

$\tau_1 T$ and $\tau_2 T$, indicate the middle points of the transition process; γ_1 and γ_2 indicate the transition speeds. The difference in transition speeds is allowed.

$$S_{it}\left(\lambda_i,\tau_i\right)=\left[1+\exp\left\{-\lambda_i\left(t-\tau_i T\right)\right\}\right]^{-1} \quad \lambda_i>0 \quad i=1,2 \tag{21}$$

$$\hat{v}_t = y_t-\hat{\alpha}_1-\hat{\alpha}_2 S_{1t}\left(\hat{\lambda}_1,\hat{\tau}_1\right)-\hat{\alpha}_3 S_{2t}\left(\hat{\lambda}_2,\hat{\tau}_2\right) \tag{22}$$

$$\hat{v}_t = y_t-\hat{\alpha}_1-\hat{\beta}_1 t-\hat{\alpha}_2 S_t\left(\hat{\lambda}_1,\hat{\tau}_1\right)-\hat{\alpha}_3 S_{2t}\left(\hat{\lambda}_2,\hat{\tau}_2\right) \tag{23}$$

$$\hat{v}_t = y_t-\hat{\alpha}_1-\hat{\beta}_1 t-\hat{\alpha}_2 S_t\left(\hat{\lambda},\hat{\tau}\right)-\hat{\beta}_2 t S_t\left(\hat{\lambda},\hat{\tau}\right)-\hat{\alpha}_3 S_{2t}\left(\hat{\lambda}_2,\hat{\tau}_2\right)-\hat{\beta}_3 t S_{2t}\left(\hat{\lambda}_2,\hat{\tau}_2\right) \tag{24}$$

$$\Delta\hat{v}_t=\delta\hat{v}+\sum_{i=1}^{p}\psi_i\Delta\hat{v}_{t-i}+\varepsilon_t \tag{25}$$

The hypotheses to be established in the analysis of the unit root are presented in Equation 26 and Equation 27.

$$H_0:\delta=0 \tag{26}$$

$$H_1:\delta<0 \tag{27}$$

Unit root testing can be performed using the two-step procedure recommended by Leybourne, Newbold & Vougas (1998). The t statistics of ρ obtained by the classical least squares method of estimation is used as the test statistics.

Cointegration Tests

The Kapetanios, Shin & Snell (KSS) (2006) Cointegration Test from the nonlinear cointegration tests, and the Banerjee, Arčabić & Lee (2017) Fourier Cointegration Test from the cointegration tests based on Fourier functions, which were used in the analysis, were explained in this part.

i.Kapetanios, Shin and Snell (KSS) (2006) Cointegration Test

Kapetanios, Shin & Snell (KSS) (2006)[42] enhanced the Engle-Granger Cointegration Test and introduced it to the literature by applying this test to nonlinear models. The alternative hypothesis stating that there is a nonlinear long-term relationship between the variables is tested against the basic hypothesis stating that there is no cointegration relationship.

The KSS Test, in which a smooth transition is modeled using a logistic function, can be used for the variable series of *raw data, demeaned data,* and *detrended data.*

$$\Delta y_t=\phi u_{t-1}+\gamma u_{t-1}\left(1-\mathrm{e}^{-\theta\left(u_{t-1}^2\right)}\right)+\psi'\Delta\mathbf{x_t}+\sum_{i=1}^{p}\boldsymbol{\omega}_\mathbf{i}'\Delta\mathbf{z_{t\text{-}i}}+\varepsilon_t$$

$$\Delta\mathbf{x_t}=\sum_{i=1}^{p}\boldsymbol{\Gamma}_\mathbf{i}'\Delta\mathbf{z_{t\text{-}i}}+\boldsymbol{\eta_t} \tag{28}$$

$$\hat{u}_t=\hat{y}_t-\hat{\boldsymbol{\beta}}_\mathbf{x}'\mathbf{x_t} \tag{29}$$

$$\Delta y_t=\delta_1\hat{u}_{t-1}+\delta_2\hat{u}_{t-1}^2+\delta_3\hat{u}_{t-1}^3+\psi'\Delta\mathbf{x_t}+\sum_{i=1}^{p}\boldsymbol{\omega}_\mathbf{i}'\Delta\mathbf{z_{t\text{-}i}}+\varepsilon_t \tag{30}$$

$$H_0:\delta_1=\delta_2=\delta_3=0\Rightarrow F_{NEC} \tag{31}$$

$$\Delta y_t=\delta_1\hat{u}_{t-1}+\delta_3\hat{u}_{t-1}^3+\psi'\Delta\mathbf{x_t}+\sum_{i=1}^{p}\boldsymbol{\omega}_\mathbf{i}'\Delta\mathbf{z_{t\text{-}i}}+\varepsilon_t \tag{32}$$

$$H_0:\delta_1=\delta_3=0\Rightarrow F_{NEC}^{*} \tag{33}$$

ii.Banerjee, Arčabić & Lee (2017) Fourier Cointegration Test

This test, which was introduced to the literature by Banerjee, Arčabić & Lee (2017)[43], is a typical cointegration test expanded in Fourier terms that takes the delayed structures of both dependent and independent variables into account. The test is logically based on error correction. As presented in Equation 34 and Equation 35, the test includes constant and trend terms, the delayed value of the independent variable, and the value of its level the previous period.

$$\Delta y_t=\alpha+\gamma_1\sin\left(\frac{2\pi kt}{T}\right)+\gamma_2\cos\left(\frac{2\pi kt}{T}\right)+\delta y_{t-1}+\psi' x_{t-1}+\theta'\Delta x_t+\varepsilon_t \tag{34}$$

$$\Delta y_t=\alpha+\beta t+\gamma_1\sin\left(\frac{2\pi kt}{T}\right)+\gamma_2\cos\left(\frac{2\pi kt}{T}\right)+\delta y_{t-1}+\psi' x_{t-1}+\theta'\Delta x_t+\varepsilon_t \tag{35}$$

$$H_0:\delta=0 \tag{36}$$

$$H_1:\delta<0 \tag{37}$$

Testing is performed based on the equation that the coefficient (δ) before the variable of y_{t-1} is equal to or smaller than zero. In other words, the null

hypothesis indicates that there is no cointegrating relationship, and the alternative hypothesis indicates the presence of a cointegrating relationship. What we need to do is to estimate this model and y_{t-1} test the coefficient before the variable. variable.

Empirical Results

This part presents the empirical findings obtained by performing the tests described in the methodology and dataset parts. The linearity test results of the series are presented in Table 2.

Table 2. Linearity Test Results

Variable	Harvey &Leybourne (2007)	Critical Value	Result
Femicide	11.57	5.991465	H_0 Rejected
Rate	52.72	5.991465	H_0 Rejected
Variable	Harvey, Leybourne & Xiao (2008)	Critical Value	Result
Femicide	9.51	9.487729	H_0 Rejected
Rate	3.49	9.487729	H_0 cannotbe rejected

According to the results of both tests, there is nonlinearity in the femicide series. In the foreign exchange rate series, there is nonlinearity, according to the Harvey & Leybourne (2007) Test, and linearity, according to Harvey, Leybourne & Xiao (2008) Test. Following the determination of the nonlinearity of the series in the linearity tests, the stationarity of the series was tested using nonlinear unit root tests. The results of the analysis are presented in Table 3.

Table 3. Stationarity Tests with Nonlinear Unit Root Tests

Variables	Leybourne, Newbold & Vougas (LNV) Unit Root Test	Critical Value	Result
Femicide	-1.90520	4.825	H_0 can not be rejected. Unit root.
Rate	-0.46622	4.825	H_0 can not be rejected. Unit root.
Variables	Harvey & Mills (HM) Unit Root Test (2002)	Critical Value	Result
Femicide	-2.19824	6.01	H_0 cannot be rejected. Unit root.
Rate	-1.55240	6.01	H_0 cannot be rejected. Unit root.

Table 4. Stationarity Tests with Traditional Unit Root Tests

ADF			
Variables	T-Statistics	%1 %5 %10	Result
Femicide	-15.035	-3.9837 -3.4223 -3.1340	Unit Root
Rate	-16.651	-3.9834 -3.4222 -3.1339	Unit Root
PP			
Variables	T-Statistics	%1 %5 %10	Result
Femicide	-259.7058	-3.9832 -3.4221 -3.1339	Unit Root
Rate	-16.58659	-3.9834 -3.4222 -3.1339	Unit Root

In order to confirm that the series that were determined to have unit roots by nonlinear unit root tests (Table 3) are stationary in I_1, the ADF and PP tests were applied by taking their first differences (Table 4). Following the determination of the stationarity of the series at I_1, cointegration tests were performed.

Table 5. Kapetanios, Shin & Snell (KSS) (2006) Cointegration Test Results

F Statistic	Critical Values	Result
15.24	15.07	H_0 Rejected

According to the results of the Kapetanios, Shin & Snell (KSS) (2006) Cointegration Test, a long-term synchronized relationship was found between the foreign exchange rate and *femicide*. Due to the provision of the precondition, which was the determination of the cointegrating relationship, the short-run causality test was performed;

Table 6. Kapetanios, Shin & Snell (KSS) (2006) Causality Test Result

Prob.	Error Correction Coefficient	Result
0.17748550	0.044197075	H_0 can not be rejected*

*0.17748550>0.05.

In the short run, no causality was determined from the exchange rate towards *femicide*.

Based on the error correction coefficient (ECC), it is possible to calculate the rebalance ratio of the system by dividing the ECC by "1" (1/0.044197075). This value indicates that the deviation caused by a 1% shock in the foreign exchange rate can be balanced after a period of 22.6 days.

Table 7. Banerjee, Arčabić ve Lee (2017) Fourier Coentegration Test Result

F Statistic	Critical Values	Result
-15.61680	4.27	H_0 Rejected

As a result of the Banerjee, Arčabić & Lee (2017) Fourier Cointegration Test, one of the cointegration tests based on Fourier functions, long-run cointegration was found between the foreign exchange rate and femicide.

Conclusion

The current living conditions of individuals and their economic status affect their psychology and behavior. Therefore, it is very imperative to investigate the widespread and systematic violence and murders of women from an economic perspective, as well as the feminist, sociological, criminological, human rights, and decolonial paradigms. It is also necessary to investigate the effects of macro-economic phenomena on the violent deaths of women and shape the monetary and fiscal policies based on the findings to prevent future murders.

All experiences are the results of the choices. For instance, as Erturk (2015), pointed out, the allocation of available resources to defense and military expenditures leads to the neglect of social development and human rights while bringing about an increase in poverty and violence. Disintegrations and fragmentation experienced, destroyed livelihoods lead to an increase in male unemployment in some areas. Losing socio-economic status and the balance of power are tried to be compensated in the form of violence against women and girls.

As mentioned by Engelen et al. (2016)[44], based on the findings of their study, the significant and strong deterrent effect of the increase in the probability of being caught and punished should be benefitted from. Nonetheless, it is also possible to identify the factors that trigger these criminal elements and prevent them with appropriate policy practices. For this reason, it is necessary to investigate the phenomenon of violence and murder against women and girls in terms of the economy. The purpose of this study carried out from this point was to investigate the presence of a relationship between the foreign exchange rate and femicide. The reason for choosing the foreign exchange rate among various variables to carry out the study was that exchange rates were one of the triggers of many crises. Crises lead to unemployment and poverty. The increase in the foreign exchange rate in Turkey, which has a chronic current account deficit and is dependent on foreign capital, affects various socio-economical factors in addition to growth and employment. The data on femicide required for conducting this study was not available; eventually, the support was requested from a non-governmental organization. The daily data on femicide and US Dollar buying rates belonging to the period between 01 January 2019 and 29 September 2020 were obtained from the We Will Stop Femicide Platform and the Central Bank of Turkey. Various econometric analyses were performed on these data. According to the results of the analyses,

- A long-run cointegrating relationship was found between foreign exchange rate and femicide.

- It was determined that the deviation caused by a 1% shock in the exchange rate could reach the balance after 22.6 days.

Based on these results, maintaining the fluctuations in exchange rates under control and ensuring that they remain within a specific range is important regarding the value of the national currency, foreign trade, growth, and employment, and also in terms of preventing deaths of women and girls. This study is a contribution to the literature as it is the first study to reveal this subject matter empirically using current and advanced analyzes. It is clear that the independence of the Central Banks, whose main task is to protect the value of the national currency, and the implementation of correct policies in this direction is of vital importance. Policymakers have important responsibilities in preventing violence and murder of women and girls, which have become widespread and legitimized by discourses and policies. It is essential to carry out future studies investigating widespread and systematic violence against women and girls and femicide from an economic perspective.

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Author contribution statements

Gülgün Çiğdem contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Conflict of Interest Statement

Author has declared that: (i) no support, financial or otherwise, has been received from any organization that may have an interest in the submitted work; and (ii) there are no other relationships or activities that could appear to have influenced the submitted work.

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