The Impact of Terrorist Attacks on Foreign Exchange Rate: Case Study of Turkish Lira versus Pound Sterling

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Abstract: In this study the impact of terrorist attacks on exchange rate is estimated. Particularly, the study focuses on Turkish terrorist attacks and its implication on Turkish lira versus pound sterling exchange rate. In order, to find the causal effect the study employed Autoregressive distributive lag (ARDL) bound testing approach as an estimation technique. Accordingly, the analysis reveals that terrorist attack has a negative impact on the exchange rate in both short and long-run. However, the negative effect of terrorism tends to be small in both the short-run and long-run. More precisely, terrorist attack depreciates the exchange rate between Turkish lira and pound sterling by approximately 0.00072 in the next trading day. The long-term effect also shows that terrorist attack depreciates the exchange rate on average by 0.00212.

Keywords: terrorism; exchange rate; ARDL; error correction

JEL Classification: B23, D74, F31

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1. Introduction

Terrorism is one of the rising global problem and the most widely discussed issues in recent years. However, according to Global Terrorism Index Report (2015), the majority of terrorist attacks were mainly concentrated in small number of countries. During the last decade, Nigeria, Iraq, and Afghanistan have experienced the highest level of terrorism in the world. Nevertheless, countries like Turkey have been suffering from terrorism for an extended period. Moreover, Turkey is exposed to high number of terrorist attacks every year. Historical statistics of the Global Terrorism Index Report in 2014 show, Turkey experiencing the highest number of terrorist attacks within the OECD countries.

From economic point of view, most of the empirical findings in the literature show that terrorist attacks induce higher level of uncertainty and affect economy negatively. There is a growing literature on the effect of terrorism on the economy in recent decades and many of these

researchers find a negative impact of terrorism on the economy (Abadie and Gardeazabal, 2003 [1]; Enders and Sandler, 1996 [2]; Chen and Siems, 2004 [3]; and Pshisva and Suarez, 2006 [4]).

Considering negative impacts of terrorist attacks on economy, in this study we aim to investigate the effects of terrorist attacks on exchange rate, in particular Turkish Lira versus British sterling. The selection of British sterling as reference for the exchange rate is because of the historical number of tourists from UK and the potential of this tourist flow being affected by terrorism attack. This research seeks to draw attention to effects of terrorist attacks because of increasing concern about terrorist attacks in recent years.

Hence, the study aims to provide an input to academia, policy makers, and business through identifying the causal effect. It aims to contribute to academia through broadening the literature and identifying the causal effect. Further, the paper contributes to policy makers and business by identifying both short term and long term effect of terrorist attacks on exchange rate. In fact, both policy makers and business could use the finding as an input for a policy intervention and trading strategy respectively.

The rest of the paper is organized as follows. Section 2 provides the empirical and theoretical findings in the literature. Section 3 describes the data sources and empirical method. Section 4 presents and discusses our results. Section 5 concludes the paper.

2. Literature review

The academic literature on the evaluation of counter-terrorism policies is still in its infancy. Nonetheless, studies in this area have been expanding very rapidly due to the increasing concern about terrorism in the world. According to a review study by (Lum, Kennedy and Sherley, 2006 [5]) studies on the evaluation of counter-terrorism programs have been increasing since the beginning of the 1990s. However, the authors indicate only 3-4 % of the studies used some empirical analysis. The majority of the papers in the literature are theoretical discussions and opinions such as the sociology of terrorism, in which the authors tried to explain what are the causes and motivations of terrorism. Other papers in the literature describe the details of the counter-terrorism program rather than evaluating it. An evaluation of counter-terrorism policies is one of the missing parts in the literature. In this regard, the objective of my research is to help to fill this gap.

A study by (Landes, 1978 [6]) is one of the earliest studies in the evaluation of counter-terrorism policies in the literature. The author examines the installation of metal detectors at airports and the increase in sentence on hijackings in the USA. Landes adapted (Becker and Ehrlich, 1972 [7]) crime participation model into hijacking and used ordinary least squares (OLS) to ascertain the effect of increasing security measures at the US airports. The author used quarterly

data on hijacking events in the USA between the periods 1961-1976. His findings reveal that both an increase in sentence and security at airports has a deterrent effect on hijacking. However, both (Cauley and Im, 1988 [8] and Enders and Sandler, 1990 [9]) show that the installations of metal detectors at airports are likely to cause substitution or displacement effect. In other words, policies designed to reduce one type of terrorist attack are likely to increase the other types of terrorist attacks.

Embassies and diplomats are other attractive targets for a variety of terrorist groups. Due to the increasing pattern in these types of attacks during the 1970s and 1980s, the US government increased security at embassies. Both (Cauley and Im, 1988 [8] and Enders, Sandler, and Cauley, 1990 [9]) examined the effectiveness of increased security policies between 1974-1976 for US embassies by using intervention analysis. Empirical findings of both of their research indicate that an increase in embassy security reduces the number of hostage-taking events in the short run, although, no discernible effects in the long run. Apart from protectionist counter-terrorism strategies many governments preferred aggressive and combative strategies to fight against terrorism. In this respect, military retaliation has been another favored counter-terrorism strategy for decades. A study by (Brophy-Baermann and Conybeare, 1994 [10]) examines the effectiveness of Israeli military-led retaliation attacks on Palestine Liberation Organization (PLO) and Lebanon by using interrupted time series analysis. The authors used major Israeli retaliation between 1968-1989 and quarterly data from ITERATE on terrorist attacks on Israel during the period 1968-1989. The authors find military retaliation has only temporary deviations of terrorist attacks and has no long-term deterrent effect on terrorism.

During the 1970s and 1980s, Spain experienced one of the most deadly separatist terrorist attacks in their history. More than 800 people were killed and thousands injured with Euskadi Ta Askatasuna (ETA) being held responsible. In a study by (Barros, 2003 [11]) the effectiveness of government counter-terrorism policies, in particularly military spending, in handling the ETA terrorism attacks has evaluated. The author used Vector Auto Regressive (VAR) model for evaluating the Spanish counter-terrorism policies. The author obtained the data from a variety of sources. He obtained the data on military spending from SIPRI-Yearbook and the data on both assassinations and kidnappings is obtained from the study of (Abadie and Gardeazabal, 2001 [12]). The author's findings indicate that increasing counter-terrorism spending has no discernible effects on terrorist attacks. A similar study by (Feridun and Shahbaz, 2010 [13]) reveal that military spending alone is not effective in terms of fighting terrorism.

A comprehensive study regarding the effectiveness of counter-terrorism policies by (Lum, Kennedy, and Sherley, 2006 [14]) provides deeper insight into the topic. The authors use Campbell

Systematic review to check the empirical findings of research papers on the effectiveness of counter-terrorism strategies. They find that existing literature on the evaluation of the effectiveness of the counter-terrorism policies does not have a discernible effect on reducing terrorism; on the contrary, in some cases, it led to increases in terrorism. In the light of their findings, the empirical literature indicates that introducing new policies or increasing counter-terrorism spending has not been an entirely successful method in terms of eliminating the terrorism threat.

The application of ARDL model, to establish short term and long term causality is getting prominence in economics studies. In fact, it has been used to estimate the causality among others between economic growth and immigration, saving and investment, energy consumption and economic growth, and terrorism and tourism. For instance, (De Vita and Abbott, 2002 [15]) using ARDL bounds testing procedure estimate the causality between saving and investment. Accordingly, the authors find that saving and investment are cointegrated in all sampling period. Further, the study finds there is evidence to support Feldstein–Horioka puzzle indicating the existence of capital mobility.

In another paper, (Morley, 2006 [16]) examines the causality between economic growth and immigration using an ARDL bound testing approach. Accordingly, the estimation shows that there is a subtle evidence supporting migration causes economic growth while there is an evidence economic growth causing immigration. Although the second finding could be affected by strict regulation countries adopting to control immigration from a theoretical perspective, the result makes sense because economic growth could potentially cause immigration from less developing countries. Similar to the previous two papers, (Odhiambo, 2009 [17]) using an ARDL bound testing approach study the causality between energy consumption and economic growth. Accordingly, the study finds unidirectional causality between energy consumption and economic growth. Notably, energy consumption causes economic growth but not the other way.

Following the success of the ARDL model in identifying both short and long term in different studied, several authors use ARDL bound testing approach to determine the causality between terrorism and tourism. For instance, (Feridun, 2011 [18]) using ARDL bound testing approach examines the long-run equilibrium level relationship between tourism and terrorist attacks. Accordingly, the study finds that there exists a negative causal effect from terrorism to tourism. However, there is no evidence to support tourism causing terrorism. The nonexistence of causality from tourist to terrorism could be explained by the precaution taken by countries to promote tourism.

In the same vein, (Raza and Jawaid, 2013 [19]) using Johansen and Jeuuselius and ARDL bound testing approach estimate the relationship between tourism and terrorism. The result is

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similar to what (Feridun, 2011 [18]) found that is there appears a negative causality from terrorism to tourism flow. However, tourist flow does not seem to influence the incident of terrorism. In a slightly different study, (Wang, 2009 [20]) investigate the causality between crisis events and tourism demand. The crisis events constitute financial, health and security crisis among others. Accordingly, the study finds that only the health and safety crisis tend to influence tourism demand negatively. However, financial crisis impact on tourism demand tends to be insignificant.

Despite the growing number of studies examining the effect terrorist attacks on some key macroeconomic variables and tourism, the number of studies examining the implication of terrorist attack on exchange rate is limited. Therefore, in this study we examine the effect of terrorist attacks on exchange rate using Turkish lira and pound sterling. Through examining the causally effect we aim to contribute to the current literature and forward an input to policy makers, business and the society. In the next section, we have presented the estimation method and data employed to achieve the objective of the study.

3. Methodology

The autoregressive distributive lag (ARDL) bound testing approach has been used in this article. The ARDL approach is employed to examine the impact of terrorism attacks on exchange rates in Turkey and Egypt. The extended ARDL approach by (Pesaran et al., 2001 [21]) which is based on the estimation of Error Correction Model (ECM) is used in this study. Applying ARDL model has several advantages among others: First, it is possible to apply bound test because ARDL can be applied with small sample size study (Pesaran et al., 2001 [21]). Second, it is possible to estimate both the short and long term relation while simultaneously solving autocorrelation and omitted variable bias. Third, according to (Harris and Sollis, 2003 [22]) the estimation gives unbiased result and the t-statistics are valid even in cases where some of the explanatory variables are endogenous. Fourth, it is possible to estimate the Cointegration relationship using ordinary least square (OLS) once we select correct lags in the ARDL model. Last but not least, variables used in the study do not need to be cointegrated in the same order.

Taking the advantages offered by ARDL bound testing approach this study estimates the causality between terrorist attacks and exchange rate using the following equation:

Model 1: Terrorism on Exchange rate

$$\Delta lnEXC_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta lnEXC_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta lnTER_{t-i} + \alpha_3 lnEXC_{t-1} + \alpha_4 lnTER_{t-1} + \mu_t \quad (1)$$

Where lnEXC is the log of the exchange rate between Turkish lira and US dollar, lnTER represents the log of terrorist attacks in Turkey; while μ is disturbance term and Δ is first difference of the

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respective variables. The exchange rate data (EXC) are computed from bank of England data, while the data for TER are computed from Global terrorism database (https://www.start.umd.edu/gtd/).

Model 2: Exchange rate on Terrorism

$$\Delta lnTER_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, \Delta lnTER_{t-i} + \sum_{i=0}^{n} \beta_{2i}\, \Delta lnEXC_{t-i} + \beta_3 lnTER_{t-1} + \beta_4 lnEXC_{t-1} + \mu_t \quad (2)$$

Similarly, in the second model lnEXC is the log of the exchange rate between Turkish lira and US dollar, lnTER represents the log of terrorist attacks in Turkey; while μ is disturbance term and Δ is first difference of the respective variables.

In estimating the ARDL bound testing approach, first we have to estimate equation (1) and (2) using ordinary least square (OLS) to examine the existence of long term relation through making joint F-tests. The joint F-test are made for the following null hypothesis, $H_0: \alpha_3 = \alpha_4 = 0$ and $H_0: \beta_3 = \beta_4 - 0$ and their respective alternative hypothesis and consequently two F-statistics are generated (Pesaran et al. 2001). Accordingly, if the F-statistics is below the critical value, the null hypothesis of no long term Cointegration cannot be rejected. However, if the F-statistics is above the critical value we reject the null and accept the alternative that is there is long term Cointegration. Contrary, if the F-statistics fall within the critical value the finding will not be conclusive.

The second step in estimating the ARDL bound testing approach, after the Cointegration is determined, the conditional ARDL long run model for EXC_t and TER_t are estimated as:

$$lnEXC_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1\, lnEXC_{t-i} + \sum_{i=0}^{n} \alpha_2\, \Delta lnTER_{t-i} + \varepsilon_t \quad (3)$$

All the coefficients represented here are similar to what already explained. The model also involves ARDL order selection using Schwarz Bayesian Criterion (SBC).

$$lnTER_t = \beta_0 + \sum_{i=1}^{n} \beta_1\, lnTER_{t-i} + \sum_{i=0}^{n} \beta_2\, lnEXC_{t-i} + \varepsilon_t \quad (4)$$

The final step is estimating the error correction model (ECM) and finds the short run parameters. Hence, the ECM is estimated as:

$$\Delta lnEXC_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1\, \Delta lnEXC_{t-i} + \sum_{i=0}^{n} \alpha_2\, \Delta lnTER_{t-i} + \emptyset ECM_{t-1} + \varepsilon_t \quad (5)$$

Where α_1 and α_2 are short term coefficients of convergence of the model and $\emptyset$ represents the speed of adjustment. While the ECM coefficient is the error correction obtained from equilibrium relation of the estimation from equation (1).

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$$\Delta lnTER_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta lnTER_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta lnEXC_{t-i} + \varphi ECM_{t-1} + \mu_t \quad (6)$$

Similarly β_1 and β_2 are short term coefficients of convergence of the model and φ represents the speed of adjustment. While the ECM coefficient is the error correction obtained from equilibrium relation of the estimation from equation (2).

4. Estimation Result

The first step in applying ARDL model is checking neither of the series are I(2). Therefore, to confirm both are not I(2) we used Augmented Dickey Fuller test and Schwarz Info Criterion with maximum lag. Accordingly, the ADF test to the levels of EXC and TER, the p-value shows 0.9061 and 0 respectively. Indicating while TER is stationary at level EXC fails to be stationary. However, after applying first difference on EXC series, the p-value becomes 0 indicating it is stationary. Therefore, the estimation shows that neither of the series are I(2).

Table 1 Unit Root Test Results

Augmented Dickey-Fuller Test			
Variables	Intercept	Intercept & trend	Decision
EXC	-9.241440***	-9.352369***	I(1)
TER	-10.57320***	-10.72092***	I(0)

Source: Authors own computation

Note: ***,**,* show significance level for 1%, 5%, and 10% level while the variables EXC and TER represent sterling to lira exchange rate and number of terrorist incident respectively. The lag length is determined through Schwarz information Criterion.

Then, since neither of our series are I(2) , we can apply Autoregressive Distributed Lag (ARDL) bounds testing approach to estimate the impact of terrorism on the exchange rate between sterling and Turkish lira. However, before we apply the Autoregressive Distributed Lag (ARDL) bounds testing approach, the appropriate lag length is selected using Schwarz Criteria (SC) and it revels ARDL (2,2) is the appropriate model.

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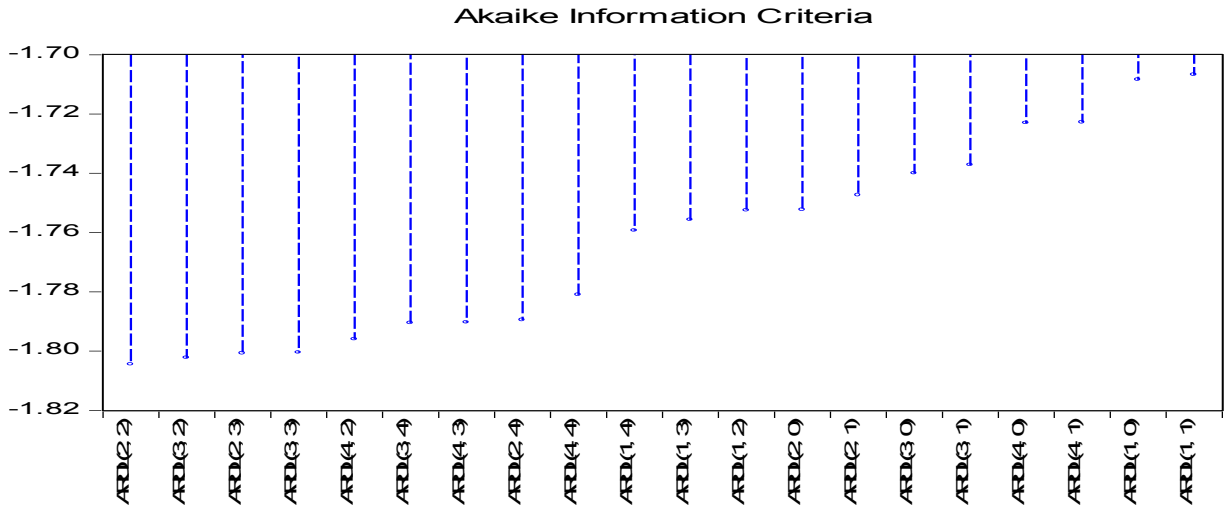
Figure 1 Schwarz criteria



Source: author's own Eviews plotting

The bound test in table 2 shows that, the computed F-statistics (51.101478) is greater than the upper bound of 7.84 at one percent level. Hence, we can reject the null hypothesis no long-run relationship exist, accepting the alternative there exists long-run Cointegration relation between terrorism incident and exchange rate in turkey.

Table 2 ARDL Bounds Test

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	51.01478	1
Critical Value Bounds		
Significance	lower Bound	upper Bound
10%	4.04	4.78
5%	4.94	5.73
2.5%	5.77	6.68
1%	6.84	7.84

Source: Authors own computation

Note: The lower and upper bound values are obtained from Pesaran et al. 2001, p.300. The F-statistic is the computed value.

After confirming the existence of Cointegration relation between the covariates, the long-run coefficients for the selected ARDL (2,2) are presented in the following table. The result below shows that the estimated coefficient of terrorism is significant and negatively affects the exchange rate. Accordingly, the result shows that a one terrorist attack negatively affects the exchange rate by

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0.002117 units all things being the same. The empirical finding we got confirms that terrorist attacks have a long lasting effect of Turkish lira exchange rate with British sterling.

Table 3 Long-Run Coefficients Using ARDL (2,2)

Dependent variable : D(EXC)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TER)	-0.002117	0.000663	-3.192802	0.0018
C	0.010292	0.007391	1.392620	0.1666

Source: Authors own computation

The short-run dynamics coefficients from the estimation of the ARDL ECM are shown in table 4. Similarly, to our previous lag selections the error correction lag for the ARDL (2,2) are selected through Schwarz criteria (SC). As can be seen in table the estimated error correction coefficient is significant at one percent level and have negative sign. Indicating, the adjustment is not only slow but tends towards divergence from the initial level. Specifically, in the current period the exchange rate tend to further diverge from the log-run equilibrium level. Since our error correction coefficient is significant at one percent level, the finding confirms there is a short-run negative impact of terrorism on the exchange rate between Turkish lira and British pound.

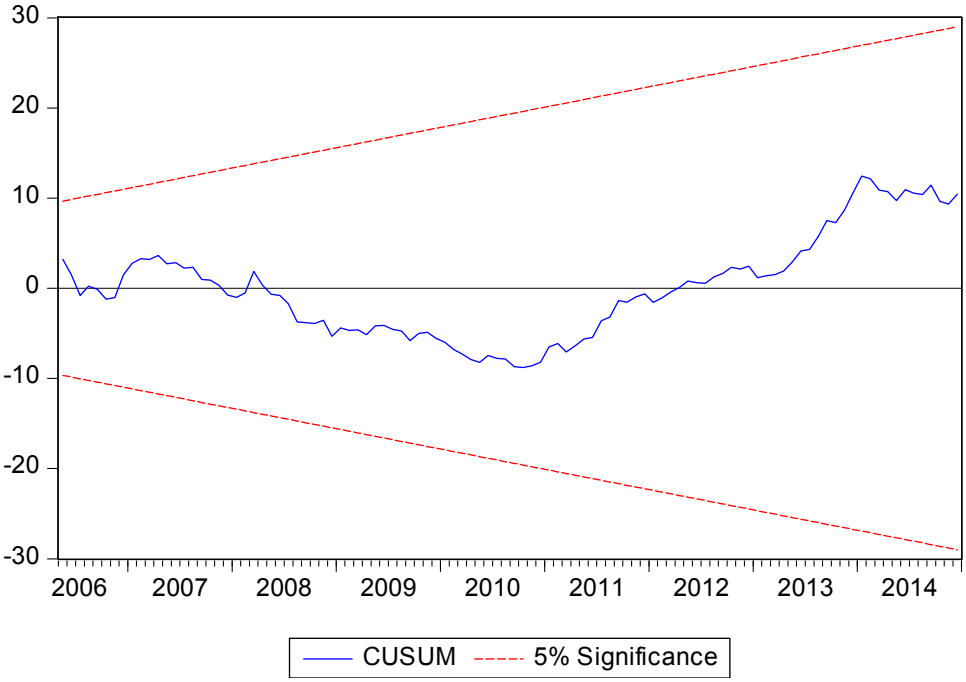
Table 4 Error Correction Estimation for Estimated ARDL (2,2)

Dependent Variable: D(EXC)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXC(-1), 2)	0.243723	0.089068	2.736373	0.0073
D(TER, 2)	-0.000715	0.000308	-2.322655	0.0221
D(TER(-1), 2)	0.000899	0.000311	2.892511	0.0046
ECM(-1)	-1.207987	0.122467	-9.863758	0.0000
ECM = D(EXC) - (-0.0021*D(TER) + 0.0103)				
R-squared	0.144638	Akaike info criterion (AIC)		-1.812668
F-statistic	3.652465	Schwarz criterion (SC)		-1.668658
Prob(F-statistic)	0.004309	Hannan-Quinn criter. (HQ)		-1.754223
Durbin-Watson stat	1.876302			

Source: authors own computation

Last, we plot the cumulative sum of recursive residuals (CUSUM) to check the stability of our finding from the estimation of both long and short-run parameters from the ARDL (2,2) model with error correction. Accordingly, the CUSUM plot shows that the statistics remains with the bound of five percent significance level. Therefore, we cannot reject the null hypothesis that all the coefficients are stable.

Figure 2 Cumulative sum of Recursive Residual



Source: authors own Eviews plot

5. Conclusion

The main objective of the study is to examine the impact of terrorist attacks on exchange rate in the case of turkey. In addition, the paper aims to contribute academia, policy making and business. More specifically, the paper aspires to contribute to the existing research through widening the dimension of the research on the effect of terrorist attack. In fact, to the author's knowledge this study is unique in identifying the effect of terrorist attack on exchange rate between Turkish lira and pound sterling. Further, the paper aims to provide an input to both policy makers and business in formulating policy intervention and trading strategies respectively.

Therefore, In order to achieve the objective, the study employs Autoregressive distributive lag (ARDL) bound testing approach as an estimation technique. Accordingly, the analysis reveals that terrorist incident has a negative impact on the exchange rate in both short and long-run. However, the negative effect of terrorism tends to be small in both the short-run and long-run. More precisely, the short-run effect seems much lower than the long-run effect of terrorism on exchange rate. For instance, everything remains constant a one person causality terrorist attack results in depreciation of Turkish lira versus pound sterling by 0.00072 the next trading day. Further, one person causality terrorist attack has a depreciation effect in the next month by 0.00212.

Although the depreciation seems small per one causality person when considering the historical number of the terrorist attack causalities in turkey the impact becomes large. For instance, everything remains constant a terrorist attack with causality of 100 people could result in

depreciation of Turkish lira by approximately 0.072 against pound sterling. The significance of this depreciation could be understood when considering the implication on foreign trade, servicing foreign debt, stock and financial market. More specifically, a terrorist attack with 100 causality could make domestically produced commodities cheaper in the international market and expensive to import foreign goods resulting in inflation. Similarly, the same terrorist attack could make servicing pound sterling loans expensive.

In a nut shell, the present study provides a valuable policy and business strategy input for policy makers and business respectively. For instance, policy makers could use the result to eliminate the inflation pressure resulting from the depreciation of Turkish lira and business to either maximize/minimize their profit/lose.

Last but not least, although the average effect of terrorist attacks on Turkish lira is negative, in some incidents we see the exchange rate either remaining constant or appreciating (appendix). This could be due to the location of the city the terrorist attack happened and the media coverage given. For instance, if the attack is in tourist destination cities and subject to high media coverage we expect the exchange rate to depreciate significantly. However, if the terrorist attack is not tourist destination city we expect the media coverage to be low and so does the effect on exchange rate. Therefore, to capture the effect of location and media coverage it requires the use of panel data and panel estimation technique.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix

Figure 3 terrorist attack and Turkish lira vs. pound sterling exchange rate

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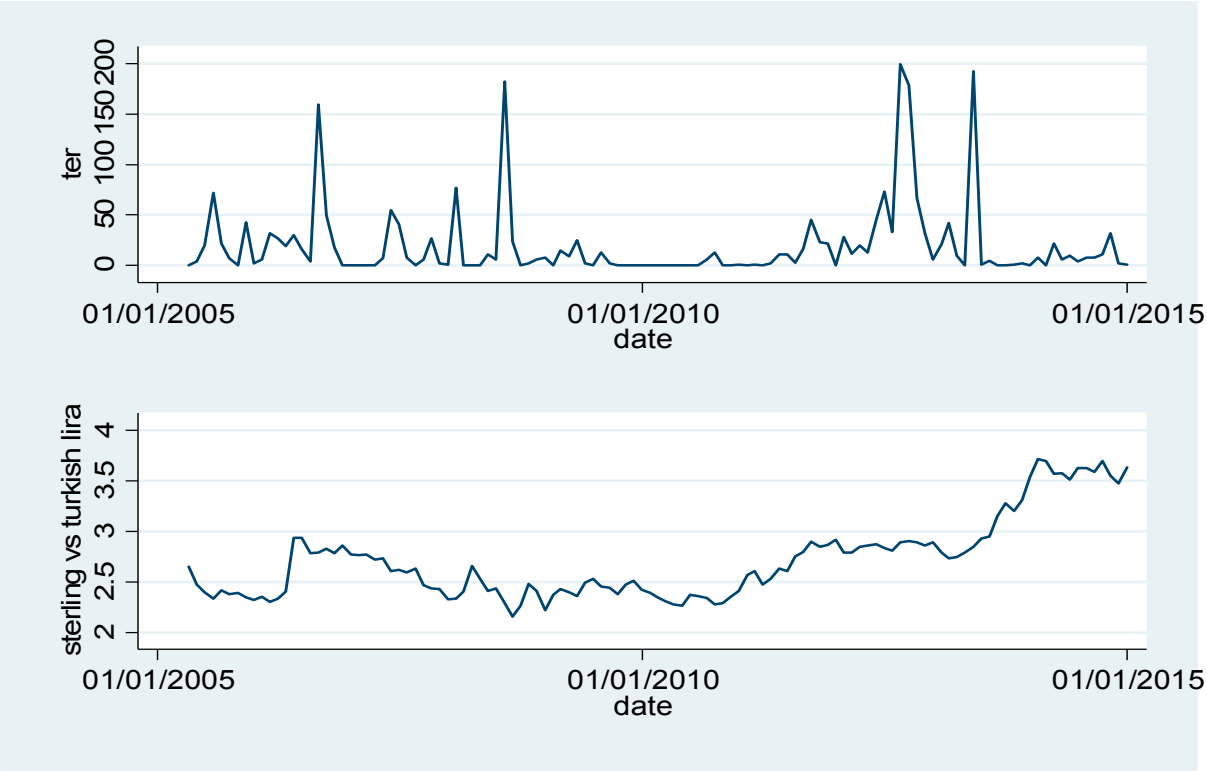

Source: author's own stata plotting

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