

# Examining the impact of Exports and Exchange rate on Economic Growth of Turkey

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## Research

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# Abstract

## Purpose

This study intends to analyze the long-run and short-run relationships along with the identification of causal links between exports, economic growth, and exchange rate in Turkey.

## Data/Design:

This study uses auto-regressive distributed lags (ARDL) and Granger causality over time series monthly data from the year 2010–2018. The results indicate that exports are significantly positively related to economic growth while the exchange rate is found to be negatively related to economic growth.

## Findings:

Moreover, findings from the test of Granger causality indicate that a unidirectional causal association is found from exports to foreign direct investment and economic growth and from economic growth to foreign direct investment. The Granger causality results indicate that an increase in exports accelerates the economic growth of Turkey and a change in growth rate and exchange rate leads to a change in foreign direct investment.

## Originality of work:

The overall findings suggest that exports should be promoted along with the liberal-investment economic policies to boost the overall economic growth in Turkey.

## 1. Introduction

Economic growth is affected by various factors and has been widely studied in the literature. Among others, one of the main factors is the country's exports (Medina-Smith, 2000). Export provides employment opportunities and makes contributions to the country's balance of payments. Exports encourage local producers to be more efficient in the global market by using better and advanced production techniques. It helps in reducing the impacts of external shocks to the economy and promotes intra-industry trade among economies to integrate with the global market (Abou-Stait, 2005).

Exports impact on the economy can be identified via various channels. Country's real output increases by an increase in its exports. Besides, increase in country's exports encourage domestic firms to be specialized in the production of export goods and eventually leads an increase in the level of productivity. Moreover, export-oriented sectors employ more skilled and efficient labors Saleem et al, (2019). Trade allows a country to attain economies of scale in the global market by improving its production techniques

as trade provides access to more advanced production techniques which will increase country's growth rate (Giles & Williams, 2000). Export-oriented country's real GDP growth and its rate will be higher than less export-oriented country (Dadora, 1991). Therefore, trade is considered a major factor in accelerating economic growth (Fajana, 1979).

On the other hand, among others, FDI (foreign direct investment) is also an economic growth's major indicator, particularly in economies having low saving rates. FDI not only provides capital but also the know-how of technology and management required for the firms in restructuration (Borensztein et al. 1998; Shabbir et al, 2019; Chao and Yu, 1994). FDI plays a crucial role in the country's development. Many economies are gaining growth by attracting FDI and by promoting better investment environment to the foreign investors.

Foreign exchange policies have huge impact on economic growth and a significant divide is there between economists and policy-makers while discussing exchange rate and economic growth relationship. On a view of common laymen and politicians, lower exchange rate may accelerate economic growth. Whereas, Economists suggest that in long run, relative price of two currencies can be considered as an essential driver of economic growth and exchange rate may be treated as an endogenous variable while considering its contribution to economic growth.

Turkey is considered as an upper-middle income country, located between Europe and Asia, having a population about 80.7 million (WDI, 2017), and a candidate of EU membership. Turkey sustained its annual growth at 4–5%, despite its political and economic problems in the last decade and about 3–4% annual growth rate is forecasted for the next coming years (WorldBank, 2016). Turkey, as an emerging economy, is expected to be FDI-attractive market but because of its investment environment, it lagged behind other emerging economies (Eduardo and Martin, 2014; Erkilek, 2003). On average Turkey's performance is worse as compared to other emerging economies. From 2002 to 2007, Turkey's FDI inflows raised from 0.5–3.4% of GDP but later again because of global financial crises, it reduced to 1.5% of GDP. However, EU accession process and new reforms in the Turkish economy (which includes liberalization and privatization) created a more suitable environment in attracting more foreign portfolio investment in the country. The causal relationships between exports, economic growth, and FDI inflows remain controversial. Thus, considered to be a crucial matter among researcher and economists. Analyzing these relationships are more important particularly in emerging economies having and suffering more from economic problems (Ericsson and Irandoust, 2001; Zhang, 2001).

This is the pioneer study analyzing the relationship between exports, exchange rate and economic growth of Turkey, where industrial production is used as a proxy for economic growth in order to avoid the income identity problem between exports and economic growth. This study intends to analyze the long-run and short-run relationships along with the identification of causal links between exports, foreign direct investment, economic growth, and exchange rate in Turkey by using the methodologies of auto-regressive distributed lags (ARDL) and Granger causality over time series monthly data from the year 2010–2018.

The remaining study is organized in the following manner: the review of the literature, data and methodology part, findings and discussions and then the conclusion of the study.

## 2. Literature Review

The relationship between the variables including FDI, export and economic growth has widely been studied in the literature (Azam et al., 2013; Mohamed et al., 2013). Hsiao and Hsiao (2006) used the Granger causality methodology and their results indicate that economic growth was directly and indirectly affected by FDI inflows: exports caused the indirect influence of FDI inflows on the growth of the economy. Moreover, a causal bidirectional link was found between the variables, economic growth, and exports.

According to the statistical data evaluated by Katircioglu (2009), there exists a causal association between FDI inflows and economic growth in the context of the Turkish economy over the time period 1970–2005. They used the methodology of ARDL along with the Granger causality and came up with a causal association (unidirectional) between FDI inflows and economic growth rate.

By employing fixed effect panel data approach, Nath (2009) investigate the influence of FDI besides trade on economic growth in thirteen Europe economies and in the region of Baltic for the period of 1991 to 2005. Consequently, the significant positive impact of trade and the insignificant influence of FDI were found on the growth. Nevertheless, a significant correlation between the variables, FDI and economic growth, was found after controlling domestic investment and trade effects on FDI over the period of 1995 to 2005.

Alexiou and Tsaliki (2007) investigate the time series data of Greece over the period of 1945–2003 and found the significant link between the variables, FDI inflows, and economic growth. The findings show the presence of long-run association and the non-existence of causality link between the variables. Consequently, the FDI-led economic growth hypothesis could not be accepted for the case of Greece. The links between FDI, GDP, Export, and Employment are examined by Kersan-Skabic and Zubin (2009) for the economy of Croatia. The results show a negative relationship between FDI and employment while no relationship is found between export and GDP growth.

The study of Miankhel et al. (2009) investigated the nexus of export-FDI-economic growth, by employing VECM for the economies including Chile, Pakistan, Malaysia, Mexico, Thailand, and India. Their findings indicate that the Malaysian economy is having a bi-directional causality link between FDI and economic development while the export-led growth hypothesis was accepted for all the studied economies. Besides, causality from export to growth and FDI was found in only Latin American economies.

For sixty-six economies, Makki and Somwaru (2004) examine the relationship between the variables; FDI, trade and economic growth. Human capital, FDI, domestic investment and trade was found to be important determinants of economic growth. Moreover, a strong relationship was found between trade and FDI in promoting economic growth. Hansen and Rand (2006) examined the link between GDP and

FDI inflows in thirty-one emerging economies by employing Granger causality. They explored that FDI is positively associated with economic growth through adoption of new & advanced technology and through knowledge-transfer. Their results indicate bi-directional causality link between GDP and FDI inflows. Besides, previous literature focused on the nexus of FDI-exports-growth. However, this study also includes exchange rate while discussing the relationship between FDI, exports and economic growth by employing the ARDL Bound testing approach and Granger causality test to find out the causal relationships between these variables for the Turkish economy over the period of 2010–2018.

### 3. Data And Methodology

Monthly data regarding the variable inflows of foreign direct investment (FDI) (Million USD), exports (EXP), exchange rate (EXR) and industrial production (IND) are taken from the Central Bank of Turkey (CBT). All the variables including dependent and independent variables used in this study are in real form; EXP is constant at 2010 USD prices, EXR is constant at 2003 USD prices and IND is constant at 2015 USD prices. The variable FDI is measured by real FDI adjusted by CPI and then was converted into log form. The Data description and source, descriptive statistics of the variables, Graphs, correlation table, which are included in the empirical model, are presented in the table below.

This study intends to analyze the influence of exchange rate (EXR) and exports (EXP) on the economic growth (IND) in Turkish economy over the period of 2010 to 2018 by employing the ARDL Bound testing and also intends to find out the causal links between these variables by using Granger causality test. The foreign direct investment (FDI) has been taken as control variable. Industrial production has been used as a proxy for real economic growth in Turkey.

Here, we lay our discussion about the relevant methods utilized for conducting of this paper. Which include the unit root tests and bounds test for cointegration and causality within the ARDL modelling approach. This model has been developed by Pesaran et al. (2001); and can be applied without considering the order of integration of the variables (whether regresses are purely I (0), purely I (1) or mutually co-integrated). This is particularly linked with the ECM models that are called VECMs.

In ARDL model normally first step is determining the order of integration of each variable because it uses the variables at the level which they are stationary Shabbir and Muhammad (2019). For testing the stationary of the series, the paper uses the Augmented Dickey Fuller (ADF) unit root testing procedure (Dickey and Fuller, 1979). In the ADF test, we want to determine the size of the coefficient  $\delta_2$  in the following equation:

$$\Delta Z_t = \delta_0 + \delta_1 t + \delta_2 Z_{t-1} + \sum_{i=1}^n \beta_i \Delta Z_{t-i} + \varepsilon_t$$

The ADF regression tests for the existence of unit root of  $Z_t$ , in all model variables at time  $t$ . The variable  $\Delta Z_{t-1}$  shows the first differences with  $n$  lags and final  $\varepsilon_t$  is the variable that modifies the errors of autocorrelation. The coefficients,  $\delta_0$ ,  $\delta_1$ ,  $\delta_2$ , and  $\beta_i$  are estimated ones. The null and alternative hypothesis for the presence of unit root in variable  $Z_t$  is as follow:

$$H_0: \delta_2 = 0, H_1: \delta_2 < 0$$

### 3.1 Testing for Granger causality in the Bounds test approach

In this study we carry out the Bounds test to evaluate the existence of causality between exports, exchange rate, and economic growth in Turkey. The model for the relationship between export, exchange rate, and economic growth carried out in this paper is defined as:  $IND_t = f(EXP_t, EXR_t, FDI_t)$  in which  $IND_t$ ,  $EXR_t$ , and  $FDI_t$  represent net export, exchange rate, and foreign direct investment. The following equations are the error correction models estimated under the ARDL Bounds testing methodology:

$$IND_t = \alpha_{11} + \delta_{12} IND_{t-1} + \delta_{13} EXP_{t-1} + \delta_{14} EXR_{t-1} + \delta_{15} LFDI_{t-1} + \sum \varphi_{1i} IND_{t-i} + \sum \beta_{1i} EXP_{t-i} + \sum \psi_{1i} EXR_{t-i} + \sum \gamma_{1i} LFDI_{t-i} + \varepsilon_t \quad (2)$$

$$EXP_t = \alpha_{21} + \delta_{22} IND_{t-1} + \delta_{23} EXP_{t-1} + \delta_{24} EXR_{t-1} + \delta_{25} LFDI_{t-1} + \sum \varphi_{2i} IND_{t-i} + \sum \beta_{2i} EXP_{t-i} + \sum \psi_{2i} EXR_{t-i} + \sum \gamma_{2i} LFDI_{t-i} + \varepsilon_t \quad (3)$$

$$EXR_t = \alpha_{31} + \delta_{32} IND_{t-1} + \delta_{33} EXP_{t-1} + \delta_{34} EXR_{t-1} + \delta_{35} LFDI_{t-1} + \sum \varphi_{3i} IND_{t-i} + \sum \beta_{3i} EXP_{t-i} + \sum \psi_{3i} EXR_{t-i} + \sum \gamma_{3i} LFDI_{t-i} + \varepsilon_t \quad (4)$$

$$LFDI_t = \alpha_{41} + \delta_{42} IND_{t-1} + \delta_{43} EXP_{t-1} + \delta_{44} EXR_{t-1} + \delta_{45} LFDI_{t-1} + \sum \varphi_{4i} IND_{t-i} + \sum \beta_{4i} EXP_{t-i} + \sum \psi_{4i} EXR_{t-i} + \sum \gamma_{4i} LFDI_{t-i} + \varepsilon_t \quad (5)$$

Where  $\alpha_{11}$ ,  $\alpha_{21}$ ,  $\alpha_{31}$ , and  $\alpha_{41}$  are constants for the four equations. We can test for cointegration among  $IND_t$ ,  $EXP_t$ ,  $EXR_t$ , and  $LFDI_t$  using the Bounds test approach. For Eq. (2), (3), (4), and (5) the F-test (normal Wald test) is used for analyzing one or more long run relationships. Where for one or more long run relationships, the F-test specifies which variable should be normalized Saleem et al, (2019) and (Koop, 2005).

In Eq. (2) in which  $IND_t$  is the dependent variable the null hypothesis of no cointegration is  $H_0: \delta_{12} = \delta_{13} = \delta_{14} = \delta_{15} = 0$  and the alternative hypothesis of cointegration is  $H_1: \delta_{12} \neq \delta_{13} \neq \delta_{14} \neq \delta_{15} \neq 0$ . In Eq. (3) the null hypothesis of no cointegration is  $H_0: \delta_{22} = \delta_{23} = \delta_{24} = \delta_{25} = 0$  and the alternative hypothesis of cointegration is  $H_1: \delta_{22} \neq \delta_{23} \neq \delta_{24} \neq \delta_{25} \neq 0$ . In Eq. (4) the null hypothesis of no cointegration is  $H_0: \delta_{32} = \delta_{33} = \delta_{34} = \delta_{35} = 0$  and the alternative hypothesis of cointegration is  $H_1: \delta_{32} \neq \delta_{33} \neq \delta_{34} \neq \delta_{35} \neq 0$ . Lastly, in Eq. (5) the null hypothesis of no cointegration is  $H_0: \delta_{42} = \delta_{43} = \delta_{44} = \delta_{45} = 0$  and the alternative hypothesis of cointegration is  $H_1: \delta_{42} \neq \delta_{43} \neq \delta_{44} \neq \delta_{45} \neq 0$ . If the calculated F-statistic is less than the lower critical bound, then hypothesis of no cointegration might be accepted. However, if the calculated F-

statistic outreaches the upper critical bound then there might be Cointegration. In addition, the long run relation would be unresolved if the calculated F-statistic lies between the lower and the upper critical values.

After demonstration of cointegration then there has to be at least a uni-directional causality. Granger causality existence implies the presence of cointegration between variables which provides information regarding long run and short run Granger causality. For empirical aims, the error correction representation can be derived from the VECM Granger method provided as follow:

$$\begin{aligned} \Delta \text{IND}_t &= \alpha_{11} + \sum \varphi_{1i} \beta_{1i} \psi_{1i} Y_{1i} + \Theta + \eta_{1t} \\ \Delta \text{EXP}_t &= \alpha_{21} + \sum (1-L) \varphi_{1i} \beta_{1i} \psi_{1i} Y_{1i} + \varpi + (\text{ECM}_{t-1}) + \eta_{1t} \\ (1-L) \Delta \text{EXR}_t &= \alpha_{31} + \sum^{n=1} \varphi_{1i} \beta_{1i} \psi_{1i} Y_{1i} + \varpi + \eta_{1t} \\ \Delta \text{LFDI}_t &= \alpha_{41} + \sum \varphi_{1i} \beta_{1i} \psi_{1i} Y_{1i} + \varpi + \eta_{1t} \end{aligned}$$

In which (1 - L) is the difference operator,  $\text{ECM}_{t-1}$  is the lagged error correction term which is developed from long run co-integrating relationship while  $\eta_{1t}$ ,  $\eta_{2t}$  and  $\eta_{3t}$  are white noise serially independent random error terms.

$$\text{IND}_t = \alpha_0 + \sum \alpha_{1i} \text{IND}_{t-i} + \sum \alpha_{2i} \text{EXP}_{t-i} + \sum \alpha_{3i} \text{EXR}_{t-i} + \sum \alpha_{4i} \text{LFDI}_{t-i} + \sum \beta \text{ECT}_{t-1} + \varepsilon_t \quad (6)$$

If the first difference of variables shows a significant relation it is an evidence for the direction of short run causality; whereas, long run causality is represented through a significant t-statistic concerning to the error correction term ( $\text{ECM}_{t-1}$ ). Error Correction model specification is a combination of short run equations and long run representation:

## 4. Results And Discussion

Table 1  
Data Description and Sources

Abbreviations	Data Description	Frequency	Source
IND	Industrial production	Monthly	CBT
EXP	Exports	Monthly	CBT
EXR	Exchange rate	Monthly	CBT
FDI	Foreign Direct investment	Monthly	CBT

Table 2  
Descriptive Statistics

	EXP	EXR	IND	LFDI
Mean	126.3083	102.5277	93.17490	6.204504
Median	127.9700	103.0550	92.23500	6.178741
Maximum	168.1000	125.9000	129.9900	8.283900
Minimum	81.80000	64.88000	56.84000	4.777623
Std. Dev.	18.00310	11.59524	15.90988	0.692202
Skewness	-0.115947	-0.404185	0.064961	0.487759
Kurtosis	2.598601	3.305281	2.442896	3.324125
Jarque-Bera	0.931215	3.235520	1.418059	4.578997
Probability	0.627754	0.198342	0.492122	0.101317

Table 3  
Correlation Table

Variables	EXP	EXR	IND	LFDI
EXP	1			
EXR	-0.74	1		
IND	0.91	-0.81	1	
LFDI	-0.16	0.18	-0.14	1

As shown in Figs. 5, 6 and 7, IND is positively related with EXP and negatively related with EXR which implies that an increase in exchange rate causes economic growth to fall while an increase in exports in a country accelerates its economic growth. However, the relationship between LFDI and IND is not significant as shown in Tables 8 and 9 as well. The first step, done in the empirical analysis is to find out the stationary of the dependent and explanatory variables by applying the unit root test known as ADF (ADF, 1979), whose results are presented in table 4.

**Table 4: Unit Root Test Results (ADF) ( $H_0$ : Non-stationary)**

First Difference Level

Variables	intercept	Intercept and trend	intercept	Intercept and trend	Result
IND	-3.2369* (0.0210)	-3.2093* (0.0892)	-0.8022 (0.8136)	-2.4253 (0.3643)	I (1)
LFDI	-10.2508* (0.0000)	-10.3041* (0.0000)	-8.3397* (0.0000)	-8.9481* (0.0000)	I (0)
EXP	-6.3191* (0.0000)	-6.358077* (0.0000)	-1.295661 (0.6289)	-9.497916 (0.0000)	I (1)
EXR	-6.9907* (0.0000)	-7.0869* (0.0000)	0.9175 (0.9954)	-1.5757 (0.7959)	I (1)
T-statistic (probability)					
Note: (*) indicates McKinnon critical value-based significant level					

After the unit root test, optimal lag length is found by considering five various criteria and presented in Table 5 which shows that optimal length is 1 out of 3 lags.

Table 5  
Lag length Selection

Lag	LR	FPE	AIC	SC	HQ
0	NA	314969.8	24.01174	24.11531	24.05367
1	370.3414	9133.115*	20.47085*	20.98869*	20.68049*
2	22.32069	9852.194	20.54506	21.47718	20.92241
3	27.13143*	9974.799	20.55358	21.89998	21.09864
Note: (*) shows the lag order selected by different criteria.					

As presented in Table 4, all the variables except LFDI are stationary at first difference where the LFDI is stationary at its level. Therefore, the ARDL test (developed by Pesaran et al., 2001) is used to find out co-integration showing the long-run correlation between the dependent and independent variables. The results of the ARDL Wald test and long-run coefficients are presented in Table 6, 7 and 8.

Table 6  
Long-run Cointegration Results by Wald test (F-values)

Test Statistic	Probability	Cointegration (using Pesaran)
F-Statistic = 4.799984	0.0007	Present

1%		5%		10%		K
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	
2.72	3.77	3.23	4.35	4.29	5.61	3

Table 7: Estimated Long-run findings

Variables	Coefficient	Std. error	t-Statistic	Prob.
Constant	59.69278	13.81687	4.320281	0.0000
LFDI	0.622962	0.865668	0.719631	0.4734
EXP	0.592740	0.048385	12.25056***	0.0000
EXR	-0.441354	0.075313	-5.860268*	0.0000
Note: *** indicates level of significance at 1%				

In Table 6, the F-statistic value exceeds upper and lower critical bounds at 1%, 5% and 10%, illustrated in Table 7, confirming the co-integration and the long-run association between the dependent and explanatory variables.

The outcomes postulate that exports are statistically significantly positively related to economic growth. Turkish economy will grow at 0.59% by a one percent increase in its exports. The exchange rate is found to have a negative relationship with economic growth which indicates that economic growth will reduce by 0.44% by a one percent increase in the exchange rate. Moreover, foreign direct investment is found to have a positive but insignificant relationship with economic growth.

#### 4.1 Error Correction Model (Investigating Short-run Relationship)

After analyzing the long run relationship between the variables, discussed in the model, short run relationships are investigated between FDI, exports, economic growth and exchange rate by employing ECM-ARDL method, which shows that if economy is hit by any shock, then how much correction would be made in each period towards the long run equilibrium, depicted by the term ECT in table 8. Error correction model specification is a combination of short run equation and long run representation. The error correction term (ECT) is found highly statistically significant and negative, confirming the presence of co-integration and the relationship between dependent and independent variables. The ECM coefficient or the error term (-0.824151) indicates the correction speed (if the economy hit by any shock) towards the long-run equilibrium of the economy, implying that the speed of correction is 0.82% over the period of one quarter. Moreover, in short run, EXP variable is found to have statistically significant and positive relationship with economic growth at a significant level of 5% as well as FDI variable at 1%. The results of short run dynamics by utilizing the error correction methodology are shown in Table 8.

Table 8: Short-run (ECM – ARDL Model) Results

Variables	Coefficient	Standard err.	t-Stat	Prob.
Constant	0.497300	0.744111	0.668314	0.5055
D(IND(-1))	-0.040478	0.146689	-0.275941	0.7832
D(EXP(-1))	0.060281	0.087675	0.687549	0.04934**
D(EXR(-1))	-0.231214	0.350227	-0.660185	0.5107
D(LFDI(-1))	-2.725456	0.902366	-3.020343	0.0032***
ECT(-1)	-0.824151	0.139668	-5.900722	0.0000***

Note: \*, \*\*, \*\*\* indicates level of significance at 10%, 5% and 1%, respectively.

## 4.2. Diagnostic Test

In order to check the robustness and accuracy of the model, some diagnostic tests are applied including; serial correlation, heteroscedasticity and normal distribution. In all diagnostic tests, the P-value is more than 5%, which implies that there is no serial correlation in the residual, no heteroscedasticity and the model is normally distributed. The results of the diagnostic tests are presented in table 9.

**Table 9: Diagnostic Tests Results**

Test	Null hypothesis	Statistic	P-value	Accept or Reject $H_0$
SR	No serial correlation in the residual	$\chi^2 = 0.5369$	0.5618	Fail to reject $H_0$
HS	No heteroscedasticity	$\chi^2 = 0.3817$	0.2035	Fail to reject $H_0$
ND	Normal Distribution	JB = 0.7332	0.6930	Fail to reject $H_0$

## 4.3. Stability Test

In order to check the stability of the model at 95% confidence interval, test of Cumulative Sum (CUSUM) is applied which shows that the statistics-plots are within the 5% significance level of critical bounds (see Figure 8). Therefore, confirming the stability of the economic growth's determinants over the period from 2010 to 2018.

## 4.4. Granger Causality (GC) Test

After finding the co-integration and long-run relationship between the dependent and explanatory variables, the test of Granger causality is applied to find out the causal links between FDI, exports, exchange rate and economic growth of Turkey. The findings from the GC test are presented in Table 10.

**Table 10: Granger Causality (GC) Test**

Ho	F-Statistics	Prob.
EXR is granger causing EXP	8.56479	0.0004***
EXP is not granger causing EXR	1.24930	0.2913
IND is granger causing EXP	3.69740	0.0283**
EXP is not granger causing IND	2.31852	0.1038
LFDI is granger causing EXP	6.24508	0.0028**
EXP is granger causing LFDI	2.60154	0.0793*
IND is not granger causing EXR	1.98959	0.1423
EXR is granger causing IND	6.01730	0.0034**
LFDI is not granger causing EXR	0.69826	0.4999
EXR is not granger causing LFDI	2.26083	0.1097
LFDI is not granger causing IND	10.5458	7.0005
IND is granger causing LFDI	2.41060	0.0951*

Note: \*, \*\*, \*\*\* indicates level of significance at 10%, 5% and 1%, respectively.

According to the Granger causality test, a causal link (uni-directional) has been found from exchange rate to export as well as a causal association (uni-directional) is found from industrial production (a proxy for economic growth) to exports and foreign direct investment. Moreover, a causal link (uni-directional) is investigated from exchange rate towards industrial production. In addition, a causal link (bi-directional) from foreign direct investment to export and from export toward foreign direct investment. Granger causality results indicate that a change in industrial production of Turkey leads to a change in its export and foreign portfolio investment. Furthermore, a change in exchange rate causes change in exports. Additionally, bi-directional relation between foreign direct investment and export implies their causal relations.

#### 4.5. Impulse Response

The test of the impulse response lies between 95% percent confidence interval which is illustrated in the figure 9.

The given graphs above we can observe that when there is a one standard deviation shock from IND, the industrial production is decreasing rapidly and from period 2 it is increasing and again declining till period 4 and afterward becomes stable. As well as exports and foreign direct investment are declining rapidly and get negative but exports become relatively stable after period 4 and remains in positive

region; however, FDI becomes stable but remains in the negative regions after period 3. Last but not least, the exchange rate in the earlier stages has a relatively stable response in the negative part but declines gradually after second period; while, beyond the period 5 becomes stable but still in the negative region, which indicates that shocks in IND will have a negative impact on IND, EXP, EXR, and LFDI.

#### 4.6. Variance Decomposition

**Table 11: Variance Decomposition**

Variance Decomposition of IND:					
Period	S.E	IND	EXP	EXR	LFDI
1	7.320025	100.0000	0.000000	0.000000	0.000000
2	7.906315	87.45905	0.371161	0.285392	11.88440
3	8.740486	77.22104	2.361204	2.086014	18.33174
4	9.133047	71.40388	2.814358	6.635168	19.14660
5	9.605751	65.78632	2.860914	13.21356	18.13920
6	10.09038	60.34194	2.614405	20.26388	16.77977
7	10.60571	55.61053	2.367875	26.58036	15.44123
8	11.11009	51.62210	2.183499	31.88094	14.31347

We can observe that a shock in industrial production accounts for 100% deviation in the level of IND in the short-run and it decreases as the focusing horizon increases in table 11. Whereas, a shock in export counts for 3.7% variation in the level of IND in the short-run while it increases till period 5 and declines as the focusing horizon increases. In addition, a shock in exchange rate counts for 2.8% variation in the level of IND in the short-run and it increases as the focusing horizon increases. Moreover, a shock in foreign direct investment counts for 11.88% variation in the level of IND and it increases in the short-run and decreases beyond period 5 as the focusing horizon increases.

## Conclusion

This study intends to analyze the long-run and short-run relationships along with the identification of causal links between exports, economic growth, and exchange rate in Turkey by using the methodologies of Auto-Regressive Distributed Lag (ARDL) and Granger causality over time series monthly data from the year 2010–2018. The outcomes indicate that exports are positively related while the exchange rate variable is negatively related to economic growth. According to the Granger causality test, a causal link (uni-directional) has been found from exchange rate to export as well as a causal association (uni-directional) is found from industrial production (a proxy for economic growth) to exports and foreign direct investment. Moreover, a causal link (uni-directional) is investigated from exchange rate towards

industrial production. In addition, a causal link (bi-directional) from foreign direct investment to export and from export toward foreign direct investment. Granger causality results indicate that a change in industrial production of Turkey leads to a change in its export and foreign portfolio investment. Furthermore, a change in exchange rate causes change in exports. Additionally, bi-directional relation between foreign direct investment and export implies their causal relations.

In the GC test, economic growth and exchange rate are found as factors of FDI while export is found as a factor of economic growth; economic growth and exchange rate attracts FDI inflows in Turkey. Moreover, there is an indirect effect from exports to FDI; exports affect economic growth and economic growth affects FDI. The overall findings suggest that exports should be promoted along with the liberal-investment economic policies to boost the overall economic growth in Turkey.

## **Declarations**

## **Availability of data and material**

The data is available on request

### **Competing interests**

The authors declared no potential conflicts of interest concerning the research, authorship and publication of this article.

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## **Authors contributions**

Mr. Malik Shahzad has done part of Introduction and Literature review, while Mr. Muhammad Iftikhar has completed methodology and results etc.

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## **References**

1. Abou-Stait F (2005) Are exports the engine of economic growth? An application of cointegration and causality analysis for Egypt. Economic Research Working Paper No 76, 1977 2003
2. Borensztein E, De Gregorio J, Lee JW (1998) How Foreign Direct Investment Affect Economic Growth? J Int Econ 45:115–135
3. Chao C, Yu ES (1994) Foreign Capital Inflow and Welfare in an Economy with Imperfect Competition. J Dev Econ 45(1):141–154
4. Dickey DA, Fuller WA (1979) Distributions of the estimators for auto-regressive time series with a unit root. J Am Stat Assoc 74:427–431
5. Dodaro S (1991) Comparative advantage, trade and growth: export- led growth revisited. World Development, 19(9), 1153–1165
6. Eduardo M, Martín S. How Regional Integration and Transnational Energy Networks Have Boosted FDI in Turkey (and May Cease to Do So) A Case Study: How Geo-Political Alliances and Regional Networks Matter; 2014
7. Ericsson J, Irandoust M (2001) On the Causality between Foreign Direct Investment and Output: A Comparative Study. Int Trade J 15(1):122–132
8. Erkilek A (2003) A comparative analysis of inward and outward FDI in Turkey. Transnatl Corp 12:79–105
9. Fajana O (1979) Trade and growth: the Nigerian experience. World Dev 7(1):73–78
10. Giles JA, Williams CI (2000) Export-led Growth: A Survey of the Literature and some non-causality results, Part 1. J Int Trade Econ Dev 9(3):261–337
11. Katircioglu S (2009) Foreign direct investment and economic growth in turkey: an empirical investigation by the bounds test for co-integration and causality tests. Ekonomika Istraživanja 22., 1–9
12. Medina-Smith EJ (2000) Is the export-led growth hypothesis valid for developing countries? A case study of Costa Rica. Policy Issues in International Trade and Commodities. Study Series number 7, United Nations Conference on Trade and Development
13. Miankhel AK, Thangavelu SM, Kalirajan K (2009) Foreign direct investment, exports, and economic growth in selected emerging countries: Multivariate VAR analysis. MPRA Paper, No. 22763
14. Mohamed M, Singh JK, Chung-Yee L (2013) Impact of foreign direct investment and domestic investment on economic growth of Malaysia. Malaysian J Econom Stud 50:21–35
15. Nath HK (2009) Trade, foreign direct investment, and growth: Evidence from transition economies. Comparative Economic Studies 51:20–50
16. Pesaran H, Shin Y, Smith R (2001) Bound testing approaches to the analysis of level relationships. J Applied Econometr 16:289–326
17. Saleem H, Khan MB, Shabbir MS (2019) The role of financial development, energy demand, and technological change in environmental sustainability agenda: evidence from selected Asian countries. *Environmental Science and Pollution Research*, 1–15

19. Saleem H, Shahzad M, Khan MB, Khilji BA (2019) Innovation, total factor productivity and economic growth in Pakistan: a policy perspective. *Journal of Economic Structures* 8(1):7
20. Shabbir MS, Saleem H, Khan MB (2019) Impact of Internet Adoption and Mobile Phone Penetration on Corruption: Evidence from Selected Asia-Pacific Countries. *Global Business Review*, 0972150919832107
21. Shabbir MS, Muhammad I (2019) The dynamic impact of foreign portfolio investment on stock prices in Pakistan. *Transnational Corporations Review*, 1–13
22. World Bank. World Development Indicators. World Dev Indic 2016. <http://databank.worldbank.org/> [Accessed 8 December, 2018]
23. Zhang KH (2001) Does Foreign Direct Investment Promote Economic Growth? Evidence from East Asia and Latin America. *Contemp Econ Policy* 19:175–185

## Figures

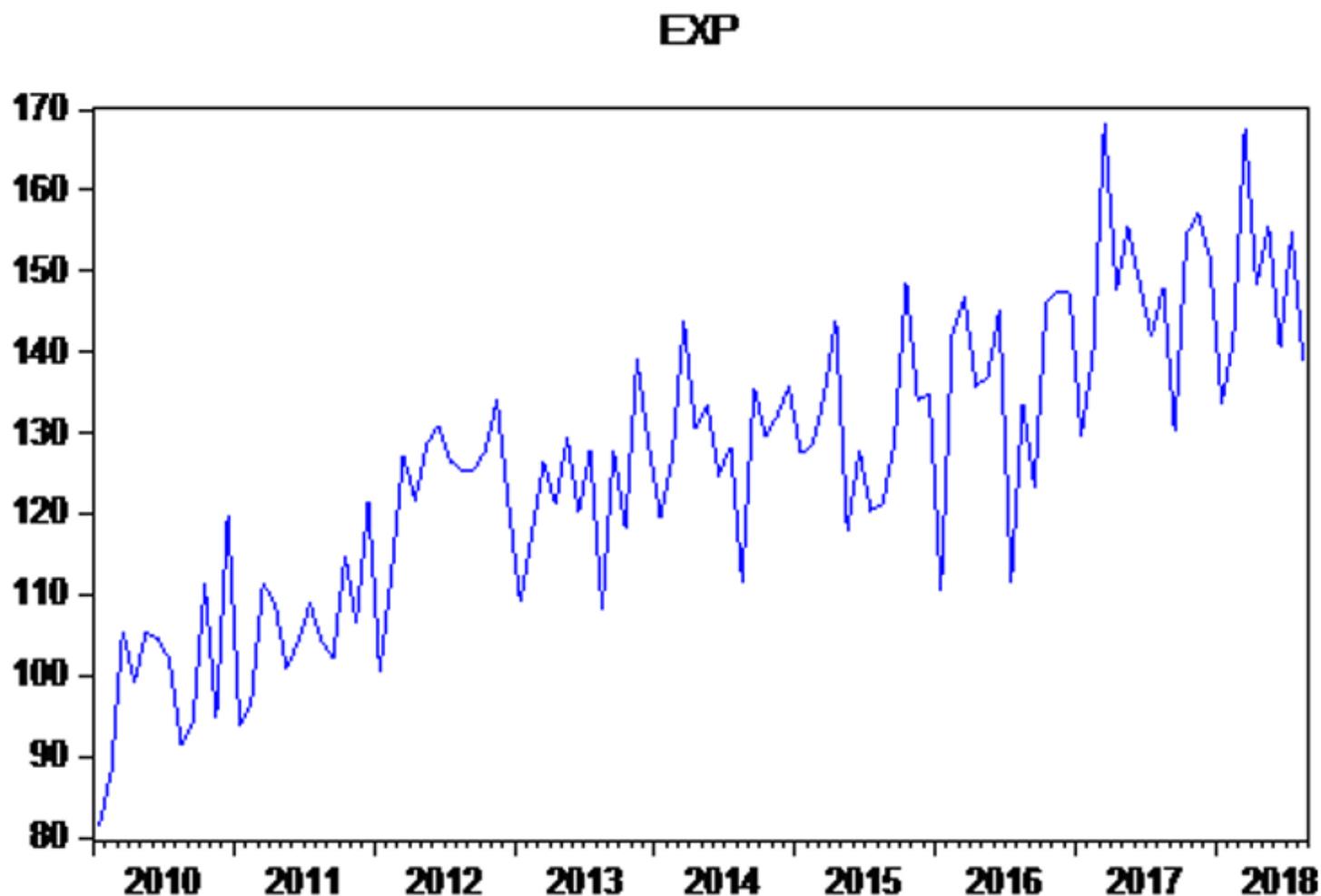


Figure 1

Historical graph of EXP

# EXR

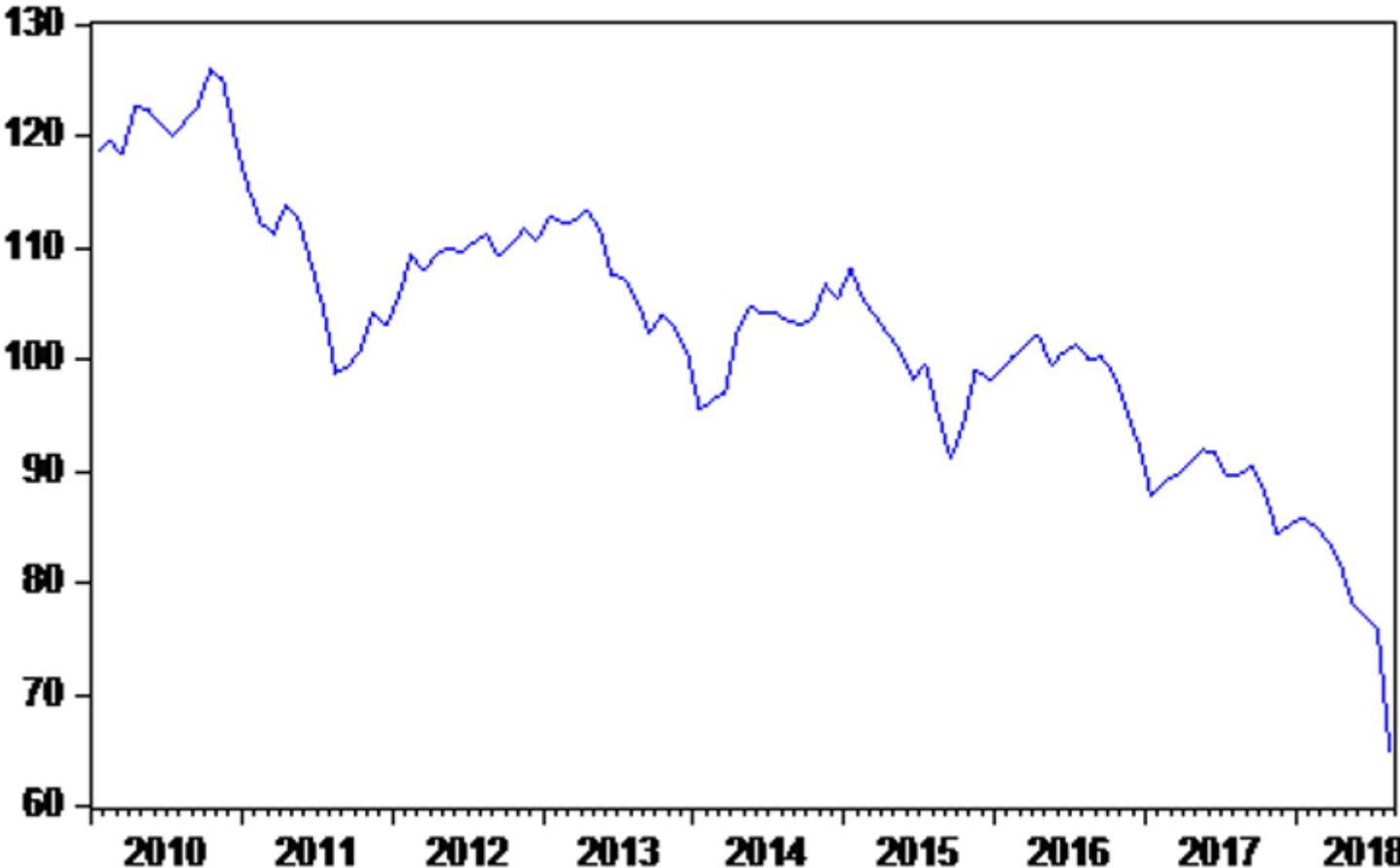


Figure 2

Historical graph of EXR

# IND

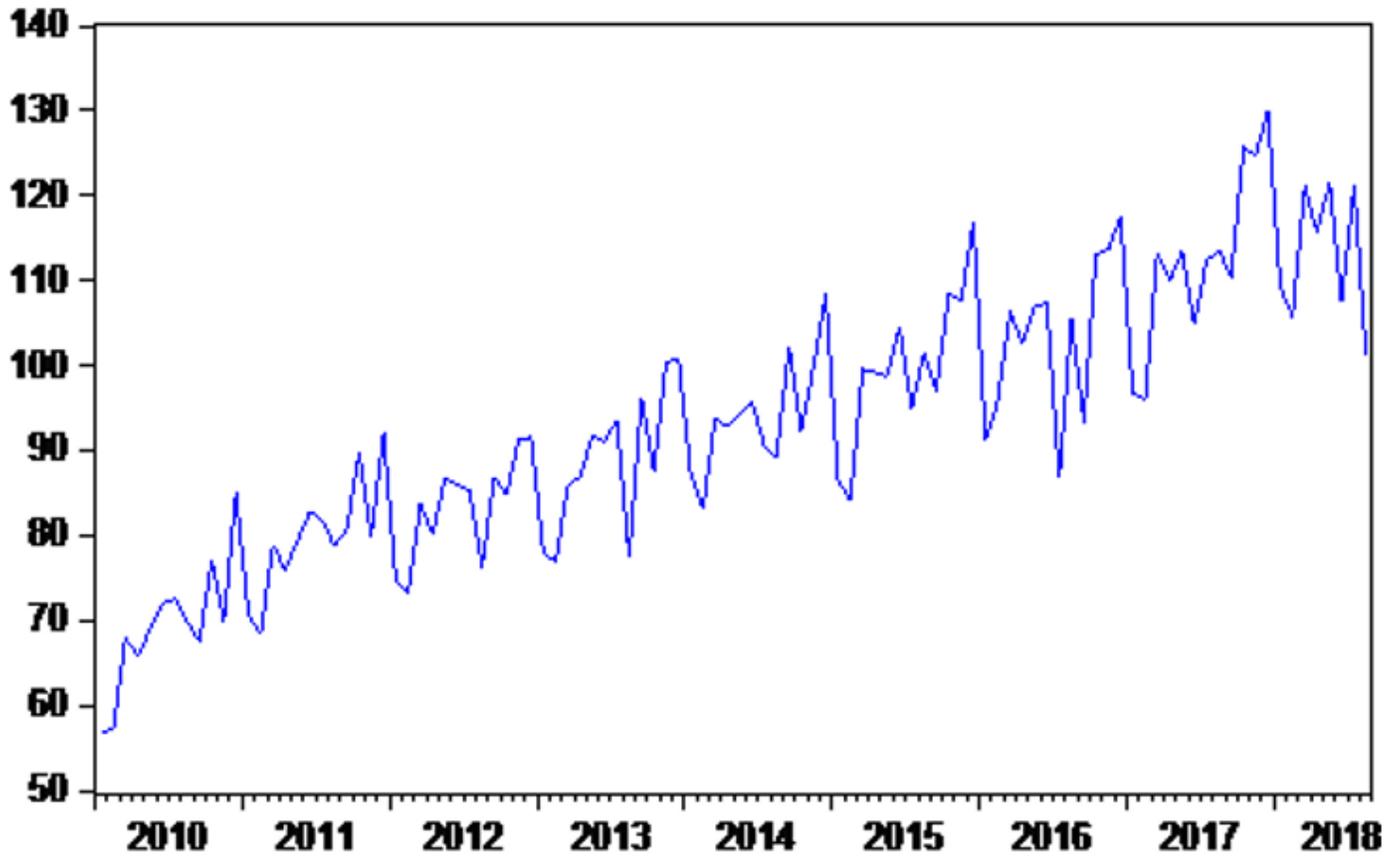


Figure 3

Historical graph of IND

# LFDI

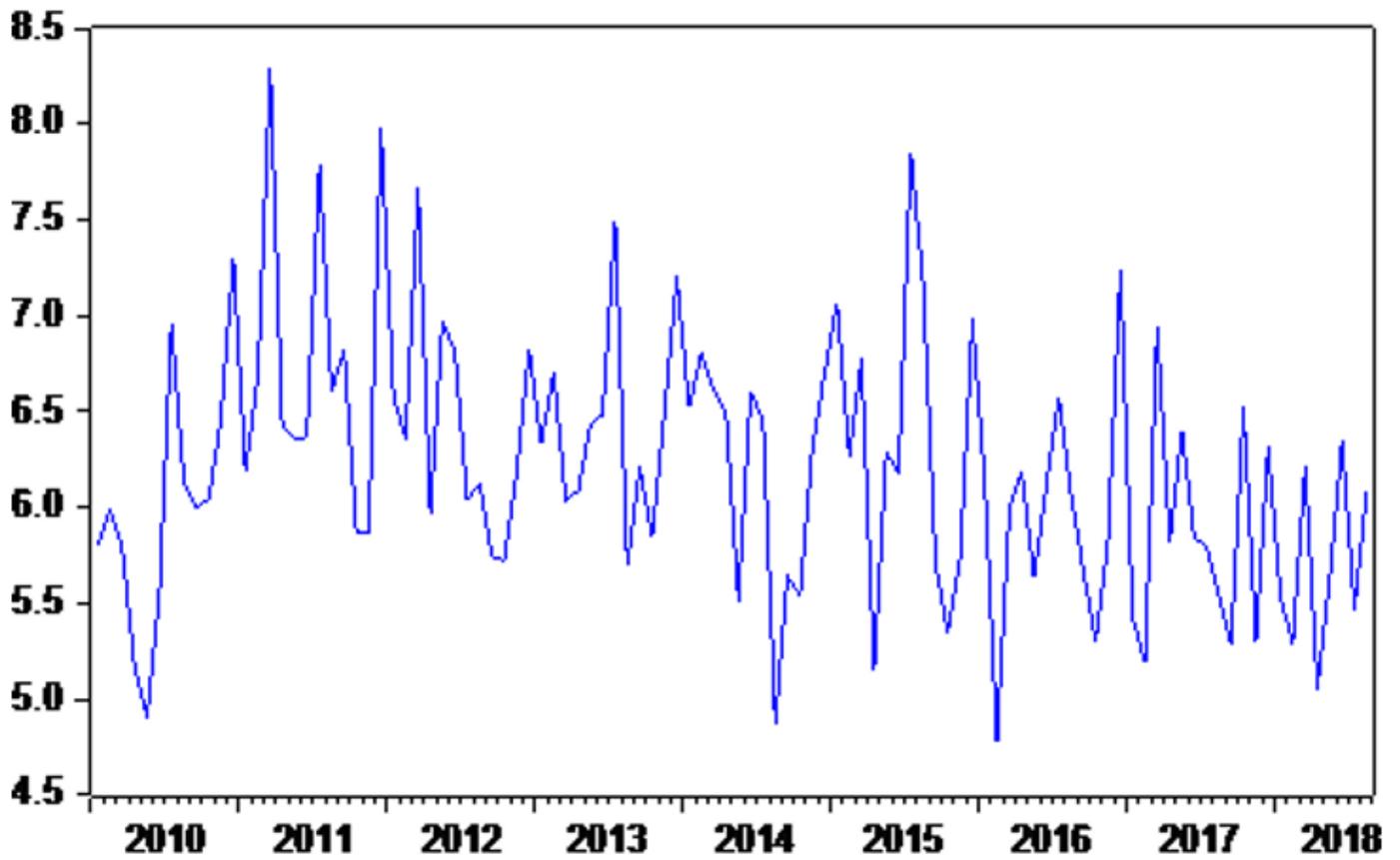


Figure 4

Historical graph of LFDI

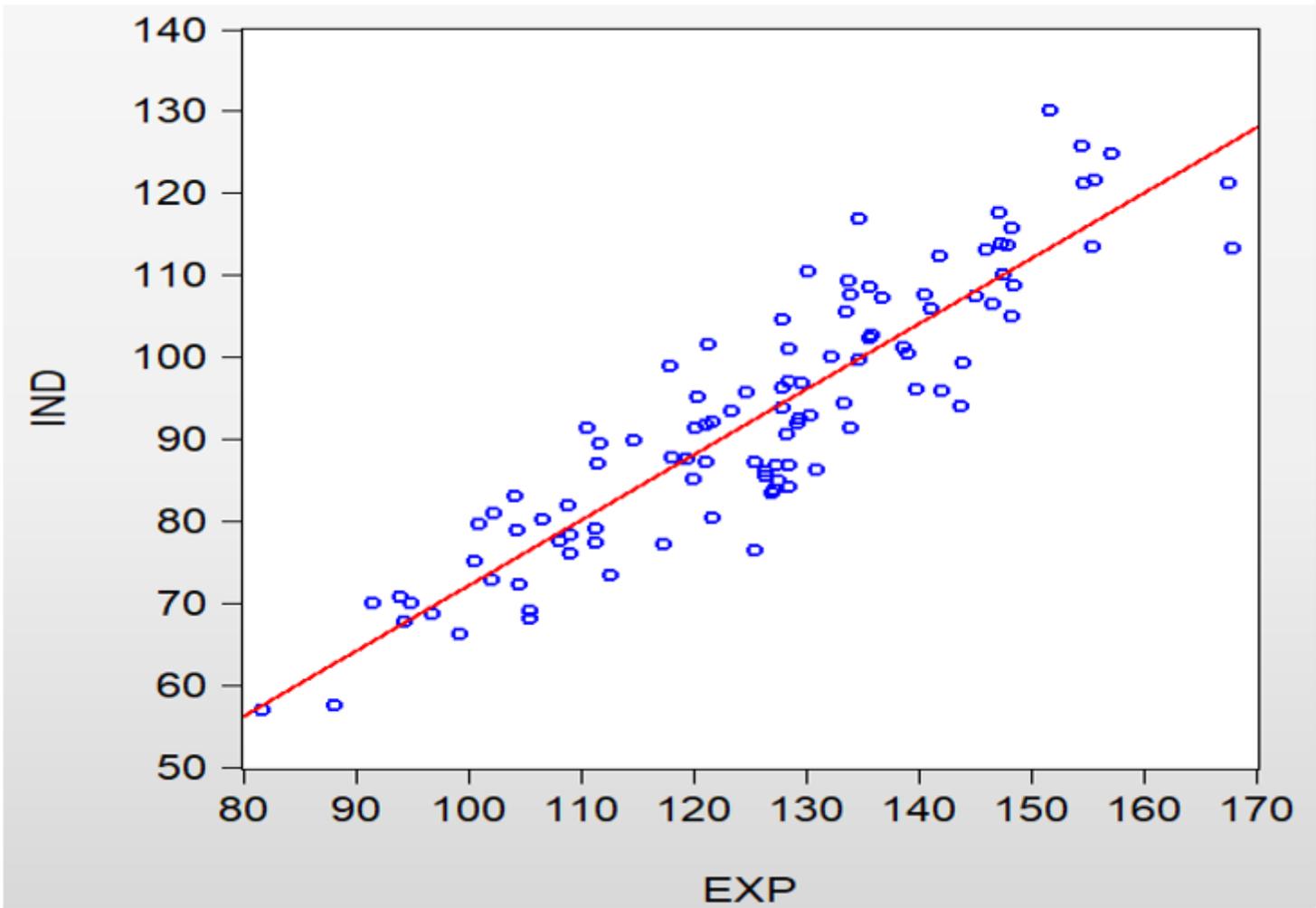


Figure 5

Relationship between EXP and IND

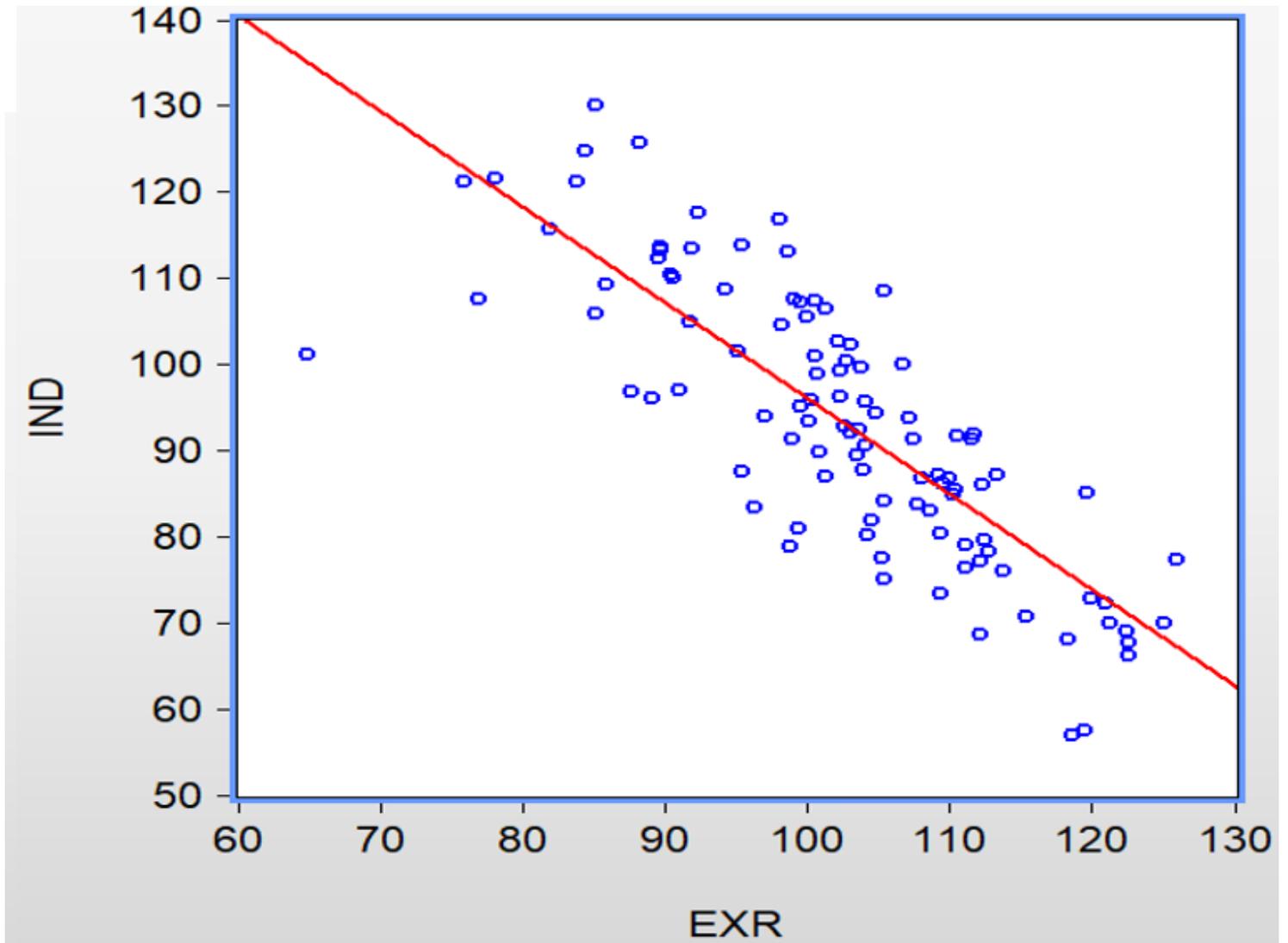


Figure 6

Relationship between EXR and IND

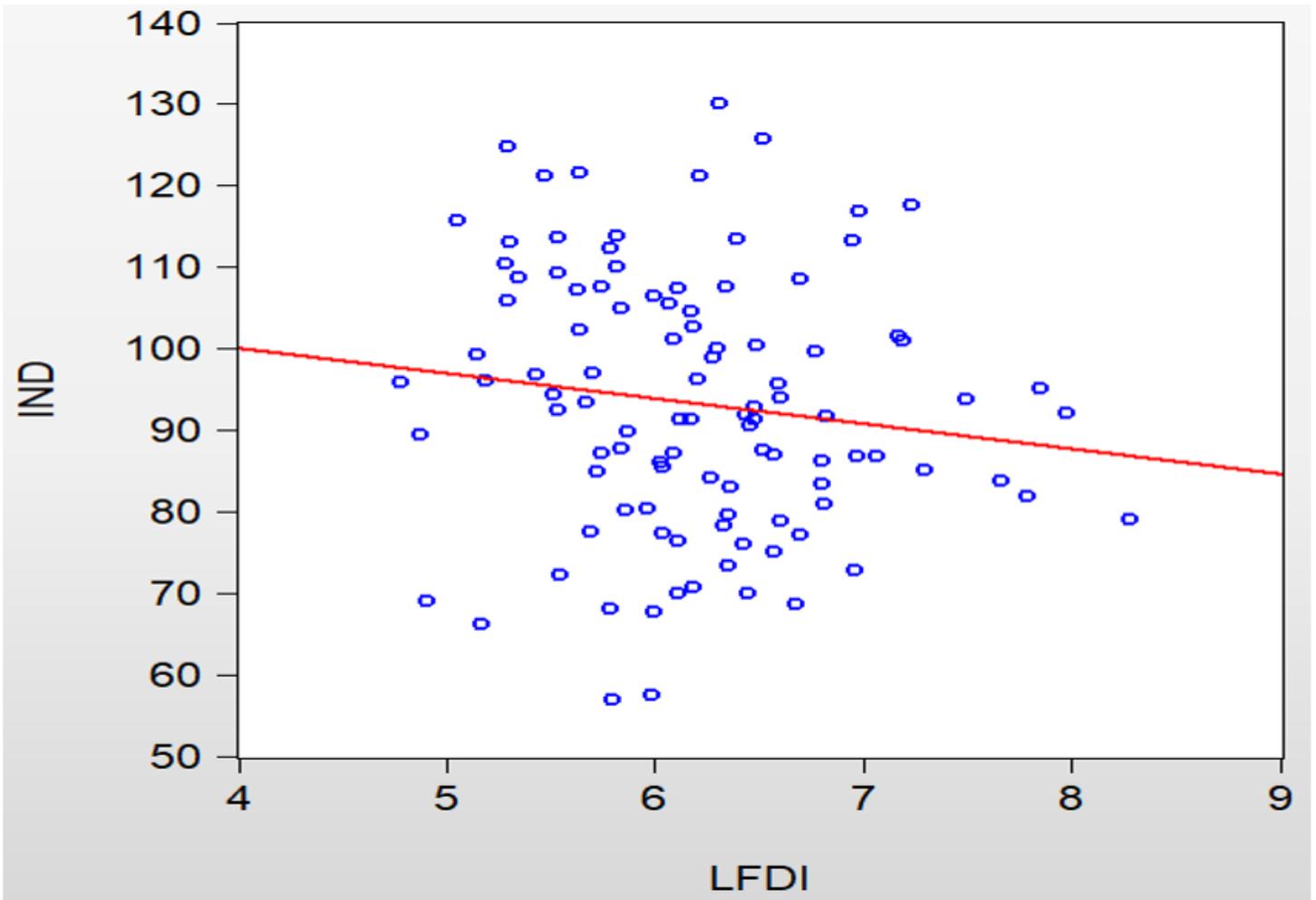
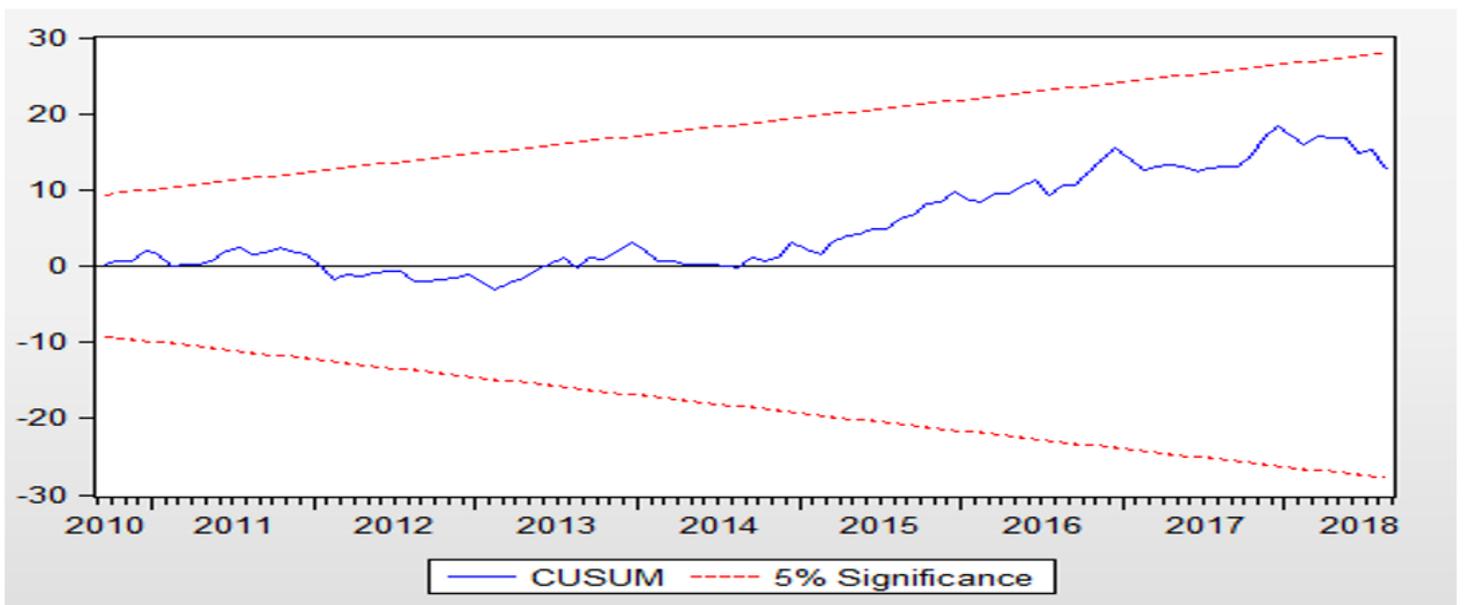


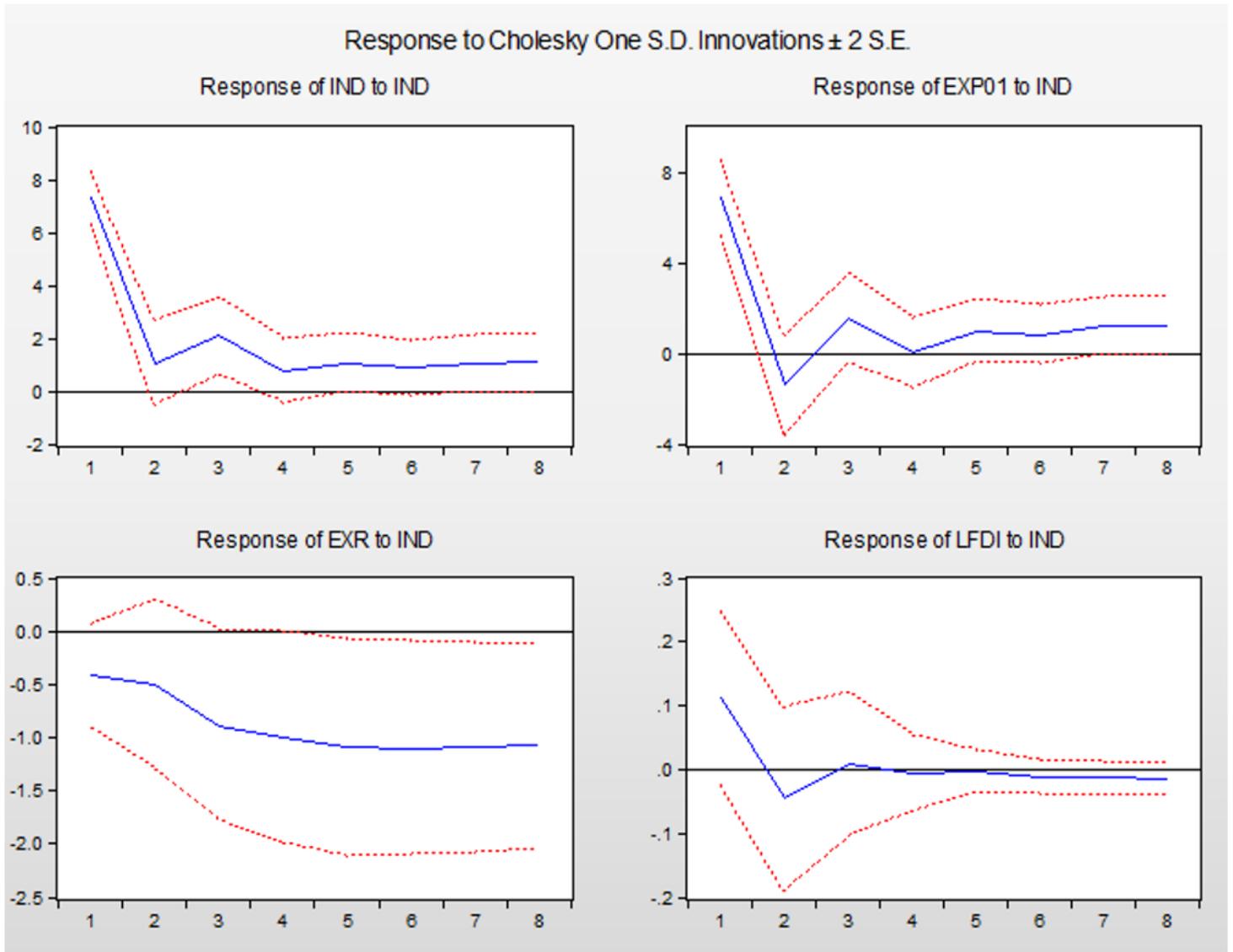
Figure 7

Relationship between LFDI and IND



**Figure 8**

Cumulative sum of recursive residuals



**Figure 9**

Impulse Response