

The Relationship between Sectoral Foreign Direct Investment and Macroeconomic Variables: Empirical Evidence from Turkey

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Abstract

The aim of this paper is to analyze empirically the relationship between sectoral Foreign Direct Investment (FDI) and macroeconomic variables in the long-run and short-run in Turkey for the period from 2005 to 2016. The cointegration analysis and error correction models are used to test long-run relationship and short-run effects respectively. It is expected that the using of sectoral level data may disentangle the relationship FDI and macroeconomic variables. Taking into consideration the characteristics of the FDI flows into Turkey, real exchange rate, real GDP, openness of the economy and real interest rate are chosen as macroeconomic variables. The empirical results show that openness of the economy to international markets is an important variable on the FDI flows into Turkey. The sign of real exchange rate varies depending on the type of sectors as expected. Real GDP has positive effects on agriculture and three sectors. Real interest rate has positive effects on total FDI, financial and insurance activities and banking sectors that have the highest shares in total FDI.

JEL classification numbers: F20, F21, F31, C12, C32

Keywords: foreign direct investment, real exchange rate, unit root test, cointegration analysis, error correction models.

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1 Introduction

Since the beginning of the 1990s, the foreign direct investment (FDI) inflows to the emerging market economies showed an increasing trend. The FDI can be defined as the investment made by a company or individual in a foreign country in the form of either establishing business operations or acquiring business assets in the foreign country, such as ownership or controlling interest in a foreign company. As compared to other forms of capital flows, i.e., bank credits or portfolio investment, the FDI is more stable and may not be affected from the speculative attacks easily. The FDI is very important for the emerging market economies due to their stability and their positive contributions to economic development. The main advantages of the FDI flows to the emerging market economies can be summarized as follows: The FDI can transfer new technologies to the emerging market economies. This new technology transfer may affect positively development of emerging market economies and may help to use of natural resources in an efficient way. Since the use of new technologies require educated labor force, developed countries educate the labor force in the emerging market economies. The collection of taxes from the FDI profits leads to increase of tax revenues of the emerging market economies. Besides, the FDI flows to emerging market economies showed their resilience during the financial crisis such as the South East Asia financial crisis 1997-1998. During this financial crisis, the FDI did't left the countries immediately -such as portfolio investments or short-term capitals.

In this paper, the macroeconomic variables that affect the FDI in the long-run and short-run are analyzed for the period from 2005 to 2016 by using both aggregate and sectoral level data. It is expected that the using of sectoral level data may disentangle the relationship FDI and macroeconomic variables. The cointegration analysis and error correction models are used to test long-run relationship and short-run effects respectively. The structure of this study is organized as follows: The second part gives a brief literature review. In the third part, the evolution of sectoral FDI in Turkey is explained. In the fourth part, theoretical framework of the study is explained. In the fifth part, methodology of research and data sources are explained. In the sixth part, empirical results of the research are presented and discussed, and the last part concludes the study.

2 Literature Review

In the literature, empirical studies about the macroeconomic variables that affect FDI flows use different variables depending on economic and physical characteristics of countries. Blonigen (2005), Root and Ahmed (1979), and Schneider and Bruno (1985) give detailed information about determinants of FDI. Ahmad, Draz and Yang (2016) examined the FDI determinants in developing Asian countries and found that real exchange rate and economic growth have

positive effects on FDI. This paper showed that the depreciation of domestic currency is an incentive for FDI inflows. Most of the existing empirical studies about Turkey as well as other countries used aggregate FDI data. However, the current debate about this issue is that sectoral data can be helpful to disentangle the linkages between macroeconomic variables and FDI flows.

In this framework, Walsh and Yu (2010), examined the effects of macroeconomic variables on sectoral level FDI for 27 developed and emerging market economies for the period 1985-2008. But, taking into consideration different effects of macroeconomic variables on sectoral level FDI, the sectors divided as primary, secondary and tertiary sectors. Primary sectors includes agriculture and mining, and the relationship between the macroeconomic variables and primary sector FDI is minimal. Secondary sectors include manufacturing sectors and it is assumed that real exchange rate has important effects on secondary sectors. The tertiary sector includes services sectors and it is assumed that openness and real exchange rate have important effects on tertiary sectors. The empirical results of the study supports their assumptions.

The empirical studies that examine the effects of macroeconomic variables on FDI in Turkey can be summarized as follows: Polat (2015) examined the major determinants of FDI in the manufacturing sub-sectors during 2007-2012. This study found that turnover indices and new investment incentives introduced in 2009 have positive impacts and the Country Risk Index of the USA, taxes and energy prices that affect production costs have negative impacts on FDI inflows into the manufacturing sub-sectors. Ögül and Eryiğit (2015) found positive effects of GDP, export and bribery and corruption index and negative effects of import, political stability and cost of infrastructure on sectoral FDI between 1995 and 2012 period.

Topallı (2016) examined the relationship between FDI and economic growth and openness in BRICS countries and Turkey between 1982-2013 period. This study found a uni-directional causality from economic growth to FDI and bi-directional causality between FDI and openness in the BRICS countries. Regarding Turkey, this study found a uni-directional causality from economic growth to FDI, but no causality is found between FDI and openness or economic growth and openness. Eşiyok (2011) examined the determinants of FDI using a panel of bilateral outward FDI stocks of 19 OECD countries in Turkey between 1982 and 2007. This study showed that the prospect of European Union membership, infrastructure, political stability and openness to trade have important effects on FDI flows into Turkey. Erdal and Tatoğlu (2002), found that the size of market, openness, physical infrastructure and real GDP have positive effects on total FDI between 1980 and 1998.

As compared to previous empirical studies about Turkey, this research uses both aggregate and sectoral level FDI data. Secondly, the time period covered and macroeconomic variables used in the estimations are different from the previous

empirical studies about Turkey. Besides, this research uses different data source from the previous empirical studies that use sectoral level data.

3 Evolution of Sectoral FDI in Turkey

In Turkey, the capital account liberalisation started in 1980 together with the starting of the economic and financial liberalisation and was completed in 1989.² While the amount of international capital flows were limited during the first half of the 1980s, starting from the second half of the 1980s, the amount of international capital flows increased in high amounts. The short-term capital flows constituted an important part of international capital flows that came after 1989. The banks' and private sectors' credits from the international financial markets constituted an important part of the long-term capital flows. The FDI did not constitute an important share of the international capital flows during this period.

Starting from 2004, an increase in FDI inflows into Turkey has been realized. The major reasons for this increase could be global liquidity abundance together with macroeconomic stability in the Turkish Economy. The Foreign Direct Investment Law was enacted on 5 June 2003. The major aims of this Law are to regulate the principles to encourage FDI, to protect the rights of foreign investors, to define investment and investor in line with international standards, to establish a notification-based system for FDI rather than screening and approval, and to increase FDI through established policies. The amount of FDI inflows into Turkey reached around 5 percent of the national income during the second part of 2000, but decreased below 1 percent of the national income during the global financial crisis in 2008. Since then, the FDI inflows have been around 1-2 percent of the national income.

As can be seen from Figure 1, the FDI inflows into Turkey between 2005 and 2016 mostly concentrated on the Services Sector. During this period, the distribution of total FDI at the sectoral level are as follow: around 63 percent Services Sector, around 27 percent Industrial Sectors and around 3 per thousand Agriculture Sector. Within the 37 percent of Industrial Sectors' FDI share, 2 percent belongs to Mining&Quarrying, 23 percent belongs to Manufacturing Sector and 12 percent belongs to Electricity, Gas, Steam and Air-Conditioning Supply.

²For more information, Pinar and Erdal (2016): 394-400.

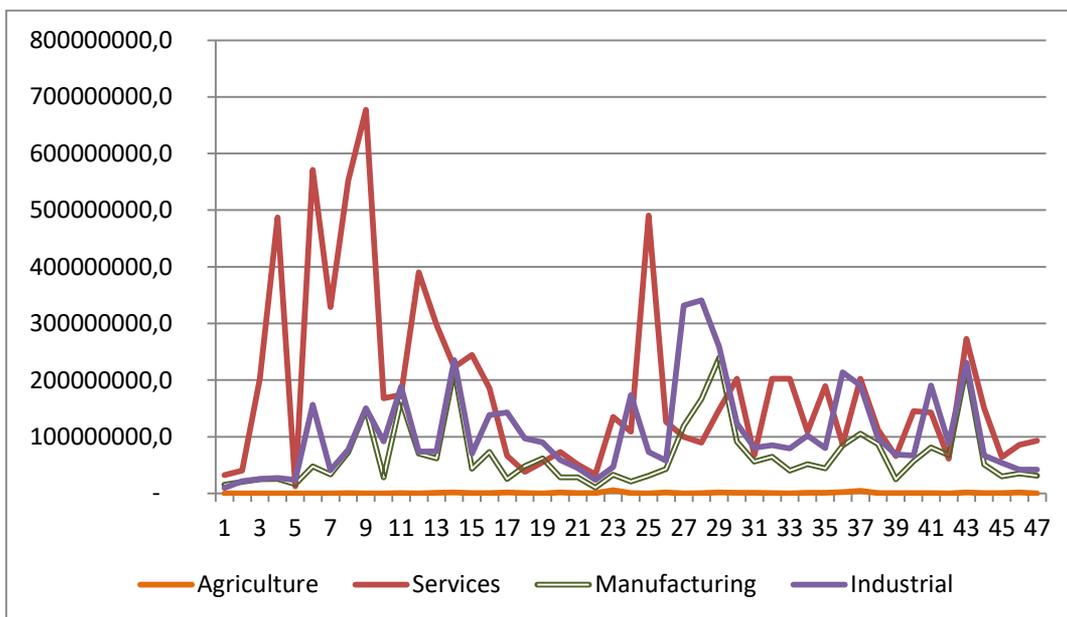


Figure 1: The FDI inflows to major sectors (2005-2016) (million US dollars)

In the Services Sector, the Financial and Insurance Activities has the highest share of FDI inflows with 58 percent, Information and Communication Services has the second highest share with 13 percent and Wholesale and Retail Trade has the third highest share with 9 percent (Figure 2). In the Financial and Insurance Activities, the Banking Sector has the highest share between 2005 and 2016, took 78 percent of FDI inflows to the Financial and Insurance Activities and 46 percent of the FDI inflows to the Services Sector. Within the Financial and Insurance Activities, after the Banking Sector, the highest share of the FDI inflows belongs to the Insurance, Reinsurance and Pension Funding (except Compulsory Social Security) followed by the Real Estate Activities.

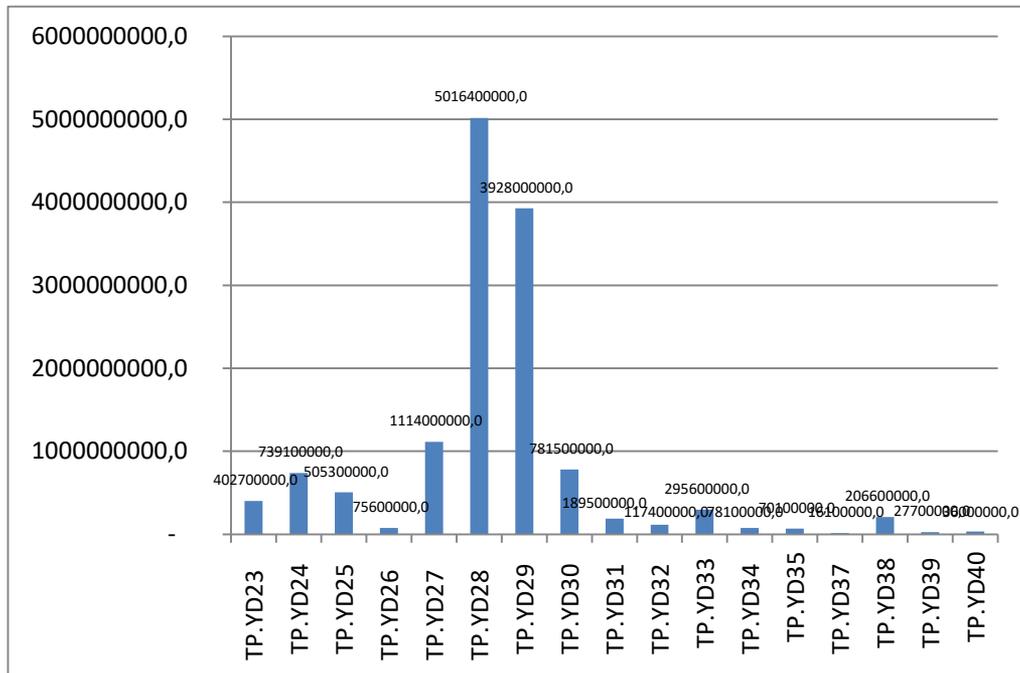


Figure 2: FDI inflows to services sub-sectors (2005-2016) (million US dollars)

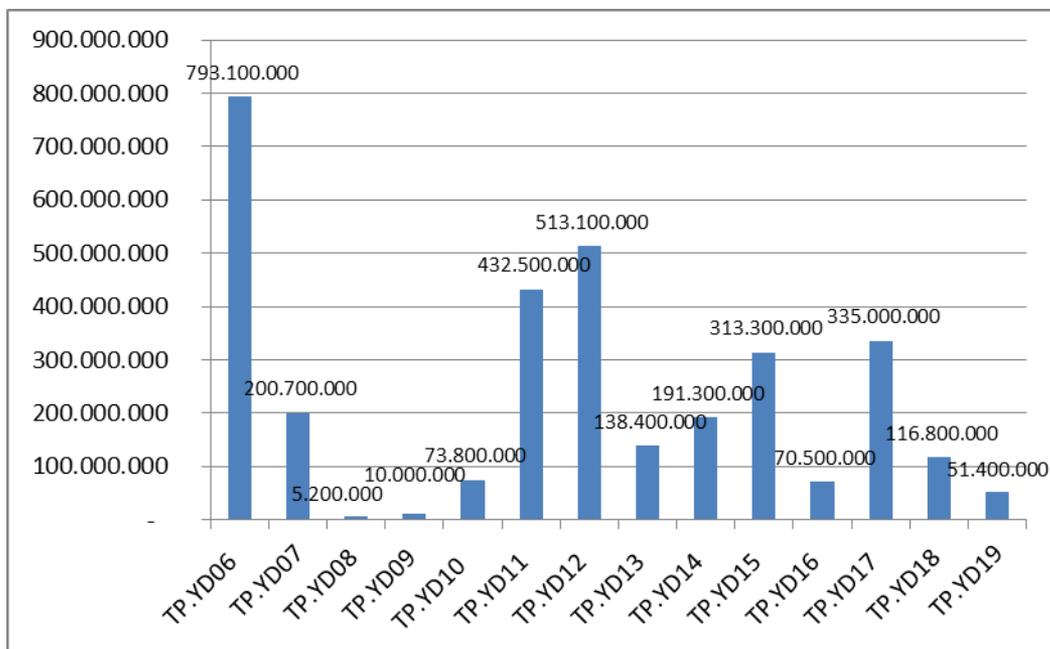


Figure 3: FDI inflows to manufacturing sub-sectors (2005-2016) (million US dollars)

In the Manufacturing Sector, the Food Products, Beverages and Tobacco had the highest share of FDI inflows, followed by the Chemicals, Chemical Products,

Basic Pharmaceutical Products, and Coke, Refined Petroleum Products, and Nuclear Fuel (Figure 3).

4 Theoretical Framework

The macroeconomic variables that affect the FDI inflows may show differences depending on the economy's characteristics. In general, the FDI equation that includes the macroeconomic variables can be written as follows:

$$FDI_{i,t} = B_0 + B_1 REALFX_t + B_2 REALGDP_t + B_3 OPENNESS_t + B_4 REALINTEREST_t + u_t \quad (1)$$

where $FDI_{i,t}$ is the volume of foreign direct investment at sector i and time t , $REALFX_t$ is the real exchange rate at time t , $Y REALGDP_t$ is the real domestic economic activity at time t , $OPENNESS_t$ is the openness of the economy at time t , $REALINTEREST_t$ is the real interest rate at time t and u_t is the error term. The expected signs of the coefficients are as follows:

B_0 = The sign of the coefficient is expected to change depending on the sectors. In the manufacturing sector, the depreciation of real exchange rate leads to higher FDI with lower wages, lower cost investments and export-led production. Froot and Stein (1991) showed that the depreciation of national currency increased FDI. In the services sector, an appreciation of domestic currency leads to increase of FDI. In the agriculture and mining and quarrying sectors, no effect is expected. Here, CPI-effective foreign exchange rate is used, so an increase of exchange rate means an appreciation of domestic currency.

B_1 = Real GDP shows all demand variables in the recipient country. Since, investment is a linear function of real GDP, an increase in real GDP may lead to increase of investment. But, at the sectoral level, the results may change. While the sign of the coefficient is expected to be positive for the manufacturing and services sectors, no effect is expected for the other sectors.

B_2 = As the openness of economy to international markets increases, productivity increase with the specialization (Erdal, 2017). The sign of the coefficient is expected to change depending on the sectors. While the sign of the coefficient is expected to positive for manufacturing and services sectors, no effect is expected for the other sectors.

B_3 = Real interest rate is the nominal interest rate deflated by inflation rate. An increase in real interest rate rises cost of borrowing and direct investment may be affected negatively. The sign of the coefficient is expected to change depending on the sectors. The sign of the coefficient is expected to be negative for manufacturing sectors and positive for services sectors. Because, higher real interest rates in the services sectors means higher profit for investors who invest these sectors. No effect is expected for agriculture and mining and quarrying sectors.

5 Research Method

In the empirical part of the study, the long-run and short-run effects of macroeconomic variables on total and sectoral level FDI data are examined for Turkey for the period 1. Quarter 2005 to 3. Quarter 2016 (Appendix-1). The major characteristics of this period can be summarized as follows: 1- The Foreign Direct Investment Law was enacted on 5 June 2003, 2- The Turkey's candidacy to European Union membership was approved by the European Union members, and 3- The flexible exchange rate regime has been adopted. All these developments led to an increase of FDI inflows into Turkey starting from 2004.

Doing that, the sub-sectors that have taken the highest FDI inflows are analyzed. Initially, the empirical analysis is done for all sectors and sub-sectors that have data, however, statistically significant estimation results couldn't be obtained for all of them. Firstly, the Augmented Dickey-Fuller (ADF) test is done if the variables have a unit root. Then, cointegration analysis is conducted and error correction models are estimated. The following FDI equation is estimated:

$$\ln FDI_{i,t} = B_0 + B_1 \ln REALFX_t + B_2 \ln REALGDP_t + B_3 \ln OPENNESS_t + B_4 \ln REALINTEREST_t + u_t$$

where $FDI_{i,t}$ is the real FDI inflow, $REALFX_t$ is the real exchange rate, i.e., the amount of Turkish lira per unit of US dollar, $REALGDP_t$ is the real Gross Domestic Product or domestic income or demand, $OPENNESS_t$ is the openness of the economy to international markets and $REALINTEREST_t$ is the real interest rate. All the variables, except openness and real interest rate, are in logarithmic forms. The data is monthly and data sources and variable construction are presented in Table 1.

Table 1: Variable description and data sources

Name	Description	Source
$FDI_{i,t}$	Total and sectors FDI inflows from abroad (in million US dollars)	The Central Bank of Republic of Turkey (CBRT), Electronic Data Dissemination System (EDDS)
$REALFX_t$	CPI- effective exchange rate	The EDDS of the CBRT
$PRICE LEVEL_t$	Consumer Price Index (CPI) in Turkey	Turkish Statistical Institute (TSI)
$OPENNESS_t$	The ratio of total foreign trade to GDP (export+import/GDP)	The EDDS of the CBRT
$REAL INTEREST RATE_t$	Weighted average interest rates for banks' loans – inflation rate	The EDDS of the CBRT and TSI
$REALGDP_t$	Real GDP= Current GDP/CPI (in million US dollars)	The EDDS of the CBRT

6 Empirical Results

Firstly, each of the variable is tested using ADF test whether the variable has a unit root. The ADF test consists of regressing each series on its lagged value and lagged difference terms. The ADF test results are shown in Table 2. The ADF test results show that independent variables are nonstationary in their levels and they are integrated of order one. The dependent variables are stationary in their levels. In order to analyze long-run and short-run effects of real exchange rate, real GDP, real interest rate and openness on total and sectoral FDI flows, cointegration analysis and error correction models are used.

Table 2: Unit root test results

Variable	Level	First Difference
Real exchange rate	-1.895	-6.388
Real GDP	0.840	-4.392
Real interest rate	-2.476	-7.369
Openness	-3.310	-11.187
Total FDI	-5.386	-
Agriculture Sector	-3.450	-
Industrial Sectors	-4.735	-
Mining and Quarrying	-7.083	-
Manufacturing Sector	-4.479	-
Services Sector	-5.755	-
06: Food Products, Beverages and Tobacco	-5.745	-
11: Coke, Refined Petroleum Products and Nuclear Fuel	-4.416	-
12: Chemicals, Chemical Products, Basic Pharmaceutical Products and Materials	-6.059	-
15: Basic Metals and Fabricated Metal Products	-10.454	
17: Computers, Electronic-Electrical and Optical Equipment	-4.579	
20: Electricity, Gas, Steam and Air-conditioning Supply	-6.05	
24: Wholesale and Retail Trade	-6.507	-
27: Information and Communication Services	-11.809	-
28: Financial and Insurance Activities	-5.413	-
29: Financial Service Activities (Banks)	-5.679	
30: Insurance, Reinsurance and Pension Funding (Except Compulsory Social Security)	-5.642	

Note: McKinnon critical values are -3.58 at 1 % level, -2.92 at 5 % level and -2.60 at 10 % level.

6.1 Cointegration Analysis

The Johansen test statistics (trace and maximum eigenvalue) are used for the cointegration analysis. The cointegration test results for FDI inflows, real exchange rate, real GDP, real interest rate and openness of the economy are presented in Table 3. The test results show that cointegration exists between variables. The existence of cointegration between variables means that there is a long-run relationship among FDI inflows, real exchange rate, real GDP, real interest rate and openness of the economy .

Table 3: Cointegration test results

Sector	Eigenvalue	Trace statistics	0.05critical value	Probability*****	Number of observations
<u>Total Sector**</u>					
None***	0.79	89.47	47.85	0.00	45
At most 1	0.37	34.56	29.79	0.01	
At most 2	0.25	14.06	15.49	0.08	
At most 3	0.15	1.02	3.84	0.31	
At most 4	0.01	0.60	3.84	0.43	
<u>01 Sector **</u>					
None***	0.70	92.67	69.81	0.0003	
At most 1	0.33	37.50	47.85	0.32	
At most 2	0.20	18.96	29.79	0.49	
At most 3	0.14	8.83	15.49	0.38	
At most 4	0.03	1.65	3.84	0.19	
<u>03 Sector **</u>					
None***	0.69	93.01	69.81	0.0003	
At most 1	0.37	39.54	47.85	0.23	
At most 2	0.19	18.44	29.79	0.53	
At most 3	0.15	8.67	15.49	0.39	
At most 4	0.02	1.15	3.84	0.28	
<u>04 Sector *****</u>					
None***	0.67	101.79	69.81	0.00	
At most 1	0.49	50.79	47.85	0.02	
At most 2	0.21	19.68	29.79	0.44	
At most 3	0.15	8.80	15.49	0.38	
At most 4	0.02	1.01	3.84	0.31	
<u>05 Sector **</u>					
None***	0.68	89.48	69.81	0.0006	
At most 1	0.31	36.94	47.85	0.35	
At most 2	0.22	20.18	29.79	0.41	
At most 3	0.15	8.92	15.49	0.26	
At most 4	0.02	1.22	3.84		
<u>06 Sector *****</u>					
None***	0.62	97.01	69.81	0.0001	
At most 1	0.46	53.10	47.85	0.01	
At most 2	0.29	24.58	29.79	0.17	
At most 3	0.16	9.006	15.49	0.36	
At most 4	0.02	1.039	3.84	0.30	
<u>11 Sector **</u>					
None***	0.65	91.30	69.81	0.0004	
At most 1	0.39	43.26	47.85	0.12	
At most 2	0.22	20.77	29.79	0.37	
At most 3	0.16	9.46	15.49	0.32	
At most 4	0.03	1.41	3.84	0.23	
<u>12 Sector **</u>					
None***	0.79	114.76	69.81	0.00	
At most 1	0.39	43.55	47.85	0.11	
At most 2	0.24	21.12	29.79	0.34	
At most 3	0.14	8.40	15.49	0.42	
At most 4	0.02	1.10	3.84	0.29	
<u>15 Sector *****</u>					
None***	0.64	102.08	69.81	0.00	
At most 1	0.51	56.04	47.85	0.0007	
At most 2	0.27	23.08	29.79	0.24	

At most 3	0.15	8.38	15.49	0.42
<u>17 Sector **</u>				
None***	0.63	91.02	69.81	0.0004
At most 1	0.44	45.57	47.85	0.08
At most 2	0.21	19.36	29.79	0.46
At most 3	0.14	8.41	15.49	0.42
At most 4	0.02	1.27	3.84	0.25
<u>20 Sector**</u>				
None***	0.61	88.16	69.81	0.0009
At most 1	0.41	44.88	47.85	0.09
At most 2	0.24	20.67	29.79	0.37
At most 3	0.12	8.15	15.49	0.44
At most 4	0.04	1.89	3.84	0.16
<u>22 Sector*****</u>				
None***	0.67	99.75	69.81	0.0000
At most 1	0.41	48.54	47.85	0.04
At most 2	0.29	24.04	29.79	0.19
At most 3	0.15	8.26	15.49	0.43
At most 4	0.02	0.92	3.84	0.33
<u>24 Sector **</u>				
None***	0.64	91.29	69.81	0.0004
At most 1	0.38	44.05	47.85	0.10
At most 2	0.28	21.98	29.79	0.29
At most 3	0.13	6.93	15.49	0.58
At most 4	0.01	0.62	3.84	0.43
<u>27 Sector **</u>				
None***	0.71	99.69	69.81	0.0000
At most 1	0.34	42.89	47.85	0.13
At most 2	0.27	24.00	29.79	0.20
At most 3	0.16	9.32	15.49	0.33
At most 4	0.02	1.01	3.84	0.31
<u>28 Sector *****</u>				
None***	0.72	109.48	69.81	0.0000
At most 1	0.44	50.83	47.85	0.02
At most 2	0.29	24.04	29.79	0.19
At most 3	0.15	8.43	15.49	0.41
At most 4	0.02	0.96	3.84	0.32
<u>29 Sector **</u>				
None***	0.71	112.42	69.81	0.0000
At most 1	0.50	55.89	47.85	0.0073
At most 2	0.28	24.03	29.79	0.19
At most 3	0.15	8.85	15.49	0.37
At most 4	0.02	1.13	3.84	0.28
<u>30 Sector **</u>				
None***	0.62	86.95	69.81	0.001
At most 1	0.40	42.60	47.85	0.14
At most 2	0.19	19.57	29.79	0.45
At most 3	0.16	9.79	15.49	0.29
At most 4	0.03	1.69	3.84	0.19

(*) Trace test indicates no cointegrating equation at the 0.05 level.

(**) Trace test indicates 1 cointegrating equation at the 0.05 level.

(***) denotes rejection of null hypothesis at the 0.05 level.

(****) MacKinnon-Haug-Michelis (1999) p-values.

(*****) Trace test indicates 2 cointegrating equations at the 0.05 level.

The estimation of cointegrating relationship for total FDI and sub-sectors are given in Table 4 and the summary of long-term effects are given in Table 5 respectively. As can be seen in Table 4 and Table 5, the signs of the explanatory variables are as expected as a whole, except that of real GDP. The sign of the real exchange rate varies depending on the type of sectors as expected. The sign of the real exchange rate variable is negative and statistically significant for the Industrial and Manufacturing sectors as expected. In the Manufacturing Sector, the increase of real exchange rate, or appreciation of national currency, from the perspective of high wages, high cost investments and export-oriented production may lead to decrease in FDI inflows. Real exchange rate has also negative effects on the Mining and Quarrying; Coke, Refined Petroleum Products and Nuclear Fuel Chemicals; Chemical Products, Basic Pharmaceutical Products and Materials; Information and Communication Services.

Real exchange rate has positive and statistically significant effects on Agriculture; Food Products, Beverages and Tobacco; Electricity, Gas, Steam and Air-Conditioning Supply; Wholesale and Retail Trade sectors. On the other hand, real exchange rate has no statistically significant effects on total FDI, Services Sector and two services sub-sectors, i.e., Financial and Insurance Activities and Banking Sector. The coefficient of the real GDP that shows total demand of the recipient country is positive and statistically significant for the Financial Services Activities or Banks' Activities, which took the highest share of total FDI inflows between 2005-2016 in Turkey. This empirical result is also as expected. The increase of total demand or income leads to an increase in demand for banking activities. Real GDP has also positive and statistically significant effects on Agriculture; Food Products, Beverages and Tobacco; Wholesale and Retail Trade. Real GDP has negative and statistically significant effects on total FDI and the FDI flows to all the other sectors. The variable that measures the openness of the economy to the international markets has positive and statistically significant effects on sectoral FDI flows, except Agriculture; Food Products, Beverages and Tobacco; Wholesale and Retail Trade. As openness of the economy to the international markets increases, productivity increases with specialization. It is expected that this specialization may lead to increase investment.

Table 4: Estimation of cointegrating relationship

$$FDI_{i,t} = B_0 \ln REALFX_t + B_1 \ln REALGDP_t + B_2 OPENNESS_t + B_3 REALINTEREST_t + u_t$$

$FDI_{i,t}$	$\ln REALFX_t$	$\ln REALGDP_t$	$OPENNESS_t$	$REALINTEREST_t$
01: Agriculture	113.39** (9.23)	70.51** (8.29)	-0.79** (9.64)	0.17 (0.94)
03: Industrial Sectors	-9.37** (3.50)	-6.45** (4.66)	0.14** (7.84)	-0.03** (1.70)
04: Mining & Quarrying	-12.64** (3.26)	-10.84** (5.42)	0.17** (8.74)	-0.11** (3.66)
05: Manufacturing	-7.73** (3.19)	-4.04** (3.23)	0.14** (9.01)	0.004 (0.23)
06: Food Products, Beverages and Tobacco	62.23** (4.58)	41.52** (5.91)	-0.39** (4.33)	0.29** (2.58)
11: Coke, Refined Petroleum Products, and Nuclear Fuel	-671.21** (4.47)	-429.86** (5.52)	5.99** (5.87)	-2.53** (2.024)
12: Chemicals, Chemical Products, Basic Pharmaceutical Products, and Materials	-7.87** (3.64)	-4.75** (4.25)	0.13** (0.01)	0.01 (0.91)
15: Basic Metals and Fabricated Metal Products	-41.33** (3.06)	-32.57** (4.69)	0.52** (5.64)	-0.23** (2.06)
17: Computers, Elektronik-Elektrical Optical Equipment	-29.15** (3.52)	-18.38** (4.28)	0.36** (7.2)	-0.15** (2.27)

Note: "***" shows that the variable is significant at 5 % level. The values in the paranthesis are t-statistics.

Table 4: Estimation of cointegrating relationship (continued)

$$FDI_{i,t} = B_0 \ln REALFX_t + B_1 \ln REALGDP_t + B_2 OPENNESS_t + B_3 REALINTEREST_t + u_t$$

$FDI_{i,t}$	$\ln REALFX_t$	$\ln REALGDP_t$	$OPENNESS_t$	$REALINTEREST$
20: Electricity, Gas, Steam and Air-Conditioning Supply	326.92** (4.29)	210.83** (5.36)	-2.50** (4.84)	1.27** (2.00)
22: SERVICES	-2.28 (1.05)	-2.80** (2.48)	0.11** (7.37)	0.02 (0.01)
24: Wholesale and Retail Trade	24.62** (4.28)	15.32** (5.15)	-0.17** (4.54)	0.06 (1.41)
27: Information and Communication Services	-34.40** (5.08)	-19.84** (5.75)	0.19** (4.37)	-0.051 (0.94)
28: Financial and Insurance Activities	0.89 (0.30)	-2.44* (1.60)	0.14** (7.10)	0.04** (1.80)
29: Financial Service Activities (banks)	-0.84 (0.23)	3.83** (2.03)	0.17** (6.95)	0.04* (1.62)
30: Insurance, Reinsurance and Pension Funding (Except Compulsory Social Security)	-19.52** (2.16)	-20.28** (4.68)	0.38 (6.27)	-0.15** (2.02)
43: TOTAL SECTORS	-0.13 (1.04)	-0.93** (1.82)	0.08** (11.7)	0.03** (3.68)

Note: "***" shows that the variable is significant at 5 % level. The values in the paranthesis are t-statistics.

Table 5: Summary of long-term effects*

Sectors	Independent variables			
	lnREALFX _t	lnREALGDP _t	OPENNESS _t	REALINTEREST _t
01: Agriculture	+	+	-	0
03: Industrial sectors	-	-	+	-
04: Mining&Quarrying	-	-	+	-
05: Manufacturing	-	-	+	0
06: Food Products, Beverages and Tobacco	+	+	-	+
11: Coke, Refined Petroleum Products, and Nuclear Fuel	-	-	+	-
12: Chemicals, Chemical Products, Basic Pharmaceutical Products, and Materials	-	-	+	0
15: Basic Metals and Fabricated Metal Products	-	-	+	-
17: Computers, Elektronik-Elektrical Optical Equipment	-	-	+	-
20: Electricity, Gas, Steam and Air-Conditioning Supply	+	+	-	+
22: Services	0	-	+	0
24: Wholesale and Retail Trade	+	+	-	0
27: Information and Communication Services	-	-	+	0
28: Financial and Insurance Activities	0	-	+	+
29: Financial Service Activities (banks)	0	+	+	+
30: Insurance, Reinsurance and Pension Funding (Except Compulsory Social Security)	-	-	+	-
43: Total Sectors	0	-	+	+

(*) “+” shows positive and statistically significant effect, “-“ shows negative and statistically significant effect and “0” shows statistically insignificant effect.

The coefficient of real interest rate has positive and statistically significant effects on total FDI; Food Products, Beverages and Tobacco; Finance and Insurance Activities and Banking sectors. These empirical results are as expected in the study. The increase of real interest rate encourages foreign banks to invest and work in Turkey. Real interest rate has negative and statistically significant effects on Industrial Sectors; Mining and Quarrying; Coke, Refined Petroleum Products, and Nuclear Fuel; Basic Metals and Fabricated Metal Products; Computers, Electronic-Electrical Optical Equipment. This empirical result is also expected in the study. An increase in real interest rate may lead to decrease demand for physical investment.

Real interest rate has no statistically significant effects on Agriculture; Manufacturing; Services sectors and three sub-sectors: Chemicals, Chemical Products, Basic Pharmaceutical Products and Materials; Wholesale and Retail Trade; Information and Communication Services. This result can be considered as

an indicator that the FDI inflows into these sectors have not been affected from the real interest rates.

6.2 Error Correction Models

As a third step, the Error Correction Models (ECMs) are estimated. The cointegration will be supported if ECM_{t-1} carries a negative and statistically significant coefficient. Besides, the coefficient of ECM_{t-1} represents the proportion of the disequilibrium in FDI in one period corrected in the next period. Since, investment decisions are made depending on past real GDP, the lag of the real GDP is used in the ECM models. As can be seen in Table 6, the coefficients of ECM_{t-1} for total sectors and all sectors, except, information and communication sector, have a negative sign and statistically significant, which confirms all the variables are cointegrated. The coefficients of ECM_{t-1} also show that about half of the deviations from the long-run values are corrected in the following period for total FDI and all sectors.

The first difference of real GDP appeared to be positive and statistically significant for total FDI and half of the sixteen sectors and sub-sectors as expected in the study.

Tablo 6: ECMs Results

$$\Delta FDI_{i,t} = B_0 \Delta \ln REALFX_t + B_1 \Delta \ln REALGDP_t + B_2 \Delta OPENNESS_t + B_3 \Delta REALINTEREST_t + u_t$$

$\Delta FDI_{i,t}$	$\Delta \ln REALFX_t$	$\Delta \ln REALGDP_t$	$\Delta OPENNESS_t$	$\Delta REALINTEREST_t$	ECM_{t-1}	R^2	DW
01: Agriculture	42.20** (2.009)	-2.96 (-0.36)	0.04 (0.44)	0.26 (1.29)	-0.60** (-3.45)	0.3	1.69
03: Industrial Sectors	-5.12** (-1.83)	1.48** (1.94)	0.02** (2.24)	0.01 (0.49)	-0.79** (-5.17)	0.51	2.10
04: Mining&Quarrying	0.69 (0.12)	-0.27 (-0.12)	0.02 (0.73)	-0.02 (-0.37)	-1.18** (-7.25)	0.57	1.98
05: Manufacturing	-3.35 (-1.15)	1.88** (2.32)	0.01 (1.08)	0.01 (0.39)	-0.92** (-5.56)	0.54	1.92
06: Food Products, Beverages and Tobacco	-5.16 (-0.97)	-0.47 (-0.23)	0.01 (0.72)	0.02 (0.47)	-1.06** (-6.80)	0.58	2.04
11: Coke, Refined Petroleum Products, and Nuclear Fuel	19.10 (0.53)	-2.01 (-0.14)	0.12 (0.68)	0.11 (0.32)	-0.73** (-4.40)	0.34	1.93
12: Chemicals, Chemical Products, Basic Pharmaceutical Products, and Materials	4.53 (0.79)	3.46** (2.14)	0.01 (0.61)	0.10 (1.88)	-1.20** (-7.14)	0.57	1.89
15: Basic Metals and Fabricated Metal Products	-0.10 (-0.01)	4.34** (2.39)	0.02 (0.88)	-0.06 (-0.94)	-1.03** (-6.57)	0.53	2.08
17: Computers, Elektronik- Elektrical Optical Equipment	-15.23** (-2.78)	1.63 (0.77)	0.01 (0.59)	-0.05 (-0.97)	-0.69** (-4.66)	0.52	1.95

Not: "***" shows that the variable is significant at 5 % level. "Δ" shows the first difference of the variable. The values in the paranthesis are t-statistics.

Table 6: ECMs Results (continued)

$$\Delta FDI_{i,t} = B_0 \Delta \ln REALFX_t + B_1 \Delta \ln REALGDP_t + B_2 \Delta OPENNESS_t + B_3 \Delta REALINTEREST_t + u_t$$

$\Delta FDI_{i,t}$	$\Delta \ln REALFX_t$	$\Delta \ln REALGDP_t$	$\Delta OPENNESS_t$	$\Delta REALINTEREST_t$	ECM_{t-1}	R^2	DW
20: Electricity, Gas, Steam and Air-Conditioning Supply	-11.00 (-0.89)	-0.72 (-0.22)	0.01 (0.26)	0.09 (0.77)	-0.91** (-8.23)	0.63	1.87
22: Services	4.91 (1.37)	1.23 (1.27)	0.03** (2.38)**	0.07** (2.27)	-1.22** (-7.57)	0.63	1.91
24: Wholesale and Retail Trade Services	-8.59** (-1.73)	0.02 (0.01)	0.02 (0.99)	-0.02 (-0.58)	-1.07** (-6.87)	0.57	2.06
27: Information and Communication	8.17 (1.07)	6.16** (2.03)	0.10** (2.55)	0.05 (0.71)	-0.96 (-6.26)	0.57	1.94
28: Financial and Insurance Activities	3.80 (0.71)	5.77** (3.84)	-0.007 (-0.35)	0.08 (1.57)	-0.82** (-5.07)	0.48	1.70
29: Financial Service Activities (banks)	4.91 (0.67)	6.62** (3.32)	-0.005 (-0.22)	0.05 (0.82)	-1.01** (-6.56)	0.56	1.79
30: Insurance, Reinsurance and Pension Funding (Except Compulsory Social Security)	10.12 (1.51)	5.08** (2.76)	0.048** (1.98)	0.11** (1.73)	-1.13** (-7.006)	0.61	1.81
43: TOTAL SECTORS	1.07 (0.4)	2.04** (2.02)	0.05** (3.64)	0.03 (1.44)	-1.21** (-7.71)	0.66	1.83

Not: “***” shows that the variable is significant at 5 % level. “ Δ ” shows the first difference of the variable. The values in the paranthesis are t-statistics.

5 Conclusion

This paper analyzed empirically the macroeconomic variables that affect the FDI inflows into Turkey in the long-run and short-run during the period from first quarter 2005 to third quarter 2016. It is expected that the using of sectoral level rather than aggregate data may be helpful to disentangle the relationship between FDI inflows and macroeconomic variables. The empirical findings of this study support the expectation that the using of sectoral level data may help to disentangle the effects of macroeconomic variables on FDI inflows into Turkey. Taking into consideration the major characteristics of the FDI inflows, real exchange rate, real GDP, openness of the economy and real interest rate are taken as macroeconomic variables.

In general, the empirical results show that openness of the economy to international markets is an important variable on the FDI flows into Turkey. The variable that measures the openness of the economy to the international markets has positive and statistically significant effects on sectoral FDI flows, except Agriculture; Food Products, Beverages and Tobacco; Wholesale and Retail Trade. The sign of the real exchange rate varies depending on the type of sectors as expected. The sign of the real exchange rate variable is negative and statistically significant for industrial and manufacturing sectors as expected.

The coefficient of the real GDP is positive and statistically significant for the Financial Services Activities or Banks' Activities, which have taken the highest share of FDI inflows between 2005 and 2016. This empirical result is also as expected. Real GDP has also positive and statistically significant effects on Agriculture; Food Products, Beverages and Tobacco; Wholesale and Retail Trade. Real interest rate has positive and statistically significant effects on total FDI; Finance and Insurance Activities and Banks' Activities. These empirical results are as expected in the study. The increase of real interest rate encourages foreign banks to invest and work in Turkey. Real interest rate has negative and statistically significant effects on Industrial Sectors; Mining and Quarrying; Coke, Refined Petroleum Products and Nuclear Fuel; Basic Metals and Fabricated Metal Products; Computers, Electronic-Electrical Optical Equipment. This empirical result is also expected in the study. An increase in real interest rate may lead to decrease demand for physical investment. Real interest rate has no statistically significant effects on Agriculture; Manufacturing; Services sectors and three sub-sectors (i.e., Chemicals, Chemical Products, Basic Pharmaceutical Products and Materials; Wholesale and Retail Trade; Information and Communication Services).

Consequently, from macroeconomic point of view, the macroeconomic policies that would lead to increase domestic demand or income should be implemented to attract more FDI inflows. Secondly, the implementation of free trade policies should be continued and new policies should be developed to

continuation and increase of Turkish economy's integration with the international markets.

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Appendix-1: Main Sectors and Sub-Sectors

TP.YD01: AGRICULTURE

TP.YD02: A.Agriculture, Forestry and Fishing

TP.YD03: INDUSTRIAL SECTORS

TP.YD04: B.Mining and Quarrying

TP.YD05: C.Manufacturing

TP.YD06: CA.Manufacture of Food Products, Beverages and Tobacco

TP.YD07: CB.Manufacture of Textiles and Textile Products

TP.YD08: CC.Manufacture of Leather and Leather Products

TP.YD09: CD.Manufacture of Wood and Wood Products

TP.YD10: CE.Manufacture of Pulp, Paper and Paper Products and Publishing and Printing

TP.YD11: CF.Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel

TP.YD12: CG.Manufacture of Chemicals, Chemical Products, Basic Pharmaceutical Products and Materials

TP.YD13: CH.Manufacture of Rubber and Plastic Products

TP.YD14: CI.Manufacture of Other Non-Metallic Mineral Products

TP.YD15: CJ.Manufacture of Basic Metals and Fabricated Metal Products

TP.YD16: CK.Manufacture of Machinery and Equipment n.e.c.

TP.YD17: CL.Manufacture of Computers, Electronic-Electrical and Optical Equipment

TP.YD18: CM.Manufacture of Transport Equipment

TP.YD19: CN.Manufacturing n.e.c.

TP.YD20: D.Electricity, Gas, Steam and Air-conditioning Supply

TP.YD21: E.Water Supply: Sewerage, Waste Management and Remediation

TP.YD22: SERVICES

TP.YD23: F.Construction

TP.YD24: G.Wholesale and Retail Trade

TP.YD25: H.Transportation and Storage

TP.YD26: I.Accommodation and Food Service Activities

TP.YD27: J.Information and Communication Services

TP.YD28: K.Financial and Insurance Activities

TP.YD29: Financial Service Activities (Banks)

TP.YD30: Insurance, Reinsurance and Pension Funding (Except Compulsory Social Security)

TP.YD31: Activities of Holding Companies

TP.YD32: Other Activities Auxiliary to Financial Services

TP.YD33: L.Real Estate Activities

TP.YD34: M.Professional, Scientific and Technical Activities

TP.YD35: N.Administrative and Support Service Activities

TP.YD36: O.Public Administration and Defence, Compulsory Social Security

TP.YD37: P.Education

TP.YD38: Q.Human Health and Social Work Activities

TP.YD39: R.Arts, Entertainment and Recreation

TP.YD40: S.Other Service Activities

TP.YD41: T.Activities of Households as Employers: Undifferentiated Goods- and Services-Producing Activities of Households for Own Use

TP.YD42: U.Activities of Extra-Territorial Organisations and Bodies