Received Date: 02 August 2022 I Accepted Date: 25 January 2023

OPUS Journal of Society Research

RESEARCH ARTICLE

An Analysis between Foreign Direct Investment and Intra-Industry Trade in Turkey: A VECM Approach [1]

Canan Şentürk [1]

[1] Assistant Professor, Süleyman Demirel University, Faculty of Economics and Administrative Sciences, Isparta//Türkiye
ORCID: 0000-0001-7714-844X
E-Mail: cananssenturk@sdu.edu.tr

Corresponding Author:
Canan Şentürk

January 2023
Volume:20
Issue:51
DOI: 10.26466//opusjsr.1152707

Citation:
Şentürk, C. (2023). An analysis between foreign direct investment and intra-industry trade in Turkey: A VECM approach. *OPUS– Journal of Society Research*, *20*(51), 76-85.

Abstract

The stylized world of identical technologies between countries, perfect competition and homogeneous products in the markets, and inactivity of production factors/inputs between countries is no longer valid. Knowledge economy, imperfect competition, differentiation, industrial clusters, new economic geography, transportation and transaction costs are among the factors that create the transformation in international trade. However, there is a specific literature that highlights the existence of examples of firms that are competitors or interconnected as parts of a single supply chain in the international economy, and spread of production activities to the world geography as an extension of the global transformation in production processes. In this context, since multinational firms mostly produce differentiated goods and a large part of intra-industry trade (IIT) is based on intra-firm trade of these firms, the linkage between foreign direct investment (FDI) and IIT is important. This connection is also supported by the fact that FDI is among the country-specific determinants of IIT in the literature. For this purpose, in this study, IIT index values for the period 1995-2020 in Turkey are calculated based on the distribution of exports and imports according to BEC classification. And FDI values related to industrial sectors in the same period are taken as basis. The relationship between the series is examined by cointegration analysis and the direction of the relationship is revealed by causality analysis based on vector error correction model (VECM). In the results of the study, it has been determined a one-way causal relationship from FDI to IIT for capital goods; and from IIT (total) to FDI. This is consistent with the result of the existence of a significant and positive relationship between technology intensity and IIT thanks to FDI in the literature.

Keywords: *International Trade, Foreign Direct Investment, Intra-Industry Trade, VECM.*

Öz

Ülkeler arasında özdeş teknolojilerin, piyasalarda tam rekabetin, homojen ürünlerin var olduğu, üretim faktörlerinin/girdilerinin ülkeler arası hareketsizliğinin stilize edilmiş dünyasının bugün artık geçerliliğini yitirdiği bilinmektedir. Bilgi ekonomisi, eksik rekabet, farklılaştırma, endüstriyel kümelenmeler, taşıma ve işlem maliyetleri uluslararası ticaretteki dönüşümü yaratan unsurlar arasında ön plana çıkmaktadır. Bununla birlikte üretim süreçlerindeki küresel dönüşümün uzantısı olarak üretim faaliyetlerinin dünya coğrafyasına yayılması ve uluslararası ekonominin rakip ya da tek bir tedarik zincirinin parçaları olarak birbirine bağlı firma örnekleriyle dolu olduğunu vurgulayan özel bir literatür söz konusudur. Bu bağlamda, çok uluslu firmaların farklılaştırılmış malların üretiminde söz sahibi olması ve endüstri-içi ticaretin büyük bir kısmının söz konusu firmaların firma-içi ticaretine dayanması, doğrudan yabancı yatırımların endüstri-içi ticaret ile bağlantısını önemli kılmaktadır. Söz konusu bağlantı, literatürde doğrudan yabancı sermaye yatırımlarının endüstri-içi ticaretin ülkeye özgü belirleyicileri arasında yer almasıyla da desteklenmektedir. Bu amaçla çalışmada Türkiye'de 1995-2020 dönemi için endüstri-içi ticaret endeks değerleri ihracat ve ithalatın Geniş Ekonomik Gruplar (BEC) sınıflamasına göre dağılımları esas alınarak hesaplanmakta ve yine aynı dönem sınai sektörlere ilişkin doğrudan yabancı sermaye yatırım değerleri temel alınmaktadır. İki seri arasındaki ilişki, eşbütünleşme analizi ile incelenmekte ve yönü vektör hata düzeltme modeli (VECM) nedensellik analizi ile ortaya koyulmaktadır. Çalışmanın sonuçlarında, doğrudan yabancı yatırımdan sermaye malları endüstri-içi ticaretine ve endüstri-içi ticaretten doğrudan yabncı yatırıma tek yönlü ilişki tesbit edilmektedir. Bu ilişki, literatürde 'doğrudan yatırımlarla ile IIT arasında anlamlı ve pozitif bir ilişkinin var olduğu' sonucu ile tutarlıdır.

Anahtar Kelimeler: *Uluslararası Ticaret, Doğrudan Yabancı Sermaye Yatırımı, Endüstri-İçi Ticaret, VECM.*

[1] *This study is an expanded version of the abstract presented at the 6th IERFM, 12-14 May 2022.*

Introduction

Since the second half of the 20th century in international trade, as a result of the structural differentiation of trade, the share of Intra-Industry Trade (IIT) has increased, developing countries have started to export industrial products, and the share of foreign direct investments in the world economy has increased. In developing countries, the fact that the FDI firm provides the intermediate goods to be used from its investments in other countries can increase the country's imports even more because the exports are dependent on imports in these countries. Therefore, this process has witnessed changes that were not seen in previous periods with the dimension of structural developments. Despite the fact that international/interregional goods and services flows have developed within the liberalization and globalization processes, production processes are divided into stages and shifted to geographical areas that will provide cost advantages to companies. Therefore, the presence of trade in the intermediate goods or final goods of multinational firms sent from one country to another causes an increase in IIT. Therefore, it is evaluated that foreign direct investment will reduce IIT, based on the negative impact of foreign trade volume of multinational firms that produce for the market of the country where it was established and settled. However, it depends on whether the relationship between foreign direct investment and IIT is substitute or complementary. In other words, in this case, it is thought that foreign direct capital flows will exhibit a trade-creating (complementary) or trade-substituting structure.

Especially with the 90s, the importance of foreign direct investment and intra-industry trade has increased with the approaches of Krugman's "New Economic Geography" and Porter's "Competitive Advantage of Nations" (table 1). And also in the years, the rate of increase in foreign direct investments has been twice the rate of increase in world trade; it is seen that the world GDP has reached three times the size (Adda, 2005). In addition, the concentration in multinational enterprises, which have been performing more than half of the global foreign trade since the mid-1990s, causes the concentration of international production in certain countries and regions. The world's 100 largest multinational firms, all but four of which are owned by developed countries and accounting for only 0.2% of the total number of multinational firms, own 14% of the sales revenue of foreign subsidiaries in all of the world, 12% of their assets. And 13% of employment is carried out by these companies (Aktan and Vural, 2012). These values emphasize the importance of multinational firms for the globalization of production and trade. However, it should be underlined that multinational enterprises have become an important actor in foreign trade today and have an important place in world trade with their activities spread to various parts of the world.

Table 1. The Development and Implications of International Trade Theories

Time	Theory	Implications
1950s	"Traditional Foreign Trade Theory" Integration=Specialization=Industrial Trade	Over-Specialization in Common Market Member Countries, Especially in Europe.
1960s	"Traditional Foreign Trade Theory" Integration=Specialization=Industrial Trade	The rise in intra-European trade: The rise of IIT
1970s and 1980s	"New International Economics" New Foreign Trade Theories Based on Imperfect Competition	Increased Intra-Industry Trade The rise in intra-European trade: The evolution of intra-industry trade
Mid 1980s	"Helpman and Krugman Synthesis" Between Different Countries: Inter-Industry Trade Between Similar Countries: Intra-Industry Trade (in similar ie horizontally differentiated goods)	Increased Intra-Industry Trade Integration=Intra-Industry Trade= Gains from Diversity and Limited Compliance Costs
Late 1980s	"Vertical Intra-Industry Trade" Products may vary in quality. (due to capital intensity, R&D, qualified workforce, etc.) Between Different Countries: Intra-Industry Trade Cross-Country Disparities lead not only to inter-industry but also intra-industry trade in differentiated goods. Specialization is shaped on the basis of quality.	Increased Intra-Industry Trade With the expectation that European integration will have a catch-up effect in favor of the less developed member countries, it can create potential income variances between countries.
1990s and later	Krugman and the "New Economic Geography" Porter and "Competitive Advantages of Nations" Inter-industry trade has not been based on macro-economic differences between countries. Asymmetry between countries can increase	Increasing FDI and IIT New Industrial Regions and Clustering Approaches

	with external economies of scale and agglomeration effect.

Source: Prepared by author based on the study of Fontagne and Freudenberg (2002).

In the study, it is aimed to specifically examine the relationship between foreign direct investment and IIT in the axis of the related fundamental theoretical framework. In this context, intra-industry trade index values for the period 1995-2020 in Turkey are calculated based on the distribution of exports and imports according to BEC classification. And foreign direct investment values related to industrial sectors in the same period are taken as basis. The relationship between the series is examined by Johansen cointegration analysis and the direction of the relationship is revealed by causality analysis based on vector error correction model (VECM).

Literature Review

There is a specific literature that highlights the existence of examples of firms that are competitors or interconnected as parts of a single supply chain in the international economy, and spread of production activities to the world geography as an extension of the global transformation in production processes. In this context, since multinational firms mostly produce differentiated goods and a large part of IIT is based on intra-firm trade of these firms, the linkage between foreign direct investment and IIT is important. This connection is also supported by the fact that foreign direct investment is among the country-specific determinants of IIT in the literature.

Among the studies that deal with FDI and trade connection on a theoretical basis, Vernon (1966) focuses on why the United States is a leader in many superior goods in his product cycle theory, which is seen as an extension and generalized form of the technology gap theory. In the theory, which forms the basis of technology transfer of foreign direct investments, an approach focused on the invention of new goods and innovation processes is adopted. In the model, the rapid increase in exports, especially in some underdeveloped and newly industrialized countries, is explained in this method. Brander and Krugman (1983), who created an intra-industry trade model in oligopoly markets, focus on the link between intra-industry trade and FDI. To explain two-way trade in similar products, Brander (1981) outlines the model of strategic interaction between firms. This is called reciprocal dumping. This model is detailed in the work of Brander and Krugman (1983) and Brander and Spencer (1984). In the model, it is assumed that firms have to produce in their own countries. Under the assumption of production cost equality, firms have the incentive to accumulate transportation costs by performing their production close to the market (market). But if allowed to do so, each firm would seek to increase production in both countries. And at this stage, the situation in question directs the model setup from the mutual dumping model in trade to the two-way foreign direct investment model (Brander and Krugman, 1983, p.321). Helpman (1984) focuses on the reasons why firms invest directly in other countries, due to transportation costs, high trade tariff barriers, and tax advantages in the host-country. Helpman and Krugman (1985) and Markusen and Markus (2001) are among the first studies which recognised that multinational firms changed international economic relations and the study claims that the relationship between foreign direct investment and IIT is substitution. As countries become richer and more similar in size and factor endowments, index of intra-industry trade remains lower than the index of intra-industry affiliate sales.

Porter (1998), points out that the effects of foreign direct investment and trade are observed together on international competition in the theory of competitive advantage. It emphasizes that the continuous exports of the host country with other countries and foreign direct investments made due to the qualifications of the host country are the main determinants of international competitiveness.

Examining the relationship between IIT and FDI in the empirical literature, on the one hand,

there are positive and important linkage between FDI and IIT, on the other hand, its negative effects are discussed. It depends on whether the relationship between foreign direct investment and intra-industry trade is substitute or complementary.

In case of an increase in tariff rates and the replacement of imports by multinational enterprises, there is a substitution effect. In this regard, some studies emphasize that intra-industry trade partially reflects the heterogeneity in product categories and that foreign direct investments, which are considered as a substitute for foreign trade in the long run, tend to reduce intra-industry trade. If it is complementary to trade, its effects on creating a new market, creating a new field of activity or developing an existing one are also emphasized. Moreover, some studies in the empirical literature primarily mention the existence of a significant and positive relationship between technology intensity and vertical intra-industry trade, and it is stated that foreign direct investments increase intra-industry trade in this direction. In this context, with the spread of production activities to the world geography as a result of the globalization process in production, foreign direct investments, including both technology and knowledge and information transfers, are considered to have a positive effect on both inter-industry and intra-industry trade.

It is observed that the studies in the literature mostly focus on the relationship between trade and FDI. The number of studies dealing with IIT and FDI is relatively small. In these studies, FDI is highlighted as a determinant of IIT in different countries and industries.

Table 2. Literature Review

Study	Country	Time	Method	Impact
Caves (1981)	13 OECD Countries	1953-1961 1953-1970 1961-1970	OLS, Logit	(-)
Balassa (1986)	USA ve 37 trade partners	1979	OLS, Logit	(-)
Balassa and Bauwens (1987)	38 countries	1979	OLS, Logit	(-)
Sharma (1999)	Australia	1979-1980; 1992-1993	OLS, Logit	(-)
Aturupane (1999)	EU and 8 Middle and East European Countries	1990-1995	OLS, Logit	HIIT (-) VIIT (+)
Blanes and Martin (2000)	Spain	1988-1992	OLS, Logit	(+)
Fukao, Ishido and Ito (2003)	Japan	1988-2000	OLS, Logit	(+)
Reganati and Pittiglio (2005)	Italy	1996-1999	OLS, Logit	(+)
Caetano and Galego (2007)	EU and Middle and East European Countries	1993-2001	Panel Data	(+)
Yoshida, Letiao, Faustino (2009)	EU, Japan	1988-2004	Panel Data	(+)
Türkcan and Ateş (2010)	ABD	1989-2006		HIIT (+) VIIT (-)
Ambroziak (2010)	8 EU member countries	1995-2017	Panel Data	(+)
Ambroziak (2012)	The Czech Republic, Hungary, Poland Slovakia	1995–2008	Panel Data	(+)
Han and Lee (2012)	Korea China	1992-2006	Panel Data	(+)
Doğanay, Değer and Genç (2014)	Turkey	2006-2013	Granger Causality	FDI-IIT one-way relationship
Burange, Thakur and Kelkar (2017)	India	1992-2013	VECM	(+)

Research Goal

This study aims to investigate the relationship between IIT and FDI. For this purpose, IIT index values for 2000-2020 in Turkey are calculated based on the distribution of exports and imports according to BEC classification. And foreign direct investment values related to industrial sectors in the same period are taken as basis. The relationship between the series is examined by cointegration analysis and the direction of the relationship is revealed by causality analysis based on vector error correction model (VECM).

Sample and Data Collection

The analysis is conducted on intra-industry trade and foreign direct investment. Grubel-Lloyd Index is calculated using total export and import values and export and import values for capital goods by BEC classification. Although many indices have been developed in the literature, the index obtained as a result of static measurements made by Grubel and Lloyd in 1971 is widely used to measure IIT. Grubel and Lloyd (1971) define IIT for industry i as the export value of an industry corresponding to the imports of exactly the same industry at any level of aggregation (Grubel and Lloyd, 1971: 496). The X_i and M_i values in the index are defined as the export and import values in the same industry (in domestic currency), respectively (Grubel and Lloyd, 1971:496).

$$IIT_{GL} = 1 - \left[\frac{|X_i - M_i|}{(X_i + M_i)}\right] \times 100$$

The index shows bidirectional trade in the same industry and values range from 0 to 1. An index value approaching 1 indicates that intra-industry trade has increased.

In addition, Broad Economic Categories (BEC), one of the goods classifications, is used for the import and export values used in the calculation of the equivalent values in the study. Mainly, it is a three-digit classification and is one of the classifications available for general economic analysis of international trade in goods data. The BEC was originally designed by the United Nations Statistics Division to summarize data on international trade. But it is also designed to serve as a means of transforming foreign trade data compiled at the SITC into categories approximating the three basic classes of goods, within the framework of the System of National Accounts (SNA), capital goods, intermediate goods, and consumer goods (UN, 2002). And the 'other goods' category has been added as the 4th category. According to this classification, the following groups are included in the content of capital goods in the data obtained from TURKSTAT in this study.

Capital goods (Sum of categories) (UN, 2002):

- 41 Capital goods (except transport equipment)
- 521 Transport equipment, industrial

Annual (inward) foreign direct investment data are sourced from World Development Indicators (World Bank) for the 1995-2020 periods. The variables are used with their natural logarithms to reduce the varying variance in the model.

Table 3. Definition of Variables

Variables	Definition	Source
LFDI	Foreign direct investment of Turkey	World Bank
IITT	Intra-industry trade (using BEC classification, total export and import value)	TÜİK
IITIND	Intra-industry trade (using BEC classification, export and import for capital goods)	TÜİK

This study shapes around three main stages. First of all, the stationarity of the variable is determined by using unit root tests. Then, the long and short-run causality relationship is examined using the Johansen cointegration test and vector error correction model.

Analysis Results

Since each of the unit root tests has separate features, more than one unit root test is often used for a time series in practice. The unit root tests used in the study are the Extended Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, which are the most widely used in the literature. In these tests, "the series contain unit root" is tested with the null hypothesis. ADF and PP test results in level and first differences are shown in Table 4 and 5. Ho hypothesis was accepted in both series. The series contains a unit root according to both ADF and PP test results at level. When the first differences of the series are taken, the series become stationary according to both ADF and PP analyses, so the ADF and PP test results support each other.

Table 4. Unit Root Tests (at level)

Variables		ADF Test		Phillips-Perron Test	
		t-stat.	Prob.	t-stat.	Prob.
	None	0.716075	0.8633	0.727903	0.8656
FDI	Trend and intercept	-1.288236	0.8674	-1.288236	0.8674
	Trend	-1.534923	0.4999	-1.531817	0.5014
	None	-2.772131	0.0076	-3.038720	0.0039
IITIND	Trend and intercept	-1835065	0.6571	-1.766690	0.6902
	Trend	-2.187600	0.2153	-2.269854	0.1887
	None	-1.296980	0.1742	-0.983560	0.2825
IIT	Trend and intercept	-4.103720	0.0179	-4.111886	0.0176
	Trend	-2.872943	0.0628	-2.872943	0.0628

Table 5. Unit Root Tests (at first differences) I(1)

Variables		ADF		Phillips-Perron Test	
		t-stat.	Prob.	t-stat.	Prob.
	None	-4.786255	0.0000	-4.786255	0.0000
FDI	Trend and intercept	-5.027389	0.0025	-5.136122	0.0020
	Trend	-4.842340	0.0008	-4.842287	0.0008
	None	-5.084096	0.0000	-5.143871	0.0000
IITIND	Trend and intercept	-6.246329	0.0002	-6.147831	0.0002
	Trend	-5.774963	0.0001	-5.718357	0.0001
	None	-7.900482	0.0000	-9.359992	0.0000
IIT	Trend and intercept	-7.709339	0.0000	-16.90301	0.0000
	Trend	-7.923428	0.0000	-17.03435	0.0001

Table 5 shows that the series is integrated at the I(1) level and all of the variables contain unit root I(1). Another important indicator is the lag length. Table 6 shows the lag length selection.

Table 6. Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	18.36214	NA	4.97e-05	-1.396559	-1.247780	-1.361511
1	50.43498	52.48282	6.17e-06	-3.494089	-2.898975*	-3.353898
2	59.56957	12.45626	6.45e-06	-3.506325	-2.464875	-3.260990
3	77.93276	20.03257*	3.19e-06*	-4.357524*	-2869739	-4.007047*
4	84.39700	5.288917	5.49e-06	-4.127000	-2.192879	-3.671379

**Indicates lag order selected by the criterion.*

When table 6 is examined, the optimal lag length in the model is one according to SC and three according to AIC, FPE, LR, HQ. The lag lengths were determined 3 by considering the AIC and HQ criteria.

The fact that all variables are stationary at their first difference allows it to be investigated whether there is a long-term relationship between the variables. In this study, Johansen (cointegration) test is applied to determine whether there is a long-term relationship between the variables. The Johansen cointegration test is considered powerful in detecting more than one cointegration relationship between the series when there is more than one explanatory variable. The Johansen cointegration test is based on the vector autoregression model (VAR) analysis developed by Sims (1980), in which each variable in the model includes both itself and its lagged values (Sims, 1980).

According to the results in Table 7, the null hypothesis (H0) of "there is no cointegrated vector" cannot be accepted because the calculated trace statistical value (58,08538) is greater than the critical value (35,19275) in the model where foreign direct investment is the dependent variable. Therefore, according to the trace statistics, the variables are cointegrated at the 5% significance level. In addition, since the maximum eigenvalue statistical value (41.06753) is greater than the critical value (22.29962), the null hypothesis that there is no cointegration relationship between the series is rejected, while the alternative hypothesis stating that there is at least one cointegration relationship between the series is accepted. Therefore, according to the maximum eigenvalue statistics, it is observed that there is a cointegrating relationship between the series and the series move together in the long run.

Table 7. Johansen Cointegration Test Results

Trace				
	Hypothesized Eigenvalue	Trace Stat.	0.05 Critical Value	Prob.
0*	0.845368	58.08538	35.19275	0.0000
At Most 1	0500155	17.01786	20.26184	0.1318
At Most 2	0.076959	1.761805	9.164546	0.8245

Max-Eigenvalue				
	Hypothesized Eigenvalue	Max-Eigenvalue Stat.	0.05 Critical Value	Prob.
0*	0.845368	41.06753	22.29962	0.0000
At Most 1	0500155	15.25605	15.89210	0.0627
At Most 2	0.076959	1.761805	9.164546	0.8245

**Denotes rejection of H0 at the 0.05 level.*
Trace and Max-Eigenvalue tests indicate one cointegrating equation at the 0.05 level.

If there is a cointegrating relationship between the series, vector error correction model (VECM) should be applied for long and short term

analysis (Engle and Granger, 1987). In case of cointegration between series, short-term deviations may occur between series that move together in the long-term. VECM primarily enables long-term analysis of how long it will take to compensate for these deviations, and short-term analysis for causality between series. Thus, if the time series are not stationary in level but are cointegrated at the first difference, VECM should be applied. Conventional ECM for cointegrated series is;

$$\Delta y_t = \beta_0 + \sum_{i=1}^{n} \beta_i \, \Delta y_{t-i} + \sum_{i=1}^{n} \delta_i \, \Delta x_{t-i} + \varphi z_{t-1} + \mu_t \quad (1)$$

"z" is the ECT and is OLS residuals from following long-run cointegrating regression and is defined as;

$$z_{t-1} = ECT_{t-1} = y_{t-1} - \beta_0 - \beta_1 x_{t-1} \quad (2)$$

"z" relates to the fact that last period deviation from long-run equilibrium influences the short-run dynamics of the dependent variable. "φ" is the speed of adjustment, because it measures the speed at which y returns to equilibrium after a change in x. Thus, cointegrating equation (long-run model) is;

$$ECT_{t-1} = 1.0000FDI_{t-1} + 28.67669IIT_{t-1} - 8.370428IITIND_{t-1} - 20.27349 \quad (3)$$

$$D(LFDI) = 0.066159\ ECT(-1) - 0.050394\ D(LFDI(-1)) + 0.190273D(LFDI(-2)) - 0.234739D(LFDI(-3)) - 7.503650D(LIIT(-1)) - 1.573803D(LIIT(-2)) - 0.046653D(LIIT(-3)) + 0.304418D(LIITIND(-1)) + 0.717455\ D(LIITIND(-2)) + 1.108692D(LIITIND(-3)) \quad (4)$$

Table 8. Vector Error Correction Model Results

Long-run			
FDI(-1)	1.0000		
IIT(-1)	28.67669		
	(5.74569)		
	[4.99104]		
IITIND(-1)	- 8.370428		
	(0.80498)		
	[-10.3983]		
c	- 20.27349		
	(1.05697)		
	[-19.1808]		
Short-Run			
	D(FDI)	D(IIT)	D(IITIND)
ECT(-1)	0.066159	0.014814	0.132204
	(0.12226)	(0.01456)	(0.02227)
	[0.54112]	[1.0179]	[5.93742]
D(FDI(-1))	-0.050394	0.50445	-0.027914
	(0.41726)	(0.04970)	(0.07599)
	[-0.12078]	[1.01498]	[-0.36735]
D(FDI(-2))	0.190273	-0.069123	-0.044526
	(0.30686)	(0.03655)	(0.05588)
	[0.62007]	[-1.89114]	[-0.79676]
D(FDI(-3))	-0.234739	0.050033	0.108623
	(0.25462)	(0.03033)	(0.04637)
	[-0.92193]	[1.64973]	[2.34253]
D(IIT(-1))	-7.503650	-0.416910	-3.172481
	(4.18896)	(0.49896)	(0.76288)
	[-1.79129]	[-0.83556]	[-4.15857]
D(IIT(-2))	-1.573803	-0.913210	-2.935200
	(4.35337)	(0.51854)	(0.79282)
	[-0.36151]	[-1.76111]	[-3.70223]
D(IIT(-3))	-0.046653	0.042193	-0.402716
	(3.65016)	(0.43478)	(0.66475)
	[-0.01278]	[0.09705]	[-0.60581]
D(IITIND(-1))	0.304418	-0.082215	0.132500
	(1.17070)	(0.13945)	(0.21320)
	[-0.26003]	[-0.58959]	[0.62147]
D(IITIND(-2))	0.717455	0.507162	0.897974
	(1.07153)	(0.12763)	(0.19514)
	[0.66956]	[3.97360]	[4.60163]
D(IITIND(-3))	1.108692	-0.294492	-0.269069
	(1.69537)	(0.20194)	(0.30876)
	[0.65395]	[-1.45831]	[-0.87146]

Standart errors in ( ) and t-statistics in [ ]. R-squared 0.701550; AdjR-squared =0.589631

According to the results of the vector error correction model (VECM) in Table 8, the long-term cointegration equation (3) and the short-term causality relationship are shown in equation (4). When the t statistical values are examined to check whether the coefficients are significant, the t values also confirm the cointegrated relationship, the variables act together in the long run. Accordingly, a one percent increase in intra-industry trade creates a 28.67% effect on FDI in the same direction. And 1% increase in intra-industry trade of capital goods creates 8.37% decrease in FDI. In the short term, the t statistical value of the IIT(1) coefficient is (1.79), which is statistically significant at the 0.1 significance level. It is expected that the error correction coefficient (ECT) value of the model has a negative sign and the t statistical value is significant. This indicates that there is a return to equilibrium in case of deviation from the long-term equilibrium. However, it is observed that the error correction coefficient of the model is not significant.

After establishing the model according to autocorrelation, heteroskedasticity, and normality tests are reviewed and reported in Table 9. According to the results, the model does not contain heteroskedasticity, autocorrelation and normality problems.

Table 9. Diagnostic Tests

	Obs*R-squared	**Prob.**
Breusch-Pagan-Godfrey	14.80263	0.2524
Breusch- Godfrey LM Test	2.033330	0.3618
	Jarque-Bera	Prob.
Normality Test	0.284202	0.867534

In Table 10, Wald Test results applied for causality analysis are given. It should be noted that the appropriate lag length for causality analysis based on VECM is 3 and the series are stationary.

Table 10. Vector Error Correction Model Results (Wald Test)

Direction	**Chi-square value**	**df**	**Probability**	**Result**
IIT→FDI	6.381175	3	0.0942**	✓
IITIND→FDI	1.330405	3	0.7219	No relationship
FDI→IIT	4.781965	3	0.1885	No relationship
IITIND→IIT	16.25648	3	0.0010*	✓
FDI→IITIND	6.433578	3	0.0923**	✓
IIT→IITIND	28.44170	3	0.0000*	✓

** and ** respectively indicate causality at the 5% and 10% significance level.*

According to Wald test results; there is a two-way causal relationship between intra-industry trade (total) and intra-industry trade for capital goods. It has been determined a one-way causal relationship from foreign direct investment to intra-industry trade for capital goods. And also, there is a one-way causal relationship from intra-industry trade (total) to FDI. These results are illustrated in Figure 1.

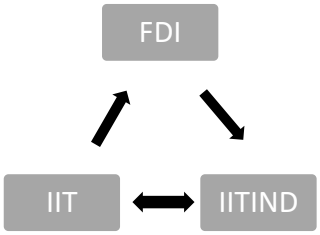

Figure 1. Causality Findings for FDI, IIT and IITIND

Conclusion

International trade cannot be explained by the classical foreign trade theory based on comparative advantages. The increase in trade in industrial goods, especially after the Second World War, does not coincide with the expectations of countries to specialize in certain sectors depending on factor density. The fact that countries rich in labour factor export capital-intensive goods, and countries rich in capital factors also trade in labour-intensive goods has revealed the need to re-explain the subject. Since the increase in trade between countries close to each other with factor equipment cannot be explained by classical foreign trade theories, an intra-industry trade approach has been developed. It is known that international trade has undergone a transformation in theory and practice, especially in recent years. Obviously, although the globalization of production and finance has a great impact on this transformation; intra-industry and intra-firm trade is based on the challenge of traditional theories (Walther, 2002).

Multinational enterprises, which are accepted as one of the most important components of the globalization of production, direct the formation and development of world trade with their large production capacities and worldwide activities. They are of great importance in world trade and political order, as they affect regional development, competition, balance of payments and employment level, and cause capital, technology and know-how flows between countries. In this context, since multinational firms mostly produce differentiated goods and a large part of IIT is based on intra-firm trade of these firms, the linkage between foreign direct investment and IIT is important.

According to results, both Johansen cointegration test and vector error correction analysis confirm the cointegrated relationship, the variables act together in the long run. And Wald test results indicate that there is a two-way causal relationship between intra-industry trade (total) and intra-industry trade for capital goods. It has been determined a one-way causal relationship from foreign direct investment to intra-industry

trade for capital goods. And also, there is a one-way causal relationship from intra-industry trade (total) to FDI.

In the results of the study, the relationship between foreign direct investment and intra-industry trade of capital goods is consistent with the result of the existence of a significant and positive relationship between technology intensity created by FDI and intra-industry trade in the literature. In this context, with the spread of production activities to the world geography as a result of the globalization process in production, foreign direct investments including technology, knowledge and information transfers have a positive effect arising from complementarity on both inter-industry and intra-industry trade. Therefore, it is an important reason for intra-industry trade in industry groups where foreign direct investment is intense, especially in the transportation industry in Turkey. It can be interpreted that multinational enterprises do not replace imports. In this way, the effects of creating a new market and creating/developing a new field of activity are emphasized in the complementary relationship to trade. However, this relationship has been determined in the short run, and a causal relationship between the variables in the long run cannot be determined.

In this context, with the change in the global production system, the fact that different stages of production chains are carried out in different countries makes specialization in production stages more important than specialization in products. For this reason, the way countries are articulated to the international economy is related to the international production chains and the evaluation of the positions of the countries in these production chains. In order to strengthen Turkey's position in international trade and to gain more from intra-industry trade, it is necessary to it is necessary to focus on improving the quality of the goods produced. There is a need for an order in which economies of scale are widely used in Turkey, innovation is important, most of the products contain differentiated features, and a widespread and continuous technological change will prevail in Turkey. At this point, FDI's capacity to transfer technology and create employment stands out. In addition, changes in organizational methods can improve the efficiency/quality of companies' operations and decrease costs. For this reason, especially considering the choice of capital goods in the BEC classification; In order to increase the competitiveness of Turkey in industries where high value-added goods are produced, it is important to focus on cooperation and innovation and to focus on policies that will support the creation of a "new culture".

References

Adda, J. (2005). *Ekonominin küreselleşmesi,* İletişim Yayınları.

Aktan, C.C. and Vural, İ.Y. (2021). Globalleşme sürecinde çok uluslu şirketler. *http://www.canaktan.org/ekonomi/cok-uluslu/aktan-makale.pdf* . (Erişim: 01.12.2021).

Ambroziak, Ł. (2010). The foreign direct investments (FDI) as a factor of intra-industry trade development in the EU New Member States. *The European Trade Study Group*, p.9-11.

Ambroziak, Ł. (2012). FDI and intra-industry trade: theory and empirical evidence from the Visegrad Countries. *International Journal of Economics and Business Research*, *4*(1-2), 180-198.

Aturupane, C., Djankov, S. and Hoekman, B. (1999). Horizontal and vertical intra-industry trade between Eastern Europe and the European Union. *Weltwirtschaftliches Archiv/Review of World Economics, 135*, 62–81.

Balassa, B. (1986). the determinants of intra-industry specialization in the United States trade. *Oxford Economic Papers, 38*, 220-233.

Balassa, B. and Bauwens, L. (1987). Intra-industry specialization in a multi-country and multi-industry framework. *The Economic Journal, 97*(388), 923-939.

Blanes, J.V. and Martin, C. (2000). The nature and causes of intra-industry trade: Back to the comparative advantage explanation? The case of Spain. *Weltwirtschaftliches Archiv/Review of World Economics, 136*(3), 600–613.

Brander J. and Krugman, P. (1983). A reciprocal dumping model of international trade. *Journal of International Economics, 15*(3/4), 313-321.

Brander, J. (1981). Intra-industry trade in identical commodities. *Journal of International Economics, 11*, 2-14.

Brander, J. A. and Spencer, B. J. (1984). Export subsidies and international market share rivalry. *NBER Working Papers, 1464*, National Bureau of Economic Research.

Burange, L. G., Thakur, P. and Kelkar, H. K. (2017). Foreign direct investment and intra-industry trade in India's manufacturing sector: A causal relationship. *Foreign Trade Review*, *52*(4), 203-218.

Caetano, J. and Galego, A. (2007). In search for determinants of intra-industry trade within an enlarged Europe. *South-Eastern Europe Journal of Economics,* 5(2), 163-183.

Caves, R. E. (1981). Intra-industry trade and market structure in the industrial countries. *Oxford Economic Papers, 33*, 203-223.

Doğanay, M.A., Değer, M.K. and Genç, M. C. (2014). Foreign direct investment and intra-industry trade: Causality analysis of transport equipment sector in Turkey (2006-2013). International Conference on Eurasian Economies. Erişim tarihi: 21.07.2022 *https://avekon.org/papers/903.pdf.*

Engle, R. F. and Granger, C. W. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica: journal of the Econometric Society*,*55*(2), 251-276.

Fontagne, L. and Freudenberg, M. (2002). Long-term trends in intra-industry trade, Chapter 8, *Frontiers of Research on Intra Industry Trade* içinde, H. Grubel and H.-H. Lee (ed.), Palgrave.

Fukao, K., Ishido, H., and Ito, K. (2003). Vertical intra-industry trade and foreign direct investment in East Asia. *Journal of the Japanese and International Economies*, *4*(17), 468–506.

Grubel, H. and Lloyd, P. J. (1971). The Empirical Measurement of intra- industry trade. *Economic Record, 470*, 494-517.

Han, K. and Lee, J. (2012). FDI and vertical intra-industry trade between Korea and China. *Korea and the World Economy*, *13*(1), 115-139.

Helpman, E. and Krugman, P. R. (1985). *Market structure and for returns, imperfect competition, and the international econonomy*. Cambridge.

Markusen, J. R. and Maskus, K.E. (2001). *A unified approach to intra-industry trade and foreign direct investment*. NBER Working Paper No. 8335.

Porter, M. E., (1998). *The competitive advantage of nations.* Free Pres.

Reganati F. and Pittiglio, R. (2005). *Vertical intra-industry trade: Patterns and determinants in the Italian case*. Working Paper Quaderni, DSEMS 06-2005.

Sharma K. (1999). *Pattern and determinants of intraindustry trade in Australian Manufacturing*. Center Discussion Paper no. 813, Economic Growth Center, Yale University.

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica: Journal Of The Econometric Society*, *48(1)*, 1-48.

Türkcan, K. and Ateş, A. (2010). Structure and determinants of intra-industry trade in the U.S. Auto-Industry. *Journal of International and Global Economic Studies,* 2(2), 15-46.

United Nations, (2002). *Classification by broad economic categories*. Statistical Papers Series M No. 53, Rev.4, New York,

Vernon, R. (1966). International investment and international trade in the product cycle. *The Quarterly Journal of Economics, 80*(2), 190-207.

Walther, T. (2002). *Dünya ekonomisi.* Alfa Yayıncılık.

Yoshida, Y., Carlos Leitão, N., and Faustino, H. C. (2009). Vertical intra-industry trade and foreign direct investment between Japan and European Countries. *Atlantic Economic Journal*, *37*(4), 351-365.