

THREE ESSAYS ON INTRA INDUSTRY TRADE

FATMA DUYGU ATASOY



July, 2021

THREE ESSAYS ON INTRA INDUSTRY TRADE

FATMA DUYGU ATASOY



DISSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR
DEGREE OF PHD

DEPARTMENT OF FINANCIAL ECONOMICS

Yeditepe University

July, 2021

PLAGIARISM

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Date: 05/07/2021

Name/Surname: Fatma Duygu Atasoy

ABSTRACT

This study consists of two different parts of international trade which are intra-industry trade (IIT) and foreign direct investment (FDI). The thesis has meaningful contribution to the literature both it collects the intra- industry trade values by various products and industries, strengthens determinants of IIT and FDI that are exists in the literature by new indexes and making a unique comparison between marginal intra-industry trade (MIIT) indexes to explain the relationship between MIIT and labor adjustment cost.

In the first chapter, influence of currency crisis on foreign direct investment is observed with the situation of economic freedom level in the country. At the same time the chapter also presents determinants of FDI with the comparison of two methods of panel data in 37 countries in the period 1995 to 2017. The model provides special contribution to the issue of international trade by its indexes.

In the second chapter, we took various eight products that are widely imported and exported in international trade to observed determinants of IIT in 40 different countries in the periods 2002 to 2018 in tobit model. The model improved by new indexes and new point of view to the related indexes that are also used in the literature.

In the third chapter, we used three various indexes which were taken places in the literature to calculate marginal intra-industry trade (MIIT) on the issue of observation of labor adjustment cost. We investigated the relationship between marginal intra-industry trade and labor adjustment cost by compering different MIIT measurements.

ÖZET

Bu tez uluslararası ticaret konusunda önemli bir yer edinen doğrudan yabancı yatırımlar ve endüstri içi ticareti üç ayrı bölümde ele almaktadır. Birinci bölümde kur krizinin doğrudan yabancı yatırımlar üzerindeki etkisi ve eş zamanlı olarak ekonomik özgürlük seviyesi de dikkate alınarak iki ayrı modelde incelenmiştir. Burada uluslararası çapta inceleme yapabilmek adına 37 ülke 1995 il 2017 yılları arasında ele alınmıştır. Birçok ülkenin aynı zaman aralığındaki değerleri incelendiği için panel veri analizinden Genelleştirilmiş Momentler Yöntemi (GMY) fark ve sistem metodu olmak üzere iki yöntem karşılaştırılarak incelenmiş. Sonuç olarak GMY metotlarından sistem metodunun açıklama gücünün daha fazla olduğu ve bir kur krizi ortamında ülkeye gelen yatırımların ekonomik özgürlüğün artmasıyla arttığı gözlenmiştir. İkinci bölümde uluslararası ticarete önemli bir yeri olan diğer bir konu olan endüstri içi ticaret ele alınmıştır. Bu bölümde uluslararası ticarete kritik öneme sahip olan ve en çok ticareti yapılan sekiz farklı ürün ele alınmış ve bu ürünler ile endüstri içi ticareti etkileyen faktörler 40 ülke üzerine 2002 ile 2018 yılları arasında araştırma ile incelenmiştir. Bu modelde Grubel-Lyod'un endüstri içi ticaret endeksi kullanılmış ve bu endeks sıfır ile bir arasında değer aldığından araştırmada Tobit model kullanılmıştır. Bu modelin sonuçlarına göre ölçek ekonomileri, ürün farklılaşması, doğrudan yabancı yatırımlar ve ticarete açıklık endüstri içi ticareti destekleyen faktörler olarak karşımıza çıkmaktadır. Son bölümde endüstri içi ticaret ile iş gücü uyum maliyeti arasındaki ilişki incelenmiş ve üç farklı marjinal endüstri içi ticaret endeksi karşılaştırmalı olarak sunulmuştur. Bu bölümde endüstri içi ticaret bir bütün olarak 127 farklı imalat sanayi ISIC verileri kullanılarak 15 Avrupa Birliği ülkesini kapsayacak şekilde 1995 ile 2017 yılları ele alınarak GMY tahmini ile hesaplanmıştır.

ACKNOWLEDGEMENTS

I am thankful to my advisor Prof.Dr. Veysel Ulusoy of Yeditepe University for his suggestions, contributions, and comments for my thesis.

I am also grateful to my father Selahattin, mother Gülten, brother Sertan for their spiritual supports, encouragement, and patience.

I thank my husband Gökhan and my son Ömer for their understanding, patience, and love throughout the study.



INDEX

PLAGIARISM	i
ABSTRACT.....	ii
ÖZET	ii
ACKNOWLEDGEMENTS.....	iv
INDEX	v
PREFACE	x
CHAPTER1: Foreign Direct Investment and Currency Crisis	1
1. INTRODUCTION	1
1.1. Foreign Direct Investment Theory	3
1.1.1. Vernon’s production cycle theory.	4
1.1.2. The theory of exchange rates on imperfect capital markets.....	5
1.1.3. The internalisation theory.	5
1.1.4. The eclectic paradigm of Dunning.....	6
1.2. The Trade Theories.....	7
1.3. Currency Crisis	9
1.3.1. Currency crisis models.	9
1.3.2. Crisis definitions and measurement issues.....	11
1.3.3. Determinants of currency crisis.....	13
1.3.4. Statistical methodology.....	14
1.3.4.1. Event study approach.	14
1.3.4.2. Signalling approach.	15
1.3.4.3. Probit/Logit and other approaches.	16
2. LITERATURE REVIEW	17
3. DATA and METHODOLOGY	19
3.1. Generalized Method of Moment Estimation Model	22
4. EMPIRICAL RESULTS	24
4.2. Effect of Currency Crisis on FDI	28
5. CONCLUSIONS	31
REFERENCES.....	34
APPENDIX A	41
APPENDIX B	42
CHAPTER 2: Determinants of Intra-industry Trade in cross Country Analysis.....	45
6. INTRODUCTION	46

7. LITERATURE REVIEW	48
7.1. Type of Market Structure	51
7.1.1. Perfect competition.	51
7.1.2. Pure monopoly.	51
7.1.3. Monopolistic competition.	52
7.1.3.1. Large number of firms.	53
7.1.3.2. Product differentiation.	53
7.1.3.3. Competing on quality, price, and marketing.	54
7.1.3.4. Entry and exit.	54
7.1.4. Oligopoly.	55
7.2. Economies of Scale	55
7.2.1. Internal economies of scale.	56
7.2.1.1. Dividing production process and specialization.	56
7.2.1.2. Technological advantages.	57
7.2.1.3. Managerial Advantages.	57
7.2.1.4. Financial Advantages.	57
7.2.2. External economies of scale.	57
7.2.2.1. Advantages from intermediate goods.	58
7.2.2.2. Advantages of specialized manpower.	58
7.2.2.3. Advantages of purchased services.	58
7.2.2.4. Advantages of plant and services of infrastructure.	58
7.3. Intra-Industry Trade Theory	58
8. DATA and METHODOLOGY	60
8.1. Tobit Model	63
9. EMPIRICAL RESULTS and DISCUSSION	67
10. CONCLUSION.....	73
REFERENCES.....	76
APPENDIX C.....	81
APPENDIX D	85
CHAPTER 3: Marginal Intra-Industry Trade and Labor Adjustment Cost in EU	86
11.INTRODUCTION.....	87
12.LITERATURE REVIEW	88
13.DATA and METHODOLOGY	89
13.1. Panel Data GMM Estimation	96
13.2. Specific- Factor Model with IIT	97
14.EMPIRICAL RESULTS and DISCUSSION	100

15.CONCLUSION.....	106
REFERANCES.....	110
APPENDIX E	112



LIST OF TABLES

TABLE 1: JOINT EFFECT GMM ESTIMATION RESULTS.....	26
TABLE 2: ABSOLUTE GMM ESTIMATION RESULTS.....	29
TABLE 3: LIST OF COUNTRIES CONSIDERED.....	40
TABLE 4: DESCRIPTIVE STATISTICS.....	40
TABLE 5: CORRELATIONS BETWEEN VARIABLES.....	40
TABLE 6: PANEL UNIT ROOT TESTS.....	42
TABLE 7: IIT VALUES OF COUNTRIES ACCORDING TO AVERAGE OF EIGHT PRODUCTS AT PERIOD 2002 TO 2018.....	64
TABLE 8: THE EMPIRICAL RESULTS OF IIT AT EIGHT DIFFERENT PRODUCTS.....	69
TABLE 9: THE EMPIRICAL RESULTS OF IIT AT EIGHT DIFFERENT PRODUCTS WITH THE MARKET DEMANDS OF COUNTRIES.....	70
TABLE 10: THE SITC EXPLANATIONS OF PRODUCTS.....	79
TABLE 11: THE LIST OF COUNTRIES CONSIDERED.....	79
TABLE 12: DESCRIPTIVE STATISTICS.....	80
TABLE 13: CORRELATIONS BETWEEN VARIABLES.....	80
TABLE 14: ISIC DESCRIPTIONS.....	90
TABLE 15: THE EMPIRICAL RESULTS OF MEASUREMENT OF MARGINAL INTRA- INDUSTRY TRADE AND LABOR ADJUSTMENT COST.....	102
TABLE 16: THE LIST OF COUNTRIES CONSIDERED.....	109
TABLE 17: DESCRIPTIVE STATISTICS.....	110
TABLE 18: CORRELATIONS BETWEEN VARIABLES.....	110
TABLE 19: PANEL UNIT ROOT TESTS.....	110
TABLE 20: DATA SOURCES.....	111

THE LIST OF FIGURES

FIGURE 1: Net FDI Inflow of Countries at period 1995- 2017.....	42
FIGURE 2: Currency Crisis of Countries at the period 1995- 2017.....	43
FIGURE 3: The Average of Trade Indexes and FDI.....	43
FIGURE 4: Average Unit Cost in Economies of Scale.....	54
FIGURE 5: The graphics of IIT of 8 commodities and their averages.....	81
FIGURE 6: The graphics of correlation between IITav and explanatory variables.....	82
FIGURE 7: Average IIT indices of 15 EU Countries between the period 1990 and 2017.....	93
FIGURE 8: The Average of MD1*HI, MD2*HI, and MIIT*HI in 15 EU Countries.....	111
FIGURE 9: Herfindahl-Hirschmen Index of 15 EU Countries in 2017.....	112
FIGURE 10: Aggregated IIT of 15 EU Countries in 2017.....	112

PREFACE

The international trade has crucial effect in both countries' internal economies and whole world economy. In this concept we analyzed two factors that are special in the international trade concept which are foreign direct investment (FDI) and intra-industry trade (IIT).

Foreign direct investment (FDI) takes place in the world economy from the years that increase of multinational firms with the rise of internalisation. FDI Theory have comprehensive explanation with Vernon's production cycle theory, the theory of OLI of Dunning, the theory of internalisation and the theory of exchange rates on imperfect capital markets. Vernon states that production has four stage and U.S. used at first stage its technological advantages and exported its technologically improved products to European market. Thus, demand to U.S. products increased and the need of production in Europe occurred. Dunning indicates ownership, location and internalisation advantages supports FDI rising. It is obvious that the need of investment of production at another country have increased in time with different causes.

There are also three trade theories that impact production decision and trade pattern of countries in the world. Mercantilism indicates to give surplus so to make more export than import to a country. Besides, the absolute trade theory suggests to a country to have more efficiency about producing a product than other countries and the comparative trade theory proposes to produce a commodity that the country has relatively advantage.

One of the other main issue in the thesis is intra-industry trade (IIT) that is also a significant concept in the international trade. IIT can be defined by import and export of the same industries' products at the same time by a country for instance

import and export of shoe by a country. IIT raised with demand to differentiated products and exploiting from economies of scale. The differentiated products are produced by various firms under different brands that they are very similar with their taste and smell, they are differentiated with packaging and advertisement consciously. Therefore, those products substitute with each other easily. Besides that, firms use internal and external economies of scale to decrease their unit cost and increase their production level is another fundamental concept of IIT.

Intra- industry trade has influence on adjustment cost of labor and firms. In the inter- industry trade situation labor force move from one industry to another with causes of higher wages or better working conditions so, that means more adjustment cost to the new industry for both firms and labor. However, IIT provides to labor to move in the same industry thus, the adjustment cost of labor is less than to move another industry because labors can use their experience and knowledge in new sub-sector which is defined as Smooth Adjustment Hypothesis (SAH).

This thesis composed of three chapters which are connected to each other around the issue of FDI and IIT at many countries in the wide time periods which represented in panel data. The thesis presents comprehensive statement of theories related to FDI, IIT, trade and other accomplished subjects. Furthermore, the thesis shows empirical results that are supported with strong econometric tests and interpretations.

In the chapter one, we searched the currency crisis effect on FDI with the change of economic freedom in the host country and determinants of FDI. The analyze is done with 37 countries from the world in the period 1995 to 2017 with panel data GMM model. The model brings different view to the FDI with the investigation of impact of currency crisis under the change of economic freedom of

the host country. Additionally, special sophisticated indexes are added to the model to rise meaning of results which differentiates the investigation from the previous research on the issue in the literature.

In the chapter two, we demonstrated the determinants of intra- industry trade with eight different products which are mostly traded in international trade with the panel data on 40 countries in the periods 2002 to 2018. Censored model is used because IIT takes values between zero and one. In this part we used an index to calculate difference of gross domestic products (GDP) between traded countries that is our calculation. Furthermore, economies of scale expressed with a new index different from the previous research in the literature. Tobit model gives strong results that are supported with related tests. Since in this part IIT is calculated based on commodities, we took aggregated IIT in the next chapter of the thesis.

Lastly, in the chapter three, we investigated the relationship between marginal IIT (MIIT) and the labor adjustment cost with the comparison of three different way of marginal IIT measure at 15 EU countries in the period 1995 to 2017. In this part we exploited from the marginal IIT indexes of Menon and Dixon, Brühlhart and Lovely and Nelson's interpretations according to marginal IIT and labor adjustment cost. In the literature employment change or employment movement took as labor adjustment proxy but, in this chapter, we used MIIT as the proxy of labor adjustment cost which is indicated by Lovely and Nelson in 2002. Additionally, Lovely and Nelson present a theoretical work on this issue, we represented the empirical results while making comparison between other MIIT indexes to show relationship between labor adjustment cost and MIIT. The panel data system GMM estimation results are promoted with strongly significant econometric tests.

CHAPTER1: Foreign Direct Investment and Currency Crisis

ABSTRACT

Foreign direct investment (FDI) is actively used in open economies rather than closed economies. It is generally used as substitutes of export to a country so there are some consequences of economic development of the country on FDI such as growth, unemployment, inflation, crisis, and economic freedom in a country that is active in the international economy. This chapter investigates determinants of FDI and the impact of currency crisis on foreign direct investment within change in economic freedom of a host country. To analysis the effects, the dynamic gravity model is used with general method of moments on 37 countries during the periods 1995 to 2017. Empirical results show that the currency crisis in a country affects the foreign direct investment positively also when there is an economic freedom in the country, the increase of economic freedom in that country attracts foreign investors mostly.

Keywords: Foreign direct investment; Trade Openness; Currency Crisis; Economic freedom; Gravity Model; GMM

1. INTRODUCTION

Foreign direct investment is one of the crucial determinants of an open economy and outstanding feature of globalization. It primarily effects economic growth, trade, resource inputs, technology and skill transfer, the consolidation of infrastructure (communication, airport, harbour, etc.), unemployment of a country. In the same context, economic condition of a country is an essential determinant about attracting FDI in the country, for instance crisis, trade openness, economic freedom, economic growth, and human capital. However, there may be differences across countries about FDI factors which are suitable or not for their countries (Ietto- Gillies,2005). Apart from that unexpected and sharp decrease in the value of currency of a country is

defined as currency crisis. The decrease should be minimum 25 percentage in the value of the currency to be determined as currency crisis. Therefore, in this work it is going to address the impacts of currency crisis on FDI in the situation of trade openness and economic freedom of a country. The survey is done by the gravity model of FDI because the model enables to get more robust results because it has advantages of measurement of geographical distance between countries. Therefore, the contribution of the investigation in the literature is the effect of currency crisis on FDI with observed economic freedom and trade openness of a country.

It is obvious that gravity model has an extensive use on modelling of international trade (Kahouli and Maktouf, 2015). According to the model, a trade flow between two countries or cities is directly related to their economic activity and/ or population but inversely related to distance between them. Therefore, in recent investigations it is obvious that the gravity model is significant and effectual way of analysing FDI between two countries.

As it is seen in the literature, foreign direct investment is like trade flow so it can be explained and analysed successfully by gravity model. Besides that, the gravity model is used to determine location devolves on if it has horizontal or vertical relation with any other sources of profits that a firm has. There is an interaction between foreign affiliate sales and exports that are horizontally linked, so firm takes a fundamental decision between exporting to other countries or investing at abroad and selling from those places (Helpman, Melitz and Yeaple, 2004). Deciding between export and FDI is crucial because of profitability of being in the market and it also gives control to the investors. Apart from that a gravity model that applies on FDI is deducted from a capital theory which is based on knowledge and multi- national

enterprises (Bergrstrand and Egger. 2007). There is a nonlinear relationship between foreign affiliate sales, exports, and their exogenous determinants.

The gravity model of foreign affiliate sales is like the standard gravity model of trade since it presents information about trade costs which is a communication cost that occurred by the complexity of the firm's technology and standard iceberg trade cost, from observable trade flows (Keller and Yeaple, 2009). Lastly, the equation can be used to predict trade substitution elasticities (Raimondi and Olper, 2011). However, there are some issues of using the gravity model of trade and FDI that are omitted sample selection bias, endogeneity and situations concern to the model specification.

The endogeneity among right- hand side coefficient estimates can be divided in to three parts as simultaneity, omitted variables and management error (Woolridge,2002). At this point our investigation has endogeneity problem that is seen in the gravity model because of role of multilateral resistance terms (Anderson and Van Wincoop, 2003), so we will use panel data and general method of moment (GMM) to eliminate endogeneity problem and get more robust results.

The other parts of the chapter consist of 4 sections. Section 1 shows FDI Theory and definition of currency crisis and its measurement. Section 2 presents a literature review on FDI. Section 3 discusses methodology and information about data. Section 4 shows the empirical results. Section 5 provides outlines of policy implications/ recommendations and conclusion.

1.1. Foreign Direct Investment Theory

In the literature there are many theoretical papers that investigate foreign direct investment from various aspects. J. Dunning, S. Hymer and R. Venon are some examples of main research on this field. Internalisation has been increased with the

multinational enterprise (MNE) growth across the world. So, the reasons and needs to make foreign direct investment rise. The theories of FDI can be divided in to three categories.

1.1.1. Vernon's production cycle theory.

Production Cycle Theory was brought out by Vernon in 1966. The theory was examined foreign direct investment that were made by some U.S. companies at Western Europe on an industry of manufacture after the Second World War.

Accordingly, the production cycle theory states that production consists of four stages which are defined as innovation stage, growth stage, maturity stage and decline stage. In the innovation stage, transnational companies in United States form original innovative productions both for inner market and export their surplus to foreign markets. As the production cycle theory states that the demand of European countries for products like those are manufactured in U.S. was increased after the war. Therefore, U.S. companies used technological advantages on international competitors and export those products to other countries.

Manufacturers had an advantage of new technologies since they applied the technology firstly during production process while the first stage of the cycle. After the products were developed, the technology easily spreads in the market and becomes known by other producers in a market. Thus, some European firms began to copy those kinds of products that were produced with new technology in America and exported to European countries. Therefore, US companies were coerced to perform their production facilities to preserve their market shares in European countries.

The production theory investigates the foreign direct investment of American companies in Western Europe between 1950-1970 period because of their technological advantages. However, it is also observed that American firms were

made investment in some fields of Europe where they did not have any technology advantages.

1.1.2. The theory of exchange rates on imperfect capital markets.

The theory of exchange rate defines FDI by exchange rate uncertainty from the view of the international trade. Itagaki (1981) and Cushman (1985) investigate this uncertainty as a factor of FDI. Therefore, Cushman argues if the real exchange rate rises, the FDI which made in USD is encouraged. However, foreign currency appreciation causes decrease in FDI of American. Thus, Cushman states that appreciation in dollar values causes decrease in FDI in U.S. about 25%. However, the exchange rate theory is not able to explain detailly simultaneous FDI between countries from various currencies.

1.1.3. The internalisation theory.

The internalisation theory explicates the development of transnational companies and so their process for succeed in FDI. Coase firstly declared the theory in 1937 nationally but Hymer in 1976 states the theory international. After them, Buckley and Casson in 1976, Hennart in 1982 and Casson in 1983 developed the theory.

Hymer in his doctoral dissertation argued that there are two main determinants of FDI. First is elimination of competition and second is advantages that some firms have about production process or factors. He indicates that FDI take place when the firm-specific advantages are used to outperform the relative cost of the operations abroad. He also states that MNE rises because of the imperfection in the production market for instance information risk of foreign firms according to local firms, particular applications of government and currency risk. Therefore, transnational companies have some adjustment cost to foreign market. Buckley and Casson also

develop this theory which indicates the transnational companies systemize their internal activities to have crucial advantages on production related to other companies. Hennart (1982) develop the international theory by vertical and horizontal integration.

1.1.4. The eclectic paradigm of Dunning.

The eclectic theory consists of three theories of FDI that are named as OLI. “O” expresses the ownership advantages, “L” expresses the location advantages and “I” for internalisation.

The ownership advantages of transnational companies are related to intangible assets that are unique possesses of the company. Thus, the company would have lower costs and higher income. Entering successfully to a foreign market, the company should have some special characteristic and come over the operating costs in foreign market. The company have some advantages because of these special advantages, so to have more marginal profitability and less marginal costs than their competitors (Dunning, 1973, 1980, 1988). Those advantages consist of firstly monopoly advantages of companies that having crucial special aspect in markets like patent, natural resources, and trademarks. Secondly, technological advantages of companies which are defined as having last technological level and full knowledge according to a production process of a good or field. Thirdly, having economies of scale and scope or developed admission to financial capital markets.

Location advantages is important for the countries to determine the host country of transnational companies to make foreign investment. Relative to those characteristics, countries should have some specific advantages. One of them is the economic benefits that is related to qualitative and quantitative factors of production, telecommunication, cost of transportation, market size etc. Other advantages that

countries should have is political advantages that are applied by governments which affected FDI inflow to the country. Last category is social advantages that the host country has like cultural diversity, language and home and host countries 'distance to each other.

Internalisation is significant factor for FDI to developed around the world. Dunning, 1973 states that it is profitable for companies to integrate its location and ownership advantages aspects with a factor outside the country. By this third characteristic of OLI paradigm provides transnational companies to exploit their sales of goods and services at different countries around the world. Therefore, internalisation give benefits to companies to make foreign production at cross border countries rather than offering the production or service right under license or franchise.

As the eclectic paradigm contains ownership, location and internalisation aspects of companies, each company shows different properties at this field because of their economic, political, geographic, and social differences. Thus, companies have various objectives and strategies, different magnitude, and pattern of production to foreign markets according to opportunities offered by their host countries

1.2. The Trade Theories

Trade is a significant and indicative activity for FDI and essential for economic well- being of a country. There are different kinds of trade theories in the literature but there are three main theories which are mercantilism, the comparative advantage theory, and the absolute trade theory.

Mercantilism is a theory of trade that indicates a country should make export more than import, so the country maintains its trade surplus. Government intervention is crucial to support this surplus in the balance of trade. Mercantilism defines trade as

a zero-sum game which defines while one country gains, another country loss. Mercantilism fundamentally aims to increase the wealth power of a nation which is measured by the amount of treasure the country has. Mercantilism is still popular; some firms and their workers find attractive mercantilist policies so modern supporters of those policies are known as neo-mercantilists.

The absolute advantage trade theory supposes that a country has an absolute advantage when it is more efficient about producing the product than other countries. By that way global efficiency increases through participation in free trade. According to Smith countries have this absolute advantage by skilled workers who are repeating the same tasks, so they do not waste time by switching one kind of production to another. Also, longer production gives more incentive to the development of more effective working approach.

The comparative advantage trade theory was defined by David Ricardo in 1817. He shows that a country maximizes its well-being through specialization in production of services and goods which can be produced comparatively efficiently. Ricardo also argues that one country may both have absolute and comparative advantages. Besides that, the country has its own well-being by focusing on the production of the good that the country has more advantage. He determines trade as a positive sum game.

The comparative advantage theory and the absolute advantage theory have same assumptions and limitations generally. Firstly, resources are fully employed, there are only two countries and two economies, exclusion of transportation cost and services, free factor mobility, division of gains from specialization and pursuit of economic efficiency objectives.

Besides that, other theories that are country size, factor proportions and country similarity, explaining patterns of trade. That means what type of commodities are traded or which countries will be a trade partner. According to the theory of country size, countries which are big in surface area export small part of their production also they import small amount of their consumption. Because of their country size, they have various kind climate, and many natural resources so large countries are more self- sufficient. Besides that, those countries have higher transportation cost since their survey is bigger. Heckscher Ohlin Theory or factor proportion theory indicates that countries export products which have concentrated factors that are abundant in a country and import products that have factors which are rare in a country.

However, Leontief states previously that economist accepted the export of a country consist of commodities which are most abundant in the country like labour or capital, but United States has more capital than most other nations, its' export base on labour-intensive products and import base on capital-intensive products. This idea is known as Leontief Paradox in the literature. Lastly, theory of human skills underlines differences between factor endowments and intensities of skilled and unskilled employers in a country such as U.S. has more skilled employers relative to other countries, so it tends to export skilled- labour intensive goods.

1.3. Currency Crisis

1.3.1. Currency crisis models.

Currency crises have an extended field in economic literature both at theoretical and empirical research. As it is observed in the literature, theoretical models consist of first, second and third generation models.

The first-generation models base on inconsistencies among domestic macroeconomic policies (Krugman, 1979) for instance commitment on exchange rate policy and permanent budget deficit policy of government. The deficit requires to be used up assets of government such as foreign reserves and borrowing for finance the deficit. But none of depleting reserves or borrowing policies are impracticable because the government cannot apply them without any fiscal reforms. On the other hand, if government does not make fiscal reforms it must monetize to finance the deficit. Increasing money amount is inconsistent with fix exchange rate policy since excess money in an economy leads to inflation. Therefore, the first- generation models argue that the regime unavoidable falls.

In the literature the second-generation models of currency crises represent that policy makers compare the negative and positive sides of defending exchange rate, so they leave the exchange rate target policy if the cost of the policy is more than benefits of them (Obstfeld,1986,1994). Besides that, in these models if the policy makers use the exchange rate target policy even its excess cost cause the existence of multiple equilibria. Also, speculative attacks rise and achieve their aims although there is no inconsistency between current policy and the exchange rate commitment. Since the policy makers willing to preserve the exchange rate at a same level, they use those polices like increase in domestic interest rate raises bank funding costs. On the other hand, the private sector queries why the government sustains the fix exchange policy while other macroeconomic policies are compromised. Therefore, a speculative attack becomes more successful if high domestic interest rate increases fragile employment and banking system in an economy. So, detecting time of the speculative attack is not possible since it is no more unique.

The third -generation models centre on deformation in financial markets and banking system that causes currency crises. In some models these deformations rise in the type of credit restraints. Aghion, Bacchetta and Bnanerjee (2001) state that a decline in currency increases the foreign currency debt burden of companies so decreases their net incomes. Borrowing capacity of firms is limited with those restrictions on credits. Therefore, decrease in investment and output of production occurs and causes depreciation in the demand of domestic currency so a currency crisis comes out. Besides that, other third- generation models show that unsustainable fiscal deficits and moral hazard may cause to currency crises since they rise by financial liberalization and private sector liabilities that are guaranteed by government. McKinnon and Pill (1995) indicate that foreign and domestic credit enlargement causes a banking and currency crisis because financial liberalization with deposit insurance leads to encourage banks lending.

1.3.2. Crisis definitions and measurement issues.

In the empirical literature there are various definitions of currency crisis. Some research papers make narrow definition for the crisis and others use broader definition for it. A narrow definition for instance can define as a crucial depreciation of the exchange rate may occur because of a successful attack. Frankel and Rose (1996) determine the currency crisis as a minimum 25 percent of nominal depreciation with respect to previous year's currency. Milesi- Ferretti and Razin (1998) determine the currency crisis not only a 25 percent of nominal depreciation but also the depreciation rate should be two times or more relative to preceding year. Also, they give a specific example if the currency was stable relative to previous year, they make another determination that there should be at least 15 percent nominal depreciation in the

exchange rate. That means, the rate of depreciation in the currency is expected to be a minimum 10 percent in relative to the prior year.

The broader definitions of the currency crisis are made by other papers. Those investigations indicate unsuccessful attacks they are caught by too many changes in exchange rate which pressure on index that determined as weighted average of changes in reserve losses and exchange rate. Eichengreen, Rose and Wyplosz, 1995; Kaminsky and Reinhart, 1999 argue that there is a pressure on a currency because of its own weights and reservation components and the variance of each component change over the structure of each country. Therefore, if a negative event occurred against a currency of a country for example a sudden increase of demand to foreign currency, the exchange rate would depreciate, and the central bank of the country is going to sell foreign currency to defend the exchange rate.

Apart from currency depreciation percentage there is also a threshold that expresses changes in the index. This threshold is used to present crises for example 1 for crisis and 0 for no crisis. Generally, the definition of threshold is determined as a country specific condition. For instance, Eichengreen, Rose and Wyplosz (1995) apply one and a half standard deviation threshold in their investigation. There are some different usages of the threshold in the literature like Glick and Hutchison (2001, 2005, 2006) who use a 2-standard deviation of threshold in their paper also, we observed different usage in searches of Kaminsky and Reinhart (1999) and Kaminsky, Lizondo and Reinhart (1998) who apply a 3-standard deviation cut off.

Generally, minimization of the chances is crucial for catching the continuance of the same currency crisis period. When each great change in currency pressure is determined after that any huge changes in the fixed- period more than one year like

two years are handled as a part of the same currency crisis incident. After the two years, the period skipped, and the new episode is identified as new crises is continued.

1.3.3. Determinants of currency crisis.

In the theoretical and empirical literature there are wide range of determinants of currency crises for instance some important investigations are Frankel and Rose, 1996; Kaminsky et al., 1998; Kaminsky and Reinhart, 1999. Those determinants consist of financial and macroeconomic variables like the current account deficit, fiscal deficit, money growth, real exchange rate overvaluation, domestic credit growth. Besides that, there are other variables that measure fragility of country to attacks such as needs to foreign financing, the solidity of financial sector and measures of sufficiency of international reserves with respect to feasible short-run foreign and domestic liabilities. Also, there may other variables like risk appetite of investors, trade and financial openness, interest rate differentials, transmission of crises from other countries.

The monetary growth at anchor currency causes high inflation that result in depreciation of currency of the home country. If the country hold depreciation for a while, sudden and large depreciation will result in currency crisis in the home country. On the other, an increase in the credit growth will cause inflationary pressures so banking system's short- term domestic currency liabilities rise.

Having high level of foreign reserve is significant to be strong against speculative attempts. The ratio of $M2^1$ to reserves shows how much of liabilities of banking system can be financed by international reserves. During the condition of currency crisis, the demand of citizens turning domestic currency into foreign

¹ M2 is broader measure of Money supply than M1, which just includes cash, easily convertible near money, and checking deposits.

currency increases and the central bank can stabilize the currency and supply this demand with the ratio.

An exchange rate overvaluation indicates an increment in probability of a currency crisis since the crisis negatively affects the competitiveness in market. Because of import prices increase, purchasing power erodes and the trade performance of country turns adverse. Since decrease in real GDP growth, economic activity of the country gets worse and discourages investment to the home country.

1.3.4. Statistical methodology.

A statistical methodology is crucial because generates warning for crises. Thus, after identifying significant indicators that is gathered as information should be unified objectively. From the point of view, three approaches are used for this aim which are the signalling method such as Kaminsky, Lizondo and Reinhart, 1998, event studies like Kaminsky and Reinhart, 1999, and lastly probit/ logit model for instance Frankel and Rose, 1996.

1.3.4.1. Event study approach.

The behaviour of indicators during the period that leads up to crises is crucial to investigate for the event study approach. In this approach, behaviour of each variable is compared between during pre-crisis periods and non-crisis periods. Kaminsky and Reinhart, 1999 show that the ratio of 12-month growth in domestic credit/GDP is higher in crisis periods than non-crisis periods. Growth in that ratio is more than normal as the currency crisis is getting closer which is consistent with a credit boom. They also declare that the 12- month change in ratio of M2/ reserves of central bank grows more in the crisis period than prior non-crisis periods. Since the central bank tries to stabilize the exchange rate, foreign currency reserves decline so, the ratio is getting increase in the crisis periods. The year prior to currency crisis, the

exchange rate appreciates with respect to non-crisis periods thus, the exchange rate overvalued. The appreciation in the real exchange rate turns in to devaluation quickly. When the crisis proceeds in the next periods, trade activities are getting worse. Therefore, the overvaluation of the currency and deterioration of trade affect negatively the economic activity in a country and decrease output relative to non-crisis periods.

1.3.4.2. Signalling approach.

The signalling approach also detects future currency crisis by monitoring key variables likewise the event study approach that we mention at the previous part. The signalling approach uses an individual numeric threshold to specify future crisis for instance if the current account deficit to GDP ratio is bigger than 3 percent that would indicate possibility of a crisis. If policy makers use this signal to make provision for any future crisis there will be two possibilities. First one can be a right signal so expected crisis take place. Second one can be a wrong signal and crisis does not happen. If a signal does not come out, there will also be two kinds of possibilities. First one in case of no signal, crisis occurs, and false signal is taken place by indicators. Second one is no signal and crisis does not happen so the signal is accurate.

Determining the best threshold level is significant because fail to forecast a future crisis which occurs that shows a Type I error and forecast that a crisis will happen but, it does not occur that presents Type II error, so the threshold needs to have balance between them. Therefore, when too loose the threshold, it achieves to catch all crises but at the same time many wrong signals will come over. Then again, when too tight the threshold, it will miss all the crises but never give any wrong

signal. Therefore, the optimum threshold should be taken that maximizing the good signal to noise ratio.

The selection of one of those indicators depends on the good and false signal ratio of indicators or loss function of policymakers. If an indicator shows four times good signals more than false signal that also expressed by noise, it is reputed as better than another indicator that have 2 times good signal for every false signal. Hence, an indicator that predicts 50 percent of crises is more efficient than any other indicator that predicts 25 percent of crises.

Edison², 2003 investigates 19 different indicator variables of 28 countries between periods 1970 to 1995 by monthly frequency. In his investigation the indicators were ranked based on their signal to noise criterion for instance the real exchange rate is a top performer indicator since it is signal to noise ratio 4:1, short-term debt to reserves ratio is second best performer indicator and 12 months change in this ratio is crucial since it is signal to noise ratio is 2,5:1.

The signalling approach has some shortcomings. First, it investigates all variables separately, it does not think about interrelated conditions may make economy fragile to the crises. A second short coming of the signalling approach, it does not consider correlations between different indicators. Lastly, the signalling approach focuses only binary signals like value of indicator is significant with respect to threshold, if it is above the threshold, it indicates a signal on the other hand under its threshold, it indicates no signal concerning to a potential future crisis.

1.3.4.3. Probit/Logit and other approaches.

The probit and logit approaches come out since the signalling approach has some shortcomings. The approach predicts a probability of relationship between

² Edison (2003) shows an instrumental table of indicators in his work that presents effectiveness of those indicators.

dependent and independent variables by regressing the dependent variable that shows discretely measured crisis for example it takes 1 if the crisis occurs or takes 0 if the crisis does not occur, on a set of explanatory variables. Besides that, the probit approach makes prediction by investigating correlations between the prognosticative variables and lets to test the statistical significance of variable so, it can estimate the likelihood of future crisis. The effect of a specific variable related to the magnitude of all other variables. Therefore, the contribution of variables to the estimation of crisis and the relationship of changes in individual variables is not generally transparent.

Recently, there are more other models that are developed new methods to increase the estimation performance for example the piecewise- linear generalization that is a kind of a probit model, clarifies the explanatory variable of crisis from a binary to trinary structure for non-crisis period, crisis period and post-crisis recovery periods. Also, there are more econometric techniques like regime switching model with time varying probabilities and autoregressive conditional hazard model. On the other hand, some studies exercise classification rules to specify protective fields for fundamentals in the situation of the non-crisis to investigate any probable interaction between time-varying economic determinants and structural variables like financial, public sector and corporate governance which are stable over time.

2. LITERATURE REVIEW

There are many investigations according to FDI in the literature including determinants of FDI, different macro-economic variables that effecting FDI, essential theories of FDI, the relationship of trade with FDI. Walch and Wörz (2012) suggest that one of the important determinants of FDI is GDP that shows economic size of the host country and exploit growth opportunities of the host country. GDP per capita also suggests income level of the consumers so it is crucial for the attraction of FDI to the

host country (Hoshi and Kiyota, 2019). Human Capital Index based on schooling and return to education so increase of human capital index of country have positive effects on attraction of FDI (Nawaz and Bilal, 2013). Besides that, Fontagne (1999) argues export is substituting local sales on foreign markets and import is complementary to FDI in the host country. Additionally, Mebratu (2014) indicates a bidirectional relation between FDI and trade openness in sub-Saharan economies.

On the other hand, literature related to exchange rate movements shows capital market is imperfect and depreciation in the currency of the host country would increase FDI in the host country because wealth of foreign investors would rise relatively and costs of inputs of production fall in the home country currency so let the foreign investors finance more of investment internally. Blonigen (1997) analyses Japanese acquisitions in the US in the period 1975-1992 and discovers strong negative correlation between the volume of Japanese FDI for industries which likely included firm specific assets and US dollar. Similarly, Harris and Ravenscraft (1991) indicate a weaker dollar results in larger FDI inflows into the US (Goldberg and Klein, 1998). Therefore, the current literature shows that a depreciation of host country currency promotes FDI inflows. To the extent that when the value of national currency in a country collapses suddenly and drastically in a time, the national currency depreciates so currency crisis is occurred in the economy. The results of the currency crisis on FDI are expected to be like depreciation of national currency of host country because the market become relatively cheaper for foreign investors so FDI inflows would increase.

On the other hand, Quazi (2007) presents Heritage Foundation's Economic Freedom Index (IEF) as a significant determinant of FDI in East Asian countries during 1995- 2000 period. Also, Kapuria-Foreman (2007) examine a cross sectional

analysis to test for the impacts of IEF and the Fraser Institute's "Economic Freedom of the World Index" (EFWI) on FDI by a sample developing countries in period of 1995-97 and 1990-97, respectively. They found some important results that blocks to capital flows and foreign investment, shortage of property rights protection, government intervention has negative and significant effects on FDI.

The purpose of this chapter is to evaluate the impact of currency crisis on FDI inflows while taking into consideration other FDI determinants like GDP per capita, human capital, trade openness in thirty-seven countries from 1995 to 2017. It further investigates both the individual and joint impacts of economic freedom and currency crisis on FDI. Therefore, the contribution of the study in the literature consists of two parts. The effects of currency crisis on FDI inflow in the situation of trade openness. Secondly, the impact of currency crisis is measured with the joint effect of the economic freedom of the host country, meaning of in the situation of currency crisis in a country the impact of change in economic freedom on FDI inflows in this country.

3. DATA and METHODOLOGY

At this part we present the database and estimation techniques. Data³ is consisting of 37 countries annual data over the period of 1995 to 2017⁴. The database is strongly balanced panel data with 851 observations.

The dependent variable of FDI inflow, GDP per capita, export, import data and industry output are taken from World Development Indicator (WDI). Moreover, Economic Freedom Index data is taken from Heritage Foundation. Currency Crises' year data which is collected for many years by Carmen Reinhart is taken from Harvard Business School's web page. On the other hand, distance data is used from

³ Data is stationary at 1% significance level except XR and MR variables as results of ADF, PP, LLC and IPSW test. First difference of XR and MR are taken at GMM tests.

⁴ Data countries are shown in Appendix.

CEPII database. Human Capital Index data is taken from Penn World Table 9.1 version. Inflation data is taken from OECD database. Lastly, unemployment data is taken from World Bank database.

Our empirical model is developed to analyse the determinants of FDI and conclude the impact of currency crisis on FDI inflow with observed economic freedom in a country. The general form of gravity equation is shown as follows:

$$FDI_{ij} = \alpha_0 GDP_{jt}^{\alpha_1} HC_{jt}^{\alpha_2} XR_{jt}^{\alpha_3} MR_{jt}^{\alpha_4} ECOCR_{jt}^{\alpha_5} DIST_{ij}^{\alpha_6} UNEMP_{jt}^{\alpha_7} INF_{jt}^{\alpha_8} ECOFREE_{jt}^{\alpha_9} CRISIS_{jt}^{\alpha_{10}} u_{ijt} \quad (3.1)$$

This model is static form of the Gravity Model⁵. In our investigation we use dynamic form of the model otherwise the static model ignores the impact of previous year FDI on current FDI, the previous years' FDI should be taken into consideration because of its delay effects on the current FDI otherwise this situation causes erroneous conclusion at estimation. To estimate the dynamic gravity equation for FDI we applied eq. (1) in a log-linear form (2)

$$\begin{aligned} \ln FDI_{jt} = & \alpha_0 + \alpha_1 \ln FDI_{jt-1} + \alpha_2 \ln GDP_{jt} + \alpha_3 \ln HC_{jt} + \alpha_4 \ln XR_{jt} + \alpha_5 \ln \\ & MR_{jt} + \alpha_6 \ln ECOCR_{jt} + \alpha_7 \ln DIST_{ij} + \alpha_8 \ln UNEMP_{jt} + \alpha_9 \ln INF_{jt} + \alpha_{10} \\ & ECOFREE + \alpha_{11} CRISIS + u_{ijt} \end{aligned} \quad (3.2)$$

Where FDI_{ijt} is the net inflow of foreign direct investment to country j at year t. FDI_{ijt-1} is the lagged value of FDI_{ijt} . GDP_{jt} shows the per capita gross domestic product of country j in year t in proportion to per capita gross domestic product of United State in year t. HC_{jt} represents Human Capital Index of country j at year t that base on years of schooling and returns to education in the country. $ECOCR_{jt}$ shows economic freedom of country j multiple by crisis in country j at year t. $ECOFREE_{jt}$

⁵ Gravity Model can be shown by $TRADE\ FLOW = \frac{M_i M_j}{D_{ij}}$ (D expresses distance between two countries, M expresses economic dimensions of the countries.)

describes the Economic Freedom Index of country j in year t . $CRISIS_{jt}$ represents a dummy variable for currency crisis in country j in year t if there is a currency crisis in year t , the value of dummy takes 1 otherwise it takes 0 value.

We also take those variables separately in the empirical investigation part. u_{ijt} shows an error term of the estimation. $UNEM_{jt}$ presents the unemployment rate in country j in year t which is the number of unemployed people as percentage of the labour force. INF_{jt} describes inflation rate of country j in year t that is measured by consumer price index (CPI)⁶. To analyse change over time in income per capita and external trade of countries easily we compose three indexes. Apart from that to test technological effect of trade we used export and import indexes.

Where those indexes,

$$GDPR_{jt}^7 = GDPpc_{jt} / GDPpc_{usat} \quad (3.3)$$

$$XR_{jt} = [\sum EXP_{ijt} / \sum (EXP_{ijt} + IMP_{ijt})] * IndustryOutput_{jt} \quad (3.4)$$

$$MR_{jt} = [\sum IMP_{ijt} / \sum (EXP_{ijt} + IMP_{ijt})] * IndustryOutput_{jt} \quad (3.5)$$

IMP_{ijt} shows the total value of import of goods and services of country j from other countries which are top 10 countries that the import is done mostly in year t . EXP_{ijt} represents the total value of export of goods and services of country j to other countries which are the top ten countries that the export is done mostly in year t . The export and the import values that the trade is done mostly is considered to show technological transfer which spreads by trade activities from developed countries to developing countries. $EXP_{ijt} + IMP_{ijt}$ represents total value of import and export between those countries in year t that are used in XR_{jt} and MR_{jt} . In those indexes, we multiple trade index with industry output which shows average output of the 10 countries which used in the indexes in country j at year t . We have estimated the

⁶ CPI is a measure of average change over time in the prices paid by consumers in urban households for a basket of goods and services.

⁷ GDPR represents GDP ratio.

model by including $GDPR_{jt}$ in all estimations on the other hand XR_{jt} and MR_{jt} is taken into consideration separately because of high correlation between them. Also, economic freedom and crisis are used both separately and as multiple of those two variables like in the estimation equation to test their individual and joint effects on FDI inflow to a country.

3.1. Generalized Method of Moment Estimation Model

In our empirical work, we estimate the gravity model using dynamic panel data by difference GMM and system GMM estimations because they are suitable for comparison of the model. In simple dynamic panel models if a data has small time span, the usual fixed effects estimators will be inconsistent because ordinary least square (OLS) estimator rely on first differences (Nickell, 1981). Therefore, Arellano and Bond, 1991 presented generalized method of moment (GMM) to improve an applicable method for dynamic model from panel data. They take advantage of linear moment restrictions with some assumptions of no serial correlations in the error terms and the equation that includes lagged dependent variables, no strictly exogenous variables, and individual effects. The simplest model that has no strictly exogenous variable is an autoregressive specification of the form.

$$y_{it} = \alpha y_{i(t-1)} + \eta_i + v_{it} \quad |\alpha| < 1 \quad (3.1.1)$$

In this equation, a random sample which has N individual time series ($y_{i1}, \dots, y_{iT}$). T presents small and N shows large. The v_{it} are accepted to have finite moments and individually $E(v_{it}) = E(v_{it} v_{is}) = 0$ for $t \neq s$. It is assumed that it doesn't have a serial correlation but, inevitably independence over time. If the model is extended with exogenous variables, then it will have new form.

Where.

$$y_{it} = \alpha y_{i(t-1)} + \beta' x_{it}^* + \eta_i + v_{it} = \delta' x_{it} + \eta_i + v_{it} \quad (3.1.2)$$

In this extended equation, x_{it}^* includes a combination of both bias and strictly exogenous variables. The performance of difference- GMM depends on the performance of the estimators so determination of α depends on lags of y_{it} . The strict exogeneity of x_{it} cause the over-identifying restrictions and the lack of correlation with η_i .

However, there are some costs of that estimation. The first difference equation removes the fix effects and time- invariant regressors that are suitable with specification of Arellano and Bond, 1991. Besides that, the difference GMM performs weakly when it is applied to short panels of continuing time series (Blundell and Bond, 1998) so system GMM is suggested to exercise moment conditions which depend on the Arellano and Bond type orthogonality conditions and level equations. Where those moment conditions are shown below:

$$E (y_{it-s} \Delta v_{it}) = 0 \quad \text{for } t= 3, \dots, T \text{ and } s \geq 2 \quad (3.1.3)$$

In contrast to the non- linear moment restrictions, Blundell and Bond consider the following T-3 linear moment conditions:

$$E (u_{it} \Delta y_{i, t-1}) = 0 \text{ for } t = 4, 5, \dots, T \quad (3.1.4)$$

Arellano and Bover (1995) suggest using of the lagged differences as an instrument for level equations. Besides that, u_{it} indicates $\eta_i + v_{it}$. Because of Δy_{i2} is detected, there is an additional restriction which is defined specifically,

$$E (u_{i3} \Delta y_{i2}) = 0 \quad (3.1.5)$$

The system GMM estimator that uses the further T-2 moment restrictions which follow by assumption 10 and homoskedasticity through time of v_{it} .

The problem of finite sample bias due to weak instruments in first differenced GMM estimator is disappeared when system GMM is used (Blundell and Bond, 2000). Moreover, system GMM controls any endogeneity problem of independent variables consisting of the delayed dependent variable and uses suitable lagged values of variables as an instrument value. So, GMM estimation allow us to have more robust and consistent results for panel data estimation.

Lastly, in our investigation we use difference GMM and system GMM estimation for the dynamic panel data. We estimate the model by these estimation techniques and interpret the results in the next part.

4. EMPIRICAL RESULTS

Our objective in this study is to examine the effects of currency crisis on the foreign direct investment with observed economic freedom in a host country. We also analyse⁸ determinants of FDI so the effects of the import that is mostly done with ten countries and the export that is mostly done with ten countries are used with industry output level. Besides that, to measure income per capita level in the host country we use the effect of GDP per capita relative to GDP per capita of USA. At the same time the consequence of the economic freedom, unemployment rate and inflation rate to FDI inflow in the host country is observed. Table 1 and 2 presents estimates of dynamic gravity equation.

4.1. Joint Effect of Economic Freedom and Currency Crisis on FDI

The FDI lagged variable⁹ has positive and significant effect on FDI at 1% level in all columns (Mina, 2012). That means high FDI in previous year has positive effect on FDI at current year. At GMM-Diff estimation in Table 1 column 1, the magnitude of 0.496 implies that a 1% increase in lagged FDI increases FDI by around

⁸ The results are acquired from Stata.

⁹ Descriptive statistics and correlations between variables are shown in Appendix A.

0.5% (Kahouli and Omri, 2017). Similarly, $GDPR_{jt}$ has positive and significant effect on FDI in all columns. This means 1% increase in per capita income of host country in \$ with respect to per capita income of USA increases FDI inflow by around 0.28%. Therefore, FDI is more observed by high income countries (Hoshi and Kiyota, 2019). Since GDP per capita income is so important to indicate well-being of economy and purchasing power of citizens in a country, GDP per capita income is significant indicator for foreign investors (Callen, 2008).

In our empirical work HC has positive and significant impact on FDI with 1% significance level in column one. This implies 1% increase in human capital index of country increases FDI inflow by around 4.10% which consistent with the literature (Noorbakhsh, Paloni & Youssef, 2001). As human capital presents knowledge and skills of citizens, an improvement in the index will positively effect FDI because employees would have more skills to produce more so increase in human capital attracts foreign investors. The result is consistent with the Network Model of Modern FDI Theory which base on pre-requisite of international operations, the theory shows supports of FDI about development of not only objective and experimental knowledge but also capabilities based on it. Besides that, the XR has positive and significant effect on FDI inflow. This indicates that 1% increase in industry production that is exported to mostly exported ten countries relative to total trade amount of a country increases FDI inflow by about 0.47%. The variable is also important to show technology transfer to other countries. The result is compatible with the international trade and traditional FDI theory. The international trade theory argues that a country export goods which of resources and factors are intense in that country so foreign investors are attracted by increase in export because of location specific advantages so the result is coherent with traditional FDI theory (Rugman, 1981 and Caves, 1971).

Additionally, ECOCR has significant and positive effect on FDI inflow. 1% increase in economic freedom index of a country that has currency crisis, increases FDI inflow by about 0.04% (Kapuria-Foreman, 2007; Economou, 2019). Since, economic freedom is measured by four broad categories which are regulatory efficiencies, rule of law, government size and open markets, an improvement in those freedoms improves market conditions of the country. Besides, those four categories consist of twelve freedom and each freedom has equal weight while a country's overall economic freedom value is derived by averaging these twelve freedoms. If a country's economic freedom score increases that means the twelve freedom which are financial freedom, business freedom, trade freedom, investment freedom, labour freedom, government spending, tax burden, monetary freedom, fiscal health, government integrity, property rights and judicial effectiveness are improved so economic and investment situations in the country improved. Therefore, foreign investors are more willing to invest in this market. Those results are shown in the Table 1 below.

Table 1. Joint Effect GMM Estimation Results

Variables	Dependent Variable: lnfdi													
	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys
lnFDI(t-1)	0,496 (15.94)***	0,505 (36.19)***	0,504 (17.10)***	0,535 (27.29)***	0,361 (5.44)***	0,485 (25.60)***	0,345 (5.31)***	0,497 (22.72)***	0,492 (14.74)***	0,510 (45.08)***	0,505 (15.22)***	0,527 (34.92)***		
lnGDPR	0,285 (2.18)**	0,214 (3.18)***	0,342 (2.61)***	0,301 (4.10)***	0,480 (2.63)***	0,214 (3.18)***	0,549 (2.94)***	0,276 (3.97)***	0,314 (2.38)**	0,197 (2.80)***	0,359 (2.80)***	0,274 (3.83)***		
lnHC	4,101 (7.62)***	2,506 (9.77)***	3,846 (6.74)***	1,914 (5.13)***	5,092 (7.15)***	2,693 (9.18)***	5,002 (7.05)***	2,313 (6.75)***	2,902 (6.07)***	1,304 (5.70)***	2,697 (5.43)***	0,904 (3.88)***		
lnXR	0,477 (3.95)***	0,623 (8.33)***	-	-	0,387 (3.69)***	0,635 (7.18)***	-	-	0,458 (3.86)***	0,567 (6.87)***	-	-		
lnMR	-	-	0,471 (4.21)***	0,531 (5.05)***	-	-	0,353 (2.95)***	0,522 (4.85)***	-	-	0,443 (3.93)***	0,552 (6.10)***		
lnECOCR	0,041 (1.90)**	0,036 (2.04)**	0,043 (1.96)**	0,035 (2.55)**	0,037 (1.80)**	0,034 (1.75)***	0,037 (1.73)*	0,028 (2.22)**	0,046 (2.37)**	0,048 (3.57)***	0,048 (2.44)**	0,039 (3.23)***		
lnDIST	-	-0,335 (-2.37)**	-	-0,246 (-4.82)***	-	-0,359 (-2.37)**	-	-0,204 (-2.94)***	-	-0,268 (-2.06)**	-	-0,270 (-3.64)***		
lnUNEM	-	-	-	-	-0,560 (-2.64)***	-0,170 (-1.47)	-0,649 (-3.16)***	-0,248 (-2.13)**	-	-	-	-		
lnINF	-	-	-	-	-	-	-	-	-0,024 (-2.14)**	-0,036 (-4.75)***	-0,023 (-1.83)*	-0,033 (-3.60)***		
Constant	7,349 (7.51)***	11,262 (11.56)***	7,457 (7.17)***	10,643 (23.32)***	10,513 (6.24)***	11,964 (9.28)***	11,171 (6.39)***	11,187 (12.67)***	8,867 (8.98)***	12,114 (15.82)***	8,808 (8.42)***	12,222 (18.87)***		
Sargan test	32,984	34,359	33,156	33,174	33,215	35,105	33,096	34,227	33,406	35,237	33,485	34,547		
AR(2)	0,11	0,11	0,10	0,09	0,16	0,11	0,17	0,11	0,11	0,11	0,11	0,09		
Number of Instruments	26	47	26	47	27	48	27	48	27	48	27	48		
Number of Observations	771	810	771	810	771	810	771	810	674	746	674	746		
Countries	37	37	37	37	37	37	37	37	37	37	37	37		

*, **, *** indicate significance level at 10%, 5% and 1% respectively. The values in parentheses are t- statistics. AR (2) Arellano-Bond Test for analysing the autocorrelation existence of second order (p-value).

4.2. Effect of Currency Crisis on FDI

In this part we observed currency crisis and economic freedom effects separately. In the empirical literature there are different definitions of currency crisis as we mentioned previously. Narrow definition determines the crisis by successful attack is result in a crucial depreciation of exchange rate for instance, Frankel and Rose (1996). On the other hand, the broader definition of currency crisis is unsuccessful attacks as caught by a threshold of the index. Apart from that economic freedom shows weighted average of twelve freedoms totally which we also explained in the related previous part.

In our empirical work, the table 2 shows that economic freedom and currency crisis effects on FDI inflow separately. CRISIS has positive and significant effect on FDI inflow in both GMM- Diff and GMM- Sys. This indicates if there is a currency crisis in a country, FDI increases by about 0.16% in column 3. This shows that if there is a currency crisis in a country, foreign investors are attracted because of low market price level in the country so their national currencies become more valuable and making investment become cheap and easy in the country (Blonigen, 1997; Froot and Stein, 1991; Osinubi and Amaghionyeodiwe, 2009).

On the other hand, ECOFREE has positive and significant impacts on FDI at both GMM estimation method. 1% increase in economic freedom of a country increases FDI inflow by around 2.16% (Bengoa, Sanchez- Robles, 2003; Kapuria-Foreman, 2007). Furthermore, DIST is measured by GMM- Sys and it shows significant and negative effect on FDI. That indicates 1% increase in distance decreases FDI by 0.29% in column two, the result is consistent with gravity model (Anderson J.,1979) which indicates if the distance between two points increases, trade or FDI between those points decreases. Besides those, MR has positive and significant

impact on FDI inflow. 1% increase in industry output which is imported to ten countries that import is mostly done with relative to total value of trade, increases FDI inflow by about 0.47% in column five. This indicates that foreign investor can import capital or intermediate goods to produce final goods so increase in import of the country attracts FDI into the country. Moreover, technology transfer is occurred by import activity from mostly trade 10 countries and foreign investors willing to invest in the country because it is an encouraging market for imported products, so they are going to be interested in manufacture those kind of products in the importing country (Albahi, S.E, Si, Ak, 2016).

Table 2. Absolute GMM Estimation Results

Variables	Dependent Variable: lnfdi													
	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys	GMM-Diff GMM-Sys
lnFDI(t-1)	0,695 (18.54)***	0,540 (15.92)***	0,496 (15.92)***	0,505 (36.34)***	0,504 (17.08)***	0,535 (27.38)***	0,358 (5.44)***	0,485 (25.58)***	0,340 (5.32)***	0,492 (21.90)***	0,592 (17.49)***	0,527 (32.15)***	0,590 (17.53)***	0,529 (58.15)***
lnGDPR		0,286 (2.19)**	0,215 (3.21)***	0,300 (4.13)***	0,498 (2.82)***	0,214 (3.16)***	0,568 (3.11)***	0,266 (4.54)***	0,544 (5.41)***	0,339 (7.28)***	0,573 (5.79)***	0,374 (8.88)***		
lnHC		4,107 (7.67)***	2,511 (9.85)***	3,856 (6.81)***	1,922 (5.18)***	4,916 (9.27)***	2,701 (6.20)***	2,463 (8.06)***						
lnXR		0,475 (3.95)***	0,623 (8.30)***			0,376 (3.16)***	0,634 (7.17)***				0,363 (2.97)***	0,524 (7.86)***		
lnMR				0,470 (4.20)***	0,531 (5.09)***				0,331 (2.79)***	0,539 (5.00)***			0,310 (2.63)***	0,566 (6.86)***
lnECOFREE	2,157 (3.24)***	2,169 (13.47)***												
CRISIS		0,164 (1.83)*	0,144 (1.95)*	0,173 (1.89)*	0,141 (2.43)**									
lnDIST		-0,297 (-5.90)***	-0,335 (-2.36)**	-0,246 (-4.84)***		-0,358 (-2.35)***		-0,214 (-2.45)*		-0,245 (-3.87)***		-0,253 (-2.63)***		
lnUNEM						-0,552 (-2.68)***	-0,390 (-2.35)***	-0,260 (-2.26)**						
lnINF									-0,043 (-2.91)***	-0,047 (-6.02)***	-0,041 (-2.75)***	-0,047 (-6.61)***		
Constant	-2,021 (-0.95)	3,684 (5.24)***	7,339 (7.49)***	11,258 (11.50)***	7,445 (7.15)***	10,637 (23.54)***	10,774 (6.47)***	13,325 (12.27)***	11,495 (6.52)***	11,232 (12.46)***	10,062 (12.01)***	13,148 (18.53)***	10,114 (12.26)***	13,171 (17.35)***
Sargan test	32,444	36,892	32,987	34,379	33,165	33,185	32,834	35,126	32,765	35,331	32,754	35,643	32,970	36,008
AR(2)	0,09	0,11	0,11	0,11	0,10	0,09	0,16	0,11	0,18	0,11	0,10	0,10	0,10	0,10
Number of Instruments	23	44	26	47	26	47	26	47	26	47	25	46	25	46
Number of Observations	771	810	771	810	771	810	771	810	771	810	674	746	674	746
Countries	37	37	37	37	37	37	37	37	37	37	37	37	37	37

*, **, *** indicate significance level at 10%, 5% and 1% respectively. The values in parentheses are t- statistics. AR (2) Arellano-Bond Test for analysing the autocorrelation existence of second order (p-value).

Finally, unemployment and inflation variables are tested as a control variable. 1% rise in unemployment rate of a country decreases FDI inflow about 0.55 % in column 7 table 2. The result show that external and internal investment is low into the country so new job opportunities cannot be created in the economy. Thus, that can be seen as a signal of macro economical disequilibrium and the country may not be seen as a suitable for future investments (Brozen, 1958). There can be many economic and political reasons behind this economic trouble.

On the other hand, INF has negative but significant impact on FDI inflow. 1% increase in inflation rate of a country decreases FDI inflow by about 0.04% at last four column. Since high or increasing level of inflation rate cause instability in the economy, foreign investors do not choose to invest in the country. The instability in the economy would cause to troublesome about prediction of future production of firms because it becomes hard to predict future sale, cost and profitability of their firms so increase in inflation rate does not motivate foreign investors to invest in that country (Rogoff and Reinhart, 2002; Narayamurthy et al, 2010).

In our empirical work, the statistics Sargan is a test of restrictions on the identifications. In general, if the null hypothesis which indicates the restriction on the identification is valid, is accepted because of the test so the test shows instrumental variables are valid. The results of AR (2) tests at both two tables show that there are no second order correlation in the models.

5. CONCLUSIONS

This study investigates determinants of FDI and the impact of currency crisis on FDI inflow in the economic freedom and trade openness condition of a country. A currency crisis or depreciation at exchange rate of a country directly affects trade and FDI since decrease in the value of national currency. Since at the currency crisis the

depreciation is 25 percent and greater relative to previous year, the market becomes cheaper for the foreign investors to make investment. Therefore, FDI inflow is expected to increase according to the economic conditions of the host country like economic growth, technology transfer, infrastructure, human capital, unemployment rate etc. In global economy FDI plays significant role because of the internalization so it is important to attract more foreign investors into the country to be active in the international trade by achieving specialization.

The results show that FDI is motivated and attracted by improvement in economic development of a country like GDP level, inflation, unemployment, and industry production. On the other hand, increase in industry production of percentage of export amount to mostly exported ten countries increases the FDI because FDI transfers technology to the home country. Besides that, increase in percentage of mostly imported ten countries attracts and motivates the FDI inflow since it indicates the country can import capital and intermediate goods to produce final goods so that supports investment and production of foreign investors by increase in import level. Moreover, results show that high level GDP per capita income attracts FDI inflows to a country as it indicates high purchasing power of citizens in the country, so this encourages foreign investors in favour of that country.

In our empirical work, human capital index has strong positive impact about attracting foreign investors to a country. It is a significant variable because it shows both education, skills, and health level of workers in a country. Therefore, the result is consistent with modern FDI Theory. The Additionally, the study shows increase of economic freedom motivates FDI inflow especially if there is currency crisis at the same time in the country. Since economic freedom contains four categories of freedom which are regulatory efficiency, rule of law, government size and open

markets, an increase average of those categories means improvement in economic development of the country. Besides, some economic fundamentals like unemployment and inflation show consistent results with theory, so increase of unemployment and inflation in economy reduces FDI inflow into the country. On the other hand, currency crisis draws foreign investors to economy because the market become cheaper relative to other countries, so their national currencies become valuable and making investment become profitable. Lastly, distance between two countries impact FDI because increase in distance decreases FDI inflow to country.

The implication of this study can be improvement of economic freedom and some other fundamentals of economy like GDP per capita income, unemployment, industry production, inflation, technology transfer and trade. The countries should imply right economic policies to benefit from opportunities of low price in the market after the currency crisis. Industry production, technology transfer, export and import should be enlarged to support FDI inflow into the country because it has significant complementary role. For instance, investors should easily transfer technology and construct infrastructure of their business model in the host country to make production or give service. Therefore, this work suggests to policy makers to address policies to support and improve export, import, technology transfer, economic freedom, human capital, income level and to reduce unemployment and inflation in the host country.

REFERENCES

- Aghion, P., Bacchetta, P. and Banerjee, A. (2001). Currency Crises and Monetary Policy in an Economy with Credit Constraints. *European Economic Review*, 45(7), 1121- 1150.
- Aizenmana, J., Noy, I. (2006). FDI, trade-two-way linkages? The quarterly review of economics. *Finance*, 46, 317-337.
- Albahi, M. SE., M. Si, Ak. (2016). Export- Import and Foreign Direct Investment Indonesian Economic Study. *Journal of Economics and Finance*, 7, 37- 44.
- Anderson, J., 1979. A theoretical foundation of the gravity model. *Am. Econ. Rev.*, 69, 106- 116.
- Anderson, J.E., Van Wincoop, E. (2003). Gravity with gravitas: a solution to the border puzzle. *Am. Econ. Rev.*, 93 (1), 170-192.
- Arellano, M., Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and Application to Employment Equations. *Review of Economic Studies*, 58, 277-297.
- Arellano, M., Bover, O. (1995). Another look at the instrumental variable estimation of error- components model. *Journal of Econometrics*, 68, 29-51.
- Bengoa, M., Sanchez- Robles, B. (2003). Foreign Direct Investment, economic freedom, and growth: new evidence from Latin America. *European Journal of Political Economy* 19, 529-545.
- Bergstrand, J.H. and Egger, P. (2007). A Knowledge and Physical- capital Model of International Trade Flows, Foreign Direct Investment and Multinational Enterprises. *Journal of International Economics*, 73, 278- 308.

- Blonigen, B. (1997). Firm Specific Assets and the link between exchange rates and foreign direct investment. *American Economic Review*, 87, 447-465.
- Blundell, R., Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Economics*, 87, 115- 143.
- Blundell, R., Bond, S. (2000). GMM estimation with persistent panel data: an application to production functions. *Econometric Reviews*, 19, 321-340.
- Brozen, Y. (1958). Means of maintaining economic stability. The University of Chicago.
- Dickey, D., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time-series with a unit root. *Journal of the American Statistical Association*, 74, 427–431.
- Buckley, P. J., & Casson, M. C. (1976). The future of the multinational enterprise. London: Macmillan.
- Callen, T. (2008). Back to Basics. What Is Gross Domestic Product? Finance & Development Available at:
<http://www.imf.org/external/pubs/ft/fandd/2008/12/pdf/basics.pdf>
- Caves, R.E. (1971). International Corporations: The Industrial Economics of Foreign Investment. *Economica*, February 1- 27.
- Cushman, D.O. (1985). Real Exchange Rate Risk, Expectations, and the Level of Direct Investment. *Review of Economics and Statistics*, 67 (2), 297-308.
- Dunning, J. H. (1973). The determinants of international production. Oxford Economic Papers
- Dunning, J. H. (1980). Toward an eclectic theory of international production: Some empirical tests. *Journal of International Business Studies*, 11.

- Dunning, John H. (1988). The Eclectic Paradigm of International Production: A Restatement and Some Possible Extensions. *Journal of International Business Studies*, 19(1), 1-31.
- Economou, F. (2019). Economic Freedom and asymmetric crisis effects on FDI inflows: The case of four South European economies. *Research in International Business and Finance*, 49, 114-126.
- Edison, H. (2003). Do Indicators of Financial Crises Work? An Evaluation of an Early Warning System. *International Journal of Finance and Economics*, 8(1), 11-53.
- Eichengreen, B., Rose, Andrew K. and Wyplosz, C. (1995). Speculative Attacks on Pegged Exchange Rates: An Empirical Exploration with Special Reference to the European Monetary System. NBER Working Papers, 4898.
- Feenstra, R. (2004). *Advanced International Trade: Theory and evidence*, Princeton, NJ: Princeton University Press.
- Fontagne, L. (1999). Foreign Direct Investment and International Trade: Complements or Substitutes? OECD Science, Technology, and Industry Working Papers, 3.
- Froot, K. and Stein, J. (1991). Exchange rates and foreign direct investment: an imperfect capital markets approach. *Quarterly Journal of Economics*, 106, 1191–1217.
- Frankel, J. and Rose, A. (1996). Currency Crashes in Emerging Markets: An Empirical Treatment. *International Finance Discussion Papers*, 534.
- Glick, R. and Hutchison, M. (2001). Banking and Currency Crises: How Common are Twins? In Glick, R., Moreno, R. & Spiegel, M. M. (eds.) *Financial Crises in Emerging Markets*, Ch. 2, Cambridge, UK: Cambridge University Press.

- Federal Reserve Bank of San Francisco Center for Pacific Basin Studies
Working Paper, No. PB99-08. Federal Reserve Bank of San Francisco.
- Glick, R. and Hutchison, M. (2005). Capital Controls and Exchange Rate Instability in Developing Economies. *Journal of Money and Finance*, 24(3), 387- 412.
- Glick, R. and Hutchison, M. (2006). Currency crises, capital account liberalization, selection bias. *Review of Economics and Statistics*, 88(4), 698- 714.
- Goldberg, L.S., Klein, M.W. (1997). Foreign direct investment, trade and real exchange linkages in southeast Asia and Latin America. Working Paper, 6344.
- Harris, R. S., Ravenscraft, D. (1991). The role of acquisitions in foreign direct investment: evidence from US stock market. *Journal of finance*, 46, 825- 844.
- Helpman, E., Melitz, M. J. and Yeaple, S.R. (2004). Export Versus FDI with Heterogeneous Firms. *American Economic Review*, 94, 300-316.
- Hennart, J.F. (1982). *A Theory of the Multinational Enterprise*. University of Michigan Press, Ann Arbor.
- Hoshi, T., Kiyota K. (2019). Potential for inward foreign direct investment in Japan. NBER working paper series, 25680.
- Hymer, S. (1976) (1960 dissertation). *The International Operations of Nation Firms: A Study of Foreign Direct Investment*. Cambridge, MLT Press.
- Ietto-Gillies, G. (2005). Dunning's eclectic framework, in Grazia Ietto- Gillies (org.) *transnational corporations and international production*. Edward Elgar Publishing.
- Im, K.S., Pesaran, M.H., & Shin, Y. (2003). Testing for unit roots in heterogenous panels. *Journal of Econometrics*, 115, 53-74.
- Itagaki, T. (1981). The Theory of the Multinational Firm under Exchange Rate Uncertainty. *The Canadian Journal of Economics*, 14 (2), 276- 297.

- Kahouli, B., Maktouf, S. (2015). The determinants of FDI and the impact of the economic crisis on the implementation of RTAs: A static and dynamic gravity model. *International Business Review*, 24, 518-529.
- Kaminsky, G. and Reinhart, C. (1999). The twin crises: the causes of banking and balance of payments problems. *American Economics Review*, 89(3), 473-500.
- Kaminsky, G., Lizondo, S. and Reinhart, C. (1998). Leading indicators of currency crises. *IMF Staff Papers*, 45(1), 1-48.
- Kapuria-Foreman, V. (2007). Economic freedom and foreign direct investment in developing countries. *The Journal of Developing Areas*, 143-154.
- Keller, W., Yeaple, S.R. (2009). Gravity in the Weightless Economy. NBER Working Paper, No.15509.
- Krugman, P. (1979). A Model of Balance of Payment Crises. *Journal of Money, Credit and Banking*, 11, 311-25.
- Kahouli, B., Omri, A. (2017). Foreign direct investment, foreign trade and environment: new evidence from simultaneous-equation system of gravity models. *Research in International Business and Finance*, 42, 353-364.
- Leamer, Edward E. and James L. (1995). International Trade theory: The Evidence in Gene M. Grossman and Kenneth Rogoff, eds. *Handbook of International Economics*, vol.3 Amsterdam: Elsevier Science B.V.
- Levin, A., Lin, C.- F., & Chu, C- S.J. (2002). Unit root tests in panel data: asymptotic and finite- sample properties. *Journal of Econometrics*, 108, 1-24.
- McKinnon, R. and Pill, H. (1995). Credible Liberalizations and International Capital Flows: The 'Overborrowing Syndrome'. In *Financial deregulation and*

- integration in East Asia, Ito, T.& Krueger, A.O. (eds.). Chicago: University of Chicago Press.
- Mebratu, S., Renshui, W., Jihong, L. (2014). Foreign direct investment, trade openness in Sub-Saharan economies: A panel data granger causality analysis. *South African Journal of Economics*, 82, 402-421.
- Milesi-Ferretti, G., and Razin, A. (1998). Current Account Reversals and Currency Crises: Empirical Regularities. NBER Working Paper Series, 6620.
- Mina, W. M. (2012). The institutional reforms debate and FDI inflows to the MENA region: The “best “esemble. *World Development*, 40, 1798-1809.
- Nawaz, H., Bilal, K. (2013). Impact of Human Capital Growth on FDI: an econometric analysis. *Finance Management*, 65C, 19712- 19716.
- Narayanamurthy, V., Perumal S. and Kode, C.S. (2010). Determinants of FDI in BRICS Countries: A panel analysis. *International Journal of Business Science and Applied Management*, 5, 1 – 13.
- Newman, C., Rand, J., Talbot, T. and Tarp, F. (2015). Technology transfers, foreign investment, and productivity spill overs. *European Economic Review*, 76, 168-187.
- Nickell, S., 1981. Biases in dynamic models with fixed effects. *Econometrica*, 49
- Noorbakhsh, F., Paloni, A., & Youssef, A. (2001). Human capital and FDI inflows to developing countries: New empirical evidence. *World development* 29, 1593-1610.
- Obstfeld, M. (1986). Rational and self-fulfilling balance of payments crises. *American Economic Review*, 76 (1), 72- 81.
- Obstfeld, M. (1994). The Logic of Currency Crises. *Cahiers Economiques et Monetaires*, 43, 189- 213.

- Osinubi, T. S. and Amaghionyeodiwe, L. A. (2009). Foreign direct investment and exchange rate volatility in Nigeria. *International Journal of Applied Econometrics and Quantitative Studies*, 2, 83–116.
- Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regressions. *Biometrika*, 75, 335–346.
- Quazi, R.M. (2007). Foreign Direct Investment in Latin America: A Panel Regression Study. *International Journal of Business and Finance Research*, 1(1), 59-67.
- Raimondi, V., Olper, A. (2011). Trade elasticity, gravity, and trade liberalization: evidence from the food industry. *J.Agric. Econ.*, 62 (3), 525-550.
- Rogoff, K. and Reinhart, C. (2002). FDI to Africa: The role of price stability and currency instability. *The Annual World Bank Conference on Development Economics*, April 29-30, 2002. IMF
- Ruiz, J., M., Vilarrubia J., M. (2007). The wise use of Dummies in Gravity Models: Export Potentials in the Euromed Region. *Bancode Espana. Documentos de Trabajo*, 0720.
- Rugman, A.M. (1981). *Inside the Multinationals*. London: Croom Helm.
- Brozen, Y., 1958. Means for Maintaining Economic Stability. *Journal of Farm Economics*, 40, 1069-1078.
- Vernon R. (1966). International investment and international trade in the product cycle. *Quarterly Journal of Economics*, 80, 190-207.
- Wang, J. (1990). Growth technology transfer, the long-run theory of international capital movements. *Journal of International Economics*, 29, 255-271.

Walch, N., Wörz, J. (2012). The Impact of Country Risk Ratings and of the Status of EU Integration on FDI Inflows in CESEE Countries. Focus on European Economic Integration, 3, 8-26.

APPENDIX A

In the appendix in Table 3 below we show list of countries that are used in data. In Table 4 some descriptive statistics are demonstrated and table 5 shows correlations between variables. In table 6 panel unit root tests are presented. In the figure 1 and 2 we figured out the net FDI inflow of the countries and observed currency crisis at the period 1995- 2017 at individual countries in the dataset. Figure 3 shows average fluctuations of the trade indexes and FDI.

Table 3. List of countries considered

Turkey	Portugal	Estonia	Slovak Rep	Brazil	France	Hungary	Switzerland
Austria	Iceland	Finland	Italy	Norway	Germany	Poland	Australia
United States	Mexico	Sweden	Spain	Slovenia	New Zealand	China	
United Kingdom	Canada	Ireland	Latvia	Denmark	Chile	Czech Republic	
Belgium	Japan	Netherlands	Luxembourg	Israel	India	Greece	

Table 4. Descriptive Statistics

[illegible]

Table 5. Correlation between variables

	1	2	3	4	5	6	7	8	9	10	11
1 FDI	1										
2 GDPR	0,13	1									
3 XR	0,61	0,02	1								
4 MR	0,68	-0,03	-0,13	1							
5 HC	0,06	0,69	-0,05	-0,08	1						
6 ECOFREE	0,11	0,68	-0,15	-0,11	0,66	1					
7 CRISIS	-0,14	-0,16	-0,13	-0,11	-0,06	-0,10	1				
8 ECOCR	-0,14	-0,15	-0,13	-0,10	-0,05	-0,09	1,00	1			
9 UNEMP	-0,15	-0,07	-0,11	-0,19	0,04	-0,18	0,06	0,06	1		
10 INF	-0,19	-0,34	-0,12	-0,11	-0,41	-0,29	0,34	0,33	0,02	1	
11 DIST	-0,07	-0,38	0,08	0,27	-0,30	-0,08	0,07	0,07	-0,11	0,10	1

APPENDIX B

Stationarity and Unit Root Tests

Stationarity is a primary property that a time series should have, so determining stationarity is significant for research while beginning an analysis. Mostly, it is observed that in time series datasets estimators are weakly stationary. Weakly stationarity is defined as time- invariance of time series data at mean, variance and autocovariance.

In general series are nonstationary because of the trend component results. It is important to identify if the series have stochastic or deterministic trend to apply appropriate transformation method to have stationary series. For instance, stochastic trend is eliminated by differencing the series but in deterministic trend differencing the series cause a unit root in the moving average process.

Unit root process suppose the null hypothesis which shows a random walk and a random walk with a drift is a right process.

Let a random walk and random walk with a drift expressed as below:

$$y_t = y_{t-1} + \epsilon_t, \quad y_t = \alpha + y_{t-1} + \epsilon_t \quad (7.1.1)$$

Let's show AR (1) model as following.

$$y_t = \phi y_{t-1} + \varepsilon_t \quad (7.1.2)$$

Where ε_t is independent and distributed identically with $N(0, \sigma^2)$ distribution.

Besides, the null hypothesis indicates that $\phi = 1$ and the alternative hypothesis shows

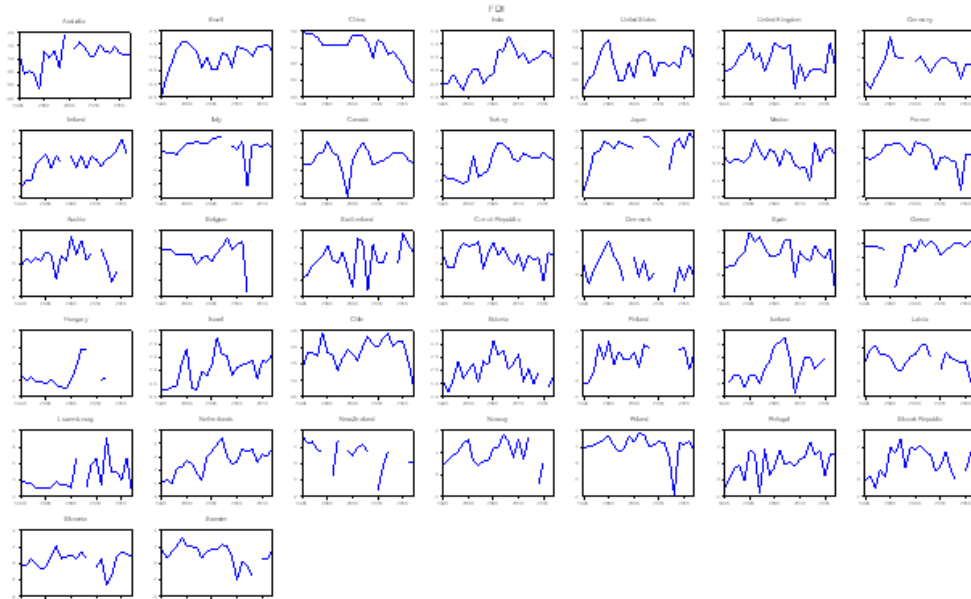
$$|\phi| < 1.$$

If it is needed to mention about meaning of value of ϕ . When the ϕ takes 1, the sample size is going to increase, the OLS estimator become closer to the true value of 1 if the process is stationary. However, the value has asymptotic distribution and nonstandard in its estimators and usual t tests of those estimators become invalid.

On the other hand, deterministic terms change according to their constants and time trend in regression so numerous asymptotic distributions occur for the test statistic. Thus, this emphasizes the significance of determining the null or alternative hypothesis.

Table 6. Panel Unit Root Tests

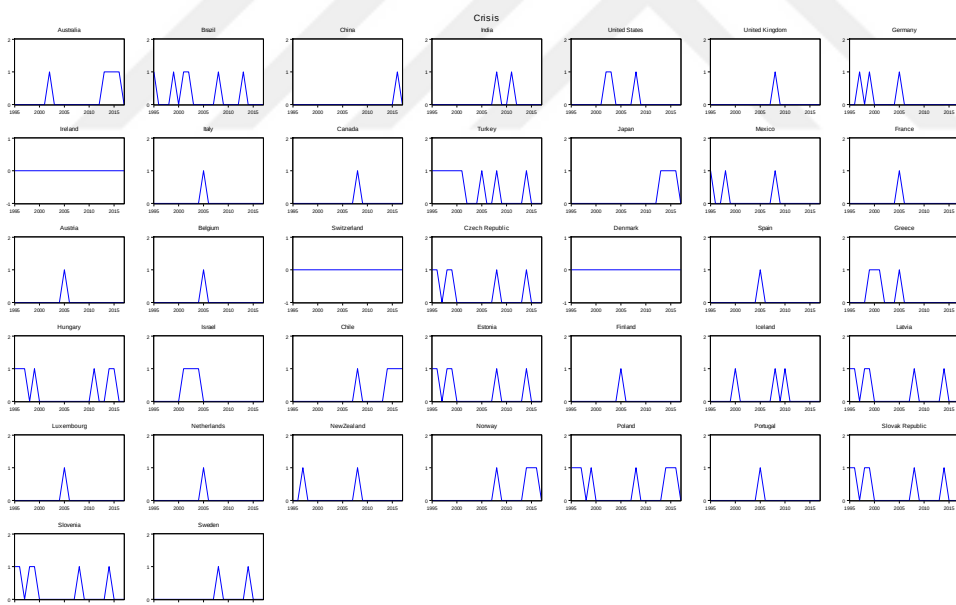
Panel Unit Root tests										
Level	lnFDI	lnGDPR	lnHC	lnXR	lnMR	lnECOFREE	CRISIS	lnECOCR	lnINF	lnUNEMP
Levin, Lin & Chu t	-5.18***	-0.18	-3.17***	-3.69***	-2.76***	-0.53	-14.52***	-14.53***	-7.00***	-1.73**
Im, Pesaran and Shin W-stat	-5.70***	0.91	-0.23	-3.54***	-1.86**	-1.40*	-14.32***	-14.28***	-5.79***	-3.23***
ADF - Fisher Chi-square	150.35***	51.12	90.92*	120.09***	96.58**	93.78*	288.90***	288.01***	184.35***	113.00***
PP - Fisher Chi-square	233.36***	24.16	72.94	104.26***	92.83*	97.14**	292.89***	292.58***	170.73***	41.47
Difference										
Levin, Lin & Chu t	-14.58***	-8.87***	-160.47***	-21.43***	-17.98***	-16.80***	-16.16***	-24.67***	-10.06***	-10.57***
Im, Pesaran and Shin W-stat	-17.05***	-5.30***	-70.50***	-19.34***	-16.86***	-17.17***	-19.18***	-25.20***	-13.79***	-8.35***
ADF - Fisher Chi-square	406.73***	136.55***	193.31***	423.12***	369.45***	383.42***	293.78***	467.35***	303.81***	195.84***
PP - Fisher Chi-square	791.05***	170.61***	53.36	874.61***	1019.56***	492.76***	1851.19***	4014.64***	776.45***	190.53***



Source: Author's calculation

Figure 1. Net FDI Inflow of Countries at period 1995- 2017

Note: The figure shows net FDI inflow of data countries from 1995 to 2017.



Source: Author's calculation

Figure 2. Currency Crisis of Countries at the period 1995- 2017

Note: The figure shows currency crisis years of data countries from 1995 to 2017.

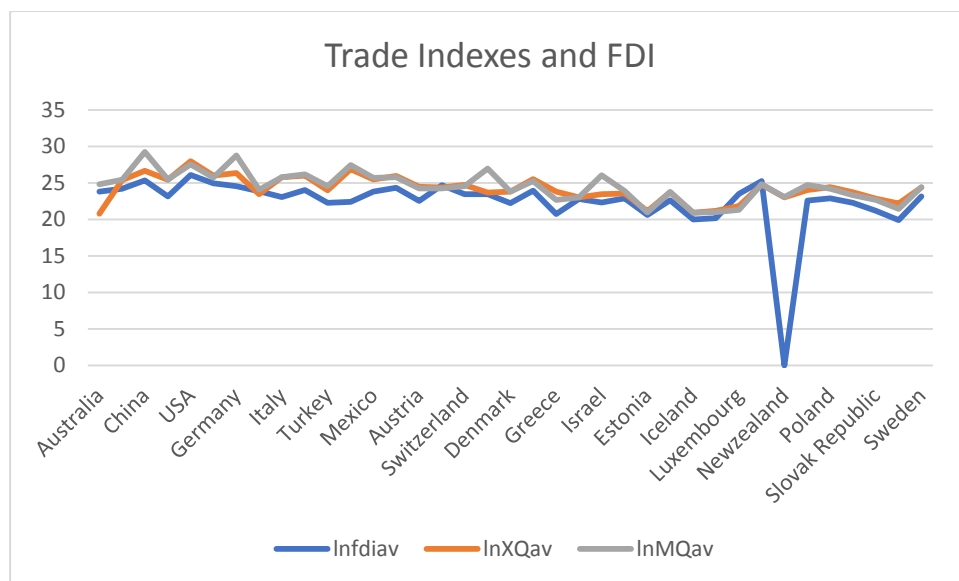


Figure 3. The Average of Trade Indexes and FDI

Note: The figure shows average value of logarithmic form of trade indexes and FDI value of data countries. The fluctuations of the indexes are parallel almost all countries with the fluctuations of FDI inflows.

Source: Author's calculations

CHAPTER 2: Determinants of Intra-industry Trade in cross Country Analysis

ABSTRACT

Intra- industry trade (IIT) has crucial part in the international trade issue especially after increase demand in differentiated goods in global economy in the world. IIT has found wide explanation field in the new trade theory in the literature. This paper analysis Intra-Industry trade level of 40 countries from different part of the world by eight goods in the period from 2002 to 2018. Additionally, the determinants of IIT are investigated on those eight different products by Tobit regression model. IIT index is measured by its natural basis of the Grubel-Lyod index. The results show

that difference in economic size of trade partners, market demand, exchange rate level, R&D spending, distance had adverse effect on IIT. On the other hand, foreign direct investment, trade openness and education spending were observed to support IIT in both finished and raw goods. Finally, economies of scale are observed at IIT in average of eight products as a positive determinant for increasing IIT level of those products in our model.

Keywords: Tobit Model, Intra-Industry Trade, Trade, Product Differentiation, Monopolistic Competition, Economies of Scale

6. INTRODUCTION

Trade has significant and huge contribution in the economic activity and wealth of countries around the world. Some Asian countries like Japan, Taiwan, Korea, and Singapore have depended on their quick economic growth to export-oriented development. On the other hand, developed countries have great bring-in from international trade like US, Germany, France, and England etc. Trade creates many links between cultures and countries. Hence raising the interaction between trade partners provide economical advantage to both of two countries and improvement in wealth of countries.

Recently, countries have started to produce same or similar industrial products and make those products trade between them. In this content, intra- industry trade (IIT) has been rose and become popular and crucial part of the international trade. IIT is often supposed to make between developed countries since they have similar capital-labour ratios and factor endowments besides developing countries are into inter-industry trade with labour- intensive production in final manufactured goods.

The goal of this article is investigating intra-industry trade of various kind of goods in different pattern of countries and identifying their determinants. The index is measured in its natural basis of bilateral trade and goods in the research consist of both raw and manufactured goods for all eight categories of Standard International Trade Classification (SITC). Additionally, the analysis comprises of a broad sample of 40 countries from different parts of the world like US, Germany, England, India, China, and Russia etc. Also, period is widely taken from 2002 to 2018 which is rarely used in searches in the literature. Finally, the effects of foreign direct investment, openness, GDP difference, inflation, exchange rate, distance, education expenditure and R&D expenditure are tested with Tobit regression model to get more robust and consistent results.

Our results present that difference in economic size of countries has negative effect on IIT at average of all eight goods. Foreign direct investment (FDI) has positive impact on IIT because FDI supports export in total trade. In addition, education and R&D spending, distance, economies of scale, market demand and openness are significant determinants of IIT. Education spending have positive effect, but R&D spending has negative effect on IIT because of most of those spending consists of the technology investments. Inflation do not have an influence on IIT. Lastly, exchange rate has small negative effect on IIT.

The organization of the chapter is respectively section nine presents literature review. Section 10 shows methodology of measurement of IIT and regression model to estimate determinants of IIT. Section 11 represents results of the estimation model for 40 countries of the sample for the eight SITC categories. Finally, section 12 gives the conclusions of the research.

7. LITERATURE REVIEW

Intra industry trade is one of the popular subjects in the literature as it is compared with the inter industry trade. The first investigation concern to the issue is Balassa in 1966. Early works often focused on the measurement of intra industry trade and extent of its specialisation. Afterwards, intra-industry trade theory was improved widely and much more investigations were made on the issue of determinants of intra-industry specialisation. Balassa and Bauwens (1987) studied on many different hypotheses of determinants of intra-industry trade specialisation of manufactured goods with common and country characteristics additionally industry characteristics. They indicate average income level, trade orientation, average country size, common borders, product differentiation, being in a trade union positively and offshore procurement affect the extent of intra-industry trade positively but tariff dispersion, income inequality, distance, foreign direct investment, and inequality in country size affect negatively. Similarly, Bergstrand, 1990; Balassa, 1986; Loertscher and Wolter, 1980 focused on determinant of intra-industry trade on industries so scale economies, categorical aggregation, product differentiation and standardization, market power, tariff protection and distance were shown as correlated variables.

There are several empirical works on IIT in the literature. Some type of studies is concern about levels of IIT Asian countries. In those kinds of studies China is the main country because of its greatest potential in the field. Zhang, Witteloostuijn & Zhou (2005), Hu and Ma (1999) and Zhang and Li (2006) investigated the magnitude of China's IIT in manufactured goods and also its determinants of IIT at that field in 1990s. Additionally, to China, Japan (Xing, 2007), Korea (Lee & Han, 2008) and India (Veeramani, 2002; Das, 2005) are another significant

trade actor at the region so, the analysis of IIT on those countries are extensively investigated in the literature.

On the other hand, investigations in the literature are mainly on IIT in Asian region and trade blocs that are mostly about East Asian countries and the ASEAN. According to Thorpe and Zhang (2005) analyse determinants of IIT in manufactured goods in East Asia and their IIT level. They show that IIT index level grew from 24 to 50 percent during the period 1970 to 1996. The result comes out because Asian countries are major beneficiary of international fragmentation of production and vertical specialization of production (Ando, 2006; Wakasugi, 2007). However, East Asian countries have more dependence on international specialization than Europe and North America (Athukorala and Yamashita, 2006). In addition to Cortinhas (2007), Sohn and Zhang (2005) show that IIT improves economic integration between East Asian countries and among ASEAN¹⁰ members. So that shows IIT is the major factor of business cycle in this field by construction of multinational companies' supply chain and production network (Rana, 2006, 2007).

Most of the studies in the literature are concern about correlations in intra industry trade issue rather than its determinants because of that the theoretical base of those studies are generally not clear. However, Helpman (1987) work on an intra industry trade study that depend on monopolistic competition model. Hummels and Levinsohn (1995) studied on Helpman's work, and they show that IIT is mostly depend on the country and its trade partner.

The IIT theory is an extension of Heckscher- Ohlin (H-O) trade theory and it takes part in the new trade theories which show that monopolistic competition puts

¹⁰ The Association of Southeast **Asian** Nations (**ASEAN**) is a regional grouping that promotes economic, political, and security cooperation among its ten **members**: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam.

forward an idea of 'economies of scale and product differentiation are factors that are improve the volume of IIT'. Furthermore, Helpman and Krugman (1985) extended the IIT theory also Markusen and Venables (1998- 2000) show that FDI is a crucial determinant that increase the volume of IIT. However, the previous studies like Hughes (1993), Greenaway et al. (1994) and Bernhofen (1999) consider the effects of economies of scale and product differentiation, but they missed the positive effect of FDI on volume of IIT. In manufacturing sectors, the exclusion of FDI in IIT models, causes misspecification in the results. Additionally, the market openness is missed to include in the IIT models at previous investigations according to Leamer (1988) and Harrigan (1994, 1996) the market openness is significant determinant and contributor of the volume of IIT.

Stone and Lee (1995) investigate the determinants of IIT especially indicating differences between manufacturing and non-manufacturing countries and changes of their results after sometimes. They show demand for product differentiation, scale economies and trade orientation have positive effects, but distance and trade imbalances have negative effects on IIT. However, the investigation also presents the structural coefficients are different for manufacturing and non- manufacturing countries, the coefficient differences are mainly on distances and trade imbalance variables. Furthermore, Clark and Stanley (1999) demonstrate determinants of IIT between US and developing countries in country and industry- level. They indicate that more relative factor endowment causes less IIT. Results present vertically differentiated, made to order, nonstandard, labour incentive products that are manufactured by globally integrated industries extend IIT.

7.1. Type of Market Structure

Market structure is defined by the number of suppliers and other specialities that markets have, so there are four types of market structure in the literature.

- Perfect Competition
- Pure Monopoly
- Monopolistic Competition
- Oligopoly

7.1.1. Perfect competition.

Perfect Competition is a type of market that have an excellent competition conditions between buyer and seller, so it is an idealistic market. We mention about some crucial properties of this market.

- Atomicity: There are lots of buyers and sellers that cannot affect or change the price of products.
- Homogeneity: There is homogeneity between buyers, sellers, and products, thus they are same.
- Mobility: Entrance in the market and exit from the market is not blocked.
- Openness: All the decision units have same information, so there is clarity and transparency in the market.
- All products have one price, so buyers and sellers must accept the price.

7.1.2. Pure monopoly.

Monopoly emerges when a product which cannot be substituted by another product, is produced, or sell by one company in a market. It is supposed that there are “n” number of buyers against one seller. This market is also named as “*Monopoly of*

Seller” and has two fundamental specialities. One is the product that is supplied by a monopoly do not have substitute good. Second is another firm cannot enter the market, the market does not have mobility. The monopoly may rise because of increasing scale of a firm in the market, so decreasing its average per unit cost and reaching optimal scale of production the firm become monopoly of the market.

Sometimes there is one seller and one buyer in the market, this market is called as “*Bilateral Monopoly*”. Also, it is observed that buyers can dominate a number of buyers in the market, so it is called “*Buyer’s Monopoly*”. Occasionally, one firm buys a product from large number of producers and sell them to large number of consumers, thus the firm become monopoly both from the buyers and sellers’ side and it is called “*Double Monopoly*”. Besides there are some legal and juridical reasons of monopoly in a market.

- Fiscal objective legal monopolies: Production of some goods are provided by government to procure income for it.
- Social objective legal monopolies (Licenses and Privileges): Some social services are supplied by government to give highest quality of service to public and prevent high prices because of competition between different companies for instance electricity and natural gas distribution.
- Jural objective legal monopolies (Patent and Copyright): A firm has a monopoly power when it has patent or copyright by its new inventions.

7.1.3. Monopolistic competition.

In real world most markets have properties between the extremes of perfect competition and monopoly. Most of firms have power to put their prices as monopoly do and they have competition to enter the market like perfect competition do. This

kind of markets that have those firms are called monopolistic competition. Therefore, some characteristics of the monopolistic competition are

- Many companies compete in the market
- Every company produces a differentiated product
- Companies compete on price, product, and marketing
- Enter and exit to the market is free

7.1.3.1. Large number of firms.

In the market of monopolistic competition like in perfect competition market, the industry has many firms, and these companies have three implications. Those firms have small market share in the market, so they can only effect price of their products. They have little influence on market price. Besides that, firms have no market dominance thus single firm cannot dictate market conditions and directly affect the actions of other firms. Also, collusion is impossible, firms sometimes do illegal agreements to fix prices, but this situation is impossible when there are large number of firms in the market.

7.1.3.2. Product differentiation.

In monopolistic competition each firm produces products that are slightly different from their competing firms. Their products do not have perfect substitution, but they have close substitution. Those products differentiate from each other by colour, smell, packing and pattern. Some people will pay more for one variety of the product, so the demand decreases when its price increases. For instance, Adidas, Nike, New Balance, Puma and Reebok¹¹ are made differentiated running shoes. Therefore, product differentiation supports intra-industry trade because it increases product variety in the industry.

¹¹ Adidas, Nike, New Balance, Puma and Reebok are brands those have most market percentage in sports footwear in the world and they compete.

7.1.3.3. Competing on quality, price, and marketing.

Firms in monopolistic competition compete each other by price, quality, and marketing. The quality makes difference in the physical attributes of products. That means products can differentiate between each other by design, accessibility of product, reliability and the service provided to buyer. The quality of a product determines by high to low.

In monopolistic competition, firms have downward-sloping demand curve because of product differentiation. Since there is trade-off between the products quality and price, a firm that produces high quality product can set higher price than a firm that produces a low-quality product.

A firm must market its product in monopolistic competition because of product differentiation. Marketing consists of advertising and packaging. A firm that produces a high-quality product so its product has high price should make suitable packing and advertising to convince consumers. On the other hand, low-quality products have suitable packing and advertising to convince its consumers. Marketing is crucial for monopolistic competition market because products have small differences each other so consumer should accept that the product cannot substitute with other firms' product. Thus, firms have many marketing costs in monopolistic competition market.

7.1.3.4. Entry and exit.

In monopolistic competition, firms can freely enter the market. Firms stay in the market if they have continued economic profit. This entry cause decrease in prices and economic profit. Some firms leave the market because of economic losses. In the long-run, firms neither enter nor leave the industry the industry and the firms make zero economic profit.

7.1.4. Oligopoly.

The Oligopoly market has a few numbers of seller and “n” number of buyers. Those sellers are very few numbers in the market, so they can affect each other’s decision and market. When there are two seller and lots of buyer, it is named as “*Duopoly*”. If there are three number of sellers and a lot of buyers, it is called by “*Triopoly*”. Since the entrance in the market is prevented because of scale and cost advantage and limited price policy, there are few firms the market. Additionally, companies have dependency in their decision of advertisement, production amount and price among each other, so they are very few firms which they can affect each other’s decision.

7.2. Economies of Scale

Firms increases their production capacity in the long run by rising their scale of production plant and decrease their average cost per unit of production. We can show the output and cost relationship by a graph below.

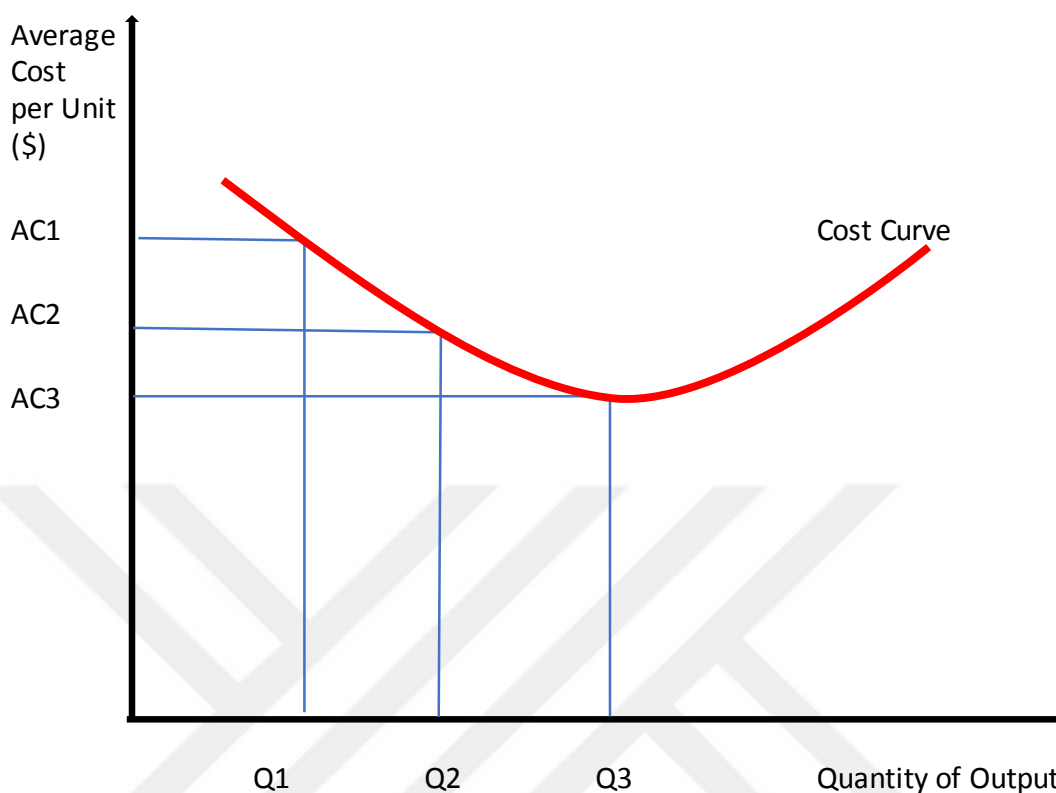


Figure 4. Average Unit Cost in Economies of Scale¹²

The reduction in average cost per unit comes out since firms have some internal and external savings that are named as “*Internal Economies of Scale*” and “*External Economies of Scale*”.

The reasons of Internal Economies of Scale are divided four groups.

7.2.1. Internal economies of scale.

7.2.1.1. Dividing production process and specialization.

Rising in scale of production plant causes in division of production process and specialization among labours which is known from Adam Smith. Division in production process and specialization are one of the crucial factors that induce in increase of

¹² The graph shows per unit cost of production in the long run.

production productivity. This increase in productivity arises from specialization of labours at doing same work and not wasting time between different works.

7.2.1.2. Technological advantages.

Large firms can exploit from new technological improvements and decline their cost of unit production because their production is large scale but for small firms using technological improvements in production increases their cost of production so they cannot exploit from technology advantage and increase productivity of production.

7.2.1.3. Managerial Advantages.

Increase in firms' production scale cause in decline of unit cost production per management unit. Not only management group cost declines but also unit cost of devices in firms are decreased.

7.2.1.4. Financial Advantages.

Input needs and marketing amount of goods by firms increases in large scale production firms. This increase provides bargain power to firms and other marketing advantages in market like discount in raw goods, finding low interest credit, cheap transportation, and advertising advantages.

7.2.2. External economies of scale.

Increase in number of firms in an industry provides to rise in volume of production in the industry so that causes decrease in cost of production in this industry since those firms benefit from some advantages that are formed in the industry because of the external economies of scale. These advantages can be explained in four group.

7.2.2.1. Advantages from intermediate goods.

Firms can have advantages from buying intermediate goods from producers that are produced those intermediate goods by low cost than themselves for instance firms that produce car, plain, television etc. generally takes many intermediate goods from other producers.

7.2.2.2. Advantages of specialized manpower.

Firms can find qualified and specialized labour force from the industry that it gives services other wives it needs to teach the labour force that it needs for production.

7.2.2.3. Advantages of purchased services.

Increase in number of firms in an industry supports to raise of other firms which give service to them on variety of issue such as logistic firms, law offices, financial advisory firms, advertising firms and research offices.

7.2.2.4. Advantages of plant and services of infrastructure.

Infrastructure services are completed by government primarily with improvement of an industry in a region for example road, electricity, water, communication, and sewer system are significant factors that decline cost of production in a firm.

7.3. Intra-Industry Trade Theory

Lancaster and Krugman (1979) indicate a market and firm structure to explain intra- industry trade in international trade. According to Lancaster and Krugman, manufacturers supply their products with new brands to the market because there is a demand for differentiated products of variety of brands, so it is profitable for the producer to differentiate their products from their competitive producers. These firms use fix cost to face development, advertisement and marketing expenditures of product while

penetrating to the market. Therefore, in the integrated world market, every country has specialization at different part of production of a brand

The country has a demand structure which contains variety of demand of consumers and demand of producers to intermediate inputs. Since every country specializes at different part of production, it will import other products that are not manufactured at home country from other countries, so this gives rise to intra-industry trade. The theory is formally expressed on multisector model by Dixit and Norman (1980), Lancaster (1980), Helpman (1981) and Ethier (1982). They show a critical distinction between intersectoral and intra-industry trade which was different from the previous formulations. Those workings developed the Chamberlin's (1933) idea on monopolistic competition in horizontally differentiation products and preferences of ideal variety of production. That research results in significance of preference because of its ability to supply brand- specific demand function and elasticities of demand.

The fundamental determinants of this approach in the integrated world economy all countries have same technology and factor inputs move freely around the world. Additionally, it supposes that an industry can manufacture different variety of brands and countries production functions on a specific brand are same. Producers equate marginal revenue to marginal cost to maximize their profit. In systematic equilibrium all brands in an industry have equal quantity and price. On the other hand, Chamberlin indicated that with free entry to the market causes to zero profit for the firms then prices are equal to unit cost. Those two price equilibriums are for competitive constant returns industries not for increasing return industries supply differentiated goods. Following price calculations contained specification of product market-clearing conditions. Thus, price calculations

consist of factor reward, output per brand in every sector, the number of brands in every sector and allocations of inputs at different sectors.

The intra- industry trade approach has risen with product differentiation and economies of scale. Firms produce very similar products with their rival firms those products substitute each other easily. Generally, these differentiated products distinguish between them by colour, smell, packing, marketing, or pattern. In this approach, firms have a large advertisement cost to convince consumers that their product is indispensable. Economies of scale is another notion at intra-industry trade approach. As we mentioned before, firms take advantage of external and internal economies of scale and increase their revenue by decrease in unit cost with the increase in total production amount.

8. DATA and METHODOLOGY

Our investigation on determinants of intra-industry trade is consist of 40 countries. We use tobit model¹³ to receive more robust and consistent results. To estimate the determinants of IIT, we use the standard Grubel-Lloyd Index (Grubel&Lyod, 1975).

Let's see GL index.

$$IIT_c = 1 - \frac{|X_c - M_c|}{X_c + M_c} \quad (8.1)$$

The research model for analysing determinants of IIT and patterns on various kind of products¹⁴, we use the model below.

$$IIT_{c,i,t} = \beta_0 + \beta_1 GDP_{c,i,t} + \beta_2 DIFGDP_{i,t} + \beta_3 FDI_{i,t} + \beta_4 EXR_{i,t} + \beta_5 EDU_{i,t} + \beta_6 OPEN_{i,t} \\ + \beta_7 R\&D_{i,t} + \beta_8 DIST_{i,t} + \beta_9 INF_{i,t} + \beta_{10} LFIP_{i,t} + \mu \quad (8.2)$$

¹³ The data fits with mixed effects model because censoring limits may be fix for all observations or vary across observations. Thus, multi-level tobit model mixed effects tobit regression (metobit) is used at Stata.

¹⁴ The explanations of eight products and their average IIT value graphs are represented in Appendix C.

The dependent variable¹⁵ is linear natural IIT index. $IIT_{c,i,t}$ shows IIT value of commodity c in country i at year t . Besides that, on the right-hand side of the equation, first variable is $GDP_{c,i,t}$ which presents per capita gross domestic product of country i at year t . $DIFGDP_{i,t}$ indicates difference GDP of country i with its biggest three trade partner at year t . The variable is crucial to test the economic size differences effect of countries on IIT. Helpman and Krugman (1985) have presented in their investigation that the volume of IIT increases with decrease in the difference of economic size of countries. Additionally, Balassa and Bauwens (1988) have used the natural logarithm of the relative difference between the GDP of countries to measure the demand for differentiated goods like Helpman.

Let's write index of GDP difference as below.

$$DIFGDP = \frac{GDP_{ht} - GDP_{ft}}{GDP_{ht} + GDP_{ft}} \quad (8.3)$$

At this equation GDP_h represents GDP value of home country and GDP_f shows the average GDP of three trade partners those of highest trade volume with the home country.

$FDI_{i,t}$ demonstrates total foreign direct investment inflow of country i at year t . FDI is significant as its export-oriented role in the economy, so it affects IIT. We take net inflow of FDI as a percentage of GDP in the model. $R\&D_{i,t}$ represents research and development expenditure in country i at year t . $EDU_{i,t}$ shows education expenditure totally at all education levels in country i at year t . R&D and EDU also include in the model as a share of GDP to measure the product differentiation and human capital intensity effects on IIT respectively. Product differentiation measures the level of intra-

¹⁵ Descriptive statistics and correlations between variables are presented in Appendix C.

industry trade. On the other hand, human capital intensity determines quality differences in production which supports the vertical IIT.

$EXR_{i,t}$ indicates exchange rate of country i at year t that represents the value of home country currency across to dollar value as yearly. $OPEN_{i,t}$ presents trade value of country i at year t as a share of GDP. $INF_{i,t}$ demonstrates inflation rate of country i at year t which is calculated by Consumer Price Index (CPI). $DIST_{i,t}$ shows distance of country i at year t that is taken every country's distance to one of the main trade centres which is Germany. Distance is important determinant of IIT because of its effects of transportation and information costs (Balassa and Bauwens, 1987). Lastly, we use $LFIP_{i,t}$ as a Labour Force Industry Production index of country i in year t to measure economies of scale effect on IIT of those products.

The LFIP index is calculated as follow:

$$LFIP = \frac{LABOUR\ FORCE\ it}{INDUSTRY\ PRODUCTION\ it} \quad (8.4)$$

At this equation labour force indicates labour amount in country i at year t based on year 2015. Similarly, industry production expresses production amount of county i at year t based on year 2015.

Economies of scale shows average cost advantages of companies with increase in production level. Companies can exploit from economies of scale by increasing their production level. Krugman (1981) improves a modern trade theory based on monopolistic competition and indicates the theory is differentiated from H-O trade theory by “economies of scale” and “product differentiations” which are very crucial determinants of IIT level among countries. Additionally, Greenway and Milner present the economies of scale are a consistent determinant of IIT. Also, Lee (1989), Hughes (1993) and Somma

(1991) show that economies of scale are important determinant of IIT in manufacturing industries. Therefore, we added economies of scale as a variable in our model and the LFIP index is used as a proxy, so the ratio is calculated by labour force amount proportion to the production amount of a country in time t . As a result, scale economies effect on IIT of the eight goods in our research is measured.

8.1. Tobit Model

James Tobin was developed tobit model as an extension of the probit model in 1958. The model is also called censored regression model in which the dependent variable is censored above or below a certain threshold. The Tobit model determines the relationship between a positive independent variable and a dependent variable or vector. The model suppose that dependent variable has some values aggregated at a limit which is generally zero. For instance, hours of work data have cluster at zero, also data on demand of consumer goods has same clustering. Additionally, the model is also known as limited dependent variable regression model because of the restrictions on the values. The Tobit model exercises all observations which are not only at the limit but also above the limit while estimating the regression line, so the model is preferable against its alternatives since they estimate a regression line that have observations only above the limit.

The tobit model can be showed by following relationship:

$$\begin{aligned}
 y_i &= \beta X_i + \mu_i \quad \text{if } \beta X_i + \mu_i > 0 \\
 &= 0 \quad \quad \quad \text{if } \beta X_i + \mu_i \leq 0 \\
 i &= 1, 2, 3, 4, \dots, N
 \end{aligned}
 \tag{8.1.1}$$

N defines the number of observations, y_i is the dependent variable, β is a vector of unknown coefficients, X_i is a vector of independent variable and μ_i is an independently distributed error term supposed to be normal which determines by zero mean and constant variance σ^2 . Therefore, the model accepts an underlying stochastic model which is equal to $\beta X_i + \mu_i$ that can be observed when it is positive, so it is determined as an unobserved, latent variable. The model can have censors at different threshold; thus, we can mention about three variations.

If the model has a censor on independent variable different from zero as y_L , the model can be expressed as following.

$$\begin{aligned} y_i &= \beta X_i + \mu_i \quad \text{if } \beta X_i + \mu_i > y_L \\ &= y_L \quad \text{if } \beta X_i + \mu_i \leq y_L \\ &\quad i = 1, 2, 3, 4, \dots \end{aligned} \quad (8.1.2)$$

On the other hand, the model may have censor at the upper limit of observations like y_u which showed as following.

$$\begin{aligned} y_i &= \beta X_i + \mu_i \quad \text{if } \beta X_i + \mu_i < y_u \\ &= y_u \quad \text{if } \beta X_i + \mu_i \geq y_u \\ &\quad i = 1, 2, 3, 4, \dots, N. \end{aligned} \quad (8.1.3)$$

The other variation is that having censors from lower and upper thresholds which is showed as following.

$$\begin{aligned} y_i &= \beta X_i + \mu_i \quad \text{if } y_L < \beta X_i + \mu_i < y_u \\ &= y_L \quad \text{if } \beta X_i + \mu_i \leq y_L \\ &= y_u \quad \text{if } \beta X_i + \mu_i \geq y_u \quad i = 1, 2, 3, 4, \dots, N \end{aligned} \quad (8.1.4)$$

In our empirical work, since IIT index takes values between 0 and 1, OLS regression estimation would result in inconsistent estimates, so tobit model generates consistent maximum likelihood estimates and capture the lower and upper censoring of the dependent variable. Tobit models allows the linear standard form of IIT equation without impose any extra restrictions. Since the tobit model do not need to transformation to the linear model, it is interpretation is easier related to Logit model that is often explained by the logarithm of the odds ratio.

In Table 7 we show intra industry trade (IIT) index values of average of eight various products that they are used in the research from 40 countries in period of 2002 to 2018. In this table it is easily observed that some of those countries' IIT levels increase from 2002 to 2018 but some of others' IIT indexes decreases, also some countries' IIT indexes does not change in that period.

Additionally, GDP, Openness, Exchange rate and Inflation variables are taken from Penn World Data 9.1. FDI, Education Spending, Industry Production, Labour Force and R&D Spending are from World Development Indicators (WDI). Distance is taken from CEPII. Lastly, Comtrade database is used for computation of IIT index. Also, IIT data is computed by 4- digit SITC level to prevent aggregation in data. However, Grubel-Lyod index is general method that is used to calculate IIT, it causes aggregation bias. Gullstrand, 2002 present the higher level of aggregation cause to enlargement in IIT estimations so it is better to use higher level of disaggregation that the data allow.

9. EMPIRICAL RESULTS and DISCUSSION

Our investigation aims to search determinants of intra-industry trade in patterns of eight different commodity. To detailly research those determinants we use those eight different products in 40 countries¹⁶ around the world in period of 2002 to 2018 by using Tobit model. We show those results in Table 8 and 9. First, we mention about determinants of IIT by GDP differences among countries that is shown on Table 8. Then we present determinants of IIT by taking account market demand of households in those countries.

In Table 8, DIFGDP has statistically significant but negative effect on IIT at almost every product at %1 significance level. That means difference in GDP value between a country and its biggest three trade partner affect the IIT between those country negatively. The negative effect between DIFGDP and IIT shows countries which have similar GDP values and so economic size have more intra-industry trade between each other. This result is consistent with the study of Helpman and Krugman in 1985 that they show smaller the difference of economic size of trading partners, larger the volume of IIT between them.

FDI has positive and significant effect on IIT average at %5 significance level. The result is consistent with the literature and the trade theory, so FDI has positive effect and supports especially vertical IIT, so it increases on the other hand it has ambiguous impact on horizontal IIT (Aturupane et al., 1999; Ambroziak L., 2012). FDI brings technology transfer into the host country and combine with the local endowments so increase production of vertically differentiated goods for export. Similarly, horizontal intra industry (HIIT) trade should increase with rise in net export besides it decreases

¹⁶ List of countries are shown in Appendix C.

HIIT. In the previous part we investigate FDI as a dependent variable, in this model we observe FDI becomes a variable of IIT above its certain level.

EXR has negative and significant effect on IIT average at %1 significance level. That means when host country currency value decreases across current dollar value that decreases IIT in host country so import products become more expensive and demand for import products declines and so import level in the country decreases. On the other hand, export of the host country increases because products that are manufactured in the host country become cheaper. Therefore, difference between export and import increases and IIT declines. The strong policy implications according to effect of exchange rate changes on trade declines by the increase of IIT over a specific level.

EDU has positive and significant effect on IIT in average at %1 significance level. That means increase in education spending as a percentage of GDP increases IIT. Since increase in education spending supports to have more qualified workforce because it concerns about human capital intensity therefore provides manufacturing more complex products and provide higher quality in differentiated goods thus increases trade volume by both export and import with any other countries and so IIT (Hurley D.T., 2003) which is suitable with IIT theory. OPEN has positive and significant effect on IITav at 5% level. Increase in total trade as a share of GDP increases IIT in average of the products. It is an expected result that raise in trade openness supports IIT and enlarges it (Sawyer W.C.; Sprinkle R.L.; Tochkov K.; 2010). Trade openness have supportive effect on both export and import activity as consistent with the traditional trade theory, so the variable provides to close the gap between them.

R&D has negative and significant effect on IITav at 1% significance level. Increase in research and development expenditures as a percentage of GDP decreases IIT as in average. That shows technology investment are made related to R&D spending, so it differentiates production content that related to trade in the country (Rice, P.; Stewart, M.; Venable, A.J., 2002). Additionally, this result indicates that because of the technological development in the industry, the country has a comparative advantage in production according to the traditional trade theory, so it affects IIT negatively and it declines.

DIST has negative and significant effect on IITav at 1% significance level. Increase in distance decreases IIT average. When increase distance between two country trade activity between them declines because of the transportation costs increases. Therefore, the result is consistent with the literature. INF has no significant effects on IIT in average and almost all IITs of products separately. That means inflation level in a country does not affect intra-industry trade volume in a country.

In our empirical work, LFIP has negative and significant effect on IIT in average. This variable shows Economies of Scale effect on production by labour amount per production amount so the negative effect of increase in the ratio of labour force against the production amount can be observed as scale economies effect since decline in labour cost per unit production. At those industries companies may utilize from some internal economies of scale advantages for example dividing production process and specialization, decreasing transportation or logistic cost, managerial and financial advantages of larger organizations. For instance, in the footwear industry Nike company as one of the footwear leaders has constructed a huge comparative advantage in

economies of scale specifically local economies of scale related to marketing and advertising sponsorship (Loertscher and Wolter, 1980; Balassa, 1986; Bergstrand, 1990).

Additionally, firms in those industries can have external economies of scale advantages like technological improvements in the industry, industry infrastructure, low demand- large supply effect, well transportation network of industry and training facilities in the industry. Tobacco firms use advantage of their transportation network of industry in economies of scale.

In Table 9, we present market demand and purchasing power of citizens by GDP per capita and other determinants that are shown previously. Most of the variables show similar results with the first model with difference in GDP among countries but at second model it is seen that FDI, and OPEN results become stronger with their significance at %1 level. Both FDI and OPEN are crucial and one of the fundamental determinants of IIT to explain it therefore, stronger significance level in those variables give us more reliable and robust results according to that issue. As a result, GDP per capita stands more effective and a little bit important determinant for IIT against difference in GDP between mostly traded three trade partner countries. This indicates wealth level of citizens, and their choices are more indicative for IIT of those eight products.

Table 8. The empirical results of the IIT at eight different products

Variable	IITav	IITcof	IITsugar	IITcot	IITcoc	IITcop	IITtob	IITfot	IITpet
DIFGDP	-0,097 (-3.76)***	-0,176 (-3.72)***	-0,104 (-2.03)**	-0,199 (-4.15)***	0,162 (3.64)***	-0,133 (-2.28)**	-0,199 (-3.30)***	-0,120 (-2.36)**	-0,139 (-2.74)***
FDI	0,001 (2.15)**	0,002 (2.09)**	-0,001 (-1.38)	0,001 (0.75)	0,003 (2.80)***	0,002 (1.63)*	0,001 (1.21)	0,002 (1.70)*	-0,00014 (-0.14)
EXR	-8.60e-06 (-4.44)***	-0,00001 (-3.62)***	-6.00e-06 (-1.56)	-8.12e-06 (-2.26)**	-4.91e-06 (-1.48)	-2.39e-06 (-0.54)	-0,00002 (-3.79)***	-0,00001 (-3.48)***	-0,00007 (-2.96)***
EDU	0,026 (5.19)***	-0,030 (-3.28)***	0,016 (1.61)	0,042 (4.57)***	0,029 (3.32)***	0,032 (2.90)***	-0,007 (-0.61)	0,043 (4.43)***	0,074 (7.65)***
OPEN	0,136 (2.00)**	-0,161 (-1.29)	-0,233 (-1.73)*	0,281 (2.23)**	-0,054 (-0.46)	0,400 (2.60)***	0,437 (2.76)***	0,131 (0.98)	0,221 (1.67)*
R&D	-0,028 (-4.26)***	-0,020 (-1.62)*	0,015 (1.14)	-0,044 (-3.57)***	-0,014 (-1.23)	-0,021 (-1.40)	-0,033 (-2.13)**	-0,079 (-6.00)***	-0,046 (-3.48)***
DIST	-9.47e-06 (-7.90)***	-0,00003 (-13.35)***	-0,00002 (-6.80)***	-8.18e-06 (-3.63)***	-9.21e-06 (-4.47)***	-3.76e-06 (-1.38)	-1.49e-06 (-0.53)	-0,00003 (-13.26)***	0,00002 (8.24)***
INF	-0,001 (-1.39)	-0,003 (-3.62)***	-0,001 (-1.30)	-0,0002 (-0.25)	-0,00007 (-0.09)	-0,00073 (-0.72)	0,004 (3.97)***	-0,003 (-3.20)***	-0,001 (-0.96)
LFI	-0,038 (-2.35)**	-0,06007 (-2.04)**	-0,035 (-1.08)	-0,05216 (-1.73)*	-0,04878 (-1.75)*	0,00672 (0.18)	-0,020 (-0.53)***	-0,09348 (-2.96)***	-0,04502 (-1.43)
CONS	0,346 (11.62)***	0,876 (16.06)***	0,282 (4.72)***	0,267 (4.76)***	-0,033 (-0.62)	0,360 (5.32)***	0,607 (8.62)***	0,668 (11.40)***	-0,086 (-1.45)
Wald	168.43	275.93	86.06	67.71	73.33	32.37	49.39	281.06	137.95
Prob	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

*, **, *** represents significant p values respectively 0.10, 0.05, 0.01. The values in parenthesis shows z values.

Table 9. The empirical results of IIT of eight products with the market demands of countries

Variable	IITav	IITcof	IITsugar	IITcot	IITcoc	IITcop	IITtob	IITfot	IITpet
GDPc	-1.70e-06 (-5.33)***	-3.32e-07 (-0.56)	-1.71e-06 (-2.69)***	-2.56e-06 (-4.29)***	-2.01e-06 (-3.64)***	-4.11e-06 (-5.72)***	2.17e-06 (2.88)***	2.17e-06 (2.88)***	1.15e-07 (0.18)
FDI	0,001 (2.86)***	0,002 (1.90)*	-0,001 (-1.01)	0,001 (1.25)	0,003 (3.65)***	0,003 (2.51)***	0,0006 (0.47)	0,001 (0.47)	-0,0004 (-0.35)
EXR	-9.45e-06 (-4.91)***	-0,00001 (-3.67)***	-6.89e-06 (-1.79)*	-9.48e-06 (-2.64)***	-5.67e-06 (-1.70)*	-4.35e-06 (-1.00)	-0,00002 (-3.61)***	-0,00002 (-3.61)***	-0,00007 (-2.77)***
EDU	0,027 (5.65)***	-0,040 (-4.50)***	0,017 (1.76)*	0,041 (4.51)***	0,049 (5.76)***	0,043 (4.01)***	-0,032 (-2.77)***	0,032 (-2.77)***	0,063 (6.66)***
OPEN	0,262 (3.56)***	-0,220 (-1.59)	-0,109 (-0.74)	0,443 (3.21)***	0,241 (1.88)*	0,760 (4.58)***	0,105 (0.60)	0,105 (0.60)	0,133 (0.91)
R&D	-0,0031 (-0.47)	0,001 (0.10)	0,041 (3.06)***	-0,001 (-0.08)	-0,012 (-1.04)	0,030 (1.96)**	-0,033 (-2.04)**	-0,033 (2.04)**	-0,032 (-2.42)**
DIST	-0,00001 (-8.80)***	-0,00003 (-13.79)***	-0,00002 (-7.23)***	-9.77e-06 (-4.38)***	-8.64e-06 (-4.22)***	-5.37e-06 (-2.02)**	-2.18e-06 (-0.78)	-2.18e-06 (-0.78)	0,00002 (7.92)***
INF	-0,001 (-1.40)	-0,003 (-4.11)***	-0,001 (-1.34)	-0,0004 (-0.43)	0,0007 (0.88)	-0,0004 (-0.45)	0,003 (3.16)***	0,003 (3.16)***	-0,001 (-1.42)
LFI	-0,052 (-3.30)***	-0,079 (-2.70)***	-0,049 (-1.56)	-0,07823 (-2.64)***	-0,037 (-1.35)	-0,017 (-0.47)	-0,035 (-0.94)	-0,035 (-0.94)	-0,059 (-1.89)*
CONS	0,295 (10.55)***	0,807 (15.42)***	0,228 (4.04)***	0,170 (3.20)***	0,017 (0.33)	0,275 (4.37)***	0,549 (8.22)***	0,549 (8.22)***	-0,136 (-2.42)**
Wald	185.83	257.23	89.83	69.24	73.72	61.00	46.75	46.75	127.55
Prob	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

*, **, *** represents significant p values respectively 0.10, 0.05, 0.01. The values in parenthesis shows z values.

10. CONCLUSION

The trade openness, economies of scale and the product differentiation are those crucial issues support to development of IIT in the world. The globalization has also increased the use of similar kind of products around the world and provide rise of vertical and horizontal IIT. Our objective in this research to evaluate the various kind of IIT patterns both in different countries and different products to estimate determinants of IIT on both raw and manufactured products. The IIT is calculated with its natural basis for eight categories of SITC. The research has contribution to the literature by big number of research countries between 2002 and 2018 with different calculations on difference in GDP values and economies of scale.

The results show difference in economic size adversely affects IIT almost all the products both refined and raw goods. Besides that, FDI has positive effect on IIT because FDI supports trade especially above some level of FDI in a country it becomes variable in IIT model. Education expenditure has a positive and significant effect on IIT in average. R&D spending has negative effect on IIT that shows those expenditures often made on technology and technological improvement cause difference between export and import in an industry so decreases IIT. Distance affects inversely IIT index when the distance increases between two country the IIT index declines like trade. Exchange rate has negative effect on IIT in average and all the products. Increase in value of host country across to dollar cause decline in import but increase in export. Therefore, increasing gap between two values cause decline in IIT index. Inflation variable does not show meaningful effect on IIT index in our model.

Additionally, LFIP index which is proxy of economies of scale have significant and negative effect on IIT in average. In these industries companies may have some internal and external economies of scale advantages for instance specialization in production and technologic improvements in the industry, thus they use comparative advantages to achieve scale economies. Therefore, positive effect of economies of scale is consistent with the IIT literature.

On the other hand, GDP per capita also investigated instead of differences in GDP value among countries. The effects of those two independent variables take separately because they cause endogeneity in the model so that result in inconsistency and weakness in the model. The results show that GDP per capita (GDPc) has negative and significant effect on IIT in average. Thereby, increase in income of citizens differentiates consumer' preferences so demand content of their market change. As a result, that causes change in export and import balance of countries in average of the eight products and so their IIT level decreases.

Consequently, the importance of IIT have been rising with the increase of demand of the product differentiation and the globalization around the world. In our empirical work, difference in GDP, GDPc, FDI as an important variable at a certain level of trade, exchange rate level, education and R&D spending, distance, openness, and economies of scale are one of the crucial determinants of IIT in our model. In the model we see those variables are significant for most of the eight products when they are analysed one by one except inflation because it is meaningful for only coffee, tobacco and footwear products but difference in GDP, GDPc, economies of scale, education spending and distance variables have significance at 1% significance level at almost all of eight products that

are used in the research so we can say they have strong results for all the products and they are substantial determinants of IIT. However, inflation does not have influence on IIT so we can say it is not a determinant of IIT according to our model.



REFERENCES

- Ambroziak, L. (2017). FDI and Intra-industry trade in the Automotive industry in the New EU Member States. *International Journal of Management and Economics*, 52 (1).
- Ando, M. (2006). Fragmentation and vertical intra- industry trade in East Asia. *North American Journal of Economics and Finance*, 17, 257-281.
- Athukorala, P., & Yamashita, N. (2006). Production fragmentation and trade integration: East Asia in a global context. *North American Journal of Economics and Finance*, 17, 233- 256.
- Aturupane, C., Djankov, S., Hoekman, B. (1999). Horizontal and Vertical Intra Industry Trade between Eastern Europe and the European Union. *Weltwirtschaftliches*, 135, 62- 81.
- Balassa, B., & Bauwens, L. (1987). Intra-industry specialization in a multi- country and multi- industry framework. *Economic Journal*, 97, 923-939.
- Balassa, B. (1986). The determinants of intra-industry specialization in United States trade. *The American Economic Review*, 38 (1), 220- 233.
- Bergstand, J.H. (1990). The Heckscher- Ohlin-Samuelson model, the Linder hypothesis, and the determinants of bilateral intra-industry trade. *The Economic Journal*, 100 (4), 1216- 1229.
- Bernhofen, D.M. (1999). Intra-industry trade and strategic interaction: theory and evidence. *Journal of International Economics*, 47 (1), 225- 244.
- Chamberlin, E. (1933). *The Theory of Monopolistic Competition*. Harvard University Press.

- Clark, D.P., Stanley, D. (1999). Determinants of Intra-Industry Trade Between Developing Countries and the United States. *Journal of Economic Development*, (24) 2.
- Cortinhas, C. (2007). Intra-industry trade and business cycles in ASEAN. *Applied Economics*, 39, 893-902.
- Cramer, J. (1991). *The Logit Model: An Introduction for Economists*. Edward Arnold, London.
- Das, G. (2005). Growth and pattern of intra- industry trade in manufactures in India's overall trade: A quantitative analysis. *Indian Journal of Economics and Business*, 4, 162- 184.
- Dixit, A. K., Norman, V. (1980). *Theory of International Trade: A Dual General Equilibrium Approach*. Cambridge University Press.
- Ethier, W. (1982). National and International Returns to Scale in the Modern Theory of International Trade. *American Economic Review*, (72), 389-405.
- Greenaway, D., Hine, R.C., Milner, C.R. (1994). Country specific factors and the pattern of horizontal and vertical intra-industry trade. *Weltwirtschaftliches Archiv* 130, (1), 77- 100.
- Grubel, H.G., Lloyd, P.J. (1975). *Intra-industry Trade: The Theory and Measurement of International Trade in Differential Products*. Wiley, New York.
- Gullstrand, J. (2002). Does the measurement intra- industry trade matter? *Weltwirtschaftliches Archiv/ Review of World Economics*, 138, 317-339.
- Harley, D. (2003). Horizontal and Vertical Intra- Industry Trade: The Case of ASEAN Trade in Manufactures. *International Economic Journal* 17:4, 1-14.

- Harrigan, J. (1996). Openness to trade in manufacturing in the OECD. *Journal of International Economics*, 40 (1), 23- 29.
- Harrigan, J. (1994). Scale economies and the volume of trade. *Review of Economics and Statistics*, 76 (2), 321-332.
- Helpman, E. (1981). International trade in the presence of product differentiation, economies of scale and monopolistic competition: Chamberlin-Heckscher- Ohlin approach. *Journal of International Economics*, (11), 305- 340.
- Helpman, E. (1987). Imperfect competition and international trade: evidence from fourteen industrial countries. *Journal of the Japanese and International Economies*, 1, 62-81.
- Helpman, E., Krugman, P.J. (1985). *Market Structure and Foreign Trade*. MIT, Cambridge, MA.
- Hu, X., & Ma, Y. (1999). International intra-industry trade of China. *Weltwirtschaftliches Archiv/ Review of World Economics*, 135, 82- 101.
- Hughes, K. (1993). Intra-industry trade in the 1980s: a panel study. *Weltwirtschaftliches Archiv*, 129 (4), 560- 572.
- Hummels, D., Levinsohn, J. (1995). Monopolistic competition and trade: reconsidering the evidence. *Quarterly Journal of Economics*, 110, 799-836.
- Krugman, P.R. (1981). Intra-industry specialization and gains from trade. *Journal of Political Economy*, 89 (7), 959-973.
- Lancaster, K. (1980). Intra-Industry Trade under Perfect Monopolistic Competition. *Journal of International Economics*, (10) 151-75.

- Leamer, E. (1988). Measure of openness. In: Baldwin, R.E.(Ed.), Trade Policy Issues and Empirical Analysis. University of Chicago Press, Chicago.
- Lee, J., & Han, S. (2008). Intra-industry trade and tariff rates of Korea and China. *China Economic Review*, 19, 697-703.
- Loertscher, R. and Walter, F. (1980). Determinants of Intra-industry Trade: Among Countries and Across Industries. *Weltwirtschaftliches Archiv*, 116, 280-93.
- Markusen, J.R., Venables, A.J. (1998). Multinational firms and theory of international trade. *Journal of International Economics*, 46(1), 183-203.
- Rana, P.B. (2007). Trade intensity and business cycle synchronization: The case of East Asia. Asian Development Bank Working Paper Series on Regional Economic Integration, 10.
- Rice, P.; Stewart, M.; Venable, A.J. (2002). The Theory of Intra-Industry Trade. Empirics Centre for Economic Policy Research.
- Sawyer, W.C.; Sprinkle R.L.; Tochkov K. (2010). Patterns and Determinants of Intra-Industry Trade in Asia. *Journal of Asian Economics*, 21:5, 485- 493.
- Sohn, C.H., & Zhang, Z. (2005). How intra-industry trade is related to income difference and foreign direct investment in East Asia. *Asian Economic Papers* 4, 143-156.
- Stone, J. A., Lee, H. H. (1995). Determinants of intra-industry trade: a longitudinal, cross country analysis. *Weltwirtschaftliches Archiv* 131 (1), 67- 85.
- Thorpe, M., & Zhang, Z. (2005). Study of the measurement and determinants of intra-industry trade in East Asia. *Asian Economic Journal* 19, 231-247.
- Tobin, J. (1958). Estimation of Relationships for Limited Dependent Variable. *Journal of the Econometric Society*, 28.

- Veeramani, C. (2002). Intra- industry trade of India: Trends and country- specific factors. *Weltwirtschaftliches Archiv/Review of World Economics* 138, 509-533.
- Wakasugi, R. (2007). Vertical intra-industry trade and economic integration in Asia. *Asian Economic Papers*, 6, 26-39.
- Xing, Y. (2007). Foreign direct investment and China's bilateral intra- industry trade with Japan and the US. *Journal of Asian Economics*, 18, 685- 700.
- Zhang, J., Witteloostuijin, A., & Zhou, C. (2005). Chinese bilateral intra- industry trade: A panel data study for 50 countries in the 1992- 2001 period. *Weltwirtschaftliches Archiv/ Review of World Economics*, 141, 510- 540.
- Zhang, Z., & Li, C. (2006). Country- specific factors and pattern of intra- industry trade in China's manufacturing. *Journal of International Development*, 18, 1137-1149.

APPENDIX C

Appendix C consists of 4 Table that are shows SITC explanations of products, list of countries considered, descriptive statistics, correlation between variables respectively. Also, there two figures in this part first one shows IIT of eight commodities and their averages and the second figure presents correlations between IIT average and explanatory variables. At appendix D contains the Wald test explanation.

Table 10. The SITC explanations of products

Name	Product Description
IITcof	Coffee, green or roasted
IITpet	Crude Petroleum
IITsug	Raw Sugar, beet& cano
IITcot	Raw Cotton, other than litters
IITcoc	Cocoa beans, raw or roasted
IITcop	Copper and allays, unwrought
IITtob	Tobacco, manufactured for smooking
IITfot	Footwear
IITav	Average of the eight products in the research

Source: Author's calculation

Table 11. List of countries considered

Australia	United Kingdom	Turkey	Belgium	Greece	Finland	New Zealand	Slovenia
Brazil	Germany	Japan	Switzerland	Hungary	Iceland	Norway	Sweden
China	Ireland	Mexico	Czech Repub	Israel	Latvia	Poland	Iran
India	Italy	France	Denmark	Chile	Luxembourg	Portugal	Russia
United States	Canada	Austria	Spain	Estonia	Neterland	Slovak Repul	Venezuela

Table 12. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max.
DIFGDP	680	0,72	0,23	0,00	1,00
FDI	680	4,70	10,27	-58,32	86,59
EXR	680	410	2.727	-23	33.226
EDU	680	4,96	1,29	1,87	8,56
OPEN	680	0,02	0,09	-0,77	0,50
RD	680	1,63	1,00	0,03	4,58
DIST	680	3.663	4.531	174	18.824
INF	680	5	13	-10	255
LFIP	680	1,05	0,33	0,55	7,37

Source: Author's calculation

Table 13. Correlation between variables

	DIFGDP	FDI	EXR	EDU	OPEN	RD	DIST	INF	LFIP
DIFGDP	1								
FDI	0,08	1							
EXR	0,04	-0,06	1						
EDU	0,15	-0,01	-0,17	1					
OPEN	0,07	-0,22	-0,03	-0,02	1				
RD	-0,31	-0,02	-0,18	0,47	0,11	1			
DIST	0,08	-0,14	0,01	-0,14	-0,20	-0,16	1		
INF	0,15	-0,06	0,14	-0,14	-0,36	-0,27	0,12	1	
LFIP	0,18	0,03	-0,01	0,07	-0,11	-0,08	-0,97	0,02	1

Source: Author's calculation

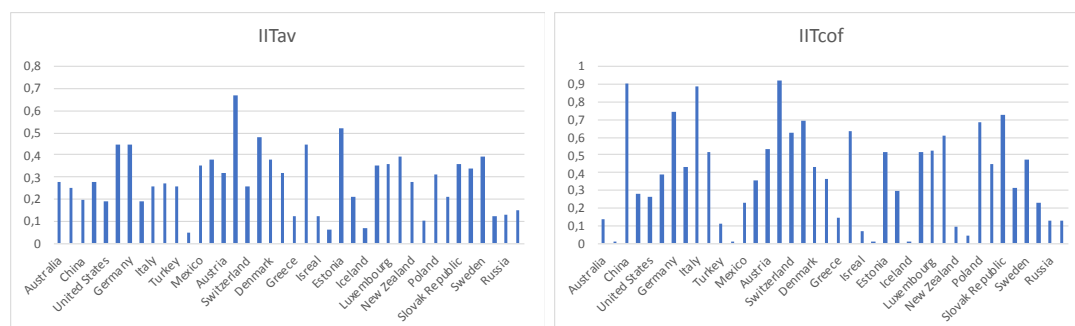
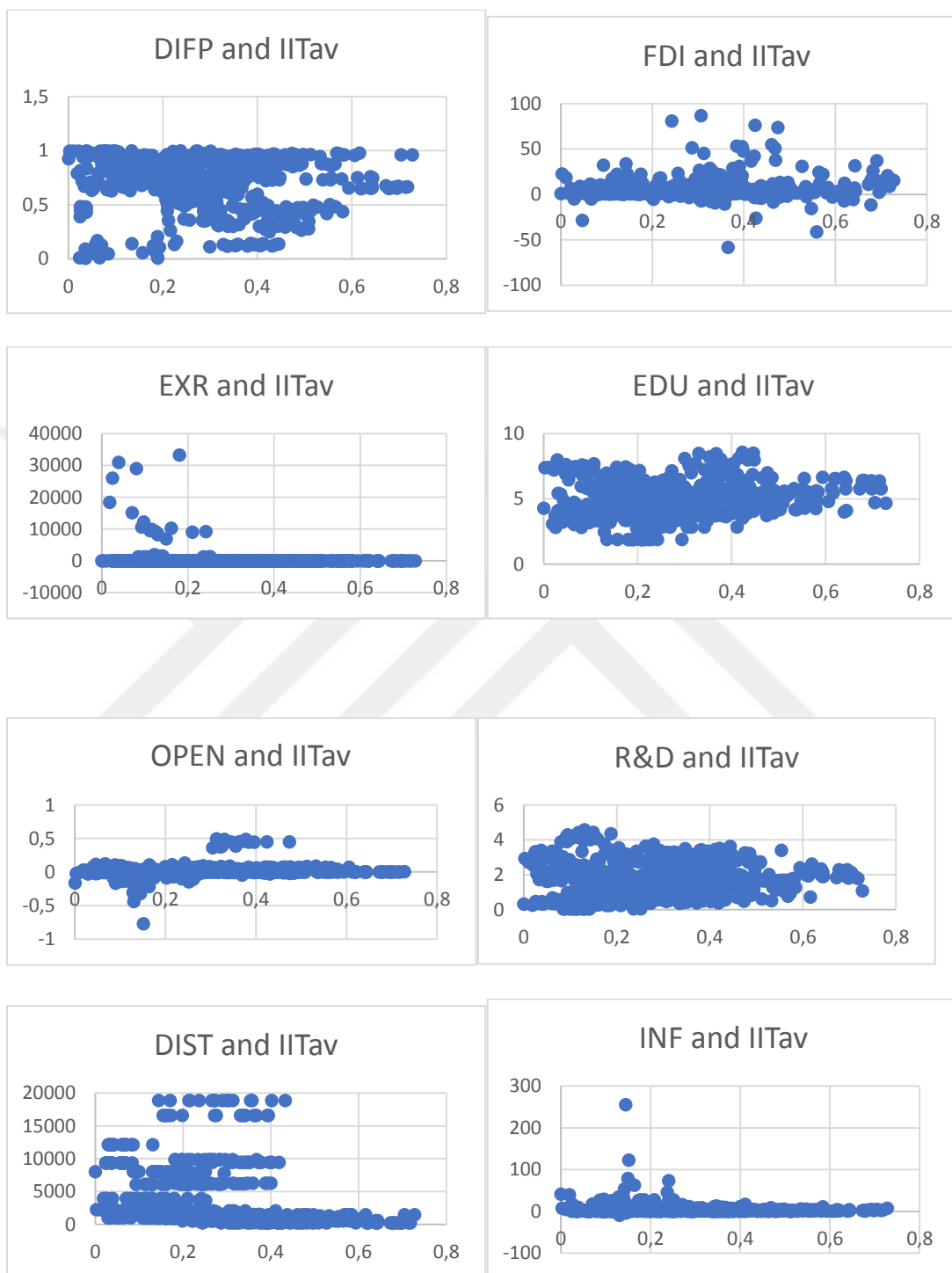




Figure 5. The graphics of IIT of 8 commodities and their averages

Source: Author's calculation



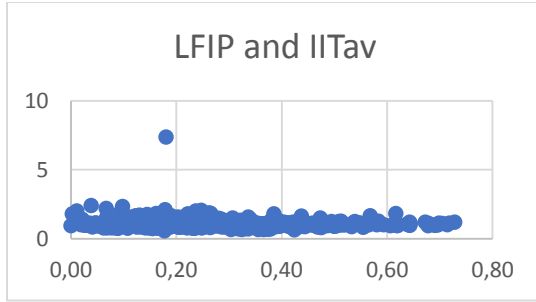


Figure 6. The graphics of correlation between IITav and explanatory variables

Source: Author's calculation

APPENDIX D

Wald Test

The Wald test is used to test if the set of parameters have some value, so the null hypothesis test two coefficients of explanatory variables are equal to zero. If the null hypothesis cannot be rejected, the test show that removing the variables from the model will not damage the fit of the model. Because the explanatory variable that have a very small coefficient than from its standard error, thus do not have much effect to estimate the dependent variable. Also, the Wald test evaluates simultaneous coefficient effects of parameters difference from zero. Let show the hypothesis below.

We assume that we try to estimate $\hat{\theta}$ as an estimator of parameter θ which is unbiased and asymptotically normal.

$$H_0 = \hat{\theta}_{1,2,3,\dots} = 0 \quad (14.2.1.1)$$

$$H_1 = \hat{\theta}_{1,2,3,\dots} \neq 0 \quad (14.2.1.2)$$

If $\text{Prob} > \text{Chi2} = 0.000$, we will reject H_0 . Therefore, coefficients are simultaneously do not equal to zero and using all those predictors improve the fit of the model by statistically significance results.

CHAPTER 3: Marginal Intra-Industry Trade and Labor Adjustment Cost in EU

ABSTRACT

Intra- Industry Trade is a crucial issue from the point of view both increase importance in international trade and its' labour adjustment cost influence in the literature. Labour movement occurs from one industry to another, so this movement rises adjustment cost of labour to new industry and decreases productivity of production in the whole economy. To decline high adjustment cost of labour and increase the productivity in the production, the labour allocation should be occurred in the same industry. Increase of IIT in the industry will rise allocation of labour in the same industry therefore, low labour adjustment cost takes place. In this chapter, we analyse the relationship between IIT and MIIT with the labour adjustment cost and compare different measure of marginal intra-industry trade. Brülhart's A index which measures marginal intra-industry trade which is widely used in the literature is compared with Dixon and Menon's MD1 and MD2 index that are different measures of MIIT. In our empirical research we used 127 manufacturing subsectors at 15 European Union countries in the period between 1990- 2017. Result of dynamic panel data of system GMM shows since MD2 measurement method explains the low adjustment cost better than MD1 ($MD1_j > MD2_j$) it has significant correlation with a few of variables which are concern to trade. MD1j has strong relationship with sectoral employment, consumption, productivity, and openness in manufacturing industry at EU. Three various measures of MIIT presents that there is a negative link between MIIT and adjustment cost which is suitable with the literature.

Key Words: Intra-Industry Trade, Trade, Marginal Industry Trade, Smooth Adjustment Hypothesis, Dynamic Panel Data

11.INTRODUCTION

The analysis of condition of a country in international trade and trade pattern of this country has significant role about understanding the economic wellbeing and development among other countries. Therefore, in the issue of international trade Intra-Industry Trade (IIT) is observed one of the fundamental factors currently. With the increasing demand of product differentiation, the production of more company in a same industry rises and they have started to sale similar products. Thus, many countries trade pattern has evolved into products that are produced under the same industry, so IIT have increased among different countries and become prominent in the international trade.

The influence of IIT in the international trade and changing trade pattern of countries also have affected and transformed various part that are concern with international trade. Greenaway and Hine (1991) indicate that “specialization in Europe may have started a new phase, and that this could place greater problems for adjustment”. One of those effected part in international trade is labor market, this market transformed by various aspects from the increase in IIT in international trade.

Firstly, movement of labors across different industries decrease by rise in IIT since there are huge amount of demand in differentiated products in same industry, they do not need to change their working industry when they need to change their position, firm or etc. Those labors can easily find new positions in the same industry so movement of labor flow away from an industry to another industry to into the same industry. Since change in demand of firms’ production, the firm needs to alter its level of production and bear to a cost that is defined as adjustment cost. By the movement of labor in the industry, adjustment cost of labor become lower rather than the adjustment cost of labor who move

from one industry to another. This situation is named as Smooth Adjustment Hypothesis (SAH).

In this research, we investigate the link between labor market adjustment cost and IIT, MIIT and change in IIT to the percent change in total trade (MD1_j) and part of trade change in matched changes in imports and exports (MD2_j). We present this chapter in those parts; the sixteenth part represents literature review, the seventeenth part is about data and methodology, the eighteenth part is about results and comments and the nineteenth part gives concluding remarks. Lastly, the twentieth part is references.

12.LITERATURE REVIEW

There are several investigations in the literature according to link between Intra-Industry Trade (IIT) and labor adjustment cost. Balassa's (1966) work was seen firstly in the literature and showed Intra- Industry Trade adjustment may have lower cost than Inter-Industry Trade adjustment. Labor markets are affected many different factors like trade, shift in labor supply and technological changes and IIT suggests a way apart from those factors. IIT approach give related information according to trade pattern to produce disruptive structural change. Dixon and Menon (1997)¹⁷ use IIT as an indicator of "non-disruptive trade growth". Brühlhart (1994) indicates that trade pattern results change related to measure way of Marginal Intra-Industry Trade (MIIT). This result was also supported by Greenaway, Hine, Milner, and Elliott in 1994. Hamilton and Kniest (1991) point out the weakness of evidence about relationship between adjustment and MIIT. A similar result was also implied by Brühlhart and Elliott in 1998.

¹⁷ Dixon and Menon (1997) show basic theory. Menon and Dixon (1996) improve the application to regional trade arrangements, and Menon and Dixon (1996b) develop a framework which the contributions of exports and imports of a commodity are separately considered.

In the literature a big amount of research has made comparison between various measure of IIT such as IIT, MIIT and Δ GL. Those investigations resulted in MIIT has more strong effect about describe the relationship between labor adjustment cost and intra-industry trade rather than IIT. Especially Δ GL implies misleading results at these papers. Dixon and Menon (1997) show considering structural adjustment cost and IIT measure exports and imports have important contributions to MIIT but Δ GL has deceptive result. Brühlhart and McAleese indicated similar effects of MIIT and Δ GL which presents MIIT is correlated with measuring industrial performance about adjustment cost but Δ GL is misleading.

Sarris, Papadimitriou and Mavrogiannis (1999) demonstrate crucial relationship between sectoral employment which was used as an adjustment measure, and MIIT. Likewise, Kol and Kuijpers (1999) display important relation between MIIT and sectoral employment. Additionally, the significant relationship between MIIT and sectoral employment and output change as a structural adjustment measure has been indicated by Brühlhart, McAleese, O'Donnell (1999) and Porto and Costa (1999). Tharakan and Calfat (1999), Smeets (1999) and Rossini and Burrattoni (1999) in the literature demonstrate that there is no evidence for a relationship between sectoral change and MIIT or inter sectoral adjustment in EU and MIIT.

13.DATA and METHODOLOGY

The calculations according to the dataset consists of the period from 1990 to 2017 of 15 European Union (EU) countries. Also, IIT calculations are made by the export and import data of the ISIC 4- digit dataset of manufacturing industry. Since 4-digit level gives higher level of disaggregation, industries are more homogenous at those level and

more disaggregation at the data provide to calculate less inflated IIT values. By those two features both wide period coverage and the level of disaggregation provides a comprehensive IIT indicator for fifteen EU countries presently. At table 14, 127 manufacturing industries that are used in IIT calculation in the research is presented. The data sources table is represented in the appendix part.

To analyze different measure of MIIT and relation with labor adjustment cost we use the empirical model is shown below:

$$MD1_j * HI = \beta_0 + \beta_1 LNCONSUME_{j,t} + \beta_2 WAGE_{j,t} + \beta_3 LNEMPL_{j,t} + \beta_4 LNPROD_{j,t} + \beta_5 LNOPEN_{j,t} + \beta_6 IIT_{j,t} (MIIT_{j,t}) + \mu \quad (13.1)$$

Also, in this model we change the index in the dependent variable which are MD1, MD2 and MIIT to test various measurement of marginal intra-industry trade. We use most of the explanatory variables in the natural logarithm form except wage and intra-industry trade in the model. HI indicates Herfindahl-Hirschman Index which shows market share of companies so indicates market concentration in each industry. By the way the index demonstrates if there is a monopoly or a situation that declines competition in the industry. MD1HI is used to analyze covariant effect of marginal intra-industry trade and market share of firms at the same time.

$\ln CONSUME$ presents the natural logarithm of consumption in manufacturing industry of country j in year t . $WAGE$ shows average wage in manufacturing industry of country j in year t . $\ln EMPL$ represents the natural logarithm of number of labors in manufacturing industry of country j in year t . $\ln PROD$ indicates the natural logarithm of productivity of labor in manufacturing industry at country j in year t . $\ln OPEN$ shows the

natural logarithm of trade openness in the manufacturing industry at country j in year t . Finally, we use IIT or MIIT as an explanatory variable¹⁸ in the model to test intra-industry trade and marginal intra-industry trade influence.

Let see the calculations of independent variables PROD and OPEN:

$$\text{PROD} = \frac{\text{Output in the industry } jt}{\text{Number of labors in the industry } jt}$$

$$\text{OPEN} = \frac{X_j + M_j}{\text{Sector Value Added}}$$

Which X_j and M_j shows total export and import in industry j .

¹⁸ Panel unit root test is presented in the appendix part. Variables are stationary at 1% significance level except wage and open variables. Wage and open have stationarity at 5% significance level according to LLC and IMPS methods.

Table 14. ISIC Descriptions

1511 Processing/preserving of meat	2424 Soap, cleaning & cosmetic preparations	3330 Watches and clocks
1512 Processing/preserving of fish	2429 Other chemical products n.e.c.	3410 Motor vehicles
1513 Processing/preserving of fruit & vegetables	2430 Man-made fibres	3420 Automobile bodies, trailers & semi-trailers
1514 Vegetable and animal oils and fats	2511 Rubber tyres and tubes	3430 Parts/accessories for automobiles
1520 Dairy products	2519 Other rubber products	3511 Building and repairing of ships
1531 Grain mill products	2520 Plastic products	3512 Building/repairing of pleasure/sport. boats
1532 Starches and starch products	2610 Glass and glass products	3520 Railway/tramway locomotives & rolling stock
1533 Prepared animal feeds	2691 Pottery, china and earthenware	3530 Aircraft and spacecraft
1541 Bakery products	2692 Refractory ceramic products	3591 Motorcycles
1542 Sugar	2693 Struct.non-refractory clay; ceramic products	3592 Bicycles and invalid carriages
1543 Cocoa, chocolate and sugar confectionery	2694 Cement, lime and plaster	3599 Other transport equipment n.e.c.
1544 Macaroni, noodles & similar products	2695 Articles of concrete, cement and plaster	3610 Furniture
1549 Other food products n.e.c.	2696 Cutting, shaping & finishing of stone	3691 Jewellery and related articles
1551 Distilling, rectifying & blending of spirits	2699 Other non-metallic mineral products n.e.c.	3692 Musical instruments
1552 Wines	2710 Basic iron and steel	3693 Sports goods
1553 Malt liquors and malt	2720 Basic precious and non-ferrous metals	3694 Games and toys
1554 Soft drinks; mineral waters	2731 Casting of iron and steel	3699 Other manufacturing n.e.c.
1600 Tobacco products	2732 Casting of non-ferrous metals	3710 Recycling of metal waste and scrap
1711 Textile fibre preparation; textile weaving	2811 Structural metal products	3720 Recycling of non-metal waste and scrap
1712 Finishing of textiles	2812 Tanks, reservoirs and containers of metal	
1721 Made-up textile articles, except apparel	2813 Steam generators	
1722 Carpets and rugs	2891 Metal forging/pressing/stamping/roll-forming	
1723 Cordage, rope, twine and netting	2892 Treatment & coating of metals	
1729 Other textiles n.e.c.	2893 Cutlery, hand tools and general hardware	
1730 Knitted and crocheted fabrics and articles	2899 Other fabricated metal products n.e.c.	
1810 Wearing apparel, except fur apparel	2911 Engines & turbines (not for transport equipment)	
1820 Dressing & dyeing of fur; processing of fur	2912 Pumps, compressors, taps and valves	
1911 Tanning and dressing of leather	2913 Bearings, gears, gearing & driving elements	
1912 Luggage, handbags, etc.; saddlery & harness	2914 Ovens, furnaces and furnace burners	
1920 Footwear	2915 Lifting and handling equipment	
2010 Sawmilling and planing of wood	2919 Other general purpose machinery	
2021 Veneer sheets, plywood, particle board, etc.	2921 Agricultural and forestry machinery	
2022 Builders' carpentry and joinery	2922 Machine tools	
2023 Wooden containers	2923 Machinery for metallurgy	
2029 Other wood products; articles of cork/straw	2924 Machinery for mining & construction	
2101 Pulp, paper and paperboard	2925 Food/beverage/tobacco processing machinery	
2102 Corrugated paper and paperboard	2926 Machinery for textile, apparel and leather	
2109 Other articles of paper and paperboard	2927 Weapons and ammunition	
2211 Publishing of books and other publications	2929 Other special purpose machinery	
2212 Publishing of newspapers, journals, etc.	2930 Domestic appliances n.e.c.	
2213 Publishing of recorded media	3000 Office, accounting and computing machinery	
2219 Other publishing	3110 Electric motors, generators and transformers	
2221 Printing	3120 Electricity distribution & control apparatus	
2222 Service activities related to printing	3130 Insulated wire and cable	
2230 Reproduction of recorded media	3140 Accumulators, primary cells and batteries	
2310 Coke oven products	3150 Lighting equipment and electric lamps	
2320 Refined petroleum products	3190 Other electrical equipment n.e.c.	
2330 Processing of nuclear fuel	3210 Electronic valves, tubes, etc.	
2411 Basic chemicals, except fertilizers	3220 TV/radio transmitters; line comm. apparatus	
2412 Fertilizers and nitrogen compounds	3230 TV and radio receivers and associated goods	
2413 Plastics in primary forms; synthetic rubber	3311 Medical, surgical and orthopaedic equipment	
2421 Pesticides and other agro-chemical products	3312 Measuring/testing/navigating appliances, etc.	
2422 Paints, varnishes, printing ink and mastics	3313 Industrial process control equipment	
2423 Pharmaceuticals, medicinal chemicals, etc.	3320 Optical instruments & photographic equipment	

In our empirical search, we use Grubel Lloyd (GL), 1975 index to calculate the IIT indices. This index changes between 0 and 1. The standard GL index is defined as follows:

$$GL_j = IIT_j = 1 - \frac{|X_{j,t} - M_{j,t}|}{X_{j,t} + M_{j,t}} \quad (17.2)$$

Where X_j and M_j are export and import of industry j at year t . We calculated the aggregated IIT values from the 127 manufacturing industries in figure 1 the average IIT values of 15 EU Countries in the period 1990 to 2017 is presented. Since the data has categorical aggregational problem, we need to use very narrow industry data to have disaggregated data as much as possible so 4- digit ISIC data is used.

The weighted IIT following formula is shown below:

$$W_{j, iit} = \frac{X_{i,t} + M_{i,t}}{X_{j,t} + M_{j,t}} \quad (13.3)$$

$$IIT_j = \text{Weighted Intra-Industry Trade} = \sum W_{j, iit} \times IIT_i \quad (13.4)$$

Where $X_{i,t}$ and $M_{i,t}$ indicates export and import values of subsector i at year t . IIT_i shows subsector i 's intra industry trade value. IIT_j demonstrates intra industry trade value of industry j and $W_{j, iit}$ indicates weight calculations of IIT index.

Marginal Intra-Industry Trade is significant issue in intra- industry trade concept, following Cave (1981) Hamilton and Kniest search that issue in 1991. Hamilton and Kniest indicate that the important issue is not the share of IIT has increased, the point of increase of IIT share in new trade is crucial to identify effects of change of trading situations on adjustment. Therefore, it is critical to calculate the contributions of change in intra- industry trade and variation in net trade relative to change in total trade. By the way marginal intra-industry trade (MIIT) is identified as a result. However, Hamilton and Kniest cannot show adequate intelligence on the adjustment issue and measurement of structure of trade change. Different time periods' GL index shows various features according to the trade at that period but not reflect conclusions at the structure of change

in trade. Greenaway (1994) demonstrates mistakes of this calculation. Jayant Menon and Peter Dixon basically focuses on measure of MIIT and Brühlhart (1994) concentrates on adjustment concept and suggests in latter analysis related to MIIT index developed “A index”. We use Brühlhart’s “A index” that show transposition of the GL index to trade changes as MIIT and weighted MIIT calculations which is presented below:

$$MIIT = A = 1 - \frac{|(X_t - X_{t-n}) - (M_t - M_{t-n})|}{|(X_t - X_{t-n}) + (M_t - M_{t-n})|},$$

$$A = 1 - \frac{|\Delta X - \Delta M|}{|\Delta X| + |\Delta M|} \quad (13.5)$$

$$W_{j, miit} = \frac{|\Delta X_i| + |\Delta M_i|}{\sum (|\Delta X_i| + |\Delta M_i|)} \quad (13.6)$$

$$MIIT_j = \text{Weighted Marginal Intra-Industry Trade} = \sum W_{j, miit} \times A_j \quad (13.7)$$

Where $W_{j, miit}$ shows weight calculations of marginal intra industry trade. $X_{i, t}$ and $M_{i, t}$ indicates export and import values of subsector i at year t.

“A index” difference between 0 and 1 like IIT. Where 0 demonstrates marginal trade is completely inter industry trade in this industry and 1 indicates marginal trade completely intra- industry trade in this industry. Dixon and Menon express Theory of Marginal Intra- Industry Trade measurement noticeably detail which is proportion the contribution of change in IIT value to the percent change in total trade and called it MD1.

Let see MD1_j measurement:

$$MD1_j = \frac{\Delta IIT^{19}}{TT} = \hat{IIT} * GL_j^{20} \quad (13.8)$$

Menon and Dixon prefer to use MD1_j index rather than ΔGL_j since it causes incorrect inferences related to contributions of MIIT in changing trade. Dixon and Menon

¹⁹ Lovely and Nelson (2002) demonstrated $\Delta IIT = \Delta X_j + \Delta M_j + |X_j - M_j| - |X_j + \Delta X_j - M_j - \Delta M_j|$.

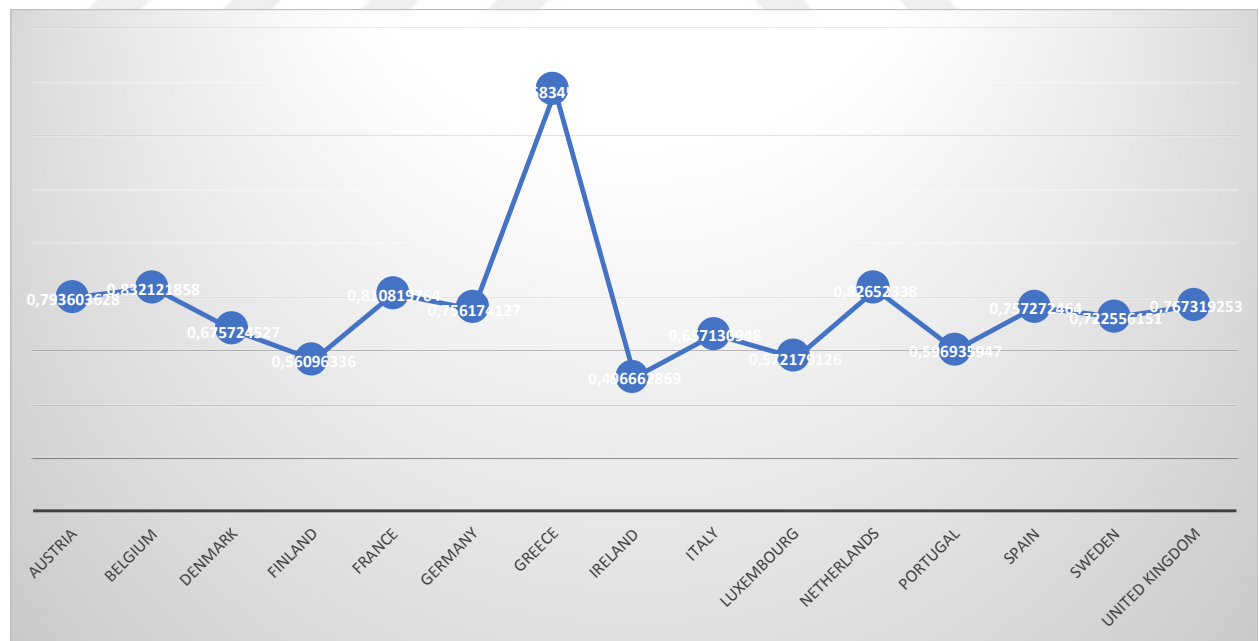
²⁰ “^” donates proportional change.

(1997) indicate nondisruptive part of change in trade will be overestimated by $MD1_j^{21}$.

As an alternative for MD1 measurement since it may produce false inference when our aim is to calculate the share of trade growth which consist of low adjustment costs, they offer $MD2_j$ measurement of the component of trade changed related to appropriate changes in exports and imports that is a measurement of percent of trade change which produces low adjustment costs. Therefore, $MD2_j$ shows point measurement of matched or dynamic changes in exports and imports concern to total trade which is defined dynamic IIT(DIIT) in Menon and Dixon's research.

Let see $MD2_j$ measurement:

$$MD2_j = \frac{2 \min[\Delta X_j, \Delta M_j]}{TT} = \frac{\Delta X_j + \Delta M_j - |\Delta X_j - \Delta M_j|}{TT} \quad (13.9) \quad 22$$



²¹ $MD1_j > MD2_j$ when $\text{sgn}[X_j - M_j] \neq \text{sgn}[\Delta X_j - \Delta M_j]$

²² $DIIT_i = 2 \min[\Delta X_i, \Delta M_i]$, $DIIT_j = \sum DIIT_i$, $MD2 = \frac{DIIT_j}{TT_j}$ from Menon and Dixon (1997)

Figure 7. Average IIT indexes of 15 EU Countries between the period 1990 and 2017

Lovely and Nelson (2002)²³ indicate that there is a problem about measurement of MIIT and by the way sensible measure of adjustment cost. The problem here come out by change in labor allocation because this change effects changes in production structure with the change in trade pattern affects change in production and demand. Thus, there is a domino effect among labor allocation, production, trade pattern and demand. Similarly, Brühlhart²⁴, Murphy and Strobl (1998) declare that Grubel- Llyod index is consistently used by the theoretical research to calculate IIT. However, there is not such kind of situation related to MIIT. MIIT is so crucial to detect relationship between trade and adjustment cost, there is a weakness in this issue in the literature which Brühlhart states. Therefore, we add on MD1 and MD2 to our analysis to make comparison between MIIT and MD1, MD2 concerning to estimate link between IIT and labor adjustment cost.

13.1. Panel Data GMM Estimation

In our empirical research we used dynamic panel data model (GMM-system). In the sense of dynamic panel data model, it contains at least one lagged dependent variable. Let consider the model:

$$Y_{it} = \alpha_t y_{i, t-1} + \beta' x_{it} + \gamma_i^* + \varepsilon_{it} \quad (13.1.1)$$

Where $i = 1, \dots, n$ and $t = 1, \dots, T$. In the formulation α_t and γ_i shows the unobserved individual and time-specific effects in the model and ε_{it} the error term with

$E(\varepsilon_{it}) = 0$, and $E(\varepsilon_{it}\varepsilon_{js}) = \sigma_\varepsilon^2$ if $j = i$ and $t = s$, and $E(\varepsilon_{it}\varepsilon_{js}) = 0$ otherwise.

²³ Lovely and Nelson (2002) argues that MIIT fail to measure labor adjustment pressures even under the best production circumstances because of demand changes.

²⁴ Brühlhart (1999) based his work on general- equilibrium analysis. He assumes that the structure of demand remains unaltered by changes in trade and domestic production.

The dynamic panel model, the formulation choice between fixed effect and random effect model has some implications which are different from the static model's implications. On the other hand, GMM estimation method rely on a model of first differences since to get rid of unobserved individual effects and time- invariant variables.

Let see the model:

$$(y_{i,t} - y_{i,t-1}) = \gamma (y_{i,t-1} - y_{i,t-2}) + \beta (x_{i,t} - x_{i,t-1}) + \varepsilon_{i,t} - \varepsilon_{i,t-1} \quad (13.1.2)$$

Where $t = 2, \dots, T$. In standard method of moments in this model become by equating the theoretical moments with their estimates which become by solving the unknown parameters in the model. GMM estimation model uses linear moment restrictions with some assumptions which are no serial correlation at error terms, lagged dependent variable can be used, not strictly exogeneous variable and individual effects in explanatory variables.

The difference GMM works poorly when it is applied to short panels of continuing time series (Blundell and Bond, 1998) so system GMM is suggested to use moment conditions depend on the level equations unitedly with the usual Arellano and Bond type orthogonality conditions. System GMM supports to come over the problem of finite sample bias and endogeneity of independent variables.

13.2. Specific- Factor Model with IIT

Lovely and Nelson used general-equilibrium model to investigate the relation between measurement of labor adjustment and measurement of MIIT analytically. It is obviously observed that MIIT literature shows labor reallocation has positive relation with production volume changes which implies growing industries increase their labors

but shrinking industries decrease their labors. To take MIIT as a proxy for labor adjustment the model of sector specific capital should be used. The model explains intra-industry trade by imperfect competition and increasing returns basis.

The model defines labor has mobility and can freely move between sub-sectors of the economy. The literature on this issue mostly model adjustment costs explicitly but this model depends on the statement of movement of labor between industries is much more costly to labor than movement between sub-sectors. Thus, movement of labor between sub-sectors of an industry with IIT provides low-cost labor adjustment.

As it is mentioned expanding sub-sectors employ more labor than contracting sub-sectors. To construct such adjustment model, a production model is composed that separates groups of intermediate products of two final good. Those inputs can be substituted among each other by using those intermediate inputs in each industry. The economy in the model is assumed to be small and prices are given. As Lovely and Nelson states that by this structural model we can focus on demand part of MIIT measurement which is ignored in the literature while they concentrate on short-run adjustment cost.

If we call final goods Y_1 and Y_2 , the production function for final goods is demonstrated by this way:

$$Y_j = F^j(A_{1j}, A_{2j}), \quad j = \{1, 2\}, \quad (13.2.1)$$

Where F^j is accepted as a linearly homogeneous and twice-differentiable function. A_{ij} shows domestic assimilation of intermediate ij . The equilibrium needs zero profits in final goods because the producers have given input and output prices.

The model assumes the economy trade intermediate inputs and put tax on imports of intermediates at every industry. The inputs are labeled by 21 and 22 are imported inputs on the other hand inputs labeled by 11 and 12 are exported. Therefore, there are both import-competing and export competing sub-sectors. In a small economy change in the home tariffs causes proportional change in the price of imported intermediates. A same amount of tariff is assumed on the final goods and inputs to prevent tariff transition from one good to another. This tariff application shows trade of final goods do not occur, all the final products are manufactured from imported and exported intermediates that it consumes in the economy.

The production of intermediate inputs consists of labor and subsector specific capital so we can show the production functions for the four intermediate inputs below:

$$X_{ij} = f^{ij}(L_{ij}, K_{ij}), \quad (13.2.2)$$

In the production function total labor²⁵ is defined fully mobile, employed, and fixed. It is shown below and where $i = \{1,2\}$ indicates the input type and $j = \{1,2\}$ indicates the output sector.

$$L = L_{11} + L_{12} + L_{21} + L_{22}, \quad (13.2.3)$$

Demand is supposed to be a function of the domestic relative price, p where $p = P_2 / P_1$ and domestic aggregate income which includes tariff revenue. Domestic demand function is presented below.

$$Z_j = D^j(p, \Gamma) \quad (13.2.4)$$

²⁵ Brühlhart (1999) uses total labor movement rather than total labor that we use here in his A index.

The equilibrium of domestic final goods occurred by consumption by market since no final is traded.

$$Y_j = Z_j, \quad j = \{1,2\} \quad (13.2.5)$$

The intermediate goods are traded opposite to final goods. Intermediate goods ij ' net exports are $N_{ij} = X_{ij} - A_{ij}$. Sum of the value of net exports needs to be zero to have balanced trade:

$$\sum_i \sum_j q_{ij}^* N_{ij} = 0, \quad (13.2.6)$$

where q_{ij}^* is the world price of intermediate ij . The domestic price of exported intermediates and the world price are same i.e., $q_{ij} = q_{ij}^*$

14.EMPIRICAL RESULTS and DISCUSSION

In our empirical work, we investigate the relationship of different measure of marginal intra- industry trade and labor adjustment cost. Our research base on 127 manufacturing industries at fifteen EU countries which are presented in Table 15. To make comparison between conflicting way of MIIT measures, Lovely and Nelson's analytical works are especially used, and we represent empirical results for those measurements. Additionally, the analyze also demonstrates an empirical comparison for the Brülhart's MIIT that is a commonly used measuring method for MIIT in literature, reckoning with the calculations of Dixon and Menon.

In Table 15, we present the empirical results of link between various measurement of MIIT and labor adjustment cost. Our analyze calculated by dynamic panel data (sys-GMM) estimation. In Table 15, first column shows MD1 type measure of Marginal Intra-

Industry Trade. As it is mentioned previous part, we take MD1 as a proxy for labor adjustment cost. At first equation it is seen previous three periods MD1HI has no significant effect on MD1HI currently. $\ln\text{CONSUME}$ has positive and significant effect on MD1HI. 1% increase in consumption amount in manufacturing industry increases MD1HI approximately 0,0013. Consumption rise in the industry increases IIT change in total trade change so rise movement of labor in the industry and concentration of firms in the industry thus decreases labor adjustment cost. Brülhart and Elliot, 1998 indicated consumption increases rise employment movement in the same industry.

1 point increase in WAGE has no significant effect on MD1HI. 1% increase in $\ln\text{EMPL}$ decreases MD1HI about 0,0018. That means increase in labor amount in manufacturing industry decreases change of IIT relative to percentage total trade with market concentration of firms. Thus, allocation of labor between subsectors of manufacturing industry decreases so adjustment cost increases. 1% increase in $\ln\text{PROD}$ decreases MD1HI approximately 0,0017 so improvement in productivity of labor force decreases change of IIT concern to percentage in total trade with the firms' market concentration, this also shrinks movement of labor between subsectors of manufacturing industry thus labor force adjustment cost increases (Brülhart and Elliot, 1998). MD1 measure has strong statistical results according to explain labor adjustment cost that demonstrates trade flow change has explanatory feature according to adjustment cost than traditional IIT index change in time (Shelburne,1992).

Openness has significant and positive effect on MD1HI. Increase of 1% in $\ln\text{OPEN}$ increases MD1HI about 0,0007. Since increase in trade openness of country supports Intra-Industry Trade and the change of IIT increase relative to percent change in total

trade. That provide increase in movement of labor between subsectors of manufacturing industry thus decreases labor adjustment cost. IIT and lag1 IIT has positive and significant influence on MD1HI. 1% increase in IIT increases MD1HI approximately 0,21. As expected, improvement of IIT percentage in total trade, increase movement of labor in manufacturing industry so adjustment cost decreases. Similarly, one-year previous IIT has positive and significant effect on MD1HI and support low adjustment cost.

In our empirical research, we also analyze the MD2 measure for marginal intra-industry trade as a scale for labor movement and labor adjustment cost. As MD2 is a direct measurement of precise changes in imports and exports relative to total trade, it is seen commonly as non-disruptive because an exact change in that part of change in total trade. In second column, we present the results of MD2HI equations. Three period lags of dependent variable are used to observe previous periods effect on MD2HI in period t. Those two-period lag has positive and significant effect on MD2HI in period t. 1 unit increase in MD2HI in lagged values rise MD2HI in period t approximately 0,14 unit. Matched changes in exports and imports at previous years support low adjustment cost at year t.

In Table 15, it is seen $\ln\text{CONSUME}$ do not have significant influence on MD2HI. WAGE has negative and insignificant effect on MD2HI. Similarly, $\ln\text{EMPL}$ and $\ln\text{PROD}$ do not have significant effect on MD2HI.

$\ln\text{OPEN}$ has positive and significant effect on MD2HI at 1% significance level. 1% increase in trade openness increases MD2HI approximately $4e-5$. Since increase in trade relative to value added in the industry supports growth of the matched export and import

changes in manufacturing industry relative to total trade. Thus, movement of labors in subsectors of manufacturing industry decreases adjustment cost of labor in the industry. MIIT has positive and significant effect on MD2HI at 5% significance level. 1 unit increase in MIIT increases MD2HI $9e-6$ unit. Increase in change of IIT relative to total trade provide to improve of covariant effect of precise change in export and import in manufacturing sector relative to total trade and market concentration of firms.

In the last equation, we analyze Brülhart's A index that calculates marginal intra-industry trade. Since it is aggregated value, it provides wide measure of MIIT by sectoral or economy. Two period delayed effect of MIITHI on MIITHI in period t have positive and significant influence at 1% significance level. 1 unit increase in both two lagged period of MIITHI rises MIITHI about 0,51 and 0,05 unit respectively. Third period lagged MIITHI has no significant effect on MIITHI. $\ln\text{CONSUME}$ has positive and significant effect on MIITHI at 5% significance level. 1% increase in $\ln\text{CONSUME}$ increases MIITHI $4e-5$ approximately. Increase in consumption in manufacturing industry rises the covariant effect of IIT change in total trade and market concentration of firms. Therefore, reallocation of labor increases in the industry and adjustment cost reduces.

WAGE has no significant influence on MIITHI at 1% significance level. $\ln\text{EMPL}$ has positive and significant effect on MIITHI at 5% significance level. 1% increment in $\ln\text{EMPL}$ rises MIITHI approximately 0,00005. Rise of labor amount in the manufacturing industry increases MIIT and movement of labor in the industry thus labor adjustment cost diminishes. $\ln\text{PROD}$ and $\ln\text{OPEN}$ have no significant influence at MIITHI and adjustment cost of labor. Lastly, marginal intra-industry trade has positive and significant

effect at 1% significance level. 1% increment in MIIT in the industry increases market concentration of firms in marginal intra industry trade at about 0,07 on movement of labor and diminishes adjustment cost.



Table 15. The Empirical Results of Measurement of Marginal Intra-Industry Trade and Labor Adjustment Cost

Dependent Variable	MD1HI	MD2HI	MIITHI
MD1HI			
L1.	0,0043181 (-0.16)	-	-
L2.	-0,001957 (-0.09)	-	-
L3.	0,0078245 (0.42)	-	-
MD2HI			
L1.	-	0,1162698 (2,40)**	-
L2.	-	0,1413088 (2,92)***	-
L3.	-	0,1540451 (1,94)*	-
MIITHI			
L1.	-	-	0,5130933 (13,92)***
L2.	-	-	0,0547212 (1,94)***
L3.	-	-	0,0361538 (1,00)
lnCONSUME	0,1322356 (2,15)**	-0,0003846 (-1,44)	0,0035673 (-1,97)**
WAGE	-5.13e-07 (-0,25)	-1.18e-08 (-0,18)	1.24e-07 (0,87)
lnEMPL	-0,1816204 (-2,59)***	0,0001138 (0,42)	0,0047658 (2,18)**
lnPROD	-0,1696081 (-2,61)***	-0,0000461 (-0,22)	0,0010538 (0,21)
lnOPEN	0,0654953 (2,90)***	0,0035424 (9,95)***	-0,0004046 (0,38)
IIT	0,2120746 (64,16)***	-	-
L1.	0,177985 (29,76)***	-	-
MIIT	-	0,0008997 (2,45)**	0,0720214 (29,74)***
L1.	-	-	-0,0327319 (-8,77)***
CONS	-0,4094868 (-1,59)	0,0063506 (2,98)***	0,0157944 (1,09)
Sargan (Prob> chi2)	0,20	0,24	0,27
Wald (Prob> chi2)	0,000	0,000	0,000
AR(1)(Prob> chi2)	0,02	0,02	0,01
Num. Of Obs.	364	375	375
Num. Of Instruments	57	56	57

*, **, *** represents significant p values of 0.10, 0.05, 0.01 respectively. The values in parenthesis shows z values.

Consequently, MD1, MD2 and MIIT have explanatory influence on labor adjustment cost. MD1 gives more strong results rather than MD2 and MIIT measurement indexes according to the labor adjustment cost in manufacturing industry in our sample data of 15 EU countries. Since MD2 is a direct measurement method on the part of trade change which shows proper changes in export and import values, MD1 have overestimation on calculation of non-disruptive component of change in trade (Dixon and Menon, 1997) since $MD1_j > MD2_j$ is observed. MD2 shows low adjustment cost suitable with the results of Dixon and Menon. Thus, MD1 is observed that has more explanatory power on consumption, employment, productivity, and trade openness of independent variables relative to MD2 and MIIT.

15.CONCLUSION

Labor adjustment cost is crucial issue in the literature, and it is related with intra-industry trade issue in international trade. Our objective in this research to make an empirical analysis to observe the relationship between different measures of marginal intra-industry trade and labor adjustment cost. To make the comparison between those various measures we used Dixon and Menon's MD1 and MD2 index and Brühlhart's A index which is widely used in the IIT literature with Lovely and Nelson's theoretical model²⁶. Besides that, IIT calculations are constructed from 127 manufacturing industries aggregated value and ISIC 4- digit categorization is used at this measurement.

In our results different from the most of searches in the literature we take MD1, MD2 and MIIT as a proxy for labor adjustment cost. Because these measures of marginal intra-industry trade are taken as a scale for labor movement between different subsectors of a

²⁶ Lovely and Nelson (2000) represents an opposite model because of liberalization which shows the change in total trade is all intra-industry while labor reallocation is all inter- industry.

given industry. Increase in IIT in total trade shows rise of labor movement between different subsectors of the industry than between various industries. Thus, labor adjustment cost declines because of change position in the same industry which is known as Smooth Adjustment Hypothesis. Low adjustment cost is significant both for labor and employer since it provides easy adaptation to new position and subsector for labors, also low cost of production for employer.

In our empirical investigation we take covariant effect of MIIT measures with market concentration index of HI as labor adjustment cost to see competitiveness in the market. At first equation rise in consumption in manufacturing sector, trade openness in the sector and aggregate IIT in year t and $t-1$ have positive and significant effect on MD1HI. Increase of consumption in the industry rises change of IIT in percent total trade and market concentration of firms in that industry. Since grow of IIT means increase of labor movement in the industry so decrease of labor adjustment cost. Similarly, improvement in trade openness provides rise in IIT thus, labor allocation occurs in the industry and supports low adjustment cost. As expected, increase in IIT like consumption and openness support low adjustment cost because of labor allocation increases in the industry with the growth of IIT.

On the other hand, labor productivity and labor amount in the industry negative and significant effect on MD1HI. Increase in those variables decreases both IIT change in percentage total trade and market concentration of firms in the manufacturing industry. The decline effects of these variable weaken movement of labor in subsectors of the industry. Therefore, labor adjustment cost increases by the allocation of labor between various industries. Average wage in manufacturing industry has no significant effect on

precising the relationship between labor adjustment cost and MD1 type marginal intra industry trade measure.

Our investigation contains MD2 index in second model which is different measure of marginal intra-industry trade. In this model labor adjustment cost is measured by MD2HI. Consumption in manufacturing industry have no significant effect on MD2HI. Openness and MIIT has positive and significant effect on MD2HI. Rise in trade openness in manufacturing industry may increase the allocation of labor in the industry so provide low adjustment cost. As expected, increase in MIIT index rise IIT in total trade so movement of labor in the industry. Number of labor and productivity of labor do not have significant effect on MD2HI.

At last model we take MIITHI as a proxy of labor adjustment cost. Previous years MIITHI, consumption, MIIT and number of labors in manufacturing industry have positive and significant effect. They increase the labor movement in the industry and decrease labor adjustment cost. Employment has positive effect on MIITHI thus rise joint effect of MIIT and market concentration of firms in the industry. By the way labor force movement rise in the industry so adjustment cost declines. Openness has no significant effect on MIITHI. Other variables of productivity and average wage have no significant effect.

Consequently, we analyze empirically MD1HI, MD2HI and MIITHI. They have different coefficients sometimes at the same variables but when we investigate those models with both are statistically significant. However, MD1 has more significance result about 1% level so it has more powerful results and shows more strong relationship with number of employments, consumption, productivity, trade openness. The research

presents that IIT and MIIT have strong relationship with low adjustment cost as suitable with the literature.



REFERENCES

- Arellano, M., Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and Application to Employment Equations. *Review of Economic Studies*, 58, 277-297.
- Arellano, M., and Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models. *Journal of Econometrics*, 68, 29- 51.
- Balassa, B. (1979). Tariff Reductions and Trade in Manufactures Among the Industrial Countries. *American Economic Review*, 56 (3): 466-473.
- Blundell, R., Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Economics*, 87, 115- 143.
- Blundell, R., Bond, S. (2000). GMM estimation with persistent panel data: an application to production functions. *Econometric Reviews* 19, 321-340.
- Brühlhart, M. (1994). Marginal Intra- Industry Trade: Measurement and Relevance for the Pattern of Industrial Adjustment. *Weltwirtschaftliches Archiv*, 130(3): 600- 613.
- Brühlhart, M., Elliott, R. (1998). Adjustment to the European Single Market: Inferences from Intra-Industry Trade Patterns. *Journal of Economic Studies*.
- Brühlhart, M., D. McAleese, and O' Donnell, M. (1999). Ireland. In M. Brühlhart and R. Hine (eds.). *Intra-Industry Trade and Adjustment: The European Experience*. London: Macmillan.
- Dixon, P., and Menon, J. (1997). Measures of Trade as Indicators of Factor Market Disruption. *Economic Record*, 73 (September): 233- 237.

- Greenaway, D., and Hine, R.C. (1991). "Intra-industry specialization, trade expansion and adjustment in the European economic space". *Journal of Common Market Studies*, Vol. 24, pp. 603-22.
- Greenaway, D., Hine, R., Milner C., and Elliott, R. (1994). Adjustment and the Measurement of Marginal Intra- Industry Trade. *Weltwirtschaftliches Archiv*, 130 (2): 418- 427.
- Hamilton, C., and Kniest, P. (1991). Trade Liberalization, Structural Adjustment, and Intra-Industry Trade. *Weltwirtschaftliches Archiv*, 127 (2): 356- 367.
- Kol, J., and Kuijpers, B. (1999). The Netherlands. In M. Brühlhart and R. Hine (eds). *Intra- Industry Trade and Adjustment: The European Experience*. London: Macmillan.
- Lovely, M.E., and Nelson, D.R. (2000). Marginal Intra- Industry Trade and Labor Market Adjustment. *Review of International Economics*, 8 (3): 436- 447.
- Lovely, M.E., and D.R. Nelson (2002). Intra- Industry Trade as an Indicator of Labor Market Adjustment. *Weltwirtschaftliches Archiv*, 138 (2).
- Menon, J., and Dixon, P. (1997). Intra- Industry versus Inter- Industry Trade: Relevance for Adjustment Costs. *Weltwirtschaftliches Archiv*, 133 (1): 164- 169.
- Porto, M., and Costa, F. (1999). Portugal. In M. Brühlhart and R. Hine (eds.), *Intra- Industry Trade and Adjustment: The European Experience*. London: Macmillan.
- Rossini, G., and Burattoni, M. (1999). Italy. In M. Brühlhart and R. Hine (eds), *Intra- Industry Trade and Adjustment: The European Experience*. London: Macmillan.

Sarris, A.H., P. Papadimitriou, and Mavrogiannis, A. (1999). Greece. In M. Brühlhart and R. Hine (eds.), *Intra-Industry Trade and Adjustment: The European Experience*. London: Macmillan.

Smeets, H.D. (1999). Germany. In M. Brühlhart and R. Hine (eds.), *Intra- Industry Trade and Adjustment: The European Experience*. London: Macmillan.

Tharakan, P.K.M., and Calfat, G. (1999). Belgium. In M. Brühlhart and R. Hine (eds.), *Intra- Industry Trade and Adjustment: The European Experience*. London: Macmillan.

APPENDIX E

Appendix consists of five tables. First one presents list of countries considered, second one shows descriptive statistics and third one represents correlations between variables. At table forth, we calculate panel unit root tests of independent variables. Data sources of variables are shown at table five. At last, two table we show Herfindahl-Hirschman Index and aggregated IIT of 15 EU countries in 2017.

Table 16. List of countries considered

Austria	Germany	Neterlands
Belgium	Greece	Portugal
Denmark	Ireland	Spain
Finland	Italy	Sweden
France	Luxembourg	United Kingdom

Table 17. Descriptive Statistics

Variable	Obs.	Mean	Std.Dev.	Min.	Max.
lnCONSUME	420	18,578	1,703	13,767	21,258
WAGE	420	42,558	9,674	23,906	69,541
lnEMPL	420	6,767	1,473	2,219	9,270
lnPROD	420	12,000	0,911	6,921	14,520
lnOPEN	420	14,824	1,212	12,308	17,152
IIT	420	0,760	1,503	0,353	31,386
MIIT	420	0,537	0,165	0,151	0,997

Source: Author's calculation

Table 18. Correlation between variables

	lnCONSUME	WAGE	lnEMPL	lnPROD	lnOPEN	IIT	MIIT
lnCONSUME	1						
WAGE	-0,22	1					
lnEMPL	0,92	-0,37	1				
lnPROD	0,43	0,32	0,12	1			
lnOPEN	0,74	0,11	0,62	0,54	1		
IIT	0,03	-0,02	0,02	0,01	0,00	1	
MIIT	0,28	0,32	0,28	0,18	0,31	0,05	1

Source: Author's calculation

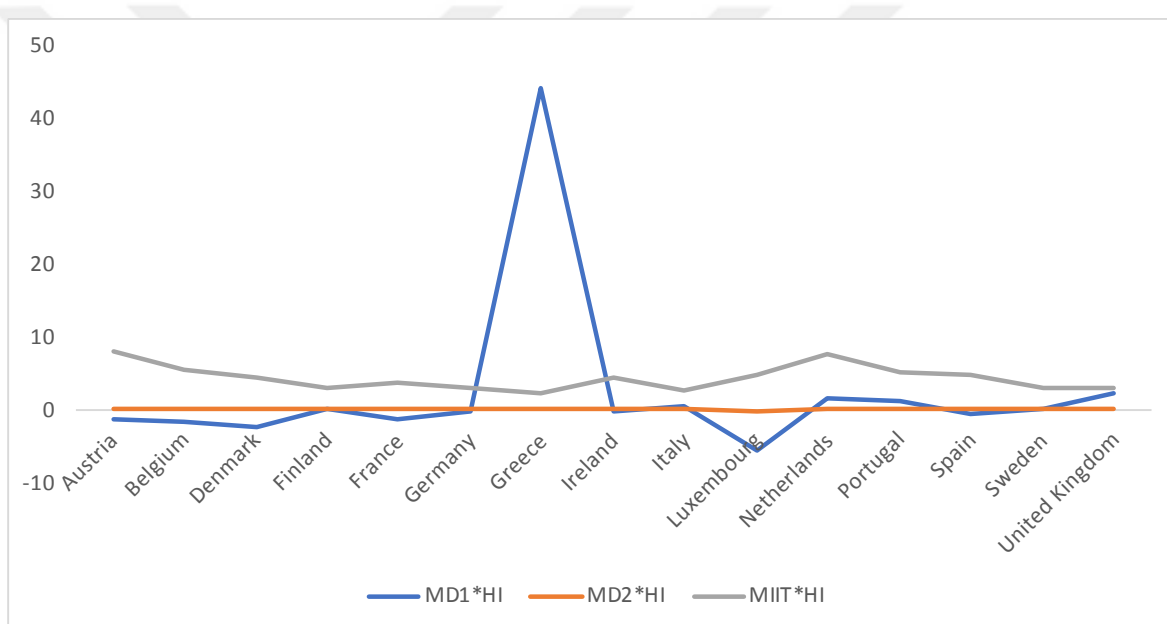
Table 19. Panel Unitroot Tests

LEVEL	lnCONSUME	WAGE	lnEMPL	lnPROD	lnOPEN	IIT	MIIT
Levin, Lin, Chu	-2,44***	-11,50***	-43,88***	-13,49***	0,44	-2,66***	-3,33***
Im, Pesaran and Shin W-stat	3,56***	-1,86**	-2,29**	-3,34***	-1,84**	-5,35***	-9,05***
ADF- Fisher Chi- Square	50,53**	30,47	27,17	45,54**	13,68	75,76***	159,42***
PP- Fisher Chi- Square	50,53**	30,47	27,17	45,54**	13,68	75,74***	159,42***
DIFFERENCE							
Levin, Lin, Chu	-8,60***	-11,43***	-85,27***	-20,46***	-85,27***	-6,77***	-7,08***
Im, Pesaran and Shin W-stat	-3,55***	-9,58***	-9,52***	-10,70***	-10,38***	-11,84***	-13,72***
ADF- Fisher Chi- Square	299,19***	238,19***	224***	301,88***	236,83***	399,53***	655,87***
PP- Fisher Chi- Square	299,19***	238,19***	224***	301,88***	236,83***	399,53***	655,87***

Source: Author's Calculation

Table 20. Data Sources

Export	United Nations Industrial Development Organization (UNIDO)
Import	United Nations Industrial Development Organization (UNIDO)
Consumption	United Nations Industrial Development Organization (UNIDO)
Output	United Nations Industrial Development Organization (UNIDO)
Wage	OECD Statistics
Employment	OECD Statistics
Trade	OECD Statistics
Value Added	OECD Statistics
HI	World Bank

**Figure 8. The Average of MD1*HI, MD2HI and MIIT*HI in 15 EU Countries**

Source: Author's Calculation

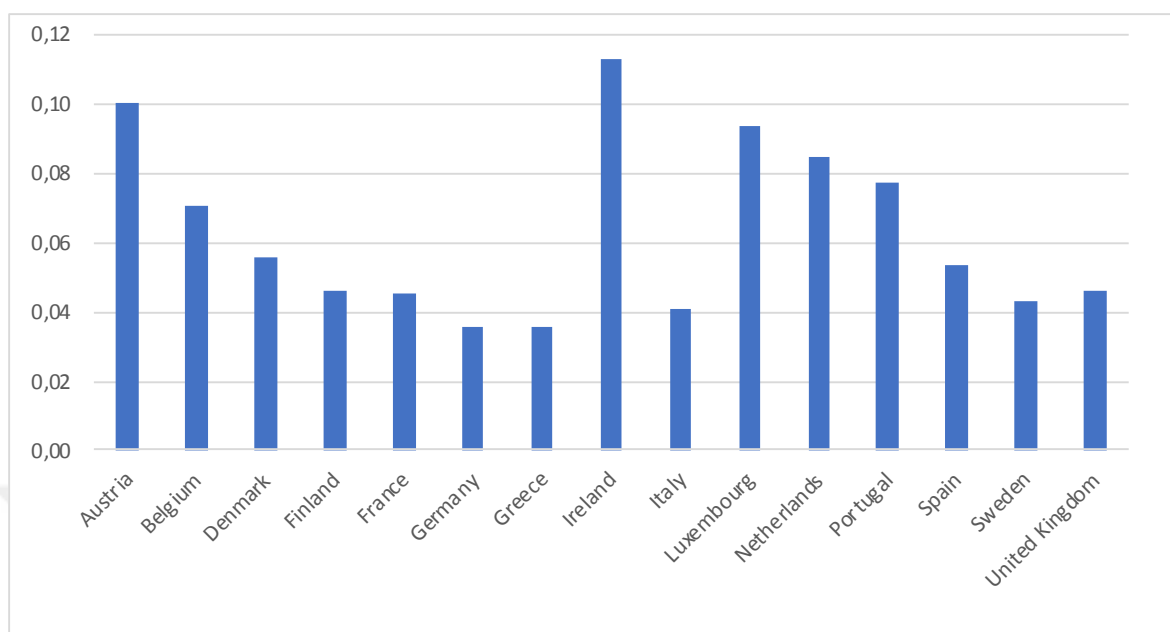


Figure 9. Herfindahl-Hirschman Index of 15 EU Countries in 2017

Source: Author's Calculation

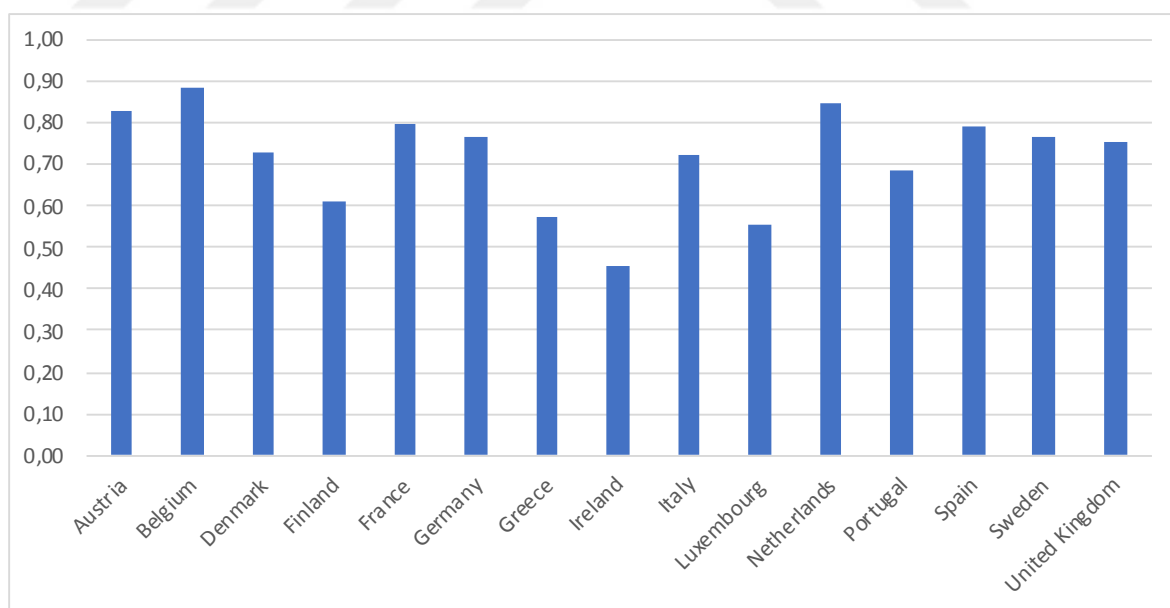


Figure 10. Aggregated IIT of 15 EU Countries in 2017

Source: Author's Calculation