

**AN ANALYSIS OF INTERNATIONAL TRADE FLOWS OF TURKEY WITH  
GRAVITY MODEL**

**Master Thesis**

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**Master Thesis**

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## FINAL APPROVAL FOR THESIS

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## **ABSTRACT**

### **AN ANALYSIS OF INTERNATIONAL TRADE FLOWS OF TURKEY WITH GRAVITY MODEL**

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In today's world, there is no country that adopts a closed economy. The reason for this is the existence of many factors that push countries to trade with each other. These factors have led to the formation of various trade theories in the international trade literature. These theories can be listed as Classical, Neo-classical and New International Trade Theories. Classical theories consist of Adam Smith's Theory of Absolute Advantages and Ricardo's Theory of Comparative Advantages. Neo-classical foreign trade theories emerged with the contributions of Heckscher (1919) and Ohlin (1933). This theory is called the Heckscher-Ohlin Model or Factor Equipment theory. New international trade theories can be listed as Qualified Labour Model (Keesing, 1966), The imitation lag hypothesis (Posner, 1961), The product cycle model (Vernon, 1966), The Linder Theory (Linder, 1961), Economies of scale (Krugman, 1980), The Krugman Model (Krugman, 1979), The reciprocal dumping model (Brander and Krugman, 1983), and the Gravity Model (Tinbergen, 1962).

The gravity model, which is among the new international trade theories, has been the subject of theoretical and empirical studies since the factors affecting trade in today's world can be tested in the model. In particular, the important effect of income level and distance, which are the main variables, on international trade necessitates the examination of the structure of foreign trade in country groups with different income levels. For this reason, this study aims to the trade flows of Turkey with different income groups in the period 2003-2019 within the framework of the gravity model.

For this purpose, a total of 165 countries, including 25 low-income countries, 39 middle-low-income countries, 44 middle-high-income countries and 57 high-income countries, are included in the analysis in two separate equations: export and import. In the study, the panel data method is preferred since there are both cross-section and time dimensions in the structure of the gravity equation. It is expected from this study to introduce a new perspective to literature by analysing international trade flows with PPML model since it has zero trade flows, robust for econometric problems and gives better results when compare to other estimation methods.

**Key words:** Gravity model, International trade, Trade relations, Panel data models, PPML

## ÖZET

Günümüz dünyasında kapalı ekonomiyi benimseyen ülke bulunmamaktadır. Bunun sebebi ülkeleri birbirleriyle ticaret yapmaya iten birçok faktörün varlığıdır. Söz konusu faktörler uluslararası ticaret literatüründe çeşitli dış ticaret teorilerinin oluşmasına neden olmuştur. Bu teoriler Klasik, Neo-klasik ve Yeni Dış Ticaret Teorileri olarak sıralanabilir. Klasik teoriler Adam Smith'in Mutlak Üstünlükler Teorisi ile Ricardo'nun Karşılaştırmalı Üstünlükler Teorisinden oluşmaktadır. Neo-klasik dış ticaret teorileri Heckscher(1919) ve Ohlin(1933)'in katkılarıyla ortaya çıkmıştır. Bu teori, Heckscher-Ohlin Model ya da Faktör Donatımı teorisi olarak adlandırılmaktadır. Yeni dış ticaret teorileri ise Nitelikli İşgücü Teoremi (Keesing,1966), Teknoloji Açığı Teoremi (Posner, 1961), Ürün Dönemleri Teorisi (Vernon, 1966), Linder Teorisi (Linder, 1961), Ölçek Ekonomileri (Krugman, 1980), Krugman Modeli (Krugman, 1979), Karşılıklı Damping Modeli (Brander ve Krugman, 1983), ve Çekim Modeli (Tinbergen, 1962) olarak sıralanabilir.

Yeni dış ticaret teorileri içerisinde yer alan çekim modeli günümüz dünyasında ticareti etkilen faktörlerin modelde test edilebilmesi sebebi ile genellikle teorik ve ampirik çalışmalara konu olmuştur. Özellikle temel değişken olan gelir düzeyi ve mesafenin dış ticaret üzerindeki önemli etkisi farklı gelir düzeyine sahip ülke gruplarındaki dış ticaretin yapısının incelenmesini gerekli kılmaktadır. Bu nedenle çalışmada, 2003-2019 dönemi için Türkiye'nin farklı gelir grupları ile olan ticaret akışlarının çekim modeli çerçevesinde analiz edilmesi amaçlanmaktadır. Bu amaç doğrultusunda, ihracat ve ithalat olmak üzere iki ayrı denklemde 25 düşük gelirli ülke, 39 orta-düşük gelirli ülke, 44 orta-yüksek gelirli ülke ve 57 yüksek gelirli ülke olmak üzere toplam 165 ülke analize dahil edilmektedir. Çalışmada, çekim denkleminin yapısında hem yatay kesit hem de zaman boyutu olduğu için panel veri yöntemi tercih edilmektedir. Bu çalışmada, dış ticaret partnerleri ile sıfır ticaret akışlarının varlığından ve diğer ekonometrik sorunlara karşı daha analitik sonuçlar vermesinden dolayı PPML model ile analiz edilmesi literatüre farklı bir bakış açısı kazandırmaktadır.

**Key words:** Çekim modeli, Uluslararası ticaret, Ticari ilişkiler, Panel veri modelleri, PPML

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03/05/2021

**STATEMENT OF COMPLIANCE WITH ETHICAL PRINCIPLES AND  
RULES**

I hereby truthfully declare that this thesis is an original work prepared by me; that I have behaved in accordance with the scientific ethical principles and rules throughout the stages of preparation, data collection, analysis and presentation of my work; that I have cited the sources of all the data and information that could be obtained within the scope of this study, and included these sources in the references section; and that this study has been scanned for plagiarism with “scientific plagiarism detection program” used by Anadolu University, and that “it does not have any plagiarism” whatsoever. I also declare that, if a case contrary to my declaration is detected in my work at any time, I hereby express my consent to all the ethical and legal consequences that are involved.

**İrem ÖNAL**

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## **SYMBOLS AND ABBREVIATIONS**

<b>CBRT:</b>	Central Bank of the Republic of Turkey
<b>CEPII:</b>	Centre d'Études Prospectives et d'Informations Internationales
<b>CES:</b>	Constant Elasticity of Substitution
<b>CPI:</b>	Consumer Price Index
<b>FEM:</b>	Fixed Effects Model
<b>FGLS:</b>	Feasible Generalized Least Squares
<b>GDP:</b>	Gross Domestic Product
<b>GCASC:</b>	Greek Cypriot Administration of Southern Cyprus
<b>OECD:</b>	Organisation for Economic Co-operation and Development
<b>OLS:</b>	Ordinary Least Squares
<b>PPF:</b>	Production Possibility Frontier
<b>PPML:</b>	Poisson Pseudo-Maximum Likelihood
<b>REM:</b>	Random Effects Model
<b>TIM:</b>	Turkish Exporters Assembly
<b>TURKSTAT:</b>	Turkish Statistical Institute
<b>TRNC:</b>	Turkish Republic of Northern Cyprus
<b>VIF:</b>	Variance Inflation Factor
<b>WHO:</b>	World Health Organization

## INTRODUCTION

International trade is the flow of goods, services, and capital outside the national borders of a country. In today's world, there is no closed economy. There are necessary reasons for countries to trade with each other. Factor endowments or resource differences cause countries to trade. Differences in geographical regions provide advantages to countries with different natural resources. For example, fishing is considerably significant in countries that have a coastline to sea. Similarly, regional differences cause differences in climatic conditions. Soil and climatic conditions must be suitable for the production of agricultural products that are necessary for people to survive. For this reason, each country produces only as far as climatic conditions allow and exports oversupply to other countries. Similarly, import goods from other countries that it cannot produce due to climatic conditions. For example, temperate climates countries are pioneers in the export of products such as cherry, plum and apricot. Another reason for the trade is supply and demand gap in countries. Occasionally countries can produce more than they need. In the opposite case, sometimes their production may not meet their needs. In case the country produces more than its needs, this surplus is exported to other countries. In other respect, the production of the country is insufficient to meet its needs, this scarce is imported from other countries. These reasons set the groundwork for the occurrence of various trade theories.

Trade has existed for centuries since the beginning of the history of humanity. International trade has a rich history, with the barter economy replaced by Mercantilism at the end of the 17th century. In the century that followed, mercantilism gave place to physiocracy and then liberalism. Classical International Trade Theory is based on the study of Adam Smith, the founder of classical liberalism, called "Wealth of Nations (1776)" in short. According to classical liberalism, three points guide international trade. The first is that individuals are rational, also known as homo economicus, and they will make their decisions according to their own interests. The second is the assumption expressed as "laissez faire, laissez passer". According to this assumption, the share of the state should be as small as possible, and its aim should only be to ensure the necessary safety. Finally, there is a price mechanism in the economy, which is called the invisible hand (Hamitoğulları, 1982, p.116-117).

Thus, Smith (1776) presented the Theory of Absolute Advantages, which explained the division of labour and the gain of the free-market economy. David Ricardo (1817) improved the classical school with his work "On the Principles of Political Economy and Taxation". With the Theory of Comparative Advantages, he argued that countries have comparative advantages, not absolute advantages. Subsequently, Heckscher and Ohlin is the representative of the neo-classical view. Heckscher (1919) and Ohlin (1933) developed the Factor Equipment Theory, or other name Heckscher-Ohlin Model (H-O). According to the model, factor endowments differences are the basis of international trade. Since the 1960s, New Trade Theories have emerged that explain the trade between different sized countries, structures, and goods. Today, international trade volume has increased substantially. World trade was \$ 122,993 billion in 1960, and \$19,051 trillion in 2019. This increase in international trade volume causes the theories that explain international trade to diversify. New Trade Theories can be listed as Qualified Labour Model (Keesing, 1966), The imitation lag hypothesis (Posner, 1961), The product cycle model (Vernon, 1966), The Linder Theory (Linder, 1961), Economies of scale (Krugman, 1980), The Krugman Model (Krugman, 1979), The reciprocal dumping model (Brander and Krugman, 1983), and the Gravity Model (Tinbergen, 1962). Each of the new international trade theories has a different starting point for explaining trade.

In this study, the Gravity Model was used in the analysis of international trade flows of Turkey because of high empirical explanation power and strong theoretical background. The purpose of the study examines Turkey's international trade flows with different income groups during the period 2003-2019 with PPML method within the framework of the gravity model. In this study, the classification of partner countries by income level, which is the most important factor affecting international trade, and the estimate with the PPML model, which realising more analytical results against the econometric problems faced by other estimation methods, provide a new perspective to the literature.

In the first section of the study, macroeconomic indicators and international trade trends will be examined according to Turkey and country groups of income level in the 2003-2019 period. In the second part of the study, the causes of international trade and trade theories will be explained. The third part of the study will dwell on the gravity model in more detail. Since there are both cross-section and time dimensions in the structure of the gravity equation, the model will be estimated by the panel data method. In the panel data set, there are a total of 165 countries, consisting of 25 Lower-income countries, 39 lower-middle-income countries, 44 upper-middle-income countries, and 57 high-income countries. The investigated period is 17 years between 2003-2019. Export and import as dependent variables are estimated in two separate equations. Trade flow data were obtained from TURKSTAT database. Distance between Turkey and countries and dummy variables such as common border, common religion and colonial ties were taken from CEPII.

## CHAPTER I

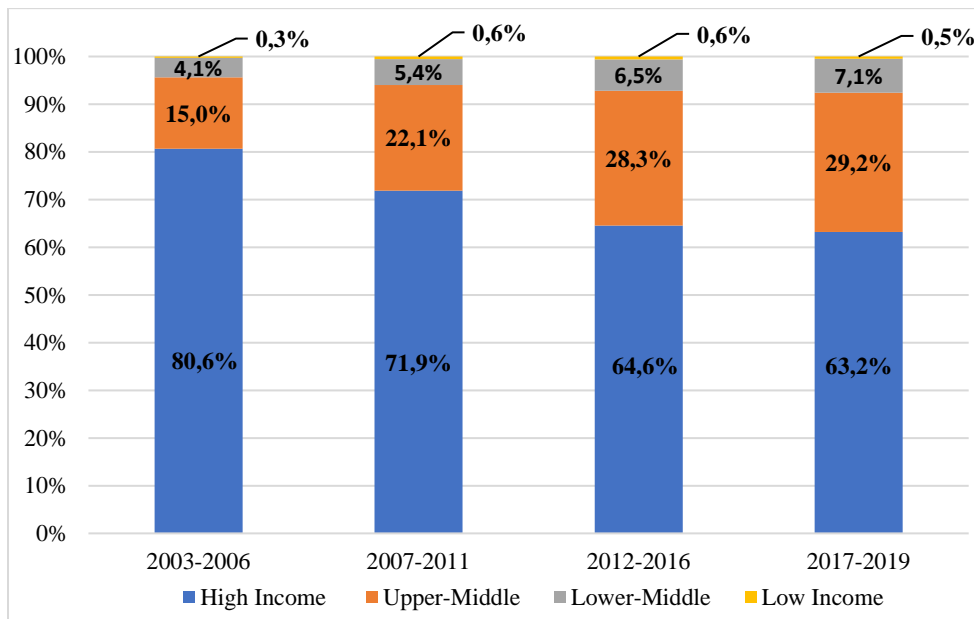
### 1. MACRO ECONOMIC INDICATORS

Economists combine observation and theory to understand what is happening in the world. In other words, economists use observations to test the validity of the theories constructed. A century ago, observation is the anecdote of everyone who comes to the market. Today, the plural form of these anecdotes is data. Therefore, economic data are an objective and systematic source of information. Governments and policymakers apply statistics to determine a policy. On the other hand, economists study them for analysis.

This chapter focus on the 3 most frequently used macroeconomic indicators by economists and policymakers. The first is the gross domestic product (GDP), which shows the total income of countries. The second is the inflation rate, which is an indicator of the rate of price increase in countries. Finally, the unemployment rate is the share of people who want to work but unemployed.

#### 1.1. Gross Domestic Product (GDP)

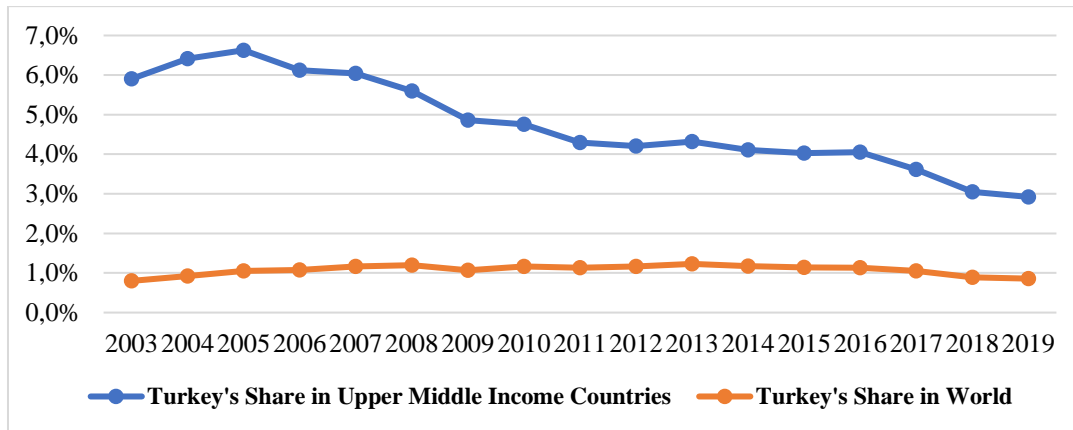
The World Bank has four classification methods for countries. These are geographic regions, income groups, operational lending categories and other groupings respectively. In this study, countries are classified according to income groups. The World Bank divides economies into four groups according to income levels by using World Bank Atlas Method. These are respectively Low- Income Economies (\$1,035 or less), Lower-Middle Income Economies (\$1,036 to \$4,045), Upper-Middle Income Economies (\$4,046 to \$12,535) and High-Income Economies (\$12,536 or more) (<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>, accessed at 15.01.2021).



**Figure 1.1.** *Between 2003-2019 shares of country groups in GDP*

As of 2019, the world has a GDP of 87.8 trillion dollars at current prices. In the 2003-2006 period, High Income Countries, which constituted the largest group with 83 countries, accounted for 80.6% of the world GDP. Although the share of High-Income Countries' GDP has decreased gradually over the years, it still constitutes 2/3 of the world GDP as can be seen in figure 1.1.

Upper-Middle Income Countries, the second most populous group, increased its share in GDP greater than any other country groups from 2003 to 2019. Increasing its share in GDP from 15% to 29.2%, it constitutes almost 3 out of 10 of the world GDP. Lower-Middle Income Countries, third with 50 countries, were able to increase their share of GDP by 3% from 2003 to 2019. The share of Low-Income Countries with 29 countries in the GDP was 0.5% with a 0.1% decrease in 2017-2019, although it showed an increasing momentum from 2003 to 2016.



**Figure 1.2.** *Between 2003-2019 share of Turkey's GDP in Upper-Middle Income Group and Worldwide*

Turkey according to size of GDP at current prices in 2019, with 761 billion dollars of GDP is 19th in the world's 20 largest economies. Additionally, Turkey has the world 0,86's% of GDP. In the 2003-2009 period, Turkey has been increasing its share of world GDP. Figure 1.2 shows that Turkey's share in the global crisis of 2008 has decreased from 1.2% to 1.07%.

There is an increasing trend until 2014 right after the crisis. Moreover, in 2013 the highest performance in Turkey showed 1.23%. Turkey's share in GDP declined steadily since 2014 due to the loss of momentum and where it is seen to be under 1% in 2018. Turkey takes place in the Middle-Upper Income Countries group has 2.92% of GDP in the 2019 data. Turkey's share in Upper-Middle Income has been increased from 2003 to 2006. In 2005, Turkey showed its the highest performance with 6.63%. While Turkey's share was 6% until 2008, with the global crisis it falls 4.86%. After the global crisis Turkey's share continued to show a decreasing trend and could not return to an earlier level.

**Table 1.1.** *GDP Growth Rate of Country Groups and Worldwide (Worldbank)*

	High Income Countries	Upper-Middle Income Countries	Lower-Middle Income Countries	Low Income Countries	Turkey	World
2003	2,2	5,2	6,4	5,1	5,6	3,0
2004	3,3	7,9	7,2	5,7	9,6	4,4
2005	2,9	7,1	6,6	6,9	9,0	3,9
2006	3,2	8,2	6,9	6,7	7,1	4,4
2007	2,8	8,8	6,9	7,6	5,0	4,3
2008	0,4	5,9	4,2	6,5	0,8	1,9
2009	-3,3	1,7	4,9	4,9	-4,7	-1,7
2010	2,9	7,6	6,9	5,8	8,5	4,3
2011	1,9	6,3	4,9	3,3	11,1	3,1
2012	1,3	5,2	5,1	2,3	4,8	2,5
2013	1,5	5,0	5,5	5,7	8,5	2,7
2014	2,0	4,1	5,8	5,0	5,2	2,8
2015	2,3	3,6	5,7	2,1	6,1	2,9
2016	1,7	4,0	5,6	3,9	3,2	2,6
2017	2,4	4,8	5,5	4,4	7,5	3,3
2018	2,2	4,5	5,2	3,6	2,8	3,0
2019	1,7	3,8	4,4	3,9	0,9	2,5

The growth rate is one of the basic indicators used to measure the economic performance of countries. This ratio, which shows the real increase rate of GDP compared to the previous year. Furthermore, the growth rate is one of the most used methods in economic performance comparisons between countries. The housing crisis began in the 2008, and the effects were seen in the following years. As it's seen on the table 1.1, in 2008 the growth rate of the world was 1.8 percent. In 2008, there was a decrease in all country groups compared to the previous year. However, the following year were devastating for almost all countries except in Lower-Middle Income Countries. The global crisis hit the developed countries most.

According to the World Bank data, the global growth rate has showed strong performance in recent years. Especially in 2017, the growth rate with 3.3% in the world is the most remarkable performance in recent years. In 2008, the year out of the crisis, Turkey's growth rate decreased up to 0.8%. Even though in 2009, the most effective year in economic crises, Turkey's economy shrinks to 4.7%. Turkey managed to get over from global crises without taking heavy damages due to soundness of its banking system (Eğilmez, 2019, p.225).

## 1.2. Inflation

Inflation is defined as a sustained increase in general price level of goods and services by Central Bank of the Republic of Turkey (CBRT). According to the CBRT, inflation includes price changes not only in one or a few goods and services but also in all goods and services used by the average consumer during the year (TCMB, 2013, p.2). The costs of inflation are extremely important not only for individuals or firms but also for society and the economy. These effects can be summarized as below:

- i. Inflation adversely affects economic growth.
- ii. Inflation causes economic fluctuations.
- iii. Inflation reduces international competitiveness.
- iv. Inflation negatively affects the labour market.
- v. Inflation negatively affects income distribution (TCMB, 2013, p.7)

Deflation can be defined as a continuous decrease in the general price level of goods and services. In other words, deflation is the opposite of inflation. For instance, high-income countries such as Germany or Japan struggle with deflation, while low-income countries struggle with inflation.

**Table 1.2.** *Inflation Rate by Country Groups and Worldwide (Worldbank)*

	High Income Countries	Upper-Middle Income Countries	Lower-Middle Income Countries	Low Income Countries	World
2003	2,05	5,16	4,51	8,20	3,02
2004	2,17	4,68	4,47	5,79	3,38
2005	2,57	4,37	5,36	8,52	4,11
2006	2,53	4,64	5,80	8,04	4,27
2007	2,79	5,84	6,98	7,96	4,83
2008	4,60	10,06	10,74	14,40	8,95
2009	1,50	2,95	4,92	5,01	2,93
2010	1,96	3,86	4,51	4,83	3,29
2011	3,38	5,24	6,43	8,49	4,84
2012	2,71	3,74	5,20	6,83	3,71
2013	1,49	2,75	5,32	5,26	2,61
2014	1,05	3,07	5,02	3,92	2,35
2015	0,32	1,90	3,23	5,63	1,39
2016	0,44	2,05	3,22	6,34	1,49
2017	1,55	3,28	3,63	8,75	2,23
2018	1,85	2,71	3,54	4,27	2,46
2019	1,62	2,72	3,32	2,87	2,30

This financial crisis mostly affected developing countries and countries where the banking sector has a great weight in the economy. In these countries, the inflation rate increases to almost 100%. (Acet, 2008, p.208). The first impact of the crisis is the sharp fall in demand for many goods and services and the contraction of GDP. For this reason, an increase in unemployment is observed in many sectors. Also, the general level of prices falls in many cases.

The global crisis, which started in the financial markets of the United States and affected the whole world from the last quarter of 2008, continued throughout 2009. The upward trend observed in oil prices in 2011 caused an increase in inflation. Later, oil prices were fall in 2015 which is unexpected for the world economy. Meanwhile, oil exporter countries lost their incomes. The Chinese economy displayed the lowest growth rate with in the last 25 years, signalling that its economy was contracting. Inflation rates were at the lowest level because Europe did not get a positive result from the monetary expansion policy implemented. High-Income countries are below the world average in terms of inflation rates as can been in table 1.2. Lower-Middle Income countries and Low-Income countries are quite above the world average. In 2019, due to global trade wars and decreasing trade volume, oil prices have decreased by almost 10%. Oil prices declined in countries that dependent on foreign energy and it has contributed to a decrease in the inflation rate.

In Turkey, inflation targets are set jointly by the CBRT and the Turkish Government for 3-year periods.

**Table 1.3.** *CBRT's Inflation Target and Realization (CBRT)*

	Target	Realization
2003	20	18.4
2004	12	9.3
2005	8	7.7
2006	5	9.7
2007	4	8.4
2008	4	10.1
2009	7.5	6.5
2010	6.5	6.4
2011	5.5	10.4
2012	5	6.2
2013	5	7.4
2014	5	8.2
2015	5	8.8
2016	5	8.5
2017	5	11.9
2018	5	20.30
2019	5	11.84

In table 1.3, inflation rate in Turkey after a 30-year period has fallen to single digits for the first time in 2004 by 9.3%. Although the inflation rate rose to 10% in the global crisis, Turkey's economy began to recover in 2009. In 2012, the lowest year-end consumer inflation in the last 44 years was reached at 6.16%. 2012-2016 period, despite Turkey having a single-digit inflation rate, Turkey still overshoots the inflation target. Since 2017, the inflation rate has been moving away from the target.

CBRT compared to developed countries set a higher inflation target. The reasons for this can be listed as follows (<https://www.tcmb.gov.tr/wps/wcm/connect/TR/TCMB+TR/Main+Menu/Temel+Faaliyetler/Para+Politikasi/Fiyat+Istikrari+ve+Enflasyon/Enflasyonun+Hedefleri>, accessed at 17.01.2020):

- The presence of structural transformation in recent years in Turkey
- Rigidities caused by the presence of high inflation in Turkey for many years
- Measurement bias caused by quality improvement
- European Union harmonization process

### 1.3. Unemployment

Unemployment rate and inflation rate are two critical macroeconomic variables used as indicators of good economic performance. According to TURKSTAT's definition of unemployment, people at 15 and over who search for a job in job-seeking channels in the last four weeks and ready for beginning to work in two weeks. The unemployment rate is defined as the rate of the unemployed population in the labour force.

**Table 1.4.** *Unemployment Rate of Country Groups and Worldwide (Worldbank)*

	High Income Countries	Upper-Middle Income Countries	Lower-Middle Income Countries	Low Income Countries	World	Turkey
2003	7,1	5,3	5,4	6,5	6,2	10,5
2004	7,0	5,1	5,2	6,3	6,0	10,8
2005	6,7	5,0	5,1	6,3	5,9	10,6
2006	6,1	5,0	4,8	6,0	5,6	8,7
2007	5,6	5,0	4,6	5,8	5,4	8,9
2008	5,9	5,0	4,6	5,7	5,4	9,7
2009	7,9	5,1	4,9	6,1	6,0	12,6
2010	8,2	5,2	4,8	5,8	5,9	10,7
2011	7,9	5,2	4,9	5,6	5,8	8,8
2012	7,9	5,1	5,0	5,5	5,8	8,1
2013	7,8	5,1	5,1	5,5	5,8	8,7
2014	7,2	5,1	5,0	5,5	5,6	9,9
2015	6,6	5,1	5,1	5,7	5,6	10,2
2016	6,1	5,1	5,2	5,9	5,7	10,8
2017	5,6	5,0	5,2	5,9	5,6	10,8
2018	5,1	4,9	5,1	5,8	5,4	10,9
2019	4,8	4,9	5,1	5,9	5,4	13,5

As expected, the 2008 global crisis affected the unemployment rate like many other macroeconomic variables. After the crisis, the unemployment rate, that is shown in table 1.4, increased across all country groups and worldwide. Despite the implementation of some economic precaution policies after the global crisis, the world average is still above the pre-crisis period.

Among country groups, the unemployment rate in High Income Countries is the most affected, increasing by 2%. In 2010, the unemployment rate further increased to 8.2%. Since 2011, the unemployment rate steadily declined to 4.8% in 2019, it was the lowest in the last 17 years. The group at least affected by the global crisis is seen as Upper-Middle Income countries. The unemployment rate, which was 5% in 2008, increased by 0.1% in 2009. The unemployment rate did not return to its pre-crisis level until 2018.

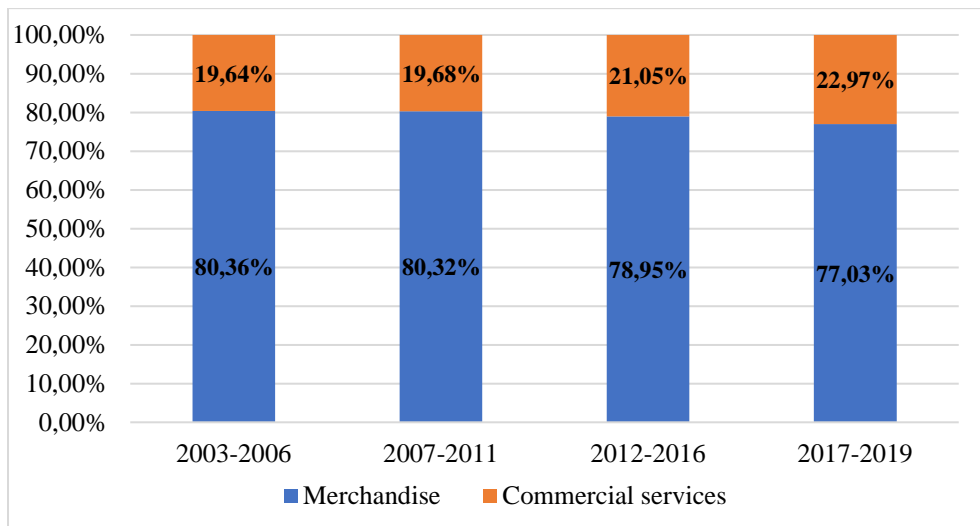
In Turkey, which is in the Upper-Middle income countries, the unemployment rate is a more chronic problem. The unemployment rate in Turkey has risen to double digits after the 2001 crisis. The unemployment rate, which was around 8% in the period from 2006 to the crisis, started to rise again in 2008. Although the unemployment rate declined to single digits again in the 2011-2014 period, it has been in an increasing trend since 2015. In Turkey, the highest unemployment rate in the last 17 years, with 13.5% seen in 2019. The main reasons behind Turkey's unemployment problem, at least some of the ongoing nature of the agricultural society, and unable to provide employment opportunities to the rapidly growing young population (Bozdağlıoğlu, 2008, p.57)

Lower-middle income countries in the pre-crisis, unemployment rates are 4.6%, increased by 0.4% after the crisis. The unemployment rate of Lower-Middle Income countries has not returned to its previous level. Low-income countries are the other group most affected by the crisis after High-Income Countries. In the first year of the crisis, the unemployment rate increased by 0.4% to 6.1%. Low-Income Countries have a decreasing trend in the period 2010-2014. After 2014 the unemployment rate is around 5.9%.

An average unemployment rate of Upper-Middle-Income countries in the last 17 years was 5.9%. While Turkey was with a 10.3% average unemployment rate which is quite high compared to Upper-Middle-Income countries. Other country groups can be listed as follows; High Income Countries 6.7%, Low Income Countries 5.1%, Lower-Middle Income Countries 5%, and the world average is 5.7%.

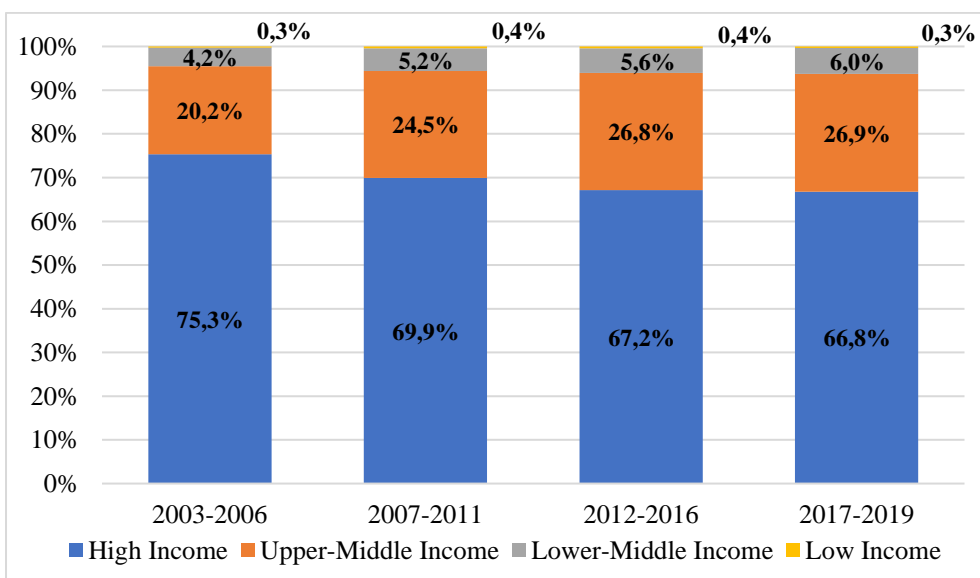
## **1.2. WORLD TRADE OVERVIEW**

On December 1, 2019, the first coronavirus case in the world was experienced in Wuhan, China. Following this, a pandemic was declared by the World Trade Organization (WHO) on March 11, 2020. Due to the occurrence of the Coronavirus or COVID-19 crisis at the end of 2019, its effects on trade and macroeconomic indicators can be observed very intensely in 2020. According to the report published by the World Trade Organization, forecasts for the growth rate and GDP for 2020 and the following years were made in an optimistic and pessimistic framework. In this study, which examines trade in the 2003-2019 period, 2019 appears to be a year in which high protectionist policies have gained weight rather than COVID-19. In terms of trade, 2019 was the year in which high protectionist policies were most intensely implemented.



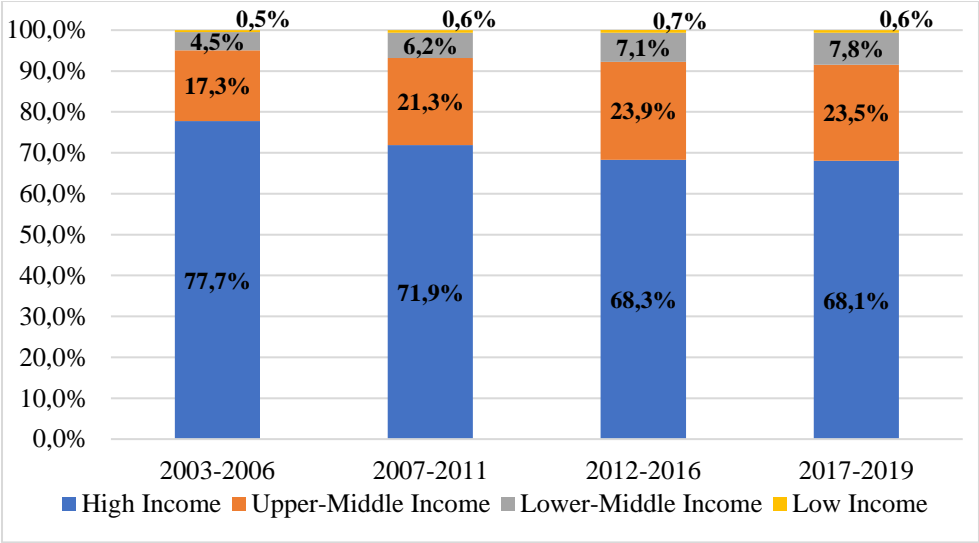
**Figure 1.3.** Share of world trade in merchandise and commercial services in the 2003-2019 period

In 2019, the world export exceeded \$24,9 trillion, on the other hand, the world imports \$24,4 trillion. High-Income Countries and Middle-Income Countries (lower and upper) generate the major players in trade, as Low-Income countries' share in world trade is quite limited. According to the figure 1.3, a significant portion of the trade in the world is merchandise trade. Commercial service trade plays an acceleratingly significant role in the global economy as it's the most dynamic component of trade. Therefore, services trade has become an important percentage of the economy since the 2000's.



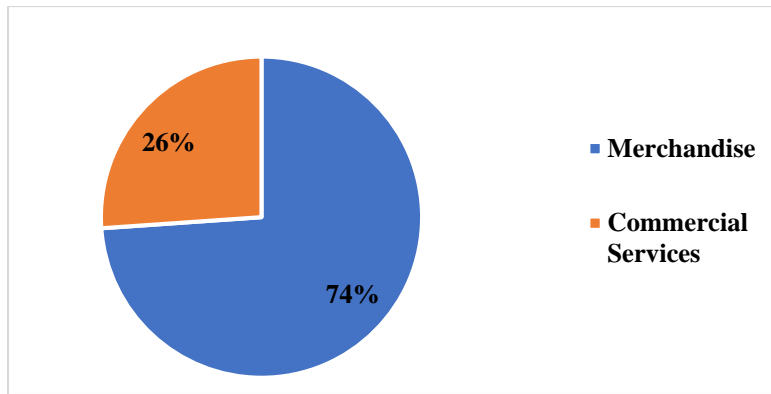
**Figure 1.4.** Share of country groups in world merchandise export

In figure 1.4, the highest share in merchandise export was 75,3% in high-income countries in 2003-2006 period. The share of High-Income Countries has been decreasing since 2006. Although 66% of world merchandise export still belongs to High-Income Countries, this group has lost an 8.5 percent share since 2003. Upper-Middle and Lower-Middle Income Countries compensate this percentage from the loss of High-Income Countries. Finally, Low-Income Countries are still having trouble with increasing their share of world merchandise export in the last 17 years.



**Figure 1.5.** Share of country groups in world merchandise import

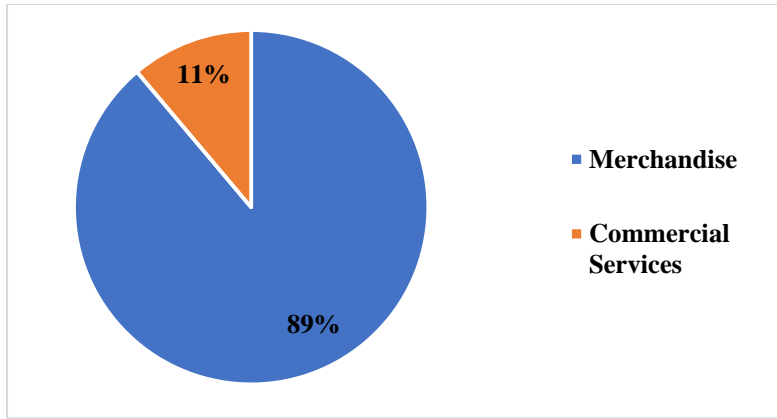
As can be seen in figure 1.5, High-Income countries have the largest share in merchandise import as in merchandise export. While 77% of world merchandise import belonged to high-income countries in the 2003-2006 period, this rate decreased to 68% in 2017-2019. Since 2003, Upper-Middle Income Countries have gradually increased their share in the merchandise import. The share of merchandise import in Upper-Middle Income Countries increased from 17,3% in 2003-2006 period to 23,5% in 2017-2019 period. Another group that increases its share in merchandise import is Lower-Middle Income countries. The share of Lower-Middle income countries in merchandise import has increased by 3% since 2003. The share of Low-Income countries in merchandise import is slightly higher than merchandise export. However, the share of this country group in world trade is quite small.



**Figure 1.6.** *Share of Turkey's export in merchandise and commercial services in 2019*

In recent years, commercial services have been observed that gained momentum and support growth. However, in Turkey, as such in the world, merchandise trade has the largest share of trade. In 2019, Turkey's merchandise export value reached \$180.8 million. In figure 1.6, 74% of Turkey's export is merchandise export. Turkey's share of merchandise exports in the world is 0.96%. With this share, Turkey's rank is 29 in world merchandise export. When investigated the components of Turkey's merchandise exports, manufactures have the highest share with 79.5%. Then the agricultural products come with a 6.8% and fuels and mining products are with a 10.8% share.

Commercial services in Turkey, as well as all over the world, have begun to be more important. When the components of commercial services export around the world are investigated, quite distinctive structures are observed. More clearly, high tourism potential countries take a significant share from commercial service export. In other respects, countries with an advantageous strategic location come to the fore with transport services. Turkey's commercial service export was around \$64.1 million in 2019. With this magnitude, commercial services have a 26% share in Turkey's export. Furthermore, Turkey's share of commercial services in the world is 1,06%. With this percentage, Turkey's rank is 26 in world commercial services export. When analysed the components of commercial services, travelling has the major share with 46,5%. Subsequently, transportation comes with a 39,5% share.



**Figure 1.7.** *Share of Turkey's import in merchandise and commercial services in 2019*

As is known, Turkey's export depends on import. Turkey's merchandise import reached \$210.3 million in 2019. With this size, merchandise import has a %89 share in Turkey's import that can be seen figure 1.7. Turkey's share in world merchandise import by nearly 1.1%. According to this, Turkey's rank is 25 in world merchandise import. When examined in detail of the components of merchandise import, manufacturing has a relatively high share of 59.3%. Turkey's import occurs mainly in raw materials, intermediate goods, machinery, and equipment. And later, fuels and mining products and agricultural products come with 27,1% and 8,2%, respectively. In 2019, Turkey's commercial services amounted to \$26.8 million. Comparing to export, Turkey's share in world commercial services import is quite low with 0.47%. In this respect, Turkey's rank is 40 in world commercial services import. When examined the main component of commercial services, transportation and travelling have with 29,5% and 15,3% share, respectively.

**Table 1.5.** Turkey's foreign trade values- Billion US\$ (TURKSTAT)

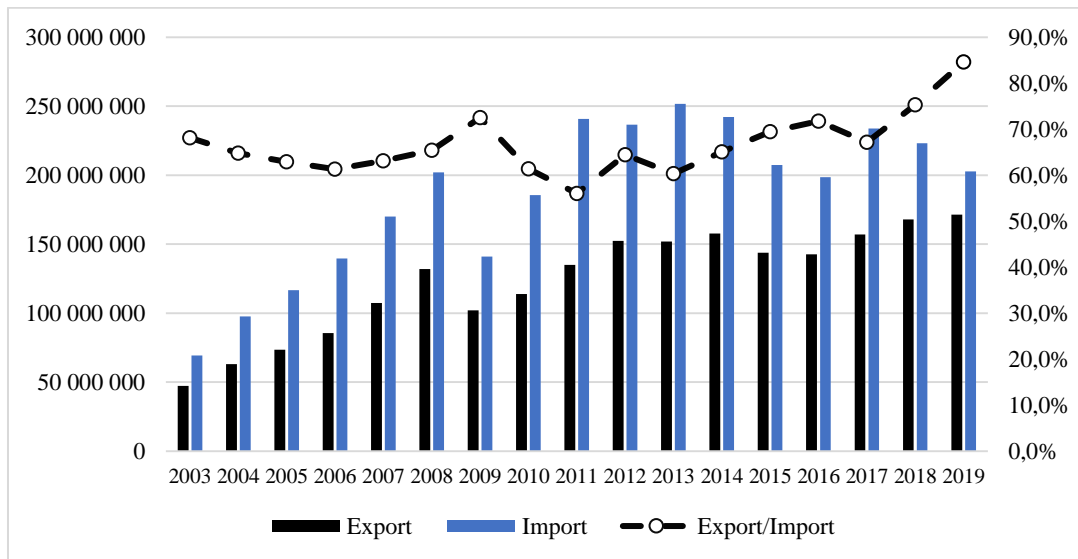
	Export Value (Merchandise)	Import Value (Merchandise)	Volume of Trade (Export+Import)	Balance of Trade (Export-Import)
2003	47.253	69.340	116.593	-22.087
2004	63.167	97.540	160.707	-34.373
2005	73.476	116.774	190.251	-43.298
2006	85.535	139.576	225.111	-54.041
2007	107.272	170.063	277.334	-62.791
2008	132.027	201.964	333.991	-69.936
2009	102.143	140.928	243.071	-38.786
2010	113.883	185.544	299.428	-71.661
2011	134.907	240.842	375.749	-105.935
2012	152.462	236.545	389.007	-84.083
2013	151.803	251.661	403.464	-99.859
2014	157.610	242.177	399.787	-84.567
2015	143.839	207.234	351.073	-63.395
2016	142.530	198.618	341.148	-56.089
2017	156.993	233.800	390.793	-76.807
2018	167.921	223.047	390.968	-55.126
2019	171.465	202.704	374.169	-31.239

An overview of Turkey's international trade can be seen in Table 1.5. As it is known, Turkey has adopted the free trade doctrine with Decisions of January 24<sup>th</sup>, 1980. With the liberalization of trade, there had been a significant increase in foreign trade volume. In the years of crisis in Turkey, the foreign trade deficit is declining sharply. The reason for this lies in the sharp decline in import. In this direction, the decrease in import causes foreign trade deficits to close (Utkulu, 2008, p.9).

In 2007, the pre-crisis year, foreign trade volume reached 277.3 billion dollars. This striking increase in foreign trade bring with the problem of the foreign deficit. While the foreign trade volume doubled from 2003 to 2007, the foreign trade deficit almost tripled. Foreign trade volume, which was 333.9 billion dollars in 2008, decreased to 243 billion dollars in 2009 with the crisis. The reason for this sharp decrease is a 77% decrease in export and a 69% decrease in import.

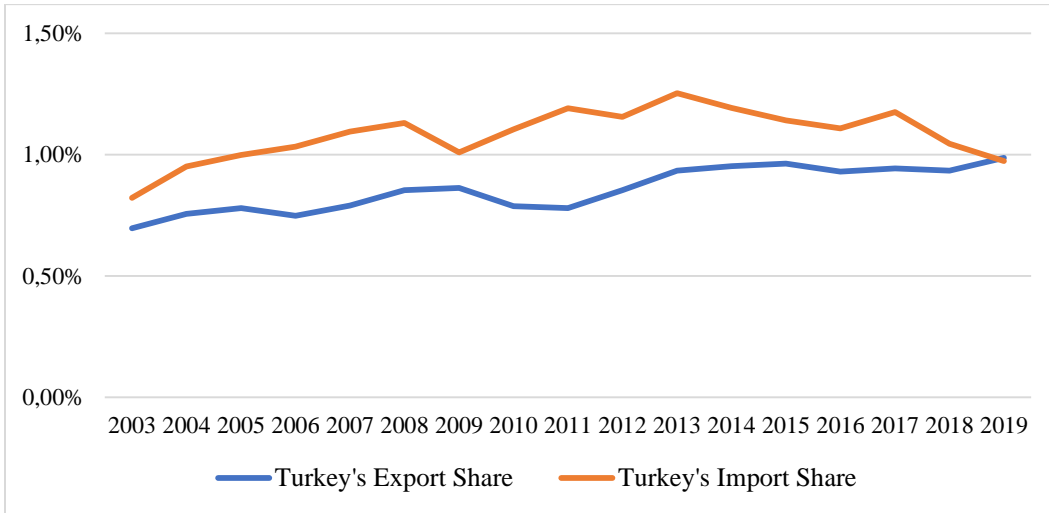
Turkey's foreign trade deficit in 2011 reached 105.9 billion and it was very difficult to close the deficit at this level. As seen in the table 1.5, Turkey's export is increasing rapidly, but Turkey's import is increasing much faster. The reason for this is that Turkey' import dependency. In 2018 due to the exchange rate crisis in Turkey, import has fallen quite sharply. Turkey's import decreased from 233 billion in 2017 to 202 billion by 2019. Thanks to this decrease, the foreign trade balance has improved.

Turkey's exports in 2019 increased by 2.1% compared to the previous year to reach \$171.5 billion. On the other hand, import decreased by 9.12% to \$202.7 billion. Turkey's foreign trade deficit amounted to 31.2 billion in the same period. Compared to 2018, the foreign trade deficit has decreased by 43.3%. Turkey's foreign trade volume in 2019 was realized as \$374.2 billion. Compared to the previous year, foreign trade volume decreased by 4.3%. Between 2003 and 2019 foreign trade volume was \$309.6 billion on average.



**Figure 1.8.** Turkey's foreign trade values and export/import ratio

Figure 1.8 shows an increasing trend in imports and exports of Turkey in general. This increase in import and export brings along an increase in international trade volume, which is the sum of import and export values. Moreover, as can be seen in the figure 8, the export/import ratio started to increase since 2017. The reason for this is the currency crisis experienced in 2018. The increase in the exchange rate caused the Turkish Lira to depreciate. The depreciation of the domestic currency provides a competitive advantage in exports, thus brings an increase in exports. On the other hand, the depreciation of the domestic currency has a decreasing effect on imports. Accordingly, export/import ratio increased from 75.3% in 2018 to 84.6% in 2019. The factor that led to a decrease in the foreign trade deficit is the decreasing in import while export increase.



**Figure 1.9** *Share of Turkey's total export and import in worldwide*

As seen in the figure 1.9, although Turkey's trade continued to increase, its share of the world was quite small. In 2019, Turkey's export's share in world export was 1,28% while its share in the world import was 1,24%. According to the report published by the Ministry of Economy, Turkish Exporters Assembly's vision of sustainable export growth, as the 100th anniversary of the Republic of Turkey, is targeting exports of \$ 500 billion in 2023. In line with this goal, Turkey will be among the top 10 economies in the world export share of 1.5% (Republic of Turkey Presidency of Strategy and Budget, 2012, p.1).

According to the eleventh development plan, a new perspective in production and foreign trade should be introduced for Turkey to escape from the middle-income trap and to reach high-income countries level. In this new perspective, to reduce the current account deficit, which is one of the chronic problems of Turkey's economy, eleventh development plan focuses on high value-added production and exports. Within the framework of this report, Turkey's short-term and medium-term objectives are to increase the share of value-added to export and decrease to import dependency. In addition to this, the report includes recommendations for reaching more distant countries with export and reducing additional costs and bureaucratic procedures (Republic of Turkey Presidency of Strategy and Budget, 2019, p.63).

More than half of \$171.465 billion export of Turkey in 2019 is with ten countries on the list below. Turkey's largest export partners, respectively, Germany, the United Kingdom and Iraq. The share of exports to the top 5 partners constitutes 31.5% of total exports.

**Table 1.6.** Turkey's top 10 export partners, value: thousand US\$ (TURKSTAT)

Country	2019	2018	2017	Share (%)	Change (%)
Germany	16 617 244	17 353 443	16 356 392	9,2	-4,2
United Kingdom	11 278 615	11 473 927	9 932 539	6,2	-1,7
Iraq	10 223 292	9 437 007	10 109 827	5,7	8,3
Italy	9 753 018	10 047 453	8 787 949	5,4	-2,9
United States	8 970 658	9 072 756	9 259 583	5,0	-1,1
Spain	8 138 744	8 121 096	6 584 921	4,5	0,2
France	7 945 607	7 655 340	6 895 251	4,4	3,8
Netherlands	5 761 921	5 100 744	4 190 305	3,2	13,0
Israel	4 463 820	4 022 878	3 504 850	2,5	11,0
Russia	4 152 137	3 652 603	2 869 847	2,3	13,7

In table 1.6, Turkey's exports to Germany fell to 16.6 billion dollars, a decrease of 4.8% in 2019. Moreover, a decrease compared to the previous year occurs in all of the top 5 export partners except Iraq. Turkey's export to Iraq showed an increase of 8.3% compared to the previous year and its value is \$ 10.2 billion. Export to the United States also decreased by 1.1% due to the protectionist trade policies implemented. The value of export to the USA in 2019 was \$ 8.97 billion. Referring to changes compared to the previous year, the country that most increased its share in Turkey's exports was Russia with 13.7%. This increase is followed by the Netherlands with 13% and Israel with 11%. Germany is the leading country with the highest decrease in export with 4.2%. In other countries, 2.9% and 1.7% are Italy and the United Kingdom, respectively.

More than half of 202.704 billion import of Turkey in 2019 is with ten countries on the list below. Turkey's largest import partners are Russia, Germany, and China. First 5 partner's share in Turkey's total import is 39.3% in table 7.

**Table 1.7.** Turkey's top 10 import partners, value: thousand US\$, (TURKSTAT)

Country	2019	2018	2017	Share (%)	Change (%)
Russia	23.115.236	22.710.751	20.097.027	11,0	1,8
Germany	19.280.399	21.535.223	22.281.369	9,2	-10,5
China	19.128.160	21.506.001	23.753.644	9,1	-11,1
United States	11.847.373	12.995.754	12.288.503	5,6	-8,8
Italy	9.349.593	10.791.919	12.119.734	4,4	-13,4
France	6.760.064	7.836.528	8.425.089	3,2	-13,7
India	6.635.217	7.524.705	6.116.451	3,2	-11,8
South Korea	5.777.022	6.638.438	6.822.629	2,7	-13,0
United Kingdom	5.638.296	7.637.468	6.806.375	2,7	-26,2
Spain	4.446.113	5.682.750	6.531.631	2,1	-21,8

Due to energy import, Russia is Turkey's biggest import partner with \$23.1 billion. Although imports with Germany have been decreasing over the years, imports with Russia are increasing can be seen in table 1.7. The reason for the 10.5% diminution in import with Germany compared to the previous year is the decrease in automobile import. Turkey's second largest import partner with China in 2018, dropped to third place in 2019. In import as well as in export with the US decreased by 8.8% to \$11.8 billion due to intense protectionist policies. In 2019, Turkey's 10 partners in import with all countries except Russia are experiencing a decline compared to the previous year. Russia is the only country that Turkey's import increased by 1.8%. The countries with the highest decrease in import are the United Kingdom with 26.2%, Spain with 21.8% and France with 13.7%.

## CHAPTER II

### 2. CONCEPT OF INTERNATIONAL TRADE

There are more than 190 countries around the world, nowadays, regardless of the economic regime, all countries participate in international trade. Some goods and services produced within every country are sold to economic agents (e.g., individuals, firms, governments) in other countries; these products are known as exports. Some goods and services consumed within a country have been purchased from economic agents in other countries; these goods are known as imports (Husted and Melvin, 2013, p.3).

A country's trade balance is the difference between its total value of exports and its total value of imports (usually including both goods and services). Countries that export more than they import, it called trade surplus, whereas countries that import more than they export, it called trade deficit (Feenstra and Taylor, 2014, p.3-4).

As in all branches of the economy, international trade aims to meet unlimited desires with scarce resources. It analyses how international transactions affects such things as income distribution, social welfare, employment, price stability, growth and the eventual ways public policy can influence the outcomes (Appleyard and Field, 2014, p.2).

International trade will remain the bridge between people (Terzea, 2016, p.244). The origin of trade in the world dates back from the stone age. Since there was no hunting and gathering in this age, people produced their own foods and needs as small producers. Over time, the people of this age needed different goods than they produced. In this period, people exchanged their own goods with other small producers to supply the goods they needed. Not only the concept of barter economy, but also trade was born in this process.

No single country in the world has enough resources to meet all of its needs. Explaining the distribution of world trade is extremely complex. The main question is "Why do nations trade?". The answer can be summed up in 3 reasons.

From past to present, price differences between countries are the main reason of foreign trade. Secondly, factor endowments or differences in resources provide an advantage to the country in trade. Finally, the existence of natural resources (oil, diamond, coffee), climate, geography (island or dessert), physical capital determines the factor endowments of countries. In addition to price differences, insufficient domestic production, product differentiation and technology difference are the other main reasons for foreign trade.

## **2.1. EVOLUTION OF INTERNATIONAL TRADE THEORIES**

In this chapter, the evolution of international trade from Mercantilists to the present will be examined in line with economic thoughts. Historically, mercantilism arise from commercial capitalism. The occurrence of capitalism in agriculture in the 18th century formed the basis for the birth of Physiocracy. Finally, the Industrial Revolution paved the way for the formation of Classical Economic Thought. In fact, the time had come for a transition from a number of local economies to a national economy, from feudalism to commercial capitalism, from a state of comparatively little trade to an epoch of extensive international commerce. That change in the economic structure is sometimes called by economic historians the " Commercial Revolution".

Today's commercial relations cannot be explained by traditional foreign trade theories. For this reason, new trade theories that try to explain the trade in today's world have emerged. In this chapter, traditional foreign trade theories are reminded, and then new foreign trade theories are examined.

### **2.1.1. Merchantilism**

The period covering the years 1500-1750 is called the Mercantilist Period, and the economic philosopher of that period is called Mercantilists. It can be said that this period, also called the commercial revolution, constituted the first stones of the capitalist order. All mercantilist doctrines aim to increase the economic power of the state. Powerful state in this sense means having treasure full of precious metals According to the thought of this period, agriculture and industry do not increase wealth. Trade routes are profitable as long as it provides markets for agriculture and industry. Therefore, the main source of wealth is trade. If a state does not have enough gold and silver mines or cannot access new ones, foreign trade is the only way the country can increase its wealth. In the mercantilist period, a foreign trade surplus is required to increase precious metal stock.

Mercantilist thought passed through four stages of development. These are:

- i. the stage before 1550 or the rudimentary stage
- ii. the stage from 1550 to 1620, which witnessed the formulation of what might be called Malynesian doctrine
- iii. the stage from 1620 to 1680, which was dominated by the doctrines of Thomas Mun; and
- iv. the stage from 1680 to 1750, which marks, on the one hand, the highest development of mercantilism and, on the other hand, the transition from the mercantilist to the classical school of thought. (Wu, 2013, p.14)

Malynes, like the thinkers before him, argues that the increase in the money supply leads to inflation. Moreover, according to Malynes, selling expensive cannot turn the foreign trade balance against the country. Malynes' scheme can be summarized as follows:

*Currency depreciation → Outflow of gold → Decrease in money supply → Decrease in prices → Pay a premium for goods but undersell → Deterioration of the foreign trade balance against the country → Outflow of gold*

In fact, Malynes confuses the balance of foreign trade with external term of trade. For this reason, Malynes did not accept that the expensiveness creates a disruptive result in the foreign trade balance. According to Thomas Mun, the reason of country's export goods is cheap or expensive is not the exchange rate. The reason is that goods are abundant or scarce. The value of the currency is determined by the balance of foreign trade.

*Foreign trade surplus → Appreciation of currency → Inflow of gold → Increase in money supply → Increase in prices → Buy cheap, sell expensive → Negative effects on trade*

According to Mun, excess gold in the country causes expensiveness. With the effect of this expense on exports, foreign trade turns against it. In the 16<sup>th</sup> and 17<sup>th</sup> centuries, the barter economy was replaced by mercantilism. A policy adopted by European monarchs to strengthen the national economy is mercantilism. Following the mercantilist thought, the agricultural revolution took place in the middle of the 18<sup>th</sup> century.

This revolution helped to trigger the Industrial Revolution. The industrial revolution brought many hardships and changes, and thus played an important role in the emergence of new economic theories. The Classical School of Economics, in contrast to Mercantilism, is an idea that completely rejects government restrictions and advocates free trade.

### **2.1.2. Physiocracy**

Physiocracy is the movement of thought that occurs in France as a reaction to mercantilism. Physiocracy, also known as the first school of thought, was pioneered by Doctor Quesnay. Quesnay emphasized in his work "Tableau Economique" that the only branch of production that produces residual products is agriculture. Income from agriculture distributed the others and it recycled to economy as purchasing power.

Unlike Mercantilists, Physiocrats believed that the source of wealth was the abundance of consumer goods. International trade was considered as at best a "pis aller" (Riviere,1767, p.390). According to the physiocrats, the size of the trade volume is an indicator of impoverishment. The expansion in trade volume is indicative of a very narrow domestic market or regional disruptions, for example grain shortages.

Physiocrats also accentuated the "distance" element. In the case of foreign trade with far countries, transportation costs are lost for the country. In case the foreign trade volume expands, transportation costs will increase in direct proportion. For the country, Physiocrats argued that it was good to decrease foreign trade rather than increase. (Bloomfield, 1938, p.731).

### **2.1.3. Theory of Absolute Advantage**

Adam Smith (1776), in his book *The Wealth of Nations*, explains the reasons for international trade. Smith's ideas in his book form the basis of Classical Liberalism or the Classical Economics.

Smith's conceptual contributions shaped the basic assumptions of Classical Economics. The concept of *Homo Economicus* is the first of these. *Homo Economicus*, or *Economic Human*, is the figurative human being characterized by the infinite ability to make rational decisions. According to this concept, while firms maximize profits, consumers try to maximize their utility. In other words, all individuals act according to their economic interests. Individuals' pursuit of their own interest also leads to the formation of social interests. According to Smith, the feature that distinguishes humans from animals is that humans are animals that can trade. People cannot meet all needs by themselves due to their nature. There is a division of labour between people. Thanks to the development of this division of labour in human nature, the welfare level of the whole society increases. (Smith, 1776, p.7).

The second concept is "laissez faire, laissez passer" which is the essence of the free market. This statement explains the principle that the state should not restrict individuals' right to individual enterprises (Salvatore, 2012, p.35). Accordingly, the desire to maximise self-interest intrinsically in our species must be supported by the state. Thanks to this instinct, both individuals and society will benefit the most, as each individual will turn to the most profitable area for their own. According to Smith, the state should undertake several duties for the free trade environment. These are as follows (Viner, 1927, p.316):

- i. The guild system should disappear. The workforce should be directed to the area where can work freely at the highest wage.
- ii. Land should not be the inherited property of aristocrats and should be freely tradable.
- iii. Barriers in trade (customs and quotas, etc.) should be removed.
- iv. Borders in trade should be removed.

The third concept is the *Invisible Hand*. There is an *Invisible Hand*, also known as the free price mechanism, which maintains order in the market and solves basic economic problems such as what, how and for whom to produce.

According to Smith, foreign trade contributes to the gain and world welfare of the countries involved in trade by causing the international division of labour. Under free trade conditions countries tends to goods that they have a comparative advantage and prefer to specialize in those goods. Resources are used most efficiently, and consumers can consume the cheapest products. Thus, an increase in welfare occurs. For this to happen, the absolute cost advantage of countries is a sufficient condition. A wise choice for every family cannot be madness for great kingdom. If a country undersells a goods compared to other country, in returns it's wiser to buy goods that has not comparative advantage (Smith, 1776, p.479).

With respect to this theory, the cost of a goods is determined by the amount of homogeneous labour used in the production of that goods. According to Mercantilism, which was the predecessor of Classical International Trade Theories, international trade is a zero-sum-game. More precisely, the gain of one country constitutes the loss of the other country. On the other hand, in this theory, total world wealth is not fixed as in Mercantilism. International trade increases the efficiency of world resources by creating international specialization and division of labour (Gerber, 2014, p.40). In this way, the two countries increase their living standards by reaching higher levels of production and consumption. For this reason, both countries can have benefits from international trade (Smith, 1776).

Adam Smith is also against imposing restrictions on imports to prevent deterioration of the foreign trade balance According to Smith, foreign trade does not have to be in balance as in the import = export equality. Balance in foreign trade means that both countries are equally profitable. However, trade is gain for countries on its own. For this reason, the foreign trade deficit is not an alarming situation, but an indicator of fewer gain compared to the other country. (Smith, 1776, p.514-516).

**Table 2.1** Adam Smith's famous Theory of Absolute Advantage example

Hours of work necessary to produce one unit		
Country	Cloth	Wine
England	90	100
Portugal	120	80

The workforce in Portugal is more efficient in wine, on the other hand, in England in cloth production that can be seen in Table 2.1. Specialization in wine production for Portugal and cloth production for England is the best choice of both. Moreover, consumers in both countries will be able to consume more wine and fabric. According to Smith, which country less or more profitable does not matter. The important point is that both countries participating in foreign trade can now use their resources more efficiently, and consumers have the opportunity to consume goods cheaper. The Theory of Absolute Advantage fails to answer a question of international trade. Smiths' theory cannot explain the question of "what international trade would be like if one country produces both goods at a cheaper price than the other country?".

#### **2.1.4. Theory of Comparative Advantage**

David Ricardo (1817) expanded the discussion of free trade in his work "On the Principles of Political Economy and Taxation". The Theory of Comparative Advantages was developed by D. Ricardo because Theory of Absolute Advantages was insufficient to explain international trade.

According to Ricardo, absolute advantages are a special case of comparative advantages. In any case where absolute advantage is valid, comparative advantage is already valid. With respect to Ricardo's idea, for international trade, a country does not need to produce goods which is subject to trade cheaper than the other country. In other words, the country does not need absolute advantage. The important point is that the country specializes in the production of goods, which has a higher level of advantage or relatively advantage in the production of goods (Ricardo, 1817).

The best policy for international trade is that the country specializes in production of goods in which the country is comparatively most efficient. In addition, the country should also export these goods, and import goods which is relatively expensive from the other country.

For example, according to Ricardo, there may be a situation where a person is more advanced in making both hat and shoes. In this case, if a person is 20% superior to his opponent in making hats and 33% in making shoes, that person should only produce shoes. This situation is beneficial for both (Ricardo, 1817, p.154).

**Table 2.2.** Ricardo's Comparative Advantage Example

Hours of work necessary to produce one unit		
Country	Cloth	Wine
England	100	120
Portugal	90	80

As seen in the table 2.2, Portugal produces both goods (cloth and wine) at a lower cost compared to England. Therefore, cloth and wine will be cheaper in Portugal. Portugal may not trade as produce both wine and cloth cheaper. According to Ricardo, specialize in cheaper goods (wine) and to import the relatively more expensive goods(cloth) from England is most profitable for Portugal.

Portugal produces 40 working hours fast in wine production, whereas it is 10 hours in cloth. It is wise for Portugal to specialize in wine production and import the cloth from England. Ricardo assumes that goods containing different labour-values in foreign trade will be exchanged with each other in equal amounts. In this case, England will specialize in cloth and import the wine from Portugal in exchange for a unit of cloth.

Total production increases when countries use their savings in areas where they have cost advantages. More import goods can be purchased in return for this increase in production. In other words, an increase in prosperity can occur in both countries. Thus, consumers have the opportunity to consume more goods.

The theory of comparative advantage is an important theory from past to the present. However, this theory has been criticized at some points and thanks to these criticisms, many new theories have been developed based on Theory of Comparative Advantages. The criticisms of Ricardo's Theory can be listed as follows (Seyidoğlu, 2003, p.21-22):

- i. The theory is based on labour theory of value, in other words, labour is the only element that constitutes cost. However, other production factors such as capital, natural resources and entrepreneurs also affect cost.
- ii. According to the theory, labour is assumed to be homogeneous. However, the productivity of labour can vary according to the education level, experience, knowledge and skills of the worker.

- iii. The theory fails to explain the difference in labour productivity between countries.
- iv. It is assumed that the labour force is fully mobile between alternative uses within a country. On the other hand, labour force is completely immobile externally, that is, it does not move between countries.
- v. This theory is supply-side, and demand conditions are not taken into consideration.
- vi. Ricardo's theory is static. This means that the time element is excluded from the theory. Over time, countries can increase their productivity through technological developments. For this reason, countries can also specialize in the production of imported goods.
- vii. It is not realistic that the theory is based on fixed costs and complete specialization.
- viii. According to theory, production is not divided into stage. More precisely, the production of a goods is finished wherever it starts.

#### **2.1.5. Theory of Heckscher-Ohlin**

The theory of Comparative Advantage is insufficient to explain the differences in international labour productivity. In 1919, Eli Filip Heckscher's most important contribution was his article "Effects of Foreign Trade on the Distribution of Income". It was the basis for Bertil Ohlin's article "Interregional and International Trade" in 1933. For this reason, Factor Endowment Theory is also known as Heckscher-Ohlin Model. It is not appropriate to think of Factor Endowment Theory from the Comparative Advantage Theory, because it brings a new interpretation to Ricardo's theory.

The Heckscher-Ohlin Model based on following assumptions; (Salvatore, 2013, p.110)

- i. There are two countries (labour abundant and capital abundant country), two goods (labour-intensive and capital-intensive commodity), and two factors of production (labour and capital).
- ii. Both countries use the same technology in production.
- iii. Goods X is labour intensive, and goods Y is capital intensive in both countries.
- iv. Both goods are produced under constant returns to scale in both countries.

- v. There is incomplete specialization in production in both countries.
- vi. Tastes and preferences are equal in both countries.
- vii. There is perfect competition in both goods and factor markets in both countries.
- viii. There is perfect factor mobility within each country but no international factor mobility.
- ix. There are no transportation costs, tariffs, or other obstructions to the free flow of international trade.
- x. All resources are fully employed in both countries.
- xi. International trade between the two countries is balanced.
- xii. The factor density of goods does not change even against different factor prices.
- xiii. There is a barter economy.

As stated in the assumptions, there are two production factors in the Heckscher-Ohlin Model: labour and capital. Factor endowment of countries the countries consists of labour and capital. One of the vital assumptions of the model is that countries are different in terms of factor endowment.

Countries' labour/capital ratio is used in the physical description of factor endowment. On the other part, factor prices are used in the economic definition of factor endowment. According to economic theory, the price of the abundant factor in the country is relatively cheap. Therefore, a comparison can be made between the factor costs of the two countries.

According to theory, a country should export the good that is relatively intensive in the factor with which country is relatively well-endowed. Capital-rich country has more capital per worker than trade partner country and should export the capital-intensive product (Helpman, 1999, p.123). Briefly, the country produces goods based on its production factor and has a comparative advantage compared to other country. For instance, when the country has relatively more abundant labour, it produces labour-intensive goods and should specialize in it. On the contrary, the capital-rich country produces and specializes in capital-intensive goods at a cheap price.

According to Heckscher, the relative scarcity of factors of countries must be different from each other for foreign trade to begin. Labour/capital ratio of a country should not be the same as labour/capital or labour/land ratio in another country. In other words, if a country is rich in labour, the other country must be rich in capital or nature. This situation is significant for the expansion of trade. But even if the difference in the relative scarcity of factors between the two countries disappears, the trade will not end. There will no longer increase in trade. (Heckscher, 1919, p.286).

From the Heckscher-Ohlin Model, three different theorems are derived, except the Factor Endowment Theory. The first of these, according to the Factor Price Equality Theorem, free trade equals factor prices between countries. Therefore, the theorem has the same results as international free factor mobility. According to the second theorem, Stolper-Samuelson, free trade raises the real income of the country's abundant factor and decreases the income of the scarce factor. According to Rybczynski, the last theorem, when the supply of a single factor increases under full employment conditions in a two-commodities and two-factors model, production increases in the goods that use it extensively, whereas in the other goods it shrinks (Seyidođlu, 2003, p.69).

#### **2.1.5.1.Leontief Paradox**

The first empirical test of the Heckscher-Ohlin Theory was made by Wassily W. Leontief in 1953. The findings of the Leontief's work are quite striking and are referred to in the literature as the Leontief Paradox. According to the paradoxical conclusion, although the United States is the most capital-intensive country in the world, U.S exports labour-intensive goods and imports capital-intensive goods ( Leontief, 1953, p.126).

In this study, American economy was tested by using input-output table for 1947. There are many criticisms of this study. These criticisms often focused on the method and the election of 1947, which was the immediate post-war period. In 1956, Leontief repeated its test for American imports and exports by using input-output table for 1951. The results show that America's export goods are more labour-intensive than import goods. The segment of America that substitutes imports is 17.57% more capital-intensive than the export segment (Leontief, 1956).

### **2.1.6. Alternative Trade Theories**

Ricardo's Theory of Comparative Advantages and Heckscher-Ohlin Model were not enough to explain international trade because of assumptions such as full competition, full employment, and fixed returns to scale. Leontief Paradox has devastated Heckscher-Ohlin's assumption that goods are produced in both countries with the same technology. As a result, the technology factor has been re-included in foreign trade theories. Beginning in 1960, alternative theories of international trade were introduced.

#### **2.1.6.1. Qualified Labour Model**

In the discussions that started after the Leontief paradox, it is focused that factors other than factor endowments also affect foreign trade. According to Keesing, countries' factor endowment does not determine trade. In contrary, existence of trade causes countries to formalization their factor endowments.

According to Keesing, the increase in processed goods in world trade and the fact that countries trade in similar goods can be explained by the difference between qualified labour equipment. A country cannot suddenly be rich or poor in qualified labour. If this was possible, all labour-rich countries could equip their workforce with the necessary skills with a short training. However, this is not possible. Qualified labour can affect trade as an element of the country's factor endowment. Another reason for that qualified labour is thought as a separate production factor is its role in economic growth. A factor that affects growth will undoubtedly influences on trade (Keesing, 1966, p.5-6).

Generally, in the model in which Heckscher-Ohlin's assumptions were used, change was made regarding the factor fluidity. In Keesing's model, factors (capital, unqualified and qualified labour) have fluidities except for natural resources in contrast to Heckscher-Ohlin. However, degrees of fluidity differ in capital and labour. The fluidity cost of capital is low, and labour is high regardless of whether it is skilled or unqualified. (Keesing, 1966, p.6)

According to Keesing's conclusion the USA, Germany, and England lead the world trade in the export of products that require science and engineering. Export of these countries are labour-intensive, and that qualified labour should be added to factor endowment models as a separate production factor (Keesing, 1966, p.17).

### **2.1.6.2. The Imitation Lag Hypothesis**

The Imitation Lag Hypothesis in international trade theory, also known as Technological Gap Theory, was first used by Michael V. Posner in 1961. This theory does not accept Heckscher-Ohlin's assumption that the same technology is available everywhere (Posner, 1961, p.324). Moreover, there is a lag in the diffusion of technology from one country to another. This assumption is unrealistic for many industries as it allows several firms to keep production technology confidential with legal support, such as patents, copyrights, industrial and intellectual property legislation. Heckscher-Ohlin Model's assumption is based on static comparative advantage. However, technological differences in time can lead to dynamic comparative advantages. This comparative advantage depends on the innovation capacity of the firm or country in the new product and production process.

According to Posner, a developed country with a new product (or production techniques) is the first exporter of this. In addition, the country has monopoly power over this product. In the process, this new technology is passed through the hands of other countries through imitation (Fagerberg, 1996, p.44). These countries are developing countries which have advantages such as low-cost labour or abundance of natural resources. Thanks to these advantages, developing countries can produce relatively cheaper and export to less developed countries. Therefore, since developed country cannot compete with this situation, it becomes an importer of this product.

Posner criticizes Heckscher-Ohlin's assumptions that production functions are identical in all countries. Technical information is not a commodity that all countries can easily access and use. According to Posner, foreign trade occurs even if there is no difference in factor endowment between countries. This is because technical knowledge in one country is not in another. According to Posner, a developed country with a new product (or production techniques) is the first exporter of this. In addition, the country has monopoly power over this product. In the process, this new technology is passed through the hands of other countries through imitation (Fagerberg, 1996, p.44).

When a new product gets into the market, there is a threat to old products because firms will have to produce that product. The reaction of companies to the new product may be delayed, but in competitive markets, this reaction does not take long. It is the first step for companies to learn about the technology of this product, and this is a technical necessity. The response of companies to this new product may be delayed or earlier, depending on market conditions.

$$\text{Domestic reaction lag} = \text{learning period} + \text{reaction lag} \quad (2.1)$$

Reaction lag can be defined as the time for a firm to react to a probability of competition in its domestic market, whether it originates domestically or abroad. The reaction of domestic manufacturers to a new product developed abroad depends on the attitude of consumers. When consumers do not prefer this product, the reaction time may be prolonged and even not traded. Replace of the consumers the new goods with the old ones can take time, and this time is called the demand lag.

Generally, the lag in the reactions of the consumers causes the manufacturers to react to foreign competition lagged. In other words, there is a linear relationship between demand lag and foreign reaction lag (Posner, 1961, p.274-278).

According to Posner, the imitation lag hypothesis has three determinants. Foreign reaction lag, domestic reaction lag and learning period are represented by  $l_1$ ,  $l_2$  and  $l_3$  respectively. Accordingly, the total imitation lag (L) is expressed as follows:

$$L = l_1 + l_2 + l_3 \quad (2.2)$$

When the demand lag is shown with  $\lambda$ , the net lag is as below:

$$\text{Net lag} = L - \lambda \quad (\text{Posner, 1961, p.334}) \quad (2.3)$$

Although there is a several evidence to support the Imitation Lag Hypothesis, it has some shortcomings. Firstly, the model is unable to explain the size of the technological gap. Secondly, the model does not explore reason technological gaps arise and how could be eliminated.

### **2.1.6.3. The Product Cycle Model**

An extension of the technological gap model is the product cycle model, which was developed by R. Vernon in 1966. According to Vernon, when a new product is launched the market, it requires highly skilled labour, which is generally found in developed countries. As the product matures and is generally accepted, it becomes standardized; thus, it can be manufactured by mass production techniques and less skilled labour, which is generally found in developing countries. For this reason, the comparative advantage in the product shifts from the developed country (innovating country) to the developing country or imitating country (Salvatore, 2013, p.172). The Product Cycle Model divides the life cycle of new product into three stages.

In the first stage or New Product Stage, the product is produced and consumed only in the domestic market (innovating country). Firms wish to be close to the market in order to better understand the consumer's response to the product, as they produce in the domestic market where demand is located. It is a continuous phase of change as firms try to obtain information about the product and the production process. At this stage, there is no international trade so that innovating country has a monopoly in both the home and export market (Appleyard and Field, 2013, p.181).

In the second stage of the life cycle is called the maturing-product stage. In this stage, the product becomes standardized (Vernon, 1966, p.196). Moreover, the firm, which is located at innovating country may find it profitable to license other domestic and foreign firms to produce the product. In this way, the imitating country starts producing starts manufacturing the product for their domestic consumption.

The last stage is the standardized-product stage. In this stage, the innovation and review process in the product and production process is completed. The product is manufactured in the developing country (imitating country) and imported by the developed country (innovating country), the reason is that production costs are relatively cheaper in the developing country.

Vernon states that technical knowledge is not always a free commodity for all manufacturers. Generally, having technical knowledge is important enough to affect even the process of choosing the place of production. Usually, the first manufacturers of a new product decide on the place of production, taking into account the market. At this stage, comparative costs and the price elasticity of demand are not important. The important things are transportation, communication network and mobility. In other words, it is important to be close to consumers and to be able to observe their reactions. According to Vernon, the reason why the first production place of many products is the American market is its large size and high-income consumers. In the new product stage, the company does not deal with traditional materials, production scale and processes. On the contrary, the company follows a flexible processing policy. According to their requirements, production factors outsource. For this reason, instead of countries that offer cheaper factors, another high-cost country with a developed industrial environment can be preferred as the place of establishment (Vernon, 1972, p.183-184).

Production costs are important in the second stage, which is the maturation process. The aim is to minimize costs with economies of scale and annihilate uncertainties at this stage. Capital migration to a foreign country occurs at this stage. The main reason for investing in those countries is not to lose a potential market to domestic producers in that country (Vernon, 1966, p.259-260).

In the standard product stage, countries with cheap labour generally have a comparative advantage. The first reason for this is that labour in these countries is cheap. Secondly, the scarcity of capital does not negatively affect costs. According to Vernon, the reasons for not adversely affecting are as follows (Vernon, 1966, p.265):

- i. In standard products, the share of labour is much higher than the share of capital.
- ii. Capital is not an expensive production factor for international investors.
- iii. The capital markets in these countries do not reflect the true value of capital.
- iv. Government agencies give capital to entrepreneurs cheaply with additional reinforcements.

As can be seen, in Vernon's model, having technical knowledge rather than production costs and taking advantage of the cost advantage provided by economies of scale play the most important role in determining comparative advantages.

#### **2.1.6.4. The Linder Theory**

This theory, also known as “Preference Similarity” or “Overlapping Demand Hypothesis”, was introduced by S. B. Linder in 1961. The Heckscher-Ohlin Model is basically supply-oriented since it focused on factor endowments and factor intensities. The main difference of the Linder Theory from the Heckscher-Ohlin Model is that it is demand-oriented.

According to the Similarity in Preferences Theory, the trade of inhomogeneous industrial products depends on demand conditions. Linder's views on processed goods trade are the domestic market that first determines the country's production and then its exports. Demand represents the country in the domestic market. For this reason, it is very important to examine the factors that determine demand. Although many factors are affecting the demand, the most significant is the income level. The similarity in average income levels can be used as the similarity index of the demand structures of countries (Linder, 1961, p.94).

Linder argues that although the demand for capital goods seems unrelated to income, this is not true. In fact, the owners of capital goods create demand for capital goods. However, capital goods abundant countries are also high-income countries. Capital stock and income level are directly related to each other. Accordingly, the demand for capital goods is greater in high-income countries. In the Heckscher-Ohlin model, foreign trade occurs in countries with completely different income levels. According to Heckscher-Ohlin, one of the countries should be labour abundant. On the other hand, the other country should be capital abundant (Linder, 1961, p.101).

When the domestic market is large enough to take advantage of economies of scale, production costs are low enough to enter overseas market. Each country exports the highly demanded goods in its domestic market. The export process of the country can be explained in three stages. In the first stage, each firm produce the goods demanded by their domestic market. The second stage is efficiency and experience gained in the production of these goods. In the last stage, these goods are exported to countries with similar tastes and preferences and income levels (Dura, 2000, p.10). Although Linder Theory was remarkable in the 1960s, it could not find much support throughout the world except Sweden.

#### **2.1.6.5. Economies of Scale in International Trade**

Some of the alternative theories of international trade are based on economies of scale. In the Heckscher-Ohlin Model, goods are produced with fixed returns to scale in both countries, while increasing returns to scale are on the economies of scale. Briefly, economies of scale mean that production at a larger scale (more output) can be achieved at a lower cost. That is, when all inputs doubled, output is more than doubled. Increasing returns to scale can occur when division of labour and specialization becomes possible.

Economies of scale or increasing returns to scale must be obviously distinguished from external economies. The first one refers to the decreases in the average costs of production as the firm's production increases. In this way, economies of scale or increasing returns to scale is internal to the firm. There is no incentive for international trade in the two-country model, where countries have the identical Production Possibilities Frontier (PPF) and demand conditions. Suppose that a shock has occurred, which has caused both countries to specialize in different goods. Although both countries initially had the same autarky position, they gained different experiences from trade thanks to the shock (Krugman, 1980, p.952).

Even if these gains are a result of economies of scale, the model has some uncertainties. Firstly, it is not possible to know which country will specialize in which goods. Secondly, the cause of the shock that drives production away from the point of autarky is unpredictable. Even if it is controversial whether increasing returns to scale is more realistic than fixed returns to scale, economists think that economies of scale are important.

#### **2.1.6.6.The Krugman Model**

This model, introduced by P.R. Krugman in 1979, is a simple adaptation of the Dixit-Stiglitz Model. Krugman extended the model by adding transportation costs to his study in 1980 and shaping the economic geography in 1991. According to Heckscher-Ohlin Model, international trade is caused by a comparative advantage or difference in factor endowments. However, this model is based on two totally different features from other traditional models. Krugman explains it with monopolistic competition and economies of scale.

Product differentiation and internal economies of scale create a cost advantage and benefit. One of the main assumptions that distinguish this model from others is that firms produce using a technology with increasing returns to scale. That is, economies of scale are valid (Krugman, 1979, p.479). Another assumption is that, unlike the Heckscher-Ohlin Model, firms produce differentiated product. This product differentiation creates the perception that it is a different product for consumer and provides brand loyalty. Thus, the firms gain a monopolistic power.

According to Krugman, even if countries have similar technology, factor endowment, cost structures and preferences, they gain from free international trade thanks to economies of scale and product differentiation (Krugman, 1980, p.952). In other words, free international trade is expanding the market for firms, so this expansion allows firms to reduce their costs by increasing their production scale. According to Krugman, these gains can also arise without free international trade. That is, when population migrates from one region to another, there are advantages in terms of consumption, production, cost and product diversity. After all, the Krugman's model can explain international trade between similar countries as in Linder Theory. This result is consistent with the current international trade.

#### **2.1.6.7.The Reciprocal Dumping Model**

The Reciprocal Dumping Model, also known as Brander-Krugman Model, was introduced by J.A. Brander and P.R. Krugman in 1983. The concept of dumping is simply that the prices of export goods are lower than domestic prices. Dumping, which is a kind of price differentiation. In the model, it is assumed that there are two identical countries and only one firm produce the same good in each country.

Each firm perceives the market of the other country as a separate market. Supposing that, profit maximization is done individually for both markets. It is accepted that firms have adopted Cournot behaviour. In other words, each firm assumes that the rival firm cannot change the amount of production. The market shares of the firms in export are smaller compared to their domestic markets. For this reason, marginal income from the foreign market is higher compared to the domestic market. However, the marginal cost of the export goods is considerably higher than the marginal cost of the goods sold in the domestic market due to the transportation costs. On the other hand, the firm has to sell its product in a foreign country at a lower price than the domestic market. According to Brander-Krugman, high marginal income from exports will cover the marginal cost. The model argued that sales can be continued profitably in both markets. As a result of the same behaviour of the companies in both firms, intra-industry trade begins between the two countries. Intra-industry trade based on mutual dumping will continue as long as firms have a profit margin to cover transportation costs (Brander and Krugman, 1983, p.314-316).

In this model, there are no foreign trade reasons such as increasing returns to scale or cost differences, but only price discrimination by firms in the oligopoly market causes intra-industry trade. There are discussions about the welfare impact of trade. Unnecessary transportation costs undoubtedly lead to a loss of welfare. On the other hand, thanks to competition with foreign firms, prices are falling and the waste of resources in monopoly decreases. Wealth loss also occurs when the firm reduces the domestic production and consumers consume more expensive imported goods. However, in conditions where transportation costs are low and get into the market is free, producers increase their profits with the start of trade. In this direction, an increase in welfare occurs (Brander and Krugman, 1983, p.320).

The Reciprocal Dumping Model, also known as Brander-Krugman Model, was introduced by J.A. Brander and P.R. Krugman in 1983. The concept of dumping is simply that the prices of export goods are lower than domestic prices. Dumping, which is a kind of price differentiation, is explained with the help of Cournot Model in this model.

The first assumption of the model is that there are two countries, a domestic country and a foreign country. Another assumption is that there are two firms that produce a homogeneous product. Furthermore, as an important feature, there are transport costs that prevent trade (Brander and Krugman, 1983, p.2).

Initially, both firms have monopoly power in their home country. However, when they launch their products on each other's market, the market share of the firms starts to change. This situation leads to a reduction in the mark-up, which is between price and marginal cost, and lower prices due to increasing competition. According to this model, welfare can be affected by two effects, positive and negative. Welfare may rise due to increased competition, and it's called positive effect. On the other hand, welfare may decrease due to waste of resources resulting from transport costs and it's called negative effect (Brander and Krugman, 1983, p.9). In conclusion, welfare effect is unclear.

#### **2.1.6.8.Gravity Model**

The Gravity Model is originally an adaptation of Sir Isaac Newton's Laws of Gravity to the international trade. In his book *Shaping the World Economy* in 1962, Tinbergen adapted the formula to foreign trade to explain the trade between the two countries. In its most basic form, the trade volume is positively related to the Gross Domestic Product (GDP) of the countries and negatively related to the distance to the between them. The distance, which is thought to have a negative effect on trade, is an indicator of the trade cost. The gravity model that constitutes the theory of this study will be explained in detail in the next section.

## CHAPTER III

### 3. GRAVITY MODEL

Gravity Model has long been one of the most successful empirical models in economics, explaining extremely well the not only trade but also factor movement. (Anderson, 2010, p.1). Basically, it is a model used to explain the flows between two or more countries. These bilateral flows can be trade, migration, foreign direct investment, or tourism. The name and mathematical representation of the gravity model was derived from Sir Isaac Newton's "Law of Universal gravitation" (Ivus and Strong, 2007, p.45). Sir Isaac Newton's law of gravitation may be mathematically expressed as:

$$F_{12} = G \frac{m_1 m_2}{r_{12}^2} \quad (3.1)$$

According to the above equation, the gravitational attraction, which is denoted with  $F_{12}$ , between two objects with masses  $m_1$  and  $m_2$  was directly proportional to the masses of the bodies. In addition, this gravitational force is inversely proportional to the distance between the two objects denoted by  $r$ . (Lerner, 2001, p:1)

In 1962, Nobel laureate Dutch economist Jan Tinbergen adapted the same formulation to international trade flows. The formulation of the exports of 18 countries analysed with the data of 1958 is as follows:

$$E_{ij} = \alpha_0 \frac{Y_i^{\alpha_1} Y_j^{\alpha_2}}{D_{ij}^{\alpha_3}} \quad (3.2)$$

$E_{ij}$  = Exports from country  $i$  to country  $j$

$Y_i$  = The economic size of country  $i$ , which is the exporter country, expressed in GNP.

$Y_j$  = The economic size of country  $j$ , which is the importer country, expressed in GNP.

$D_{ij}$  = Geographic distance between country  $i$  and  $j$ .

$\alpha_0, \alpha_1, \alpha_2$  and  $\alpha_3$  are the parameters of the model (Tinbergen, 1962, p.264).

Tinbergen argued that although there are many factors affecting trade between countries, these three variables have the most decisive influence. The effect of these variables on trade is explained as follows:

- i. The export capacity of a country depends on its economic size.
- ii. The level of export realized by the exporting country depends on the economic size of the importing country.
- iii. There is a very negative and quite strong relationship between trade volume and transportation costs. As the geographical distance between countries increases, transportation costs directly increase (Tinbergen, 1962: 263).

### 3.1. LITERATURE REVIEW OF GRAVITY MODEL

The model in which the national income of countries and the distance between them are used as variables to explain trade is called the Standard Gravity Model in the literature. Over time, the equation of gravity has been estimated by adding variables that affect trade and trade costs. The model estimated by adding dummy variables such as common religion, language, colonial and cultural similarities, regional integrations, and the existence of trade agreements is called the Augmented Gravity Model.

Tinbergen performed his second analysis by adding a dummy variable to the standard gravity equation, which has high explanatory power. The augmented gravity equation is as follows:

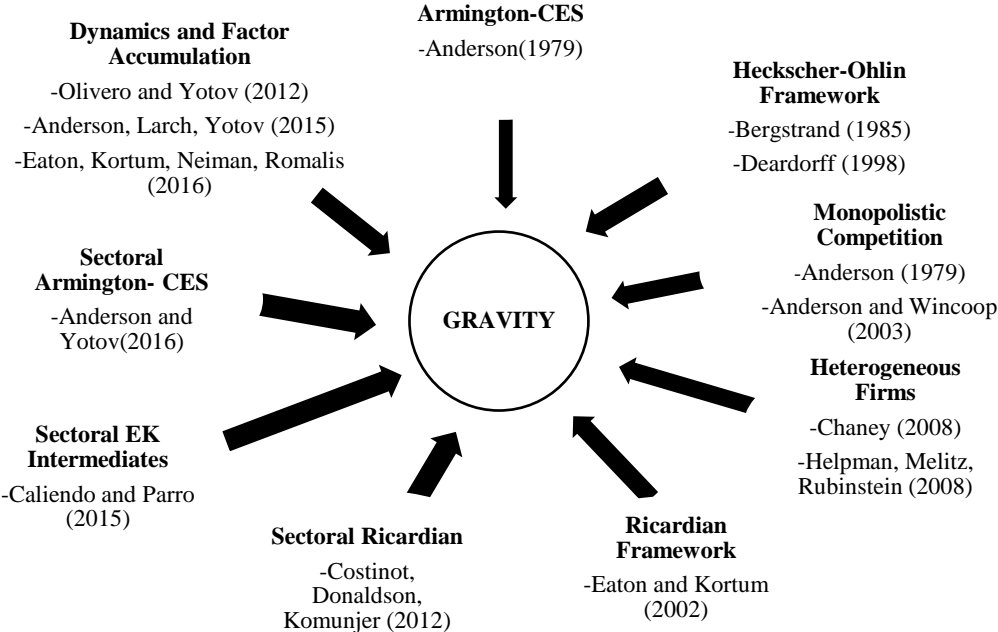
$$E_{ij} = \alpha_0(Y_i^{\alpha_1})(Y_j^{\alpha_2})(D_{ij}^{\alpha_3})(N^{\alpha_4})(P_C^{\alpha_5})(P_B^{\alpha_6}) \quad (3.3)$$

N is denoted by share a land border.  $P_C$  and  $P_B$  are shown as dummies for membership in the British Commonwealth and Benelux countries, respectively. With that analysis, while being a member of the commonwealth of nations increases trade, other dummy variables do not increase trade noticeably (Dinçer, 2013, p.6).

Tinbergen's work has also pioneered his students and colleagues. Pöyhönen (1963) is the second author to use the Gravity Model in international trade with his study “A Tentative Model for The Volume of Trade Between Countries”. The study investigated the exports of 10 European countries to each other with 1958 data. Pöyhönen found that trade increased in direct proportion to national income. However, since the distance variable replaces the transportation cost, it is inversely proportional to trade (Pöyhönen, 1963: 93-98).

Linnemann (1966) developed the gravity model by adding the population variable to the standard equation. Population variable represents the preferences of the consumer in this equation. More importantly, Linnemann was the first to contribute theoretically by try to predict the model with Walrasian General Equilibrium. In the study, trade-resistant factors are defined as barriers created by people, which is distance and tariffs, etc. (Linnemann, 1966, p: 366–368).

There are criticisms that the Gravity Model, which is empirically quite successful, does not have a theoretical background. For this reason, the studies to test the theoretical background of the model can be seen in the figure 3.1.



**Figure 3.1.** Gravity Model’s theoretical foundations (Yotov, *Piermartini*, *Monteiro*, and Larch, 2016, p.12)

Savage and Deutsch (1960) and Leamer and Stern (1970) derive the gravity model of commodity trade from the probabilistic model. Leamer (1974) estimated the movement of goods as explanatory variables together with the gravity equation and the Heckscher-Ohlin theory (H-O). However, Leamer did not integrate these two approaches theoretically.

Anderson (1979) first attempted to derive the equation of gravity based on differentiated goods using Cobb-Douglas and then Constant Elasticity of Substitution (CES) Preferences. In the study, the Armington assumption is valid, which states that the goods differ in terms of the export country. Assuming that, the choice is made by considering only the commodities subject to trade (Anderson, 1979, p.106).

Bergstrand (1985) derived the equation by adding price indices in the case where CES preferences are valid for Armington assumption. The study tests the assumptions about goods differentiation by using GDP deflators instead of price indices. Instead of constant elasticity of substitution, it is assumed that there are different substitution elasticities between import goods or between import goods and domestic goods. According to the results of the analysis, goods are not perfect substitutes for each other, but import goods are more closely substitutes for each other than domestic goods.

Bergstrand (1989, 1990) assumes that goods differ by firms rather than countries, with the Dixit-Stiglitz model. A monopolistic competition model that Dixit-Stiglitz (1977) defines as product variety and a separable between the group and all other goods. This is a hybrid model by combining the H-O model based on perfect competition and the Krugman model in which monopolistic competition exists in a single sector economy. Bergstrand (1990) investigate the intra-industry trade between two countries with a gravity model.

Helpman (1987) believes that the gravity model supports the monopolistic model of competition. Accordingly, trade between OECD countries has been tested with the gravity equation. Since monopolistic competition exists in OECD countries, the highly explanatory gravity equation has proven the existence of monopolistic competition-based trade.

Deardorff (1995) argued that the gravity equation can be derived from the Heckscher-Ohlin model (H-O). Trade between the two countries may decrease due to the distance, in other words, trade is affected by the relative distance. According to Deardorff, the gravity model is consistent with most of the international trade theories rather than describing them (Deardorff, 1995, p.27-30).

Eaton and Kortum (2002) examine the effects of geography by adopting the Ricardian model, which explains comparative advantage based on the difference in productivity. According to Eaton and Kortum, comparative advantages have an expanding effect on foreign trade between the two countries. Barriers caused by geography restrict foreign trade. Geographical barriers consist not only of transportation costs but also of customs, quotas, delays and communication (Eaton and Kortum, 2002, p.1741).

The Anderson-van Wincoop (2003) model is a demand-side model. Consumers make their own choices on the assumption of constant elasticity of substitution (CES). Consumers like variety, and this is called the “love of variety”. Consumers believe that the benefits will increase when they consume more certain goods and the number of varieties of goods, they can consume increases. The elasticity of substitution between varieties is greater than 1. The model assumes that the firms are in the monopolistic competition market. Each firm produces only one type of the same good and uses a mark-up pricing strategy. The price of the product is determined at a level that will cover its cost and market entry costs. It is assumed that producers can sell goods to all countries, while consumers can buy goods from all countries. Because consumers believe that goods differ in terms of the exporter country. This is called the Armington assumption. Merchandise export includes transportation costs. This assumption is called the Iceberg assumption. According to this assumption, part of the transported goods melts during transportation and disappears. Consumers who consume import goods cover supply with these costs. The price of the good is not affected by changes in the price of other goods. This assumption is called the separability assumption. In the Anderson-van Wincoop model, preferences determining expenditure in all countries are similar. In other words, consumers prefer domestic and import goods at the same rates. The number of firms is determined automatically according to the trade balance in the process as an endogenous variable (Anderson, 2010, p.12-13).

Helpman, Melitz and Rubinstein (2008) discuss product differentiation in terms of demand on a firm basis, not on a country basis. The study assumes that not every firm is an exporter, nor does exporters sell goods to every country. As the trade costs differ, the exporter firms will also differ and will vary from country to country.

Chaney (2008) re-formed the supply-side of the gravity model under the assumption that firms are heterogeneous. Firms differ from each other according to their efficiency level. As the substitution between goods increases, the market share of firms working with low productivity will decrease. Firms working with high efficiency will rise. In this case, the change in trade costs may cause a decrease in total trade. Constant costs determine the suffusive boundary of trade. Chaney argues that the reason for this is that the firm accepts the constant cost and does not change its decision (De Benedictis and Taglioni, 2011, p.70).

### **3.1.1. Recent Studies**

Common language and common border are the most frequently used dummy variables in gravity model studies. The reason for this is the expectation that there will be more trade between culturally close countries. According to Head (2003) and Helliwell (1996), countries with a common language trade almost twice or three times more than countries without a common language. Studies showing that the common language positively affects trade are Silva & Tenreyro (2006), Tumbarello (2007), Martin & Pham (2008), Kien (2009), Burger & Van Oort & Linders (2009), Genç & Artan & Berber (2011), Arıca (2014), and Işık (2016). On the other hand, Martinez- Zarzoso & Nowak-Lehmann (2003), Akgül (2013) and Karapınar & Atsan (2019) found that the common language negatively affects trade. The common language variable should be a common language spoken by their official or primary language or at least 9% of the population. According to CEPII, the only country where more than 9% of the population speaks Turkish is Cyprus. The Turkish speaking region is North Cyprus, also known as the Turkish Republic of Northern Cyprus. Since the TRNC is not legally recognized, only TURKSTAT separates data into TRNC and GCASC. For this reason, the common language dummy variable cannot be used in the model, since the data of other variables cannot be obtained for the TRNC.

There are examples of studies showing that the common border positively affects trade such as Bussiere & Bernd (2006), Silva & Tenreyro (2006), Martinez- Zarzoso & Nowak-Lehmann (2003), Burger et al. (2009), Ekanayake & Ledgerwood (2009), Karagöz & Karagöz (2009), Bhattacharya & Wolde (2010), Sandalcılar (2012), and Kaplan (2016). On the other hand, the studies show that common border has a negative effect are Rahman (2003), Vollrath & Gehlhar & Hallahan (2009), Abbas & Waheed (2015), Wang & Badman (2016), Shelaby & Mohamed & Salah (2018). However, in the literature, there are studies in which the common border is insignificant such as Martin & Pham (2008), Tatlıcı & Kızıltan (2011), Turhan (2012), Akgül (2013) and Ata (2012).

Common religion is another dummy variable used to explain trade. Karagöz & Karagöz (2009), Karapınar & Atsan (2019), Li & Lu & Chen (2020) are examples of studies showing that the common religion positively affects trade in the literature.

Finally, colonial ties are one of the dummy variables used to explain trade. Ata (2012), Karagöz & Karagöz (2009), Silva & Tenreyro (2006), Burger et al. (2009) concluded that colonial ties increase trade.

In the literature, Gravity Model is mainly estimated as Fixed Effects Model or Random Effects Model with panel data method. There are limited studies with Poisson Pseudo Maximum Likelihood model, in other words, PPML model. Precursor studies on this model, Silva & Tenreyro (2006), Martinez- Zarzoso & Nowak-Lehmann (2003), Martin & Pham (2008), Burger et al. (2009), Siliverstov & Schumacher (2009), Westerlund & Wilhelmsson (2009), and Yu (2010) can be ranked. In the next section, the reasons why PPML model should be used instead of OLS will be explained.

### **3.2. ECONOMIC MODEL: PANEL DATA**

In the academy literature, cross-section, and panel data, also known as longitudinal data, are used as methods. However, cross-sectional data are often used in studies before the late 1990s. This is also true for the Gravity Model, as many economists are working with cross-sectional data before 1990. As an example, respectively, Tinbergen (1962), Pöyhönen(1963), Linnemann(1966), Aitken(1973), Thursby and Thursby (1987), Breuss and Egger (1999), Endoh (1999,2000).

As can be seen in the literature since the 2000s, the popularity of panel data is increasing. Studies conducted with panel data can be shown by Sichei & Erero & Gebreselasie (2005), Paas (2005), Kien (2005), Bilgili (2007), Neyaptı & Taşkın & Üngör (2007), Kula & Aslan (2008), Egger (2008), Genç & Artan & Berber (2011), Karagöz (2011), Ata (2012), Arıca (2014), Kaplan (2016) and Tan (2019).

Panel data, or longitudinal data, is multidimensional data that includes time series size and cross-section size. The cross-section dimension is denoted by  $i = 1, \dots, N$ , and time dimension is denoted by  $t=1, \dots, T$  (Hsiao, 2006, p.1) Panel data can be classified according to whether the observation value of the variables is missing or not. In the panel data set, a time series of equal length for each cross-section is called balanced panel. However, the change of time series lengths from cross-section to cross-section is called unbalanced panel (Wooldridge, 2002, p.250).

Another classification of panel data set is comparing dimensions of time and cross-section. Macro panels are the case where  $N$  denoting the number of countries, and  $T$  denoting the length of the time series are both greater. On the other hand, micro panels are the cases where  $N$  denoting the number of countries, is quite large, but  $T$  denoting the length of the time series is small ( $N > T$ ).

Panel data analysis can be defined as the combination of time series and cross section. Therefore, panel data has many advantages over these two methods. These advantages can be listed as follows: (Baltagi, 2005, p.4-6)

- i. Panel data analysis includes inter unit variability and unobservable heterogeneity.
- ii. Panel data analysis provides more information than time series analysis and cross-section analysis. Panel data also offers the opportunity to add more variables to analysis. This also reduces the possibility of multicollinearity problems. Moreover, the high number of observations leads to a high degree of freedom and makes the analysis more effective.
- iii. Panel data analysis shows better the dynamics of adjustment.
- iv. Panel data analysis provides effects that cannot be revealed by cross-sectional or time series analysis only.

- v. Panel data analysis allows us to establish and test more complex behavioural models than others.

Panel data has some disadvantages as well as advantages. These disadvantages can be listed as follows: (Baltagi, 2005, p.7-8)

- i. Problems in collection and editing data.
- ii. High measurement errors due to the width of the data set.
- iii. Presence of selectivity problems.
- iv. Short time series dimension.
- v. Cross-section dependency and unit root problems (in case of a macro panel)

According to Baltagi, it is possible to encounter the cross-section dependency problem in panel data with a time dimension of more than 20-30 years (i.e. macro panels), even if  $N = 100$ . For this reason, cross-section dependency and unit root tests should be done in macro panels, but it is not necessary for micro panels (Baltagi, 2005, p.199).

Panel data regression model can be represented as in equation (1):

$$y_{it} = \alpha + X'_{it}\beta + u_{it} \quad i = 1, \dots, N \quad t = 1, \dots, T \quad (3.4)$$

In the equation,  $i$  denotes individuals, households, firms, countries, etc. and  $t$  denotes the time. Therefore,  $i$  denotes cross-section dimension whereas  $t$  denotes time dimension.  $\alpha$  is a scalar, moreover,  $\beta$  is  $K \times 1$  dimensional parameters column vector. And  $X_{it}$  is the  $i^{th}$  unit for  $K$  explanatory variables in the  $t^{th}$  time observation values. In addition,  $u_{it}$  is the error term at time  $t$  of the  $i^{th}$  unit.

In studies conducted with panel data, there are generally two types of approaches: Fixed Effect Models and Random Effect Model. Matyas (1998), Egger (2000), Antonucci & Manzonchi (2005), Cheng & Wall (2005), Karagöz & Karagöz (2008), Henderson & Millimet (2008), Yu (2010), and Suvankulov & Ali (2012) can be given as examples of the FEM studies. On the other hand, Martínez-Zarzoso & Nowak-Lehmann (2003), Kavallari & Maas & Schmitz (2008), Tatlıcı & Kızıltan (2011), Karagöz & Saray (2010), Arvas & İç (2013), Kapkara & Koç (2016), and Erkahraman (2018) can be cited as examples of studies apply the REM.

The Fixed Effects Model should be used when a country's trade is analysed to cover the entire population in the analysis. In other words, a country's trade with all countries in the world must be estimated by the methods of the Fixed Effects Model. However, time-invariant variables are deducted from the equation when estimated by the Fixed Effects Model methods (Gül ve Tatoğlu, 2019, p.53). Time-invariant variables can be defined as variables that remain the same over time. Distance, one of the basic variables of the gravity equation, is also time-invariant. The distance between countries does not change over the years. Also, the dummy variables used in the augmented gravity equation are religion, language, common border, etc. can be shown as an example.

### **3.3. CHALLENGES FOR ESTIMATING GRAVITY MODEL**

The gravity model has been extremely popular in the analysis of international trade flows in recent years. Although the model is preferred due to its high power to test and explain the determinants of trade, the model contains various econometric problems. Deviations in the results of the analysis will occur when the model is not properly estimated.

#### **3.3.1. Multilateral Resistances**

The first difficulty in estimating the gravity equation is the presence of multilateral resistances that cannot be directly observed. Anderson and van Wincoop (2003) define  $\Pi_i$  as outward multilateral resistances. Moreover, exports from country  $i$  to country  $j$  depend on trade costs in other possible export markets. This term measures the country  $i$ 's ease of market access. As another structural variable,  $P_{j,t}$  is defined as inward multilateral resistance. Similarly, country  $j$ 's import from country  $i$  is dependent on trade costs of other suppliers. This variable also shows the ease of market access of country  $j$ . According to Baldwin and Taglioni (2006), the case that multilateral resistances are not included in the model is called "gold medal mistakes". In studies using panel data analysis, it is sufficient to include country pair fixed effects as a solution (Baldwin and Taglioni, 2006, p.7).

As dependent variable in the estimation of gravity equation; total export flows, total import flows, an average of import and export trade flows are used. Silver medal mistakes are that the researcher should take the average of the logs rather than the log of the average. The gravity model supports the use of unidirectional trade data.

The bronze medal errors are that researchers deflate nominal flows with price indices. Trade flows should be used nominally instead of real. Export should not be deflated with price indices GDP deflator or CPI, as export is already deflated with two multilateral resistance terms. When the export is deflated with these price indices, mistaken results are obtained (Shepherd, 2016, p.9).

### **3.3.2. Zero Trade Flows**

Since Tinbergen (1962), the most commonly used technique for estimating the gravity equation has been ordinary least-squares estimator (OLS). However, the major disadvantage of the OLS approach is that at zero trade flows the observations are dropped from the equation. The main reason for this is that the logarithm of zero is undefined. Thus, leads to biased estimates.

Zero trade flows are considerably common in the bilateral trading matrix. Linnemann (1966) showed that half of the world's trade flows are zero. As product disaggregation increases, the zeros become more and more in trade. Almost half of the bilateral trade matrix is zero (Helpman et al., 2008, p.5).

The simplest and most convenient solution to the existence of zero trade flow to estimate the gravity equation in multiplicative form. Silva & Tenreyro (2006) recommend to gravity equation with the Poisson-Pseudo Maximum Likelihood (PPML) estimator. Moreover, in Monte Carlo simulation, the performance of the PPML estimator is quite good even when the amount of zeros is large (Yotov, 2016, p.19-20).

### **3.3.3. Heteroscedasticity of Trade Data**

The problem of heteroscedasticity is generally encountered when working with trade data. This is vital because, in the existence of heteroscedasticity, the estimation both biased and inconsistent when the gravity equation is estimated with the OLS estimator in log-linear form. The PPML model aims to estimate by resolving the deviation caused by the variance problem in the error term. In this direction, the “ppml” command makes robust predictions without the need for robust or other options (Shepherd, 2016, p.38).

### **3.3.4. Endogeneity of Trade Policy**

The basic assumption of the Least Squares (OLS) method is that the error terms are not associated with independent variables. This situation is called endogeneity. Tariffs are the most prominent example of endogeneity in gravity model studies. The first differencing of bilateral trade flows or use of country-pair fixed effects resolve the problem of endogeneity. Otherwise, in the gravity regression, the pair fixed effects will absorb bilateral time-invariant, such as distance.

### **3.3.5. Gravity with Disaggregated Data**

Most of the trade policies are implemented at the sectoral level. GDP, which represents the economic size of countries, cannot be a valid proxy variable to replace demand and supply in the case of disaggregated sectoral data. In such a case, it is recommended to use sectoral size as a proxy variable instead of country size. However, sectoral data is very difficult to obtain. GDP data can be used when sectoral data are not available. Attention should be paid to manage zero trade flows when using only disaggregated data.

The PPML estimator was used in this study, as the Poisson-Pseudo Maximum Likelihood estimator performed very well even in the presence of zero trade flows and heteroscedasticity. Additionally, the interpretation of the coefficients from the Poisson model is extremely simple because they are same as in OLS. The coefficients of the independent variables are interpreted as semi-elasticity, like in OLS. Pseudo-Possible Maximum Likelihood (PPML) predictions do not take the logarithm of the dependent variable, because of zero trade flows. In this direction, equation 3.5 is used.

$$X_{ij} = \exp(\beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln D_{ij}) u_{ij} \quad (3.5)$$

In the literature, the dependent variable of the gravity model is mostly considered as export (Martinez- Zarzoso & Nowak- Lehmann 2003, Burger et al. 2009, Yu 2010). Westerlund and Wilhelmsson (2009) estimated the model such that the dependent variable is import. There are also studies which the dependent variable is taken as the trade between the two countries (Silva & Tenreyro; 2006, Martin & Pham; 2008, Siliverstov & Schumacher; 2009).

### **3.4. DEFINITION OF VARIABLES AND EXPECTED SIGNS**

The main variables of the standard gravity model are economic size and distance. The variable that best representative economic size has been a topic of discussion for many years. Two indicators of the size of the economy are the population variable or Gross Domestic Product (GDP). Income is the most indicative variable in trade flows. Some scholars have used GDP variable of a representative of economic size Tinbergen (1962), Pöyhönen (1963), Bergstrand (1985,1989), Mccallum (1995), Matyas (1997), Eichengreen and Irwin (1998) Martinez-Zarzoso (2003), Anderson and Wincoop (2003) Cheng and Wall (2005). On the other hand, Satttinger (1978), Bergstrand (1989), Paas (2002), Evenett and Keller (2002), Yamarik and Gosh (2005) have used per-capita income.

In empirical studies, GDP per capita or GDP is generally used as income variable to represent economic size. In the model, GDP and trade flows should be nominal. The reason for this, price indices already been deflated with including multilateral resistance term. In this direction, aggregate GDP should be used compared to GDP per capita (Shephard, 2016, p.9). However, it should be decided which GDP will be used. Assuming that foreign trade is in international prices, GDP that calculated with purchasing power parity should not be used. In this study, the current US\$ GDP is used as an indicator of economic size, like in many empirical studies.

Another main determinant of trade is distance. In these models, the distance variable represents a population-weighted distance between most populated cities in km. In the literature, there is no consensus on the method of determining the distance between countries and whether it will be calculated according to the capital city or the most

populated cities. In general, the distance between the capitals of countries is measured by the "great circle" method (Head, 2003, p.5).

But in today's world, the capital city is not centre of commerce, but centre of bureaucratic relations. Most populated countries represent the trade centres of the countries. Therefore, in this study, the distance variable represents a population-weighted distance between most populated cities in km.

The answers to the question of why distance, which is the main variable of the gravity equation, is so important are as follows (Head, 2003, p.6):

- i. Distance is representative of transport costs. These costs include marine insurance and freight charges.
- ii. Distance is an indicator of time elapsed during shipment. During transportation between countries, long-term trips in perishable goods have a trade-reducing effect. There are three types of risks in long-term transport trade: weather conditions, product loss and market loss.
- iii. Distance can cause synchronization costs. The production location is close to raw materials and inputs in order to reach the inputs in the production process on time and to overcome the production bottleneck immediately.
- iv. According to Krugman, distance represents the exchange of information in communication between managers and customers and causes communication costs. Therefore, the short distance is significant for trade.
- v. Distance also can cause transaction costs. As the distance between countries increases, transaction costs may increase. There is a negative correlation between trade and transaction costs. The short distances help build trust between trade partners.
- vi. Geographical distances between countries cause cultural differences. These differences can cause trade-reducing effects due to various factors. These factors can be list as hindering communication, misunderstandings, and conflicts in negotiations.

In this study, Turkey's international trade flows estimates by the PPML method within the framework of Gravity Model for the period 2003-2019. Gravity equations for export and import of Turkey will be calculated separately with using Gravity Model. Explanatory variables as Turkey and the partner countries of the current US\$ denominated GDP, and population-weighted distance between the most populated cities are included in the equation. Also, the dummy variables used in the model are contiguity, common religion, and colonial-ties. The tests and results applied that in the process of obtaining gravity equations will be checked both statistically and economically. According to the PPML model, the model was estimated as a multiplicative form rather than logarithmically due to the existence of zero trade flows.

The gravity equations to be used in the model are as follows:

$$X_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIST_{ij} + \beta_4 CONTIG_{ij} + \beta_6 COLONY_{ij} + \beta_7 COMRELIG_{ij} + u_{ij} \quad (3.6)$$

$$M_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIST_{ij} + \beta_4 CONTIG_{ij} + \beta_6 COLONY_{ij} + \beta_7 COMRELIG_{ij} + u_{ij} \quad (3.7)$$

In the above equations, export (3.6) and import (3.7) are defined as dependent variables. Models 1 and 2 were estimated by the PPML method. Stata 15.0 program was used for data analysis. The variables used in the model are summarized in Table 3.1.

**Table 3.1.** Variables' definition, sources and expected signs

Variables	Definition	Source	Expected Sign
$\ln GDP_{it}$	Turkey's GDP as economic size Current US\$	World Bank, WDI	+
$\ln GDP_{jt}$	Partner country's GDP as economic size Current US\$	World Bank, WDI	+
$DIST_{ij}$	The distance between Turkey and partner country	CEPII	-
$CONTIG_{ij}$	Common border dummy	CEPII	+
$COLONY_{ij}$	Colonial-tie dummy	CEPII	+
$COMRELIG_{ij}$	Common religion dummy	CEPII	+

Export; Turkey's merchandise export to partner countries. The export data is accessible in TURKSTAT.

Import; Turkey's merchandise import from partner countries. The import data is accessible in TURKSTAT.

CEPII (Center d'Etudes Prospectives et d'Informations Internationales) database was used for the data of the distance and all dummy variables (contiguity, common religion, and colonial-ties) in the equation.

Gross Domestic Products: The main determinants of trade flows are the economic size of the exporter and importer countries. Ordinarily, countries are expected to increase in trade in relation to the economic size. The GDP of the exporter country represents the capacity to supply exporting goods. Furthermore, the GDP of the exporter country is an indicator of the product variety of exporting goods. The GDP of the importer country is a sign of purchasing power. The increasing GDP in the importer country also increases imports (Sohn, 2001, p.8). Due to these reasons, the GDP of exporter and importer countries affects trade flows positively. Assuming that prices remain constant in the economy, consumption will increase when income rises (Krugman, 1989, p.3102). An increase in consumption causes an increase in demand for both domestic and foreign goods. Therefore, GDP, which represents the size of the country's economy, is an essential variable among the determinants of foreign trade. The positive relationship between trade flows and income level and similarity has been proven by several empirical studies. Currently, these studies can be given as examples by Egger (2000) and Ghosh & Yamarik (2005).

Distance: As the distances between countries increase, imports decrease as local products will generally be cheaper than products traded over long distances. Therefore, long distances are expected to reduce trade. Thus, bilateral trade flows are reduced (Egger and Pfaffermayr, 2004, p.227). In the equation, a population-weighted distance between most populated cities in km is used distance variable. The real trade costs consist of transport and different costs of doing international trade. These costs are a vital identifier of a country's ability to entirely participate to world economy. The distance between countries, poor transportation and insufficient communication infrastructure causes some countries to be isolated from the global economy. Moreover, this situation pushes these countries out of the production network. The main factor that determines transportation costs is the distance between countries (Limao and Venables, 2001, p.1).

Contiguity: Distance is extremely significant in terms of transportation costs. For this reason, sharing a common border reduces transportation costs as it shortens the distance. Sharing a common border has some advantages to countries in the context of trade. First of all, contiguous countries naturally have integrated transport networks more that reduce the number of transfers. Furthermore, contiguous countries generally have transit and customs agreements which is decrease transit times and allow lower shipping and insurance costs. At last, the increase in trade volume between contiguous countries significantly increases the backhauling possibilities by allowing fixed costs to be split into two trips (Limao and Venables, 2001, p.3). The contiguity dummy variable takes the value 1 if countries share a common border, and 0 otherwise.

Common religion: Share common religion is expected to positively affect trade between countries like a cultural and colonial relationship. The effect of religion on international trade occurs through network effects. Sharing the same religious beliefs by people living in different countries can create networks of trust and familiarity that facilitate complex international economic transactions (Lewer and Van den Berg, 2007, p.767). In recent years, develop and increase commercial relations with Islamic countries is one of the important foreign trade policies implemented by the government. Accordingly, included in the model to test the effect of common religion values on bilateral trade. The variable takes a value of 1 for Muslim countries and 0 for other countries.

Colonial-ties: There are several studies in the literature show that when one country has colonial ties with the other, the trade volume increases. Examples of these studies are Bröcker & Rohweder (1990), Frankel, Stein & Wei (1995), and Mansfield & Bronson (1997). According to Eichengreen and Irwin (1998), there are two reasons for the positive relationship between colonial ties and trade. Firstly, colonial ties increase trade partners' perceptions of each other's cultures and legal systems. Secondly, historical linkages that have resulted in sunk costs are associated with increases in trade, such as distribution and service networks (Eichengreen and Irwin, 1998, p.35). Colonial ties will facilitate trade. The colonial ties dummy variable takes the value 1 if countries have a colonial relationship in past, and 0 otherwise.

One of the problems often encountered in regression analysis is the multicollinearity problem. The correlation matrix analysis method can be used to detect multicollinearity. In correlation matrices, the coefficient of the variable over 0.90 indicates that a serious multilinearity problem (Asteriou and Hall, 2011, p.101).

Correlation matrices of all country groups will be examined respectively. The lower right triangle part of the table shows the correlation coefficients of the export equation. The upper left triangle part of the table shows the correlation coefficients of the import equation.

**Table 3.2.** *Covariance matrix of high-income countries' export and import*

	Export/Import	Lngdp_o	Lngdp_d	Lndistw	Contig	Comrelig	Colonial
Export/Import	<b>1.0000</b>	0.6077	0.1184	-0.1777	0.0035	-0.0998	-0.1168
Lngdp_o	0.1237	<b>1.0000</b>	0.1011	-0.2213	0.0492	0.0032	0.0094
Lngdp_d	0.5887	0.1011	<b>1.0000</b>	-0.0005	0.0002	0.0006	0.008
Lndistw	-0.2511	-0.0005	-0.2213	<b>1.0000</b>	-0.2540	-0.1148	-0.5075
Contig	0.0128	0.0002	0.0492	-0.2540	<b>1.0000</b>	-0.0542	0.2731
Comrelig	-0.0032	0.0006	0.0032	-0.1148	-0.0542	<b>1.0000</b>	0.4419
Colonial	-0.0652	0.0008	0.0094	-0.5075	0.2731	0.4419	<b>1.0000</b>

Table 3.2. shows the correlation matrix of variables for the export and import equation of high-income countries. As the dependent variable is export, GDP of Turkey with a positive, partner countries' income with a positive, and also a positive correlation with contiguity can be seen in the table. There is a negative correlation between export and distance, and contrary to expectations, the correlation with common religion and colonial ties is also negative. When the dependent variable is import, the correlation directions of the variables are the same.

**Table 3.3.** Covariance matrix of upper-middle income countries' export and import

	Export/Import	Lngdp_o	Lngdp_d	Lndistw	Contig	Comrelig	Colonial
Export/Import	<b>1.0000</b>	0.5029	0.0997	0.2867	0.0513	-0.0176	-0.0892
Lngdp_o	0.1720	<b>1.0000</b>	0.1579	0.2472	0.0867	0.0111	-0.0394
Lngdp_d	0.3619	0.1579	<b>1.0000</b>	0.0.120	0.0094	0.0069	0.0087
Lndistw	0.2514	0.0120	0.2472	<b>1.0000</b>	-0.0790	-0.0819	-0.2373
Contig	0.5354	0.0094	0.0867	-0.0790	<b>1.0000</b>	0.4244	0.2318
Comrelig	0.4125	0.0069	0.0111	-0.0819	0.4244	<b>1.0000</b>	0.1481
Colonial	0.2944	0.0087	-0.0394	-0.2373	0.2318	0.1481	<b>1.0000</b>

Table 3.3. demonstrates the correlation matrix of variables for the export and import equation of upper-middle income countries. While the dependent variable is export, a positive correlation is observed between export and all variables. Although a negative correlation is expected between the distance variable and exports, a positive correlation is observed between exports and all variables. It is seen that common religion and colonial ties, which are expected to have a positive correlation with dependent variable import, have a negative correlation. Import and all other variables are in positive correlation.

**Table 3.4.** Covariance matrix of lower-middle income countries' export and import

	Export/Import	Lngdp_o	Lngdp_d	Lndistw	Comrelig
Export/Import	<b>1.0000</b>	0.5056	0.1285	-0.3348	0.0417
Lngdp_o	0.5056	<b>1.0000</b>	0.2190	-0.1720	0.0761
Lngdp_d	0.1285	0.2190	<b>1.0000</b>	-0.0000	0.0000
Lndistw	-0.3348	-0.1720	-0.0000	<b>1.0000</b>	-0.3510
Comrelig	0.0417	0.0761	0.0000	-0.3510	<b>1.0000</b>

Correlation matrix of variables for the export and import equation of lower-middle income countries can be seen in table 3.4. There is a positive correlation between export and all variables except distance, as expected. The same results are valid for the equation in which the import is the dependent variable.

**Table 3.5.** Covariance matrix of low-income countries' export and import

	Export/Import	Lngdp_o	Lngdp_d	Lndistw	Comrelig	Colonial
Export/Import	<b>1.0000</b>	0.1607	0.1741	-0.5683	0.1593	-0.0769
Lngdp_o	0.2250	<b>1.0000</b>	0.2006	0.1650	0.0507	0.1855
Lngdp_d	0.3924	0.2006	<b>1.0000</b>	0.0242	0.0101	0.0030
Lndistw	-0.0638	0.0242	0.1650	<b>1.0000</b>	-0.0928	0.0313
Comrelig	0.4044	0.0101	0.0507	-0.0928	<b>1.0000</b>	0.2962
Colonial	0.6128	0.0030	0.1855	0.0313	0.2962	<b>1.0000</b>

Finally, Table 3.5. shows the correlation matrix of variables for the export and import equation of low-income countries. There is a negative correlation between the dependent variable export and distance, and a positive correlation with the other variables. As the dependent variable is import, Turkey's GDP's, partner countries' income, and common religion has a positive correlation. As expected, the distance is negatively correlated with import. However, contrary to expectations, a negative correlation is observed between import and colonial ties.

Another method of detecting the multicollinearity problem is the Variance Inflationary Factor (VIF) test. As a rule, if the VIF values are below 10, it is accepted that there is no serious collinearity problem between the variables. When the VIF value is below 5, it means that there is almost no multicollinearity problem (Rogerson, 2001, p.136).

**Table 3.6.** VIF test result of high-income countries'

Variable	VIF values of export equation	VIF values of import equation
Lngdp_o	1.01	1.07
Lngdp_d	1.08	1.01
Lndistw	1.49	1.47
Contig	1.14	1.14
Comrelig	1.32	1.32
Colonial	1.82	1.82

VIF test results for the import and export equation of high-income countries are shown in table 3.6. According to these results, the coefficients are considerably lower than 10. This shows that there is no problem of multicollinearity between the independent variables of the group of high-income countries in both equations.

**Table 3.7.** *VIF test result of upper-middle income countries'*

Variable	VIF values of export equation	VIF values of import equation
Lngdp_o	1.03	1.13
Lngdp_d	1.11	1.03
Lndistw	1.13	1.15
Contig	1.28	1.28
Comrelig	1.23	1.23
Colonial	1.12	1.11

Table 3.7 shows the VIF test results for the export and import equations of upper-middle-income countries. As can be seen in the results, the VIF value of all variables is extremely low. It would not be wrong to say that there is no multicollinearity problem between variables for this group.

**Table 3.8.** *VIF test result of lower-middle income countries'*

Variable	VIF values of export equation	VIF values of import equation
Lngdp_o	1.05	1.08
Lngdp_d	1.08	1.05
Lndistw	1.17	1.17
Comrelig	1.14	1.14

Table 3.8 demonstrate the VIF test results of the variables of lower-middle-income countries. The VIF value of all variables in the export equation is quietly below 5. Likewise, the VIF value of all variables is less than 5 in import equation. Accordingly, it can be said that there is no multicollinearity problem in both equations.

**Table 3.9.** *VIF test result of low-income countries'*

Variable	VIF values of export equation	VIF values of import equation
Lngdp_o	1.04	1.10
Lngdp_d	1.11	1.04
Lndistw	1.04	1.04
Comrelig	1.11	1.11
Colonial	1.14	1.14

The VIF values for low-income countries are also included in table 3.9. As a result of the VIF test, maximum value for both equations is 1.11 and 1.14, respectively. Therefore, the results show that there is no multicollinearity problem between the variables of both equations.

### **3.5. ESTIMATION RESULTS**

The selected countries, the differences in their export and import values, the time interval and the high number of variables caused difficulties in creating a balanced panel dataset. The same countries are used in both equations, as it is aimed to create balanced panel data set with the augmented gravity model variables with as far as least data loss.

**Table 3.10.** Estimation results of export equation

	PPML EXPORT				FGLS EXPORT			
	Low- Income	Lower-Middle Income	Upper-Middle Income	High- Income	Low- Income	Lower-Middle Income	Upper-Middle Income	High- Income
Log exporter's GDP	1.10*** (0.15)	1.06*** (0.14)	1.05*** (0.19)	0.49*** (0.08)	1.67*** (0.19)	0.96*** (0.15)	1.17*** (0.17)	0.69*** (0.12)
Log importer's GDP	0.48*** (0.06)	0.48*** (0.01)	0.62*** (0.05)	0.87*** (0.02)	0.50*** (0.12)	0.98*** (0.09)	0.94*** (0.09)	0.97*** (0.07)
Log distance	-0.06*** (0.01)	-1.25*** (0.05)	-0.08*** (0.02)	-1.35*** (0.04)	-0.22* (0.13)	-1.68*** (0.19)	-0.35*** (0.12)	-1.16*** (0.21)
Contiguity dummy	-	-	1.10 (0.09)	-0.53*** (0.08)	-	-	1.73** (0.73)	-0.51* (0.27)
Common religion dummy	0.82*** (0.11)	0.80*** (0.06)	0.97*** (0.09)	0.61*** (0.10)	1.36** (0.54)	1.21*** (0.31)	1.58*** (0.56)	-0.07 (0.44)
Colonial-tie dummy	0.91*** (0.12)	-	1.40*** (0.09)	-0.44*** (0.08)	1.07** (0.43)	-	2.20*** (0.36)	-0.05 (0.35)
Constant	-22.33*** (3.90)	-11.88*** (4.02)	-24.22*** (5.05)	-5.26** (2.06)	-37.11*** (6.35)	-18.37*** (4.35)	-34.58*** (4.23)	-14.76*** (3.23)
R squared	0.70	0.80	0.77	0.85	0.39	0.87	0.84	0.85
Number of observations	416	663	744	965	416	663	744	965

**Table 3.11.** Estimation results of import equation

	PPML IMPORT				FGLS IMPORT			
	Low- Income	Lower-Middle Income	Upper-Middle Income	High- Income	Low- Income	Lower-Middle Income	Upper-Middle Income	High- Income
Log exporter's GDP	0.27*** (0.04)	1.29*** (0.05)	1.33*** (0.07)	0.94*** (0.02)	1.58** (0.69)	1.02*** (0.12)	1.32*** (0.15)	1.14*** (0.11)
Log importer's GDP	1.69*** (0.30)	0.30 (0.29)	-0.43 (0.27)	0.53*** (0.07)	0.37*** (0.14)	0.76*** (0.27)	-0.18 (0.36)	0.44** (0.21)
Log distance	-0.33*** (0.02)	-1.97*** (0.13)	-0.24*** (0.04)	-1.21*** (0.03)	-0.35** (0.18)	-2.14*** (0.41)	-0.39** (0.05)	-1.56*** (0.25)
Contiguity dummy	-	-	1.70*** (0.16)	-0.42*** (0.16)	-	-	2.44*** (0.70)	-1.29** (0.62)
Common religion dummy	0.40*** (0.13)	1.15*** (0.15)	-0.44*** (0.13)	-0.01 (0.08)	0.16 (1.05)	1.19** (0.53)	-0.12 (1.07)	-1.34 (1.02)
Colonial-tie dummy	-2.49*** (0.37)	-	0.75*** (0.19)	-0.44*** (0.07)	-1.67** (0.84)	-	1.58*** (0.42)	0.19 (0.62)
Constant	-31.15*** (7.89)	-6.23 (7.71)	-0.69 (6.89)	-8.99*** (2.01)	-31.94* (17.25)	-10.96 (7.88)	-7.00 (8.67)	9.34 (6.56)
R squared	0.69	0.71	0.68	0.90	0.22	0.78	0.80	0.87
Number of observations	416	663	744	965	416	663	744	965

According to Table 3.10, the economic size of Turkey denoted by "lngdp\_o", even at  $\alpha = 0.01$  significance level was significant. Turkey's GDP has a positive effect on export volume. This situation is in accord with the theory of gravity model. As the gravity model predicts, the increase in the income of the exporter country positively affects trade flows. The national income of the exporter country is a measure of its production capacity. It is also an indicator of a variety of products. Increasing national income increases production capacity and product variety. In this direction, it provides the country's exports to increase. Turkey's GDP coefficient is lower in PPML estimation than FGLS in country group except Lower-middle income country. An increase in Turkey's GDP with 1% increase its export to low-income countries 1.1%, 1.06% to lower middle-income countries, 1.05% to upper middle-income countries and 0.49% to high income countries. There is a positive relationship between the economic size of exporter country and export volume in both PPML and FGLS estimation method.

The economic size of partner countries denoted by "lngdp\_d" was significant even  $\alpha = 0.01$  significance level. Regardless of the income level of the partner country's is set to increase the country's export volume of Turkey. The sign of the coefficient of this variable is in accord with the theory as expected. When the income level of country groups examined, countries of income level increases Turkey export is also increasing. The income of importer countries shows the purchasing power of those countries. The increase in national income allows these countries to import more. Thus, Turkey's exports to these countries increased amount. Low-income countries and lower-middle income countries of the 1% increase in income is increasing Turkey's export up 0.48%. On the other hand, upper-middle income group increase 0.62% and high-income countries increase 0.87%. PPML results for the coefficient of "Lngdp\_d" variable are also lower compared to FGLS estimation.

The distance coefficient is negative, and significant even at the  $\alpha = 0.01$  significance level as expected in the PPML model. The distance variable represents the costs in trade flows. Increasing distance between trade partners also causes an increase in costs. When the distance increase %1, Turkey's export to high-income Countries decreases 1.35%. Then lower-middle income with 1.25% and upper-middle-income countries with 0.08%, respectively. Low-income countries are the least influential group with 0.06% in Turkey's export.

The contiguity dummy variable appears in the upper-middle income countries and high-income countries groups only. Although it is significant in both groups according to the FGLS method, the PPML model is significant only for the High-income countries group. The coefficient will not be interpreted as it is insignificant for upper-middle income countries. The contiguity dummy variable is expected to affect exports positively. However, according to the result, the contiguity dummy variable, which is significant even at  $\alpha = 0.01$  significance level, negatively affects export. Turkey's export with its neighbours is  $e^{0.53}$  times (approximately 1,7) lower than turkey's export to the other countries. This is not surprising because This is not surprising because the political and military tensions with Turkey's neighbour countries reduce the flow of trade.

The common religion variable representing cultural factors is significant in all country groups at  $\alpha = 0.01$  significance level in the PPML method. It is expected that having the same religion will increase trade between countries. According to the results, the common religion variable affects exports positively. The most increase can observe Turkey's export to Upper-middle income countries. The least effect of common religion can be seen in the high-income group with 0.61%.

Another representative of cultural factors is colonial ties between countries. The existence of colonial ties between countries in the past is expected to increase bilateral trade flows. The colonial ties variable can observe in the Low-income countries, Upper-middle income countries and High-income countries groups. While it is significant in all three groups according to the PPML method, it is insignificant in the High-income countries group according to the FGLS method. When a 1% increase in the colonial ties, Turkey's export with Upper-middle income countries increases 1.40%, with the low-income countries increase by 0.91%. But contrary to expectations, colonial ties have a decreasing effect on export with high-income countries. The main reason is that distance-dependent costs are more important in import decisions of high-income countries.

Estimation results in table 3.10 show that the explanatory power of independent variables to explain dependent variable, in other words  $R^2$ , in the gravity model, that applied to Turkey's export, is quite high. High-income countries are the highest explanation power, with 85%. It is followed by lower-middle income with 80% and upper-middle income with 77%, respectively. Low-income countries, on the other hand, have the lowest explanation power at 70%, but this value is quite high econometrically.

Table 3.11 shows the results of Turkey's import equation. According to PPML estimation, the economic size of partner countries denoted by "lngdp\_o", even at  $\alpha = 0.01$  significance level was significant. The fact that a 1% increase in exporter countries' income, Turkey's import will increase by 0.27%, 1.29%, 1.33% and 0.94%, respectively. This result reveals that largely Turkey's import depends on the income level. These results show that the change in income of the partner countries has more impact on import compared to the change in Turkey's income.

Turkey's income denoted by "lngdp\_d" is significant at  $\alpha = 0.01$  significance level only for low-income and high-income groups. In the other two groups, this variable is insignificant. Import with low-income countries, Turkey's income is about 6.3 times more effective than lower-income countries. In other case, import from high-income countries, the income of partner countries is approximately 1.8 times more effective than Turkey's.

The coefficient of the "Indistw" variable representing the distance between countries is negative in line with expectations and is significant at the  $\alpha = 0.01$  significance level. As the distance increases, import decreases most dramatically in lower-middle-income countries with 1.97%. Most of Turkey's import partner is High-income Countries. The effect of distance on import with this group is more than 1. Distance is less effective on Turkey's import with low-income and upper-middle-income countries, relatively.

The fact that countries share a common border and common religion, and colonial ties represent the existence of common preferences. In other words, common cultural ties between these countries. Accordingly, countries that share a common border or countries that are relatively closer to each other are expected to trade more. Analysis results for imports do not confirm the expectations.

The contiguity dummy variable appears in the upper-middle income countries and high-income countries groups only. The contiguity dummy variable exists only in upper-middle-income countries and high-income countries. Unlike the export equation, the contiguity dummy is significant in both groups in the import equation. Common border affects import negatively import from high-income countries. This result can be expected as only Greece has a common border in high-income countries.

Despite sharing a common border, the political tensions experienced from time to time negatively affect Turkish-Greek relations. Common border increases import by 1.70% in imports with upper-middle-income, which includes almost all other border neighbours.

The common religion variable representing cultural factors is significant in all country groups at  $\alpha = 0.01$  significance level in the PPML method except High-income countries. Countries which are the same religion with Turkey, are mostly located in mostly Lower-Middle income Low-income Countries groups. Accordingly, the effect of religion on import is almost as much as income with 1.15% in Upper-Middle income countries. The effect of religion on import in low-income countries is 0.40%. However, contrary to expectation, religion affects import negatively in Upper-middle income countries. The top 10 import partners of Turkey constitute almost 54% of Turkey's imports. These partner countries are usually High-income countries and Upper-middle income countries. Furthermore, neither has a common religion with Turkey.

The last indicator of cultural factors for import estimation is colonial ties. Within all three country groups, it is significant even at  $\alpha = 0.01$ . Contrary to expectations, colonial ties negatively affect imports in Low-income countries and High-income countries. As in the export equation, the decisive factor in trade with High-income countries is the distance. In addition to distance, income is also worthy in import estimation result. In import with low-income countries, the constitutive variables are income and common religion. For the last group, upper-middle-income countries, the coefficient of the colonial ties dummy variable is 0.75, which is statistically less effective than the coefficient of contiguity dummy variable. In other words, this result shows that countries share common borders have a greater effect on import than colonial ties in the past. In the case of examination of Turkey's trade flow with high-income countries group which is the largest trading partner can be seen that increase in distance diminish both export and import. However, increase the distance affects more Turkey's export compared than import. This result shows that the import decision of Turkey is independent from distance. Other variables have negative effects on Turkey's import. This situation can be interpretable that Turkey's import decisions depend on the export policy's.

## CONCLUSION

In the last two centuries, international trade has grown remarkably and turn into the global economy. With this direction, the world economy has shown sustained positive economic growth. International trade has played a significant role in the performance of countries to grow and develop economically. The globalization process started at the end of the 1970s especially, with the collapse of the Bretton Woods system after 1980, its effects are observed all over the world. It reached its peak in the 1990s. Financial liberalization is the most important step in globalization. Liberalization policies applied in developing countries emerged in the 1990s with the influence of international economic organizations such as IMF, World Bank and WTO. Turkey also put into practice agreed with the IMF with Decisions of 24 January and entered the liberalization process.

Turkey has taken a revolutionary step with the Decisions of 24 January 1980 and adopted the free-market economy system. Although the volume of foreign trade has increased gradually, it reached significant levels in the 2000s. It can be observed a significant increase in Turkey's export, especially after the 2001 crisis. The currency and export promotion policies implemented have constituted the biggest dynamics of this increase. The increase in import along with export causes a chronic foreign trade deficit. As a structural feature in Turkey's economy, import and export are believed to be mutually interdependent. From this point of view, analyse the determinants of Turkey's trade flows have been necessary. Turkey's trade flows with this study were analysed by the gravity model. This study aims to analyse the partner countries by income level, which is the most significant factor affecting international trade. For this purpose, an annual panel data set covering 165 countries and the period 2003-2019 was used. In the estimation method, PPML estimator, which is robust to the variance problem existing in trade data, was used instead of classical estimators.

The gravity model has become quite popular in the literature after Tinbergen's adaptation to international trade in the 1960s. According to the gravity model, the economic size of the countries increases their trade flows through the increase in their export and import capacity. As the distance between countries is the proxy variable representing transportation costs in general, it has a trade-reducing effect.

The reasons why the model is popular can be listed as: the ease of detection the determinants of international trade flows, the ability to measure the effects of the applied trade policies, and empirically high explanatory power.

According to PPML model results, R squared values are quite high in all country groups for both export and import equations. The estimation results summarizable as follows:

- According to the result of the export equation, the coefficient of the income variable was positive and significant. The increase in the income of the exporter country means the increase in the product variety and production capacity in the country. Thus, trade flows are positively affected. According to export result, the impact of Turkey's income increases when groups of income level decrease. For example, the coefficient is 1.1% in low-income countries and 1.06% in lower-middle-income countries. On the other side, the coefficient is %1.05 in upper middle income and %0.49 in high-income countries. Symmetrically, as the income of importer partner countries increases, their effect on trade flows increases. According to the results of the import equation, Turkey's income in other groups is positive and significant except lower-middle-income and upper-middle-income countries. This result conflict with the theoretical structure of the gravity model.
- The coefficient of the income variable of partner countries is positive and significant in all country groups in both export and import equation results. The relationship between imports and income can be explained in two ways. First of all, it is necessary to import raw materials, intermediate goods and investment goods from other countries in order to produce national income. Therefore, increase in import become inevitable when production increases. Secondly, part of the expenditures and consumption of individuals and institutions is also directed towards import goods. Therefore, in periods when national income increases, an increase in imports will be observed with the effects from both production and consumption aspects (Krugman, Obstfeld and Melitz, 2012: 425).

- The coefficient of the distance variable was found to be negatively signed and significant in all country groups not only in the export equation but also in the import equation. According to the theory of gravity model, distance generally represents transportation costs. In this context, increasing distances increases transportation costs in trade between countries. Distance has been shown to have a significant impact on Turkey's export and import. The increase in the distance reduces Turkey's exports and imports with all its groups of countries.
- Trade flows between countries that share a common border are easier and more intense. The data set of the study has two groups of countries that have a common border with Turkey: upper-middle-income and high-income countries. The coefficient of the contiguity dummy variable is found to be positively signed but insignificant in export with upper-middle-income countries. In export with high-income countries, the coefficient is negative and significant. According to the results of the import equation, import from high-income countries are also negatively signed and significant. On the other hand, the coefficient is positive and significant in import from upper-middle-income. Contrary to expectation, the common border has not been a positive effect on exports and imports with high-income countries.
- According to the export equation, the coefficient of the common religion dummy variable is positively signed and significant in all country groups. Common religion positively affects trade flows. In the import equation, the coefficient has an insignificant in the high-income group of countries, and a negative effect on trade with upper-middle-income. In the other two country groups, which is lower-middle-income and low-income countries, the common religion increases trade.

- It is expected that countries having common colonial ties in the past will increase trade flows. Only lower-middle-income countries have not had colonial ties with Turkey in the dataset. The coefficient of the dummy variable of colonial ties in export is positive and significant except for high-income countries. It is observed that colonial ties negatively affect export with the high-income countries group. According to the results of the import equation, the coefficient of the colonial ties is positive and significant only in the upper middle-income countries. In import from high-income countries and Low-income countries, colonial ties affect the trade negatively, contrary to expectations.

As a result, Turkey' and partner countries' income and distance are effective in Turkey's export. This result indicates that consistent with the theoretical structure of the gravity model of Turkey's exports. Among the other dummy variables that are thought to affect trade, only common religion has a positive effect on all country groups. While the contiguity dummy variable is insignificant in upper-middle-income countries, it has a negative effect in high-income countries contrary to expectations. This result is actually not surprising for Turkey. Turkey's export value and potential are quite lower than expected. For example, there is a border security problem caused by military and political problems, especially in its neighbours Iraq, Iran and Syria. Also, the political tensions with its other neighbour Armenia from time-to-time result in an embargo, which disrupts its commercial relations. With another border neighbour, Greece, the rising tension from time to time causes the trade to take place less than it should be. Finally, colonial ties have a positive effect on trade as expected, except for High-income countries.

When the flow of import from lower-middle-income and upper-middle-income countries are examined, Turkey's income has no significant effect on import. Contrary to expectations, this result conflict with the gravity model. However, this result is not surprising for Turkey. The reason for this, Turkey's energy dependency rate is 74% ([https://www.mfa.gov.tr/turkiye\\_nin-enerji-stratejisi.tr.mfa](https://www.mfa.gov.tr/turkiye_nin-enerji-stratejisi.tr.mfa), accessed at 13.02.2021). The energy demand of Turkey's economy is available from a small number of resources and countries. Energy imports consist of oil, natural gas and coal items.

For example, it makes up 85% of Turkey's natural gas imports of countries are Russia, Azerbaijan, Iran, Algeria and Nigeria, respectively. The three largest suppliers in these countries, Russia, Azerbaijan and Iran, are in the upper-middle-income countries group. Algeria and Nigeria are in the lower-middle-income countries group. As Turkey is a country dependent on energy import, must do whatever their income level. Contiguity dummy variable positively affects upper-middle-income countries, on the other hand, it negatively affects import with high-income countries. While the common religion dummy variable is insignificant for High-income countries, it negatively affects the import upper-middle-income countries. Finally, the dummy variable of colonial ties only increases import with upper-middle-income countries. It has a trade-reducing effect on other groups. In the analysis of Turkey's imports, dummy variables are not increased trade as expected. This is because the share of intermediate goods is 77% in total import in 2019. This ratio shows that Turkey's import intermediate goods for export. In this context, trade influential factors such as contiguity, common religion and colonial ties are invalid in Turkey's import.

## APPENDIX

**Table 3.** *Low Income Countries List*

AFGHANISTAN	BURKINA FASI	BURUNDI
CENTRAL AFRICAN REPUBLIC	CHAD	CONGO, DEM. REP.
ERITREA	ETHIOPIA	GAMBIA, THE
GUINEA	GUINEA-BISSAU	HAITI
KOREA, DEM. PEOPLE'S REP.*	LIBERIA	MADAGASCAR
MALAWI	MALI	MOZAMBIQUE
NIGER	RWANDA	SIERRA LEONE
SOMALIA*	SOUTH SUDAN*	SUDAN
SYRIAN ARAB REPUBLIC*	TAJIKISTAN	TOGO
UGANDA	YEMEN, REP.	

**Table 0.1** *Lower-Middle Income Countries List*

ANGOLA	ALGERIA	BANGLADESH
BENIN	BHUTAN	BOLIVIA
CABO VERDEN	CAMBODIA	CAMEROON
COMOROS	CONGO, REP.*	CÔTE D'IVOIRE*
DJIBOUTI	EGYPT, ARAB REP.	EL SALVADOR
ESWATINI*	GHANA	HONDURAS
INDIA	KENYA	KIRIBATI*
KYRGYZ REPUBLIC	LAO PDR	LESOTHO
MAURITANIA	MICRONESIA, FED. STS.	MOLDOVA
MONGOLIA	MOROCCO	MYANMAR
NEPAL	NICARAGUA	NIGERIA
PAKISTAN	PAPUA NEW GUINEA	PHILIPPINES
SÃO TOMÉ AND PRINCIPE	SENEGAL	SOLOMON ISLANDS*
SRI LANKA	TANZANIA	TIMOR-LESTE*
TUNISIA	UKRAINE	UZBEKISTAN
VANUATU	VIETNAM	WEST BANK AND GAZA*
ZAMBIA	ZIMBABWE	

**Table 0.2** *Upper-Middle Income Countries List*

ALBANIA	AMERICAN SAMOA	ARGENTINA
ARMENIA*	AZERBAIJAN	BELARUS
BELIZE	BOSNIA AND HERZEGOVINA	BOTSWANA
BRAZIL	BULGARIA	CHINA
COLOMBIA	COSTA RICA	CUBA
DOMINICA	DOMINICAN REPUBLIC	EQUATORIAL GUINEA
ECUADOR	FIJI	GABON
GEORGIA	GRENADA	GUATEMALA
GUYANA	INDONESIA	IRAN, ISLAMIC REP.
IRAQ	JAMAICA	JORDAN
KAZAKHSTAN	KOSOVO*	LEBANON
LIBYA	MALAYSIA	MALDIVES
MARSHALL ISLANDS	MEXICO	MONTENEGRO*
NAMIBIA	NORTH MACEDONIA	PARAGUAY
PERU	RUSSIAN FEDERATION	SAMOA
SERBIA*	SOUTH AFRICA	ST. LUCIA
ST. VINCENT AND THE GRENADINES	SURINAME	THAILAND
THAILAND	TONGA	TURKEY
TURKMENISTAN	TUVALU	VENEZUELA, RB

**Table 0.3 High Income Countries List**

ANDORRA*	ANTIGUA AND BARBUDA	ARUBA
AUSTRALIA	AUSTRIA	UNITED ARAB EMIRATES
BAHAMAS, THE	BAHRAIN	BARBADOS
BELGIUM	BERMUDA*	BRUNEI DARUSSALAM
CANADA	SWITZERLAND	CAYMAN ISLANDS*
CHANNELL ISLANDS*	CHILE	CROATIA
CURAÇAO*	CYPRUS*	CZECH REPUBLIC
DENMARK	SPAIN	ESTONIA
FAROE ISLANDS	FINLAND	FRANCE
GERMANY	UNITED KINGDOM	GIBRALTAR*
GREECE	GREENLAND*	GUAM*
HONG KONG SAR, CHINA	HUNGARY	ICELAND
IRELAND	ISLE OF MAN*	ISRAEL
ITALY	JAPAN	KOREA, REP.*
KUWAIT	LATVIA	LIECHTENSTEIN*
LITHUANIA	LUXEMBOURG	MACAO SAR, CHINA
MALTA	MAURITIUS	MONACO*
NAURU*	NETHERLANDS	NEW CALEDONIA*
NEW ZEALAND	NORTHERN MARIANA ISLANDS*	NORWAY
OMAN	PALAU*	PANAMA
POLAND	PORTUGAL	PUERTO RICO*
ROMANIA	QATAR	SAN MARINO*
SAUDI ARABIA	SEYCHELLES	SINGAPORE
SINT MAARTEN*	SLOVAK REPUBLIC	SLOVENIA
FRENCH POLYNESIA*	ST. KITTS AND NEVIS	ST. MARTIN*
SWEDEN	TAIWAN, CHINA*	TRINIDAD AND TOBAGO
TURKS AND CAICOS ISLANDS*	BRITISH VIRGIN ISLANDS*	UNITED STATES
URUGUAY	VIRGIN ISLANDS (U.S.)*	

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