Free Trade in Euro-Mediterranean Agriculture: An Economic Perspective of Turkey

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DECLERATION

I confirm that the contents of this thesis are my original research work and have not been presented or accepted in any previous application for a degree. The word length is within the prescribed limit as advised by my school and all sources are fully referenced and acknowledged.

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ABSTRACT

It is a standard result of economic theory that free trade maximises global efficiency in a distortion-free world. Over the last two decades countries have made great efforts to liberalise their trade in order to facilitate economic growth through integration in the global economy. Turkey is one of these countries whose international trade plays a significant role in her economic development.

Over time, trade increasingly links countries in the Mediterranean region and the trade policy debate is dominated by the regional trade negotiations between the European Union and the 'Mediterranean Partner Countries' (MPCs), known as the Union for the Mediterranean. Agriculture is a crucial sector in this region. Unlike manufactured goods, agricultural products have often been only partially integrated into regional trade agreements, due to the high level of protection afforded to them. Agriculture in Turkey holds the promise of making a major contribution to Turkish economic development, with the agricultural trade balance being significantly positive. Turkey is a large and important country in the region and a potential full member of the European Union.

This research explores the determining factors of Turkish agricultural export flows to the Euro-Mediterranean countries. The thesis employs the most recent econometric methods in estimating a gravity model and the analysis uses panel data covering the period 1969-2010 for 30 Euro-Mediterranean countries. In addition to performing traditional linear methods, panel unit root and cointegration tests are conducted to examine the likely long run relationship between determining factors and agricultural export flows.

The results demonstrate that, as expected, Turkish agricultural exports are positively influenced by economic size and negatively affected by geographical distance. The results also indicate that Turkish agricultural exports to the Euro-Mediterranean countries are positively associated with being a member of a free trade agreement, although this is statistically insignificant. The main inference of the findings is that they do not support the notion that free trade agreements between Turkey and the Euro-Mediterranean countries boost the agricultural exports of Turkey. Comparing the results between the standard panel data estimator and panel cointegration estimators show that there is little difference between them.

To my beloved parents,

Mehmet Sarıca and *Şerife Sarıca*

and my loving sister,

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TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

ABBREVIATIONS

ACCs	Agricultural Credit Cooperatives
ADF	Augmented Dickey Fuller
AR	Autoregressive
ARIP	Agricultural Reform Implementation Project
ASCUs	Agricultural Sales Cooperatives Unions
ASEAN	Association of Southeast Asian Nations
BELDES	Municipality Infrastructure Support Project
BLUE	Best Linear Unbiased Estimator
BRIC	Brazil, Russia, India, China
BRICS	Brazil, Russia, India, China, South Africa
BSEC	Black Sea Economic Cooperation
CADF	Cross Sectionaly Augmented Dickey Fuller
CAP	Common Agricultural Policy
CATAK	Environmentally Based Agricultural Land Protection Programme
CAYKUR	General Directorate of Tea Enterprises
CCEMG	Common Correlated Effects Mean Group
CEECs	Central and Eastern European Countries
CGE	Computable General Equilibrium
CIS	Commonwealth of Independent States
CN	Combined Nomenclature
CPI	Consumer Price Index
CSE	Consumer Support Estimate
CU	Customs Union
CUP-FM	Continuous Updated Fully Modified
CUP-BC	Continuous Updated Bias-Corrected
DAKP	Eastern Anatolia Development Project
DF	Dickey Fuller
DF-GLS	Generalized Least Square Dickey Fuller
DIS	Direct Income Support
DOKAP	Eastern Black Sea Region Development Project
DOLS	Dynamic Ordinary Least Squares
DSUR	Dynamic Seemingly Unrelated Regression

EBK	Meat and Fish Institution
ECO	Economic Cooperation Organisation
Ecu	European Currency Unit
EFTA	European Free Trade Association
EGLS	Estimated Generalized Least Squares
EMAA	Euro-Mediterranean Association Agreements
EMFTA	Euro-Mediterranean Free Trade Area
ENP	European Neighbourhood Policy
ERS	Elliot, Rothenberg and Stock Point Optimal
EU	European Union
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Statistical Database
FMOLS	Fully Modified Ordinary Least Squares
FTAs	Free Trade Agreements
GAP	South-eastern Anatolia Project
GDP	Gross Domestic Product
GLS	Generalize Least Squares
GSSE	General Services Support Estimates
ha	Hectare
HK	Hadri and Kurozumi
HQIC	Hannan and Quinn's Information Criterion
HS	Harmonized System
I(0)	Stationary Time Series
I(1)	Non-stationary Time Series
IID	Independent and Identically Distributed
IMF	International Monetary Fund
IPA	Instrument for Pre-Accession Assistance
IPARD	Instrument for Pre-Accession Assistance Rural Development
km	Kilometre
KOYDES	Village Infrastructure Support Project
KPSS	Kwiatkowski, Phillips, Schmidt, and Shin
LBUI	Locally Best Unbiased Invariant
LC	Leybourne and McCabe

LM	Lagrange Multiplier
LSDV	Ordinary Least Square Dummy Variables
MAIC	Modified Akaike Information Criterion
MARA	Ministry of Agriculture and Rural Affairs
max	Maximum
Med	Mediterranean Region
MEYSEP	Development Project on Fresh Vegetables and Fruit
MFAL	Ministry of Food, Agriculture and Livestock
MFN	Most Favoured Nation
min	Minimum
MIPD	Multi-annual Indicative Planning Document
MIT	Ministry of Industry and Trade
MP	Moon and Perron
MPCs	Mediterranean Partner Countries
MPS	Market Price Support
NAC	Nominal Assistance Coefficient
n.e.s.	Not Elsewhere Specified
NFRS	National Farmers Registry System
NGOs	Non-government Organisations
NP	Ng and Perron
NPC	Nominal Protection Coefficient
NRDS	National Rural Development Strategy
OECD	Organisation for Economic Co-operation and Development
OIE	World Organisation on Animal Health
OLS	Ordinary Least Squares
Org.	Organic
p	Provisional
PANIC	Panel Analysis of Non-stationarity in Idiosyncratic and Common
PP	Phillips and Perron
PS	Philips and Sul
PSE	Producer Support Estimate
RDISP	Rural Development Investments Support Programme
RRSS	Restricted Residual Sum of Squares
SCT	Single Commodity Transfers

SEEs	State Economic Enterprises
SEK	Milk Industry Institute
SITC Rev.	Standard International Trade Classification Revision
SP	Schmidt and Phillips
SPO	State Planning Organisation
SPS	Sanitary and Phytosanitary
std. dev.	Standard Deviation
TEKEL	Turkish Tobacco and Alcoholic Beverages Company
TIGEM	Turkish General Directorate for Agricultural Enterprises
TL	Turkish Lira
TMO	Turkish Grain Board
TSE	Total Support Estimate
TRQs	Tariff Rate Quotas
TURKSEKER	Turkey’s Sugar Factories
TURKSTAT	Turkish Statistical Institute
TYUAP	Agricultural Extension and Applied Research Project
TZDK	Turkish Agricultural Equipment Company
UK	United Kingdom
URAA	Uruguay Round Agreement on Agriculture
URSS	Unrestricted Residual Sum of Squares
USA	United States of America
USD	United States Dollar
USDA	United States Development of Agriculture
VAT	Value Added Tax
VECM	Vector Error Correction Model
VIF	Variance Inflation Factor
WTO	World Trade Organization
WWI	World War I
WWII	World War II
YEMSAN	Feed Industry Corporation

Chapter 1 . Introduction

1.1. Overview

Empirical applications suggest that international free trade tends to be advantageous to economic growth, especially for developing countries. Therefore, over the last two decades countries have made great efforts to liberalise their trade to provide faster economic growth through integration in the global economy. Turkey is one of these countries whose international trade plays a significant role in her economic development.

Turkey is a developing country which has been experiencing a steady high growth and modest inflation over a decade. In order to succeed in being a largely developed country, Turkey is undertaking a liberalisation process. For this purpose, Turkey started her integration by applying for European Union (EU) membership (then the European Economic Community) in 1959 and signed an Association Agreement with the EU in 1963. Turkey and the EU also established a Customs Union (CU) Agreement in 1996 which is restricted to industrial products. An important part of agri-food trade is however under preferential agreements. In order to gain from any future trade liberalisation, Turkey has begun to conclude free trade agreements (FTAs) with its trade partners (La Grò, 2003). At present, 19 FTAs have been signed by Turkey, excluding 11 FTAs with Central and Eastern European countries (CEECs) which were abolished due to their EU membership. In addition, Turkey has been a member of the Economic Cooperation Organisation (ECO) since 1992 and the European Free Trade Association (EFTA) since 1991 (Kavallari, 2009; RTME, 2013). Turkey has also entered into relations with the Mediterranean region. The Mediterranean region is the second most important market for Turkey after the EU, especially in agri-food products.

Trade has increasingly linked countries in the Mediterranean region. Therefore, 15 EU and 12 Mediterranean Partner countries (MPCs) (including Turkey) also established a regional trade agreement in 1995 which is known as the Barcelona process (now the Union for the Mediterranean) (EUROPA, 2010b). Today, the partnership consists of 28

EU and 15 MPCs. However, this trade liberalisation has had a slow progression in terms of the agricultural sector.

Agriculture is a crucial sector for the Turkish economy. Turkey is one of the world's leading producers in agri-food products and the share of agriculture in Gross Domestic Product (GDP) is high (9.1 per cent). There is also a positive agricultural trade balance. Turkey is the biggest agricultural exporter among the MPCs and is ranked as the first producer in tomatoes and walnuts, whilst the second in olive oils, figs and potatoes in the Euro-Mediterranean region (Kavallari, 2009; FAO, 2013). Agriculture is also a significant sector for other MPCs and receives specific attention. Therefore, agricultural trade liberalisation is significant and is a centre of focus in this region.

Modelling international trade flows has been extensively examined for the last three decades. Most of the studies related to trade flows have paid attention to ex ante or ex post analysis. Ex ante analysis employs sector-specific or economy-wide models in general, while ex post studies for modelling trade flows have been mainly based on the gravity model (Kavallari, 2009). The gravity model has been used widely to observe trade flows and has proved a successful econometric approach. Gravity models have been used in numerous studies which have effectively explained changes in trade volume between two countries, or country groups, over time. A large and recent literature either provides modelling developments and refinements or tries to clarify policy impacts on trade. However, the question of which factors determine Turkish agricultural export flows to the Euro-Mediterranean countries has not been approached by empirical studies so far. Hence, the aim of the thesis is to address this question.

1.2. Objectives of the Study

The main objective of this study is to examine empirically the determining factors of Turkish agricultural export flows to the Euro-Mediterranean countries. This main objective consists of five specific aims:

- To investigate the behaviour of Turkish agri-food trade.
- To give an overview of agricultural trade in the Euro-Mediterranean region.

- To find out whether the existing trade agreements have resulted in benefits in terms of Turkish agricultural exports.
- To model trade in agri-food products between Turkey and Euro-Mediterranean countries using panel data.
- To examine and apply panel cointegration tests and estimation techniques to the empirical analysis.

1.3. Scope of the Study

This study analyses the trade pattern and the factors affecting Turkish agricultural export flows to the Euro-Mediterranean countries. Firstly, the study focuses on the importance of agriculture and its policies in the Turkish economy. It also focuses on how significant the role of Turkey and her position in the Euro-Mediterranean region is in terms of agricultural trade. Secondly, the study uses balanced panel data for 30 Euro-Mediterranean countries trading with Turkey and focuses on the time period from 1969 to 2010, which encompasses the periods both before and after the signing of the Euro-Mediterranean Partnership (1995). Thirdly, to model trade in agri-food products between Turkey and Euro-Mediterranean, the traditional approaches are first employed. In addition, following the recent literature, the empirical analysis is extended by employing panel cointegration estimation techniques, including stationarity and cointegration tests. This also gives a chance to compare the estimation results from both techniques.

1.4. Structure of the Thesis

Following the objectives mentioned above, the study is organised into eight chapters, including the introductory chapter. Chapter 2 provides background information on the Turkish economy and agricultural sector. It presents a macroeconomic outlook of the Turkish economy by explaining economic growth, inflation, employment, trade and income distribution. Also, in this chapter special attention is given to the agriculture sector and its importance in the Turkish economy, considering agricultural structure, production and trade.

Chapter 3 discusses agricultural policies in Turkey to understand the situation of Turkish agriculture from a closer inspection. To this end, agricultural support instruments are discussed by covering payments, development programmes and trade policies in detail.

Chapter 4 gives an overview of agricultural trade in the Euro-Mediterranean region and the position of Turkey in the area. It provides a detailed investigation of the agricultural trade pattern and the trade agreements in the region. This chapter also discusses Euro-Mediterranean agricultural trade policies in detail and explains Turkish agricultural trade with Euro-Mediterranean countries.

Chapter 5 employs a gravity model using traditional estimation techniques to investigate the determinants of trade flows. The chapter starts with a literature review and theoretical framework on the gravity model. This is followed by a discussion on the hypotheses and core variables that are used in the study. After determining the econometric model specifications, a description of the data along with the sources are provided. Finally, this chapter addresses the empirical models, including the essential tests of hypotheses with panel data, and presents the results comparing diverse estimates of the gravity model. This is followed by discussion of the findings.

Chapter 6 examines the data by employing stationarity tests in order to avoid the possible spurious regression problem. After describing the stationarity tests, the test results are presented and discussed in the final section.

Chapter 7 applies recently-developed econometric techniques for panel data cointegration tests and estimation to analyse possible long run relationships between Turkish agricultural exports and its determinants. It also discusses the findings after presenting the results.

Following the findings of the empirical analysis, chapter 8 summarises the main results. Also, some conclusion, policy implications, the limitations of the study and suggestions for further research are presented in this final chapter.

Chapter 2 . Turkey's Economy and Agricultural Sector

2.1. Introduction

The Turkish economy is one of the emerging market economies with rapid growth and industrialisation, and it is working hard on being a mainly developed country by involvement in agreements such as the European Union (EU) and the Union for Mediterranean. Also, Turkey is one of the world's leading producers of agricultural goods and the contribution of agriculture to its GDP and workforce is quite high, so agriculture is an important sector for the Turkish economy. Emerging markets like Turkey have become key trading centres in the world and a trade surplus in the agriculture sector helps Turkey's economy in its development process. Therefore, the free trade perspective of Turkey in agriculture is the focus of analysis in this study.

The aim of this chapter is to provide a background of the Turkish economy and its agricultural sector. The first section gives an overview of Turkey's economy by examining economic growth, inflation, employment, trade, and income distribution. The next section investigates the importance of Turkish agriculture, covering agricultural structure, production and trade, and the chapter concludes with a summary. In providing these economic indicators, this chapter helps us to understand how large the role of agriculture is in the Turkish economy.

2.2. Overview of the Turkish Economy

Turkey is a large country in terms of land and population, but small in economic terms. This reality has a variety of political and economic implications. The Turkish economy has experienced serious instability and high inflation, making it difficult to calculate the fundamental growth rate. However, it also has endured a globalisation process over the past two decades, as a consequence of an intense trade network, financial flows and production relations.

Table 2.1 gives some main economic indicators for Turkey, and when we glance through these, an increasing population appears along with a rise in GDP per capita during the last decade. The effects of the global financial crisis on Turkey are also noticeable in this period. The growth rate shrank by 10.2 per cent, while the unemployment rate increased by 4.1 per cent from 2007 to 2009. The crisis also had a negative impact on international trade with a sudden decrease in both exports and imports in 2009. However, these indicators started to grow again after 2009. Further information about the Turkish economic indicators can be found in the following sections.

Main Economic Indicators

	2005	2006	2007	2008	2009	2010	2011	2012
GDP[3] (Growth rate) (%)	8.4	6.9	4.7	0.7	-4.8	9.2	8.8	2.1
Agriculture	7.2	1.4	-6.7	4.3	3.6	2.4	6.1	3.1
Industry	8.7	10.2	5.8	-1.3	-8.6	13.8	10	1.7
Service	8.6	7.1	6.4	2.3	-1.8	7.7	8.8	2.6
Population (Million)	68.9[1]	69.7[1]	70.6[3]	71.5[3]	72.6[3]	73.7[3]	74.7[3]	75.6[3]
GDP per capita[3] (TL) (1998=100)	1 322	1396	1443	1434	1347	1448	1552	1565
Unemployment (%)								
Turkey	10.3[1]	9.9[1]	9.9[2]	11[2]	14[2]	11.9[2]	9.8[2]	9.2[2]
Urban areas	12.7[1]	12.1[1]	11.9[2]	12.8[2]	16.6[2]	14.2[2]	11.9[2]	11.1[2]
Rural areas	6.8[1]	6.5[1]	6.9[2]	7.2[2]	8.9[2]	7.3[2]	5.8[2]	5.6[2]
Inflation[3] (%)								
CPI	8.2	9.6	8.8	10.4	6.3	8.6	6.5	8.9
PPI	6	9.3	6.4	12.7	1.4	8.8	11	6.2
International Trade[3] (billion $) (2005=100)								
Export	73.5	82.9	101.4	122.4	93.9	103.5	120.3	133.6
Import	116.8	135.4	160.7	187.3	129.6	168.6	214.7	207.2
Balance	-43.3	-52.5	-53.4	-64.9	-35.7	-65.1	-94.4	-73.6

Note:

1. CPI: Consumer Price Index, PPI: Producer Price Index.
2. International trade data is deflated by GDP deflator for the United States obtained from USDA database.

Table 2.1 Main Indicators of Turkish Economy, 2005-2012.

Source: Author [based on data from [1]TUSIAD (2009), [2]TURKSTAT (2013e), [3]TURKSTAT (2013d)].

2.2.1. Economic Growth

In the region of modern Turkey, World War I (WWI) and the Independence War (between 1919 and 1922) caused about an 18 per cent loss in population, and a large decrease in GDP per capita of almost 40 per cent (Altug, Filiztekin and Pamuk, 2008). However, a rapid improvement followed this period with the creation of the Turkish Republic in 1923. After its establishment, Turkey acted like other developing countries to survive and provide economic expansion, but in 1929 GDP per capita fell to its pre WWI level. The Great Depression caused Turkey to adopt new economic policies such as protectionism and inward-oriented industrialisation in the 1930s. Turkey had high growth rates throughout the 1930s, but World War II (WWII) changed this process negatively (Altug, Filiztekin and Pamuk, 2008). The Turkish government started with the first five-year industrial plan between 1934 and 1938 and the economy experienced significant progress during this period.

The new government followed liberal policies and achieved an increase in the growth during the multi-party system from 1945 to 1950 and post-WWII recovery was completed by 1950 (Taymaz, 1999). However, this positive process finished in 1960 with a military intervention. After a serious and long foreign exchange crisis, a new liberal policy package was introduced in 1980. The average yearly growth rate of real GDP was 5.4 per cent between 1981 and 1988. Also, the economy did not encounter any depression in this period (Ertugrul and Selcuk, 2001).

The economic crises in 1994, 1999 and 2001 induced deep recessions. A decrease in real GDP occurred due to a foreign exchange market crisis in 1994, and an uncertain international economy, political uncertainty and serious earthquakes in 1999 caused a decline in real GDP by 5 per cent. However, the most destructive recession was experienced at the beginning of 2001 as a consequence of a banking and currency crisis and the growth rate decreased by 7.5 per cent (Oskam, Longworth and Yildiz, 2005). After 2001 a stable increase in economic growth eventuated during 2002-2007 at nearly 7 per cent per year on average. On the other hand, a serious financial crisis spread though the world in the middle of 2007, starting in the USA. The effects of this crisis in Turkey began to crystallise in the non-financial sector, especially late in the year, and growth in the Turkish economy slowed to 0.7 per cent in 2008.

In the last quarter of 2008 the economy shrank by 6.5 per cent and continued to shrink abnormally in the first quarter of 2009 by 14.7 per cent (TUSIAD, 2009). Yet, the growth rate in this period started to increase again at the end of 2009 and it reached 9.2 per cent in 2010 with a remarkable recovery. However in 2011, the Turkish economy started to slow again by reason of adverse global conditions and corruption. In the first quarter of 2011 the growth rate was 12.4 per cent while it was 5.3 per cent in the last quarter. The deceleration continued in 2012 and it finished the year at 2.1 per cent. Regarding the first quarter of 2013, the growth rate was 3 per cent and overall Turkey's economy is expected to grow by 4.3 per cent by annum in 2013 (see figure 2.1) (TUSIAD, 2012).

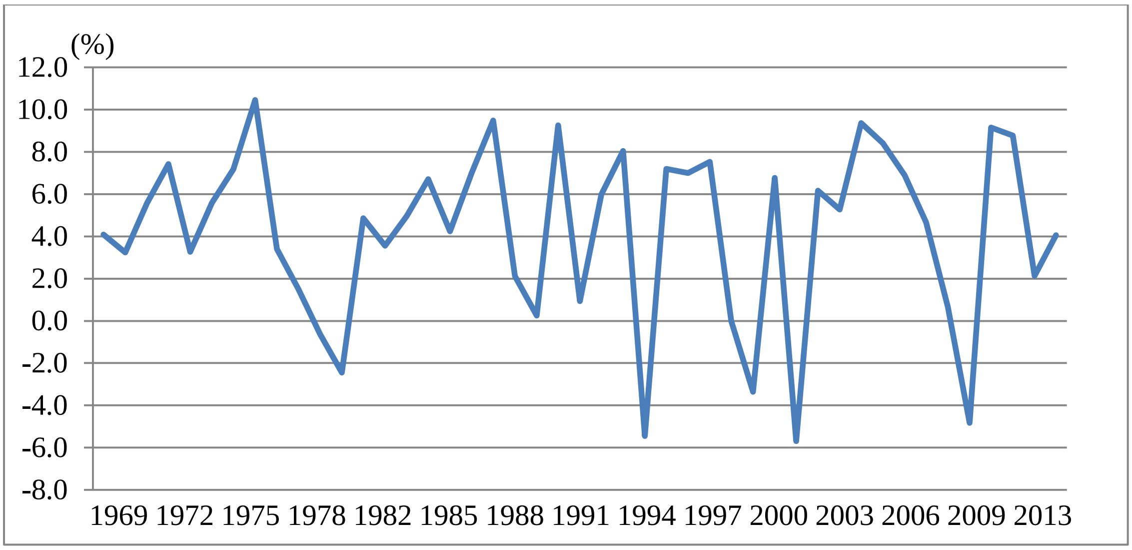
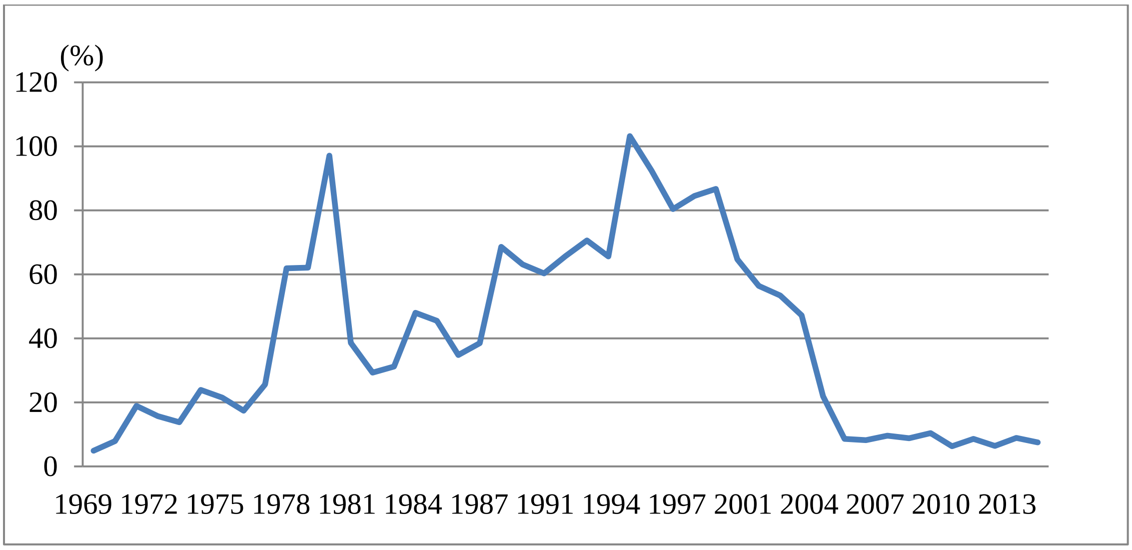


Figure 2.1 Growth Rate of GDP in Constant Prices, 1969-2013.
Source: TURKSTAT (2013d).

2.2.2. Inflation

One of the main features of the Turkish economy is high inflation. The common causes are (Dibooglu and Kibritcioglu, 2001):

- High public sector budget deficits.
- Monetization of public sector budget deficits.
- Price increments in main imported inputs such as gasoline and utilities.
- Inflationist outcomes of exchange rate growth.
- Persisting expectations for inflation.



Note:

1. Percentage change on the same period of the former year.

Figure 2.2 Inflation Rates in Turkey, 1969-2013.

Source: Author [based on data from WI (2013) database].

Inflation has been falling since 1994, and it reached single figures in 2004 for the first time for 40 years (see figure 2.2). A stabilisation programme was started at the end of 1999. At first, it was followed by fluctuating capital inflows and it achieved a decrease in inflation, but it culminated in one of the severest crises in the Turkish economy, in 2001. After this crisis, a new programme was implemented with International Monetary Fund (IMF) support and structural improvements. It used implicit inflation targeting between 2002 and 2005. As a result, inflation was 7.7 per cent in 2005.

As a result of falling domestic demand and declining international prices, for the first three quarters in 2009 the Consumer Price Index (CPI) was 7.9, 5.7, and 5.3 per cent. Towards the end of the year it slowed again before increasing because of rising food prices in 2010. When the speed of recovery in the global economy is taken into consideration, the inflation rate for 2010 was 8.6 per cent. Due to a reduction of uncertainty in external conditions and adjustments in interest rate uncertainty, inflation exceeded the target in 2011 at 6.5 per cent but increased at the end of 2011 and reached 8.9 per cent in 2012 (OECD, 2012).

2.2.3. Employment

Table 2.2 shows that in 2012 nearly 32 per cent of the Turkish population (23.2 million people) was rural while almost 69 per cent was urban. In accordance with the population ratio, the rural population supplied a workforce of 9.5 million (34 per cent) whilst 18.3 million belonged to the urban population. Furthermore, not only are labour participation rates higher in rural areas, but also unemployment rates are lower. The unemployment rate for urban areas was 10 per cent while it was 4.3 per cent for rural areas in 2012.

	TURKEY		**URBAN**		**RURAL**	
	2012	**2013**	**2012**	**2013**	**2012**	**2013**
Non-institutional population (000)	73 561	74 416	50 376	50 868	23 186	23 551
Population 15 years old and over (000)	54 680	55 566	37 641	38 133	17 039	17 432
Labour force (000)	27 803	28 844	18 284	19 178	9 519	9 665
Employed (000)	25 577	26 319	16 463	17 148	9 114	9 171
Unemployed (000)	2 226	2 525	1 821	2 030	405	495
Labour force participation rate (%)	50.8	51.9	48.6	50.3	55.9	55.4
Employment rate (%)	46.8	47.4	43.7	45	53.5	52.6
Unemployment rate (%)	8	8.8	10	10.6	4.3	5.1
Non-agricultural unemployment rate (%)	10.2	11	10.3	10.9	9.8	11.4
Youth unemployment rate[1] (%)	15.7	17.1	19	19.8	9.5	11.7
Not in the labour force (000)	26 877	26 722	19 358	18 955	7 520	7 767

Notes:

1. Total numbers may not be correct due to rounding.
2. [1]Population within 15-24 age group.

Table 2.2 Labour Force Participation and Employment by Urban/Rural Status, 2012-2013.

Source: Author [based on data from TURKSTAT (2013b)].

The number of unemployed people in 2013 increased by 299 000 and has reached 2.5 million. However, the comparisons are possibly unreliable because of the measurement error as almost half of Turkish economic activity is unregistered for tax and social security purposes (TURKSTAT, 2013b).

Table 2.3 shows the employment shares in terms of economic activities. On average over the last decade, the employment rate in the agriculture sector is 22.1, while it is 49.2 in the service sector. The employment rate was 22.5 per cent in agricultural sector in the first quarter of 2013, while it was 61.2 per cent in 1969. However, there is a substantial increase in the service sector by 31 per centage points from 1969 to 2012. This situation is a result of the migration from rural to urban areas and this movement was followed by a shift of economic activity from agriculture to services (TURKSTAT, 2010a; TURKSTAT, 2013a).

(%)	Agriculture	Industry	Construction	Services
1969[1]	61.2	10.4	4.6	18.4
1979[1]	51.3	13.9	5.5	24.3
1989[1]	47.4	28.1	5.2	31.8
1994[1]	44.1	16.5	6.0	32.9
1999[1]	40.2	17.2	6.2	36.5
2004[1]	29.1	19.9	4.9	46.0
2009[1]	24.7	19.4	5.9	50.0
2010[2]	23.7	20.3	5.3	50.7
2011[3]	25.4	19.5	6.9	48.1
2012[3]	24.6	19.1	6.9	49.4
2013[3] I	22.5	19.9	6.3	51.3

Table 2.3 Distribution of Employment by Economic Activity, 1969-2013.
Source: Author [based on data from [1]TURKSTAT (2012a), [2]TURKSTAT (2010a) and [3]TURKSTAT (2013a)].

2.2.4. Trade

There is a huge increase in foreign trade volume from 1969 to 2012 in spite of a total trade deficit. In 2012, the trade deficit in Turkey was USD 73.7 billion, with exports valued at USD 133.6 billion and imports at USD 207.2 billion. In table 2.4, it is clear that export and import values grew until 2008. In 2009, there was a sudden decrease in both exports and imports, and the main reason is the global economic crisis. There are similar situations in Turkish economic history, such as the 1999 and 2001 crises, but these led to import reductions only. After 2009, trade values started to grow again and the export value reached USD 133.6 billion, while the import value was USD 207.2 billion.

	Exports (Million $)	**Imports** (Million $)	**Balance of foreign trade** (Million $)	**Volume of foreign trade** (Million $)	**Rate of imports covered by exports** (%)
1969	2 322	3 466	-1 144	5 788	67
1979	5 163	11 574	-6 411	16 737	44.6
1989	16 707	22 696	-5 989	39 403	73.6
1994	22 551	28 983	-6 432	51 534	77.8
1999	30 546	53 621	-23 075	84 167	56.9
2004	65 195	100 671	-35 476	165 866	64.8
2005	73 476	116 774	-43 298	190 250	62.9
2006	82 985	135 414	-52 430	218 399	61.3
2007	101 377	160 718	-59 340	262 095	63.1
2008	122 420	187 268	-64 848	309 688	65.4
2009	93 946	129 630	-35 684	223 576	72.5
2010	103 501	168 630	-65 129	272 131	61.4
2011	120 249	214 673	-94 424	334 922	56
2012	133 563	207 223	-73 660	340 786	64.5

Note:

1. Data is deflated by GDP deflator for the United States obtained from USDA database (2005=100).

Table 2.4 Exports and Imports in constant prices, 1969-2012.

Source: Author [based on data from TURKSTAT (2013d)].

The key export market for Turkey in 2012 was the EU-27, with 29.3 per cent, followed by Iraq (5.4 per cent) and Iran (5 per cent). The main product group exported to EU countries was machinery and transport equipment, with a 37.4 per cent share. Other significant exports are clothing (17.5 per cent), agricultural products (8.3 per cent) and textiles (7.4 per cent). Just as in the case of exports, Turkey's most important import market was the EU-27, with 33.7 per cent of total imports in 2012. The second most important partner was Russia with 10.3 per cent and the third was China with 8.2 per cent. The most imported product groups from the EU were machinery and transport equipment (41.8 per cent), chemicals (16.2 per cent) and fuels and mining products (15 per cent). Furthermore, Turkey was rated the 7th country of major import partners for the EU and the 5th in terms of exports in 2012 (EUROPA, 2013d).

2.2.5. Income Distribution

Household income distribution demonstrates disparities in Turkey. To understand this disparity, the number of households is divided equally into five groups (quintiles) in respect of the income levels. The first 20 per cent denotes the poorest households and the last one the wealthiest. Table 2.5 collates results and focuses on urban and rural income distribution. In 2012 the richest quintile has 46.6 per cent of total household disposable income, while the poorest has just 5.9 per cent. Various economic crises and migration flows from rural to urban areas have caused the inequality to stay at high levels. In spite of the high inequality in income distribution, Gini coefficients show that income disparity in both rural and urban areas decreased in almost the same proportions (0.05 per cent) from 1987 to 2012. Also, the lowest Gini coefficient value (0.38) was in 2005 (Oskam, Longworth and Yildiz, 2005; Karaca, 2007; TURKSTAT, 2013c).

The income disparity is higher in Turkey when compared to the EU-25, Bulgaria and Romania, and it has been comparatively constant for years (Karaca, 2007). Also, according to the OECD (2013b), Turkey is the third most unequal country among the OECD countries after Chile and Mexico. Therefore, one of the most important economic challenges for Turkey is general poverty and regional inequality.

Percentage of Households	Turkey								
Quintiles	**1987[1]**	**1994[1]**	**2002[1]**	**2005[2]**	**2008[3]**	**2009[4]**	**2010[4]**	**2011[5]**	**2012[5]**
1st	5.2	4.9	5.3	6.1	5.8	5.6	5.8	5.8	5.9
2nd	9.6	8.6	9.8	11.1	10.4	10.3	10.6	10.6	10.6
3rd	14.1	12.6	14.0	15.8	15.2	15.1	15.3	15.2	15.3
4th	21.2	19.0	20.8	22.6	21.9	21.5	21.9	21.7	21.7
5th	49.9	54.9	50.1	44.4	46.7	47.6	46.4	46.7	46.6
Gini Coeff.	0.43	0.49	0.44	0.38	0.41	0.42	0.40	0.40	0.40
	Urban								
1st	5.5	4.8	5.5	6.4	6.1	6.0	6.3	6.2	6.4
2nd	9.3	8.2	9.7	11.5	10.7	10.7	11.0	10.8	10.9
3rd	13.6	11.9	13.9	16.0	15.3	15.0	15.3	15.2	15.3
4th	20.8	17.9	20.5	22.6	21.9	21.1	21.6	21.5	21.3
5th	50.9	57.2	50.4	43.5	46.0	47.3	45.7	46.2	46.1
Gini Coeff.	0.44	0.51	0.44	0.37	0.40	0.41	0.39	0.39	0.39
	Rural								
1st	5.2	5.6	5.2	6.1	6.5	6.1	6.2	6.1	6.1
2nd	10.0	10.1	10.3	11.3	10.8	10.9	11.0	10.9	11.2
3rd	15.0	14.8	14.7	15.9	15.6	15.9	15.7	15.7	15.9
4th	22.0	21.8	21.7	22.6	22.5	23.1	22.8	22.5	22.8
5th	47.9	47.7	48.0	44.2	44.5	44.0	44.3	44.8	44.0
Gini Coeff.	0.42	0.41	0.42	0.38	0.38	0.38	0.38	0.39	0.38

Table 2.5 Household Income Distribution in Turkey, 1987-2012.
Source: Author [based on data from [1]Oskam, Longworth and Yildiz (2005), [2]Karaca (2007), [3]TURKSTAT (2010b), [4]TURKSTAT (2011a) and [5]TURKSTAT (2013c)].

2.3. Turkish Agricultural Sector

Agriculture has a crucial share in the Turkish economy and social structure, with high shares in GDP and employment. Table 2.6 displays some basic indicators in the agricultural economy.

(%)	1969	1979	1989	1994	1999	2004	2009	2010	2011
Share of Agriculture in GDP[1]	31.7	23.9	17.2	15.2	11.8	10.4	9.8	9.2	8.9
Employment in Agriculture	61.2[2]	51.3[2]	47.4[2]	44.1[2]	40.2[2]	29.1[2]	24.7[2]	23.7[3]	25.4[4]
Agricultural Imports[2]	-	1.8	6.4	4.0	3.7	2.4	3.3	3.0	3.6
Agricultural Exports[2]	72.4	57.8	15.8	11.2	7.7	4.2	4.4	4.5	4.0

Table 2.6 Indicators of the Agricultural Economy, 1969-2011.
Source: Author [based on data from [1]TURKSTAT (2013d), [2]TURKSTAT (2012a), [3]TURKSTAT (2010a) and [4]TURKSTAT (2013a)].

Despite a decrease in the contribution of agriculture to GDP from 31.7 per cent in 1969 to 8.9 per cent in 2011, it still employs 25.4 per cent of total labour force. Turkey is among the top ten food exporters in the world and has conventionally had a trade surplus in agri-food products.

2.3.1. Agricultural Structure and Production

2.3.1.1. Labour in Agriculture

According to the Turkish Statistical Institute (TURKSTAT) (2012b), 6.1 million workers were employed in agriculture in 2011 or 24.6 per cent of the total employment. However, the number of workers employed in agriculture in 1998 was 8.7 million. As can be seen from the figure 2.3, the unpaid family worker rates are a high proportion of total agricultural employment. In 2011, this rate was 47 per cent, while employer and own account employed together were 43 per cent. Almost 80 per cent of female agricultural workers are categorised as unpaid family workers. The main reason is that they can contribute to agricultural production while they are raising their children and doing household activities at the same time (Burrell, 2005b).

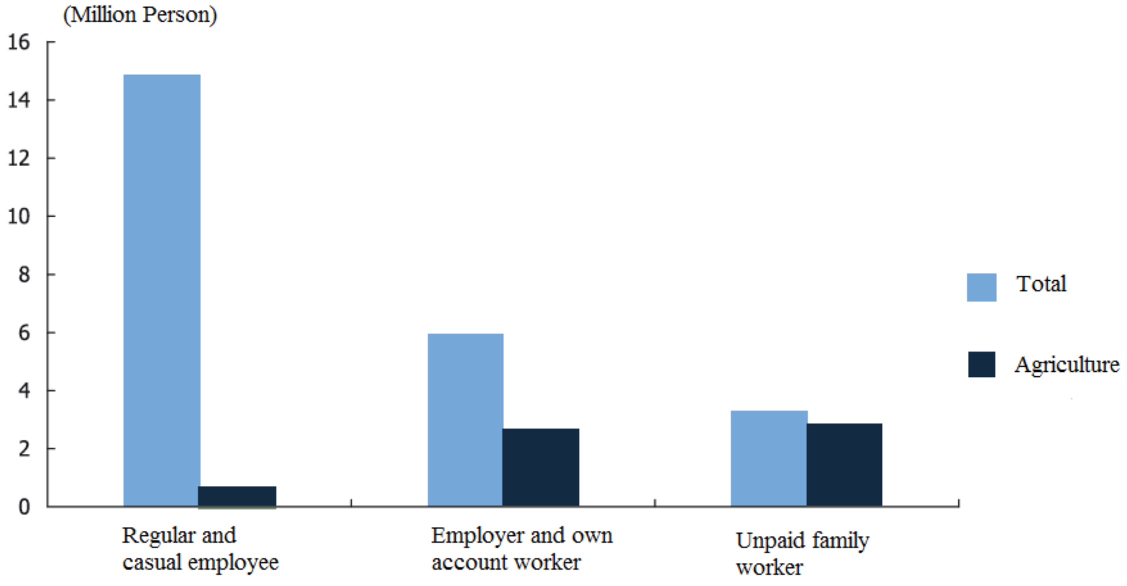


Figure 2.3 Agricultural Employment, 2011.
Source: TURKSTAT (2012b).

The comparison between Turkey and other countries is not easy in terms of unpaid family workers because every country evaluates its statistics in a different way. However, the rural and agricultural work force in Turkey is different from EU countries due to the high rates in work force participation and illiteracy, and low unemployment (Burrell, 2005b).

2.3.1.2. Land and Holdings in Agriculture

Turkey has a total area about 783 560 km^2 of which approximately 10 400 km^2 are inland lakes. Estimations for agricultural land in Turkey vary according to the source of information. The data in this study (see table 2.7) is obtained from TURKSTAT.

According to TURKSTAT, total utilised agricultural area has decreased for more than two decades. While total arable land, sown area and fallow land have declined, vegetable gardens and the area of fruit, beverage and spices have increased. Furthermore, the area of olive trees and vineyards has fallen, but for the area of olive trees the area of dispersed trees has not been included in the data since 1995. Hence, the area of olive trees has been increasing since 1995 (TURKSTAT, 2009). Although there has been a decrease in the agricultural area, Turkey had the largest area among the

Euro-Mediterranean countries until 2005. In the following years, it became the second country after Algeria. When we compare Turkey with other Euro-Mediterranean countries, it can be said that Turkey is more land-intensive. Therefore, it might be expected that Turkey has a comparative advantage in land-intensive goods and that this situation can help to boost Turkish agricultural exports.

(Thousand Hectares)	1989[1]	1994[1]	1999[1]	2004[1]	2009[2]	2010[2]	2011[3]	2012[3*]
Total utilised agricultural land	42 074	40 049	39 180	41 210	38 911	39 011	38 226	-
Total arable land	24 880	24 605	24 279	23 871	21 351	21 384	20 518	-
Sown area	19 036	18 641	18 450	18 110	16 217	16 333	15 692	15 464
Fallow area	5 234	5 255	5 039	4 956	4 323	4 249	4 017	4 286
Vegetable gardens	610	709	790	805	811	802	810	827
Area of fruits, beverage and spices	1 563	10618	1 393	1 558	1 686	1 748	1 820	1 937
Vineyards	597	567	535	520	479	478	473	462
Area of olive trees	857	881	595	644	778	784	798	814
Land under permanent meadows and pastures	14 177	12 378	12 378	14 617	14 617	14 617	14 617	14 617
Forest area	20 199	20199	20 703	21 189	21 390	21 537	21 537	21 537

Note:
1. * indicates that data is provisional.

Table 2.7 Agricultural Land, 1989-2012.
Source: Author [based on data from [1]TURKSTAT (2009), [2]TURKSTAT (2012b) and [3]TURKSTAT (2013f)].

With regard to agricultural holdings, most agricultural enterprises in Turkey are small, family-owned, divided and poorly structured. According to the OECD (2011b), the agricultural holdings were about 3.1 million in Turkey (15 million in the EU-27) and the average farm size was 6.1 ha in 2006 (13 ha in the EU-25) (EUROPA, 2010c). There is little change from 1991 to 2006 in the average size, only 0.3 ha. As can be seen from the table 2.8, about 68 per cent of holdings are less than 5 ha and 85 per cent are less than 10 ha in 1991, while it was 58 per cent and 79 per cent in 2006, respectively. A comparison between 1991 and 2006 demonstrates a decrease in the total number of agricultural holdings by 26 per cent which can be related to the reduction in agricultural employment. The distribution of agricultural area is skewed towards small and medium-sized farms (OECD, 2011b).

(%)	1991		2001		2006	
Size of holdings (ha)	**Holdings**	**Area**	**Holdings**	**Area**	**Holdings**	**Area**
No land	2.5	0.0	1.8	0.0	0.4	0.0
< 0.5	6.2	0.3	5.8	0.3	2.8	0.1
0.5-0.9	9.4	1.1	9.4	1.1	6.3	0.5
1-1.9	18.5	4.3	17.6	4.0	15.3	2.6
2-4.9	31.3	16.5	30.9	16.0	32.7	12.9
5-9.9	17.5	19.9	18.2	20.7	21.4	18.1
10-19.9	9.4	21.0	10.6	23.8	12.7	21.0
20-49.9	4.3	19.8	5.0	22.8	6.6	23.6
50-99.9	0.6	6.4	0.6	6.1	1.3	9.9
100-249.9	0.3	5.9	0.1	3.0	0.4	7.4
250-499.9	0.1	2.8	0.0	0.4	0.1	1.8
500 +	0.0	2.0	0.0	1.9	0.0	2.0
Total	100	100	100	100	100	100
Total number of (000)	4 068	23 451	3 076	18 434	3 022	18 434
Average farm size (ha)		5.8		6.0		6.1

Note:

1. Data for total area is in thousand ha.

Table 2.8 Size Distribution of Land, 1991, 2001 and 2006.

Source: Author [based on data from OECD (2011b)].

2.3.1.3. Agricultural Production

From FAO (2013) statistics, the value of production, the most produced good in Turkey, is cow milk (whole, fresh) in 2011, followed by wheat, tomatoes, grapes and indigenous chicken meat. Other significant products are cotton lint, hazelnuts, indigenous cattle meat, olives and apples. Furthermore, Turkey is the largest producer in the world for cherries, apricots, hazelnuts, figs, while the second for leeks, melons, sour cherries and the third for cucumbers, chick peas, quinces, watermelons, poppy seed and natural honey.

2.3.1.3.1. Crop Production

Table 2.9 shows the value of output for the main agricultural product categories for Turkey. Crop production is the most significant agricultural activity in terms of its share in the total marketable value of production (56 per cent). Animal products have the biggest proportion in the total agricultural production, followed by cereals and other crop products, livestock, and fruits, beverage and spices.

Crops	**Value (Thousand TL)**	**Value of Marketable (Thousand TL)**	**Distribution of Value of Marketable (%)**
Total	119 587 926	82 633 938	100.00
Crop production	**55 528 578**	**46 284 573**	**56.01**
Cereals and other crop products	22 284 189	17 396 028	21.05
Vegetables	15 938498	13 921 470	16.85
Fruits, beverage and spices	17 305 891	14 967 075	18.11
Animal production	**64 059 348**	**36 349 365**	**43.99**
Livestock	37491 835	15 058 771	18.22
Animal products	26 567 513	21 290 594	25.76

Note:

1. Data is deflated by GDP deflator for Turkey obtained from USDA database, (2005=100).

Table 2.9 Value of Agricultural Output in Turkey, 2011.
Source: Author [based on data from TURKSTAT (2012b)].

The area sown to dry pulses has fallen between 1989 and 2011 (see table 2.10). The two most important pulse crops are chickpeas and lentils, with 57 and 28 per cent of the pulse production area in 2011 (TURKSTAT, 2012b). Although the share of pulses is small in production value, chickpeas and lentils are crucial exports. Other pulses are broad beans, peas, dry beans, kidney beans, vetches, grass peas and fenugreek.

	Cereals	Dry Pulses	Oil Seeds	Fodder Crops	Other Crops	Industrial Crops*	Fallow Land	Total
1989[1]	13 741	2 051	966	293	188	914	5 234	23 387
1994[2]	14 145	1 617	730	277	190	1 457	5 255	23 671
1999[2]	13 926	1 350	698	343	220	1 723	5 039	23 299
2004[2]	13 833	1 226	635	809	179	1 280	4 956	22 918
2009[2]	12 068	801	702	1 484	145	1 018	4 323	20 541
2010[2]	12 100	822	769	1 462	141	1 039	4 249	20 582
2011[2]	11 903	778	774	1 510	145	1 055	4 017	20 182

Note:

1. *Raw materials for textiles, plants for perfumery, pharmacy or for similar purposes, tobacco and sugar beets.

Table 2.10 Area in Field Crop Production (thousand ha), 1989-2011.

Source: Author [based on data from [1]TURKSTAT (2009) and [2]TURKSTAT (2012b)].

Regarding industrial crops, the most important products are sugar beet, tobacco and cotton. In 2011, the biggest production area was cotton with 542 000 ha, followed by sugar beet and tobacco with 297 265 and 76 608 ha, respectively. Tobacco and sugar beet areas decreased in the last decade due to removal of government support on tobacco production, declining real prices and stringent enforcement of sugar quotas (Longworth, 2005; Bilir *et al.*, 2009).

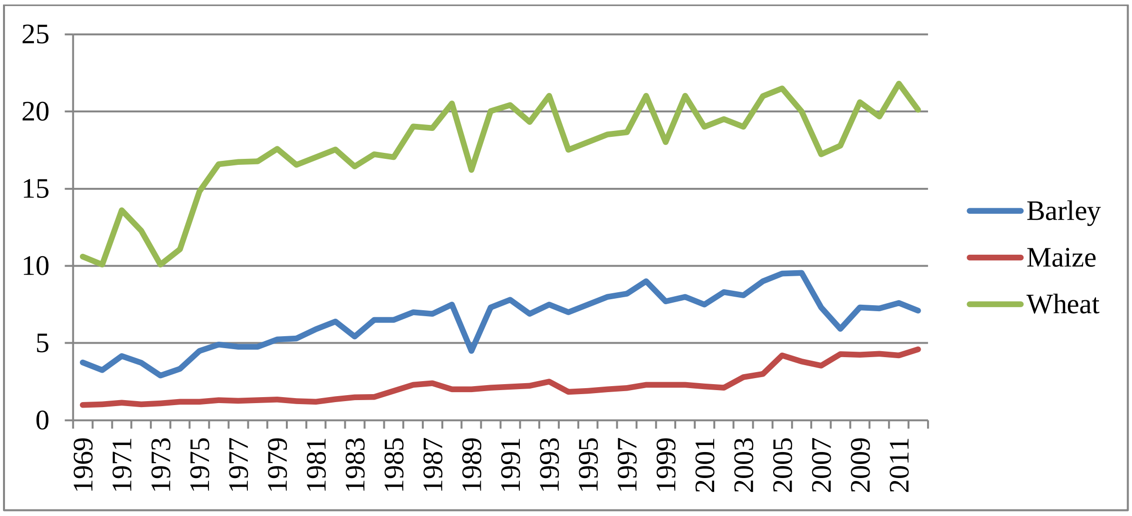


Figure 2.4 Production of Selected Cereals (million tonnes), 1969-2012.

Source: Author [based on data from FAO (2013)].

Production of some selected cereals is shown in figure 2.4 for 1969-2012. Wheat production has shown a considerable increase, while barley and maize productions have been stagnant during this period. However, the commodities are characterised by fluctuation and it is still less than the average production of the EU-27 (FAO, 2013). Also, other cereals cultivated are rye, oats, spelt, millet, rice, canary grass, mixed grain, triticale and sorghum.

2.3.1.3.2. Fruit and Vegetable Production

Fruit and vegetables are a significant part of the Turkish total agricultural production, as is their contribution to the agricultural exports. Some products are important in terms of domestic consumption and export, such as tomatoes, hazelnut and grapes. Fruit and vegetables have a high share in marketable value of production with 18.11 per cent and 16.85 per cent, respectively (see table 2.9). The most significant fruit and vegetable products are grapes and tomatoes (see table 2.11).

		Production			**Production**
Vegetables		27 548	**Fruits**		18 426
Leafy or stem edible[1]		1 478	Green Tea		1 231
	Cabbages	710	Pome Fruits[6]		3 211
	Lettuce	424		*Apples*	2 680
Bulb and Root[2]		3 426	Stone Fruits[7]		2 129
	Onion (dry)	2 141		*Apricots*	650
	Radish	158		*Peaches*	546
Fruit-bearing[3]		22 425	Olives and other nuts[8]		2 605
	Leguminous[4]	860		*Olive*	1 464
	Watermelon	3 865		*Hazelnuts*	801
	Tomatoes	11 003	Citrus fruits[9]		3 027
	Pepper	1 975		*Lemons*	673
	Cucumber	1 749		*Oranges*	1 427
Other[5]		218		*Mandarins*	757
			Other fruits[10]		1 139
				Figs	261
			Grapes		4 296

Table 2.11 Fruit and Vegetable Production (thousand tonnes), 2011.

Source: Author [based on data from TURKSTAT (2012b)].

[1] Cabbages, lettuce, artichokes, celery, spinach, swiss chard, purslane, parsley, rocket, cress, mint, dill, asparagus

[2] Onion, garlic, leek, carrots, turnip, beets (red), celeriac, radish

[3] Tomatoes, cucumber, hairy cucumber, pepper, okra, eggplant, squash, pumpkin

[4] Pea, bean, cowpea, broad beans, calavence (green)

[5] Cauliflower, broccoli, cultivated mushroom

[6] Apples, pears, quinces, loquats, medlar

[7] Peaches, plums, apricots, wild apricots, cherries, sour cherries, cornel, oleaster

[8] Olive, almonds, hazelnuts, walnuts, chestnuts, pistachios

[9] Oranges, mandarin, lemons, grape fruits, sour oranges

[10] Bananas, kiwi, avocado, figs, strawberries, raspberry, mulberry, pomegranates, persimmons, carobs

2.3.1.3.3. Livestock Production

The number of livestock excluding poultry decreased more than half over the period 1969-2011 because of the deterioration in grazing lands, high input costs, weak competitiveness against foreign products, animal hygiene problems and fast migration of new farmers to the urban areas (EUROPA, 2003; OECD, 2011b). In spite of this decline, poultry numbers grew more than six times (see table 2.12).

	Sheep	**Goats**	**Cattle**	**Poultry**
1969	36 587	20 637	13 761	35 235
1979	43 942	18 447	14 941	56 451
1989	45 384	12 562	12 562	64 054
1994	37 541	10 133	11 910	184 460
1999	29 435	8 057	11 031	243 912
2004	25 432	6 772	9 788	283 675
2009	23 975	5 594	10 860	249 043
2010	21 795	5 128	10 724	234 082
2011	23 090	6 293	11 370	239 973

Table 2.12 Distribution of Livestock (thousand head), 1969-2011.
Source: Author [based on data from FAO (2013)].

Table 2.13 shows the amount of meat production in Turkey from 1969 to 2011 including poultry meat. The most significant product in terms of value is beef and the second is poultry. However, in terms of output, poultry is the most important meat and Turkey is ranked 11th in poultry meat production in the world in 2011. There has been an almost seventyfold increase in poultry meat production in the last four decades. Also, beef production has substantially increased since 1969 and a parallel movement is observed in sheep and goat meat. Total meat production increased around 1.9 million tonnes in the period 1969-2011, due to a rise in poultry production (OECD, 2011b). Although there is a decrease in livestock production, a reason for the increase in red meat production is income losses from livestock due to drought and milk price reduction (Ünlüsoy, İnce and Güler, 2010).

	Sheep	**Goats**	**Cattle**	**Poultry**	**Total**
1969	263 000	58 000	118 383	22 040	461 423
1979	233 700	51 300	147 634	207 000	639 634
1989	307 000	68 000	367 895	380 000	1 122 895
1994	311 000	61 000	316 585	460 000	1 148 585
1999	313 000	55 000	349 681	505 132	1 222 813
2004	273 000	45 000	365 000	889 390	1 572 390
2009	262 000	37 000	325 000	1 102 900	1 726 900
2010	240 000	33 900	618 584	1 306 659	2 199 143
2011	253 000	41 600	644 906	1 457 838	2 397 344

Table 2.13 Meat Production (tonnes), 1969-2011.
Source: Author [based on data from FAO (2013)].

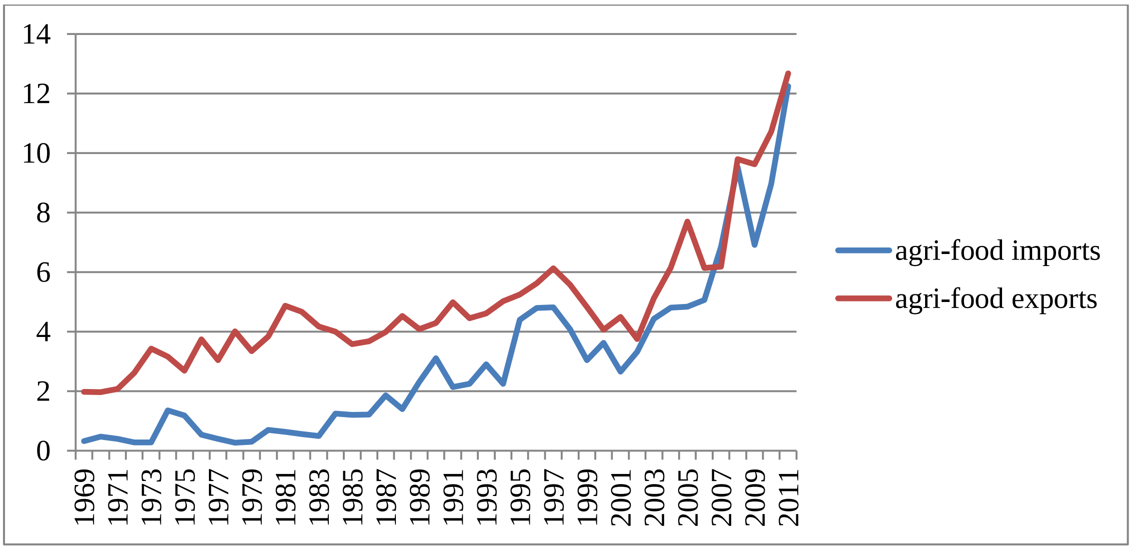
Finally, the other important livestock product is milk because Turkey is one of the largest milk producers in the world and its share in total production is 1.7 per cent. The most produced type is cow milk with 13.8 million tonnes in 2011. Sheep and goat milk production have a smaller share in total output in spite of the fact that Turkey is one of the most important sheep milk producers in the world (893 000 tons in 2011). The production of sheep and goat milk has reduced gradually over the years. Furthermore, the total milk production rose by 4.8 million tonnes within two decades as a result of the growth in cow milk production (OECD, 2011b; TURKSTAT, 2012a).

2.3.2. Trade in Agriculture

Agricultural trade is a crucial part of the Turkish economy and there has been an upward trend in both agricultural imports and exports for several decades. Turkey has a positive agricultural trade balance in spite of its total trade deficit. The proximity to Europe, the Middle East and North Africa helps Turkey to access easily large markets through the Black Sea on the north, the Aegean Sea on the west and the Mediterranean Sea on the south (Ucak, 2006). It gives Turkey an important advantage in terms of lower transportation costs and assists in creating more exports.

In 2011, agri-food product exports were around USD 12.7 billion and imports were USD 12.3 billion (in constant 2005 prices). Turkey usually has a trade surplus in terms of agricultural products (see figure 2.5). Overall, agricultural exports make a contribution of 10.6 per cent to Turkish exports, whilst the total contribution of agricultural imports is 5.5 per cent. According to TURKSTAT (2009), in 2008, fruits, nuts and citrus provided the highest share to total exports with 2.2 per cent, followed by cotton, cotton yarn and cotton fabric with 1.2 per cent. In exporting fruit and vegetables, Turkey is the third biggest exporter in the world, following the USA and the EU. More than half of the total agricultural exports consist of fruits, nuts, vegetables and related processed products. Tobacco, cereals and sugar follow with a 20 per cent share (OECD, 2011b). With regard to agricultural imports, the highest share was cotton, cotton yarn and cotton fabric with 1.2 per cent, and animal or vegetable fats and oil with 0.8 per cent.

Turkey has engaged in international trade for many years, although it cannot be described as an ‘open economy’ due to the distortions from trade policies, especially for agricultural products. Agriculture has significant support and high tariffs, which means a great amount of border protection. The livestock sector is especially influenced by important distorting policies (Burrell, 2005a). This suggests the importance of free trade agreements.



Note:

1. Data is deflated by GDP deflator for the United States obtained from USDA database.

Figure 2.5 Agri-food Trade (Billion $) (2005=100), 1969-2011.

Source: Author [based on data from FAO (2013)].

The main trade partner of Turkey is the EU for all merchandise and agricultural trade. Mediterranean and Gulf countries are also significant trade partners for Turkey. In January 1996, Turkey instituted a Customs Union (CU) with the EU for all industrial goods. Although agricultural products are not included in the CU, they have some trade priorities. In 2001, at least 60 per cent of Turkish agricultural exports to the EU did not encounter trade barriers, and another 36 per cent was subject to reduced tariff rates. Furthermore, 39 tariff rate quotas (TRQs) were executed for a large diversity of agricultural products in January 1998. Thus, many products benefit from zero-tariff TRQ (Grethe, 2004). Trade values for 2011 between Turkey and EU-27 are illustrated in table 2.14 and it is clear that Turkey has a positive trade balance in agriculture with the EU-27. “Edible fruit and nuts” (EUR 1.3 billion) and “preparations of vegetables, fruit, nuts and plants” (EUR 763 million) have the highest share of Turkish exports to the EU-27. Regarding imports from the EU-27, “live animals” has the highest share with EUR 356 million, followed by “meat and edible meat offal” (EUR 307 million), “tobacco and tobacco products” (EUR 285 million), and “oilseeds and oleaginous fruits” (EUR 257 million). Also, Germany is the main destination in the EU with over one-third of the agricultural exports. This may derive from the high incidence of Turkish population settling in Germany. According to the Turkish Ministry of Labour and Social Security, outside of Turkey, Germany has the highest Turkish population in the world with 1.6 million people. Italy, the United Kingdom (UK), the Netherlands and

France are other important destinations for the agricultural exports. These countries are also populated by Turkish people. France is the second largest populated country followed by the Netherlands, Austria and the UK. In addition to this, the main import partners for Turkey from the EU are Germany, Greece, Spain, the UK, France and the Netherlands, in order of priority (OECD, 2011b). The importance of these destinations in agricultural exports may arise from Turkish food demand by Turkish populations living in these countries, due to similar tastes and preferences. Therefore, more demand for Turkish agri-food products may lead to an increase in Turkish exports to these trade partners.

CN-codes	Products	Exports to EU-27	Imports from EU-27	Net Trade
1	Live animals	1.9	356	-354.1
2	Meat and edible meat offal	2	307	-305
4	Dairy produce	1.5	29	-27.5
5	Products of animal origin	24	6.4	17.6
6	Live trees and other plants	25	36	-11
7	Edible vegetables, roots and tubers	222	24	198
8	Edible fruit and nuts	1 274	31	1 243
9	Coffee, tea, mate and spices	26	16	10
10	Cereals	21	186	-165
11	Products of the milling industry	8.1	30	-21.9
12	Oilseeds and oleaginous fruits	65	257	-192
13	Lac, gums, resins and other vegetable saps	2.1	13	-10.9
14	Vegetable products n.e.s.	13	0.3	12.7
15	Animal or vegetable fats and oils	13	23	-10
16	Meat preparations	0.4	3.8	-3.4
17	Sugars and sugar confectionery	79	24	55
18	Cocoa and cocoa preparations	19	132	-113
19	Preparations of cereals, flour, starch, etc.	83	116	-33
20	Preparations of vegetables, fruit, nuts and plants	763	36	727
21	Miscellaneous edible preparations	182	155	27
22	Beverages, sprits and vinegar	65	194	-129
23	Residues and waste from the food industries	1	161	-160
24	Tobacco and tobacco products	94	285	-191
01-24	Total agricultural products - Chapters 01 to 24	2 983	242	2 741
Other	Other WTO products - outside Chapters 01 to 24	143	510	-367
	Total - Agricultural Products	3 286	1 392	1 894
Of which	Commodities	253	373	-120
	Confidential trade	2.1	6	-3.9
	Final Products	2 663	1 247	1 416
	Intermediate	168	1 088	-920
	Other products	40	219	-179
01-99	**Total - All Products**	42 623	65 080	-22 457

Note:

1. Data is deflated by GDP deflator for the EU obtained from USDA database (2005=100).

Table 2.14 Turkish Agricultural Trade with EU-27 (Million €), 2011.

Source: EUROPA (2013a).

2.4. Summary

This chapter has aimed to give background information about the Turkish economy and agriculture. After opening the chapter with a brief introduction, the following sections consisted of two parts. The first provided a macroeconomic overview about the Turkish economy, on economic growth, inflation, employment, trade and income distribution. The second part reviewed Turkish agriculture, considering labour, land usage, agricultural holdings, production and trade.

In summary, agriculture is an important sector of the Turkish economy, although its share in GDP has been decreasing. It is also significant in terms of international trade because the agricultural trade balance is positive, although the total trade shows a deficit. Turkey is one of the largest agricultural producers in the world and an important agricultural exporter at the same time, especially in fruit and vegetables and food preparations. Furthermore, it has experienced a tremendous increase in poultry and milk production over the last four decades. Overall, it can be said that agriculture makes a major contribution to Turkish economic development.

In this thesis, the determinants of Turkish agricultural exports to the Euro-Mediterranean countries will be examined. Therefore, before investigating the history of agricultural trade in the Euro-Mediterranean region in Chapter 4, we will briefly review Turkish agricultural policies in the next chapter.

Chapter 3 . Turkish Agricultural Policies

3.1. Introduction

In the previous chapter, an overview of the Turkish economy, its agriculture sector, its position within the economy and its trade pattern were addressed so as to give a background to our analysis. We saw that agriculture has a crucial role in the Turkish economy due to high shares in GDP and employment, a large production and trade surplus. In this chapter, agricultural policies in Turkey are discussed in order to understand the situation of Turkish agriculture from a closer inspection. It will help us to see the policies applied during the development process of agriculture since the Republic of Turkey was established.

The main aims of agricultural policies are to provide sustainable food security and safety, to generate a good structure and to benefit from export potential. Unfortunately, the policies for these purposes were not applied properly in the first decades of the republic due to playing electoral politics with agriculture. However, some significant steps have been taken with agricultural policies under pressure from the World Bank and the IMF since 2001. Thus, in order to reach the stated aims, various agricultural support instruments are used, such as direct income support, diverse payment methods, support schemes and development programmes (Oskam, 2005; OECD, 2013a). These instruments and related policies will be discussed in the following sections. The chapter is organised as follows: Section 3.2 discusses the agricultural support instruments. In section 3.3, agricultural trade policies are explained in detail; and section 3.4 summarises.

3.2. Agricultural Support Instruments

Although agriculture is an important sector in the Turkish economy, it has never achieved its full potential, due to ineffective agricultural policies, in spite of having abundant resources and self-sufficiency in foodstuffs (Cakmak, 2004). Turkey initially introduced protectionist policies at the beginning of 1930s. Recommendations from the

Soviet Union were a significant factor in order to constitute a strong central state. The principles applied for this aim concurred with the socialist doctrines of a centrally planned society (Oskam, 2005). However, the first five-year development plan was introduced in 1963. The political agenda prevented long-range policy formulation and delivery mechanisms, largely because of repeated elections. The policies have concentrated on some major issues in the five-year plans which were set by the State Planning Organisation (SPO) (Cakmak, 2004; Oskam, 2005). These are the usual ones of accessibility and stability in food supplies, improving output and yields, augmenting self-sufficiency, taking advantage of export capability, supplying steady and sustainable income levels in the sector and encouraging rural development (Anderson, 2008).

Input subsidies, price supports and supply control measures for crops have been the major policy tools. In the early 1960s, input subsidies to support agriculture for credit, agricultural chemicals, seeds and irrigation were widely used. Fertilisers joined the subsidised input list in the 1970s and livestock production has been assisted with border measures. Before 2000, there were no basic policy or delivery mechanism differences, although the level of price support for products and input usage fluctuated significantly (Anderson, 2008). Ambitious reforms, due mainly to the constraints imposed by the IMF and World Bank, have been employed since 2001. Also, policies have been determined according to the obligations given in the World Trade Organization (WTO) Agreement on Agriculture and the developments in the EU Common Agricultural Policy (CAP)[1] (Isikli and Yercan, 2005).

The agricultural support instruments can be summarised as direct income support (DIS) (removed in 2009), deficiency payments, compensatory payments, transition payments, animal husbandry support scheme, agricultural insurance support scheme, investment incentives, and rural development programmes and projects.

[1] In the early years, the CAP was intended as a policy structure that aimed to augment productivity and agricultural income. Modern reform of the CAP was first negotiated in 1999 by the Council of the Ministers of Agriculture in Berlin. The suggestions of the Council (Agenda 2000) were revised in 2003 by the Council of Luxemburg which provided the structure of the EU agriculture for the next decade.

3.2.1. Direct Income Support (DIS)

With the elimination of output and input subsidies in progressive stages, the Turkish government announced direct income support (DIS) to offset them in 2001. DIS payments were provided to all land users (owners, tenants and share-croppers) registered for the National Farmers Registry System (NFRS). The payments were defrayed for land between 0.1 ha and 50 ha and their amounts were specified by the Turkish Council of the Ministers. Additional DIS payments (conditional area-based payments) were given for organic farming, soil analysis, and use of certificated seed and seedling (Oskam, 2005; MARA, 2007).

This system was abolished in 2009 and payments based on output and current area have risen. Furthermore, unconditional area-based payments such as "diesel payments" and "fertiliser payments" had been given to every registered farmer since 2007. The quantity of DIS payments was TL 2.7 billion in 2002 and decreased to TL 2.4 billion in 2006. The last payment of TL 860 million was in 2008 (SPO, 2010; OECD, 2011a).

3.2.2. Deficiency Payments

Deficiency payments (premium payments) apply for the crop-based products having domestic supply shortages. Supported products are unginned cotton, sunflower seed, soybean, canola, maize, olive oil, safflower, fresh tea, cereals and pulses. The amount of support has been determined by considering production costs, domestic and world prices, and budgetary method. Payments have been rendered once for each production season pursuant to the Council of Ministers Decision and the Communiqués[2]. Also, all farmers registered with the NFRS are qualified for the payments (MARA, 2007; SPO, 2010; OECD, 2011a).

According to OECD (2011a), deficiency payments rose for all products in 2010 by comparison with 2009, especially barley (257 per cent), soybeans (92 per cent), wheat (86 per cent) and rapeseed (47 per cent). The amount of deficiency payments in the agricultural support budget was fixed at 4 billion TL in 2010 and almost 4.5 billion TL

[2] The Communiqués are issued depending on the decision of the Council of Ministers. The last one dated 21/09/2013 and numbered 2013/15.

in 2011 by the Ministry of Food, Agriculture and Livestock (MFAL), while it was 2.7 billion TL in 2002 (MFAL, 2011). In 2012 the Minister of Food, Agriculture and Livestock developed a “basin-based support programme” which differentiates crop deficiency payments. The differentiation method was first put into practice in 2010 in respect of 30 agricultural basins and the goals of the government are to raise productivity by considering optimum ecological conditions and to alter the crop pattern thereby producing more currently imported products and less surplus products (OECD, 2013a).

3.2.3. Compensatory Payments

Compensatory payments are granted to the registered growers with NFRS to reimburse them for income losses in specific products. For example, tea producers are recompensed for costs of the damages (by 70 per cent) incurred during pruning and payments are made per kilogram (MARA, 2007). In 2011, payments were given to tea producers depending on trimming so as to improve quality and recuperate tea fields. Compensatory payments were paid to potato producers with the purpose of restricting potato production in districts with potato wart disease in 2009 and 2010. However, the payments for potato growers were removed in 2011 (SPO, 2010; OECD, 2011a). In 2012, payments were made because of the frost disaster in potato plants which occurred in 2011. The payments for wart disease were also permitted by the Council of Ministers in May 2013 (Government of Turkey, 2013).

3.2.4. Transition Payments

Farmers are offered alternative payments to help them convert to different agricultural products from the crops in excess supply (MARA, 2007). The payments have been made to tobacco growers since 2009. Furthermore, a new payment programme was prepared to decrease hazelnut production between 2009 and 2012, while removing prior intervention measures. Therefore, registered farmers received around USD 1000 per ha for this period, while the unregistered have slightly more in their first year of the cultivation in alternative crops. The purpose of this programme is to accomplish a licensed, best quality, hazelnut production area (432 000 ha) and to stop unregistered plantations (237 000 ha) (OECD, 2011a).

3.2.5. Animal Husbandry Support Scheme

The animal husbandry support payments started as a five-year plan in 2000 (2000-2004 and 2005-2009), but have been applied each year since 2008. They encourage progress in animal husbandry and develop the quality of animal breeding with several support instruments. The share of animal husbandry support in total budgetary spending was 14 per cent in 2007, whilst it is estimated at 28.5 per cent and 27.5 per cent in 2012 and 2013. This support system is for (MARA, 2007; SPO, 2012):

- The production of fodder and certified fodder seed
- Calves, silkworm, mohair (angora wool) and milk
- The purchase of pregnant heifer
- Artificial insemination
- Cesspool
- The improvement of ovine animal breeding
- The establishment of the area free of animal diseases
- Animal registry system
- Animal vaccination services
- The protection of animal genetic resources
- Apiculture and aquaculture
- Stable or mobile milking units and cooling tanks
- The employment of veterinarians in animal origin enterprises
- Contractual livestock breeding

3.2.6. Agricultural Insurance Support Scheme

The insurance support scheme has been open to all farmers since 1996. The goal of the plan is to supply indemnity for crops, animals, aquaculture and fishery commodities and buildings against natural disasters such as hailstorm, frost and flood (MARA, 2007; OECD, 2011a). Half of the insurance costs is compensated by the government. In 2012, TL 263 million (USD 147 million) was provided for insurance support, while it was only TL 89.4 million (USD 60 million) in 2010. Also, 630 000 insurance policies were assigned in 2012 (366 410 insurances in 2010) (OECD, 2011a; OECD, 2013a).

3.2.7. Investment Incentives

Farmers obtained capital investment incentives for a five-year period starting from 1980. The incentives consist mainly of custom duty concessions for imported machinery and reductions in other tax stoppages. Many investment projects, for instance establishing feedlots, received grants after 1985. However, in 1994 this type of supports was abolished. On-farm development work was also financed by the government and its average cost was USD 23 million for 1986-90, USD 52 million for 1991-95 and USD 63 million for 1996-2000. The expenses have remained at similar amounts during the 2000s (OECD, 2011b). In 2009, a new system was introduced to incentivise investment and a similar system entered into force in 2012 again. This system regionally procures "tax reductions", "incentives for employers" social security premium contributions", "free land allocation", "value added tax (VAT) exemption", "customs duty exemption" and "interest support" for particular sectoral projects. The incentives are paid generally to the less developed areas. Also, under the 2011 Annual Investment Program the land parcel identification system was established (OECD, 2011a; OECD, 2013a).

Table 3.1 provides the budgetary information about agricultural supports between 2007 and 2013. According to the data obtained from SPO (2012), deficiency payments have the highest share in the agricultural support budget on average, followed by area based agricultural support payments. The area based agricultural support payments significantly reduced in 2009 although their share is quite high in the budget (31.7 per cent in 2012). The animal husbandry payments share is also considerably high in the agricultural support budget.

	2007	2008	2009	2010	2011	2012[1]	2013[2]
Area Based Agricultural Support Payments	2 201	1 601	893	1 393	1 366	1 420	1 422
Direct Income Support Payments	1 385	860	0	0	0	0	0
Area Based Additional Payments (Org. Farming, Good Practices, Solid Analy.)[3]	8	0	9	55	94	101	112
Gasoline	405	371	336	347	317	340	346
Fertiliser	291	265	427	421	388	406	417
Certificated Seed and Seeding	42	42	61	61	54	76	63
Environmentally Based Agricultural Land Protection (CATAK)	3	4	4	6	11	20	22
Hazelnut	0	0	0	442	442	415	395
Alternative Payments	0	0	3	6	5	5	0
**Tobacco*	0	0	3	5	4	0	0
**Hazelnut*	0	0	0	1	1	5	0
Compensatory Payments	67	60	53	55	56	58	66
**Potato Wart Support*	19	17	8	5	5	0	7
**Tea Trimming Support and Charges*	47	42	45	49	51	58	59
Deficiency Payments	**1 517**	**1 393**	**1 437**	**1 393**	**1 563**	**1 403**	**1 710**
Payment to Crops with Supply Deficits	1 075	856	591	625	806	882	889
Cereals	367	460	722	675	648	413	697
Tea	75	78	81	78	93	86	93
Pulses (Dry Beans, Chick Peas, Lentil)	0	0	43	15	14	20	31
Animal Husbandry Payments	**626**	**826**	**650**	**785**	**1 078**	**1 276**	**1 352**
Grants for Rural Development	**68**	**82**	**177**	**206**	**155**	**181**	**219**
Agricultural Crops Insurance	**34**	**35**	**44**	**54**	**149**	**169**	**173**
Natural Disaster Support to Farmers	**300**	**435**	**21**	**93**	**0**	**0**	**0**
Other	**19**	**29**	**125**	**20**	**26**	**26**	**48**
TOTAL	**4 765**	**4 402**	**3 347**	**3 944**	**4 338**	**4 475**	**4 925**
Southern Anatolia Project Action Plan Rural Development and Animal Husbandry Supports	0	19	54	85	71	70	70
GROSS TOTAL	**4 765**	**4 421**	**3 400**	**4 030**	**4 409**	**4 545**	**4 995**

Notes:

1. [1] Estimate, [2] Programme, [3]Area based payments do not include “good practices” payments for the year 2007 and 2008.
2. Data is deflated by GDP deflator for Turkey obtained from USDA database, (2005=100).

Table 3.1 Distribution of Agricultural Support Budget in Constant Prices, (Million TL).

Source: Author [based on data from SPO (2012)].

3.2.7.1. Financial Structure and Institutions

Agricultural sectors and rural activities are financed by direct payments and bank loans. Direct payments are provided by the central budget, while bank loans are mainly financed by state-owned banks. However, private financial institutions such as private banks and leasing companies have also commenced to offer credit. Ziraat Bank is the main supplier of agricultural loans and support payments and provides credit through the Agricultural Credit Cooperatives (ACCs). The bank mostly attends to large farmers, State Economic Enterprises (SEEs) and Agricultural Sales Cooperatives Unions (ASCUs), whilst the ACCs concentrate on smaller farmers (OECD, 2011b). Ziraat Bank is the largest bank in Turkey in terms of the branch network and net profit, and has given financial support to the agricultural sector for 144 years; Halkbank, Denizbank and Sekerbank also supply credits to the sector (MARA, 2007).

Regarding ACCs, they were established in 1972 and have about 1.5 million members (MARA, 2007). ACCs serve farmer members in almost every village and their primary tasks are to respond to short and medium term credit demands, to support farmers in converting their crops into profit, and to supply machinery, equipment and facilities for common use (Berkum, 2005).

ASCUs have performed their services since 1930s and focus on crop processing and sales. They usually support major products such as cotton, hazelnut, sunflowers, olive oil, raisins and sultanas (OECD, 2011b). The ASCUs have been appointed to manage the interventions related to buying commodities from the farmers. They also manage storage, standardisation, primary and secondary processing, transporting, packaging, export and domestic sales for final and intermediate goods (MARA, 2007).

Until 1994, the ASCUs were empowered to price members' products and to purchase products from the farmers for support on behalf of the government. However, although ASCUs continued to set price for the members, they stopped purchasing crops for the government after 1994. The annual average of financial transfers for ASCUs was over USD 600 million between 1995 and 2000. In 2000 the ASCU Law was enacted to decrease government intervention and to confer the Unions financial autonomy. Also within the Agricultural Reform Implementation Project (ARIP) framework (see section 3.2.8.1. for more detail), financial supports were provided to help the reorganisation and alteration of ASCUs into financially independent and self-managed cooperative organisations (OECD, 2011b). In 2010, domestic market shares of the ASCUs were 100, 97, 30 and 21 per cent for silkworm cocoon, angora wool, sunflower and rose petal, respectively (Okan and Okan, 2013).

3.2.7.2. Agricultural Producer Organisations

Agricultural producer organisations can be categorised as cooperatives, agricultural producer unions and agricultural chambers which are currently structured under the MFAL, and the Ministry of Industry and Trade (MIT). There are over 700 Agricultural Chambers with about 5 million producer members and their major duties are to supply vocational services so as to implement agricultural development, to procure the common needs for producers, to facilitate work activities and to represent producers (MARA, 2007; OECD, 2011b).

In 2004, Agricultural Producer Unions were legislated as specialised in particular products or product groups and were based on provinces or districts. The number of unions and their members are quite small due to the legal framework, but are growing. The purposes of the unions are to plan production considering demand, to provide better product quality, to offer commodities at proper standards to the market and also to give farmers permission to start producer unions in order to grow marketing power at an international and national level (MARA, 2007).

A large number of mercantile services such as input supply, purchasing, processing and selling the products are supplied to the producers by Agricultural Cooperatives. The cooperatives provide better services with the passing years due to being more independent from the government. They consist of Agricultural Development Cooperatives, Irrigation Cooperatives, Fisheries Cooperatives and Sugar Beet Cooperatives (OECD, 2011b).

3.2.7.3. State Economic Enterprises (SEEs)

Another crucial group of institutional players in the agricultural sector are the State Economic Enterprises (SEEs). They affect pricing in the market through support prices which were first determined as floor prices and then payments made following harvest and delivery. In addition, commodity purchasing and storage, subsidy payments, providing input to producers, and trading agricultural products are the other duties of the SEEs. They are supported financially by the Treasury for any loss, such as the difference between export and intervention prices (duty losses) (Kasnakoglu and Cakmak, 2000; OECD, 2011b).

The SEEs were started first for wheat in 1932 and the product number had increased to 26 by 1992. Some of the SEEs are TMO (1932) for grains, TURKSEKER (1935) for sugar, molasses and alcohol products, TZDK (1944) for fertiliser and other inputs, TEKEL (1946) for tobacco, alcoholic drinks and salt, EBK (1952) for meat and fish and later poultry, SEK (1963) for milk, CAYKUR (1971) for tea and TIGEM (1984) for certified seed, breeds and raw material. TIGEM, the Turkish General Directorate for Agricultural Enterprises, also develop and demonstrate new production techniques to the producers, and protect genetic resources. Some decisions were taken to decrease the burden of agricultural subsidies due to budgetary restraints in 1994. Only cereals, tobacco and sugar were subsidised by the SEEs until 1998 (Schmitz *et al.*, 1999; OECD, 2011b). With the application of the 2001 policy reforms, the government planned to diminish the role of SEEs and they were privatised. Furthermore, under the Ninth Development Plan (2007-2013) the government intended to stop state activities from the processing of sugar, tobacco and tea products by 2013, whilst support for Turkish Grain Board (TMO) will be continued (OECD, 2011b).

YEMSAN was privatised in 1993-95 and SEK in 1995. EBK entered into privatisation in 1992 but was excluded from the scope of privatisation in 2005 to develop and regulate the husbandry sector in accordance with the EU norms (EBK, 2011; OIB, 2013). Following the 2001 policy reforms, TZDK and TEKEL were also privatised in 2003 and 2008 respectively (OECD, 2011b). Also the Sugar Law, imposed in 2001, applies stringent quotas at the processing level, and the privatisation of the TURKSEKER has been in progress since 2008 (OIB, 2013).

The trading losses and financial requirements of the SEEs were provided by public funds. The annual average losses of TMO, TEKEL and TURKSEKER were USD 622 million from 1991 to 1995. Between 1996 and 2001, the amount was over USD 1.7

billion. Also, the average annual debt write off for TMO, TEKEL, TURKSEKER and CAYKUR was USD 550 million between 1996 and 2001 (OECD, 2011b).

3.2.8. Rural Development Programmes and Projects

With regard to rural development, various programmes and projects have been enforced by the government. The Environmentally Based Agricultural Land Protection Programme (CATAK) was implemented in 2005 with aims to decrease negative influences of agricultural implementations on the environment, to stop erosion, to sustain renewable natural resources, to preserve the structure of nature and the quality of soil and water in the fragile regions (MARA, 2007).

The Rural Development Investments Support Programme (RDISP), which was established in 2006 for 65 cities, is another programme to support rural development. Its aim is to promote investments in processing, packaging and storage of agricultural commodities, marketing, and production of machinery, and investments in infrastructure facilities to supply public services in rural areas. Projects applied in 81 provinces have the following objectives: development of income and social norms in rural areas, ensuring the integration between agriculture and industry, engendering new sources of income, more effective rural development activities, better infrastructure in rural areas and building entrepreneurial capability. The programme is funded by the national budget and the maximum overall support is TL 100 000 for individual farmers and TL 500 000 for legal entities. Fifty and 75 per cent grants have been provided for the private and the public sector investments respectively (OECD, 2011b).

Other projects for the social support and the development in rural areas are (Allen and Ozcan, 2006; MARA, 2007):

- Village Infrastructure Support Project (KOYDES)
- Municipality Infrastructure Support Project (BELDES)
- Agricultural Reform Implementation Project (ARIP) (2001-2008)
- Instrument for Pre-Accession Assistance Rural Development Programme (IPARD Programme) (2007-2013)
- South-eastern Anatolia Project (GAP) (1989-2013)

- Eastern Black Sea Region Development Project (DOKAP)
- Eastern Anatolia Development Project (DAKP) (2004-2007)
- Eastern Anatolia Basin Development Project
- Anatolian Water Basins Rehabilitation Project (2004-2012)
- Development Project on Fresh Vegetables and Fruit (MEYSEP)
- Development Project for Stock Breeding
- Agricultural Extension and Applied Research Project (TYUAP 1-2)
- Determining Suitable Methods for Common Forestry Development Project
- Commodity Stock Exchange Development Project
- Corum-Cankiri Rural Development Project (1975-1984)
- Erzurum Rural Development Project (1982-1989)
- Bingol-Mus Rural Development Project (1990-1999)
- Yozgat Rural Development Project (1991-2001)
- Ordu-Giresun Rural Development Project (2000-2006)
- Sivas-Erzincan Development Project (2005-2012)
- Diyarbakir-Siirt-Batman Development Project (2006-2011)

It can be said that Agricultural Reform Implementation Project (ARIP) and Instrument for Pre-Accession[3] Assistance Rural Development Programme (IPARD Programme) are the most extensive and comprehensive projects among them.

3.2.8.1. Agricultural Reform Implementation Project (ARIP)

The Government of Turkey started to implement the ARIP in 2000 as a result of agreement with the IMF. The main purposes of the project were to decrease the burden on the budget and support the development of agriculture. The project was funded by the World Bank under the Economic Reform Loan with loans of USD 600 million (Aksoy, 2006). The Government's agricultural reform had three elements to align Turkish agricultural policy with the CAP of the EU and with the commitments to the WTO. The first element of the reform was to remove price and input subsidies gradually and to align prices to world market prices. Therefore, DIS payments were introduced for all farmers to compensate for the loss of these subsidies. The second was to prevent raising superabundant crops by providing transition payments which reimburse

[3] To the EU.

conversion costs for alternative products. The last element was to privatise SEEs and therefore reduce government intervention in the marketing and processing activities (Olhan, 2006).

Although price supports and subsidies were reduced through DIS payments provided to farmers since 2000, Turkish agricultural policy does not match developments in the CAP. Thus, Turkey has switched from decoupled direct supports back to more coupled direct supports and price supports, whilst the EU has moved in the opposite way. Major premium payments are still paid for numerous arable crops and livestock production systems. Also, these payments are encouraging agricultural production and increasing self-sufficiency levels. Despite the abolition of DIS payments in 2009, all other support instruments are expected to continue over the next decade (Van Leeuwen et al., 2011).

3.2.8.2. Instrument for Pre-Accession Assistance Rural Development Programme (IPARD Programme)

The Instrument for Pre-Accession Assistance (IPA) has been launched by the EU to support candidate and potential candidate countries. The instrument has five parts and Turkey is permitted to utilise all of them as a candidate country. The fifth part of the IPA which is IPA Rural Development (IPARD) sustains policy improvement, the arrangements for the implementation, and administration of the Community's Rural Development Policy, CAP and relevant policies. The IPARD Programme which includes the period 2007-2013 has been prepared by considering the priorities of the 9th Development Plan (2007-2013), Agricultural Strategy (2006-2010), the National Rural Development Strategy and the EU's Multi-annual Indicative Planning Document (MIPD). Furthermore, the programme has been detailed by the Ministry of Agriculture and Rural Affairs (MARA)[4] in close collaboration with other public enterprises. Related bodies, such as local authorities, social, economic and environmental partners, centres of knowledge, non-government organisations (NGOs) and universities, also participated in the plan (Kasikci, 2009).

[4] The name of the ministry has changed as the Ministry of Food, Agriculture and Livestock (MFAL) by the Turkish Council of the Ministers in 2011.

There are three axes within the IPARD programme. The first is to contribute to the sustainable adaptation of the agricultural sector and to develop market efficiency. This axis aims to have investments in agricultural holdings, processing and marketing of agriculture and fishery products to adhere to the EU standards. It also intends to promote the establishment of producer groups. The second is to prepare for the implementation of agri-environment and local development strategies. The third focuses on the development of rural areas and its measures are the enhancement of rural infrastructure, improvement and diversification of the rural economy and training (MARA, 2007; Kasikci, 2009). The programme developed in two phases: the first is 2007-2009 and the second phase is 2010-2013. The first and the third axes are applied in the first phase of IPARD, while the second is implemented in the second phase. During the programme, technical assistance is also provided to monitor and evaluate the programme's progress.

	Public expenditure			
	Total (million €)	**EU contribution (%)**	**EU contribution (million €)**	**Share (%)**
Axis 1 - Enhancing market efficiency and implementation of the EU standards	154.955	75	116.216	73
Axis 2 - Preparations for implementation of the agri-environmental and local development actions [1]	-	-	-	-
Axis 3 - Improvement of rural areas	53.066	75	39.800	25
Technical assistance	3.980	80	3.184	2
Total	212.001		159.200	100

Note:
1. [1]Axis 2 measures will be developed in detail and represented to the Rural Development Committee for approval in a future period.

Table 3.2 Expenditures of the IPARD Programme for Turkey, 2007-2009.

Source: OECD (2011b).

Finally, the IPARD programme gives attention to milk, meat (red and poultry), fish, and fruit and vegetable sectors. Also, investments for environmental issues are in manure storage, waste treatment and waste water, energy saving and improved irrigation systems. Regarding diversification of the rural economy, the programme concentrates on the development in on- and off-farm activities in bee-keeping, medicinal and aromatic plants, ornamental plants, local products and microenterprise development of traditional crafts, rural tourism and aquaculture (MARA, 2007).

3.2.8.3. The Ninth Development Plan (2007-2013)

Development plans have been applied to ensure social and economic development of the country since 1963 by the SPO. The Ninth Development Plan covers the period from 2007 to 2013. The plan has defined five development axes to maintain economic growth and social development. These are increasing competitiveness, providing regional development, increasing employment, strengthening human development and social solidarity, and raising quality and effectiveness in public services. Furthermore, the plan emphasises building an essential institutional framework for the adaptation of the EU rural development policies and to manage effectively the EU pre-accession funds to achieve the five development axes. It also aims to employ the National Rural Development Plan which is financed by national and international sources in the direction of the National Rural Development Strategy (NRDS) (MARA, 2007).

3.2.8.4. Agriculture Strategy (2006-2010)

The Agriculture Strategy, which covers the period 2006-2010, emerged as a result of the developments in the sector and the need to advance reform initiatives in 2004. The strategy focuses on agricultural development following the framework of national strategies and purposes, and EU integration. It works as the fundamental for legislative arrangements in the agricultural sector. The major object of the strategy is to generate a sustainable, highly competitive and organised agriculture sector in terms of economic, social, environmental and international development aspects (MARA, 2007).

Agricultural support instruments for 2006-2010 were determined in the context of strategic aims. The Agriculture Strategy also mirrors the objectives of the IPARD, especially in the development of product quality and food safety, improvement of the marketing chain, strengthening of producer competitiveness, increasing rural incomes, and enhancement of rural living conditions (MARA, 2007).

3.2.8.5. National Rural Development Strategy (NRDS)

The National Rural Development Strategy (NRDS) was set-up in compliance with the EU standards within the framework of accession. It has a complete policy framework for rural development and adheres to the National Development Plans (OECD, 2011b). The key goal of the NRDS is to develop and provide sustainable living and working conditions in rural society in coherence with urban areas, on the basis of using effectively local sources and potential, and preserving the rural environment and cultural inheritance. The four strategic objectives are (MARA, 2007):

- Economic Development and Augmenting Job Opportunities
- Consolidating Human Resources, Organisation Level and Local Development Capacity
- Refining Rural Physical, Infrastructure Services and Life Quality
- Protection and Enhancement of Rural Environment

The NRDS works in line with the Agriculture Strategy and targets a broader social objective, while the Agriculture Strategy aims at a sectoral objective. By addressing the demands of agriculture and wider requirements of the rural community in a sustainable way, the NRDS employs an integrated and consistent approach for rural development (MARA, 2007). The NRDS is also in harmony with the Ninth Development Plan in terms of the objectives (Axis 1: "increasing competitiveness and improving the efficiency of agricultural structures"; "increasing employment" and "ensuring regional development"), which integrate the sectoral and territorial sides of rural development. The NRDS also highlights the need to focus on the current regional development inequalities and instabilities in rural areas (OECD, 2011b).

Finally, a "Rural Development Plan", instituted in August 2010 and covering the period between 2010 and 2013, targets the familiarising of stakeholders with the rural development subject via monitoring the actions of the government agencies engaged in the practice of rural policies (OECD, 2011b).

3.2.8.6. The Tenth Development Plan (2014-2018)

The latest five-year plan, the Tenth Development Plan, was approved in July 2013 by the Turkish government for the period 2014-2018. The plan comprises mainly of four development axes to provide a higher welfare level. These are providing steady economic growth and innovative production, strengthening human development and society, enhancing liveable spaces and sustainable environment, and participating international cooperation. While following the development axes, the plan aims by 2018 to decrease the unemployment rate to 7.2 per cent (8.8 per cent in 2013), to reach an economic growth rate of 5.9 per cent (4 per cent in 2013) and to increase exports to 277.2 billion dollar (157.8 billion dollar in 2013). Moreover, it estimates that agriculture will obtain 12 per cent share of the public fixed capital investments (10.2 per cent in the Ninth Development Plan) and agriculture’s share of GDP will be reduced to 6.8 per cent (7.7 per cent in 2013) within the period 2014-2018 (MD, 2013).

3.3. Agricultural Trade Policies

3.3.1. Tariffs

The liberalisation of agriculture has made slow progress but complies with the obligations in the terms of the Uruguay Round Agreement on Agriculture (URAA). Tariffs are the major policy instrument for agricultural trade policies in Turkey. After the URAA entered into force in 1995, tariff bindings fell by an average of 24 per cent over a decade with a minimum 10 per cent decrease per tariff line. The products on which Turkey decided to reduce by a minimum 10 per cent were several animal products, tea, most grains, flours and cereal preparations, some vegetables and nuts, sugar and unprocessed tobacco. There is a tariff acceleration on some commodities such as “edible vegetable and preparations” whilst a negative acceleration is on some important processed agricultural products (processed diary, meat and grain products). For instance, the tariff rates in 2009 for “meat and edible offal” (HS chapter 02) was

136.8 per cent, but for “processed meat products” (HS chapter 16) it was 100.8 per cent. Also, within the same year for some grain products (HS chapter 11) it was 39.5 per cent, while it was just 9.6 per cent for processed products (HS chapter 19) (OECD, 2011b).

When the tariff protection level is compared between agricultural and non-agricultural sectors, tariff protection in agricultural products is significantly higher than in non-agricultural products. The simple average, applied MFN tariff rates across all agricultural products were 59 per cent in 2007, 46 per cent in 2009 and 50 per cent in 2010 (see table 3.3). Tariff rates on some dairy and meat products were higher than 100 per cent in 2010, and sugar, cereals, and preparations of vegetables, fruit and nuts also have high tariffs (OECD, 2011b; OECD, 2011a).

Imports of live animals for breeding purposes, cotton, raw hides and skins are duty free. Turkey generally implements a restricted import policy for livestock products, but the government partially removed the import ban for live cattle and beef meat due to high prices for red meat in 2009 (OECD, 2011b).

(Code) Product Description	2007	2009	2010
(1) Live animals	46	44	54
(2) Meat and edible meat offal	138	137	138
(4) Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	98	109	119
(5) Products of animal origin, not elsewhere specified or included	3	2	3
(6) Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage	17	18	18
(7) Edible vegetables and certain roots and tubers	21	21	21
(8) Edible fruit and nuts; peel of citrus fruit or melons	45	42	44
(9) Coffee, tea and spices	38	38	39
(10) Cereals	48	52	52
(11) Products of the milling industry; malt; starches; insulin; wheat gluten	40	40	40
(12) Oil seeds and oleaginous fruits; misc. grains, seeds and fruit; industrial or medicinal plants; straw and fodder	17	18	17
(13) Lac; gums, resins and other vegetable saps and extracts	4	4	4
(14) Vegetable plaiting materials; vegetable products not elsewhere specified or included	0	0	0
(15) Animal or vegetable fats and oils and their by products; prepared edible fats; animal or vegetable waxes	22	18	22
(16) Preparation of meat, fish, crustaceans, molluscs or other aquatic invertebrates	101	101	118
(17) Sugar and sugar-based confectionery	71	78	114
(18) Cocoa and cocoa preparations	8	8	67
(19) Preparations of cereals, flour, starch or milk; pastry cooks' products	9	10	49
(20) Preparations of vegetables, fruit, nuts or other parts of plants	54	55	55
(21) Miscellaneous edible preparations	12	12	12
(22) Beverages, spirits and vinegar	40	41	41
(23) Residues and waste from the food industries; prepared animal fodder	9	9	9
(24) Tobacco and manufactured tobacco substitutes	36	24	36
(41) Raw hides and skins (other than fur) and leather	2	2	0
(5002) Raw silk, wool and flax	0	0	0
(51) Wool, fine or coarse animal hair; horsehair yarn and woven fabric	4	4	0
(5201) Cotton, not carded or combed	0	0	0
(5301) Raw flax and hemp	0	0	0
(5302) Other WTO-agricultural products	-	6	6
All WTO agricultural products	**59**	**46**	**50**

Table 3.3 Applied MFN Tariffs on Agri-food Products by HS2, 2007-2010, % (simple averages).

Source: OECD (2011b).

3.3.2. Sanitary and Phytosanitary Measures

According to the WTO Agreement, sanitary and phytosanitary (SPS) measures are applied on domestic and imported live animals, and animal and plant products. The Production, Consumption and Inspection of Food Law, enforced in 2004, aims to provide food safety, hygienic production and food packaging materials, to protect public health, to establish the minimum technical and hygienic criteria for farmers, and to organise norms for monitoring production and distribution. The relevant authority for the safety of imported and domestic products is the MFAL which controls the inspection and quarantine services. Turkey also decides which countries are eligible to import live animals into the country in accordance with the World Organisation on Animal Health (OIE) disease notifications (OECD, 2011b).

3.3.3. Export Subsidies

The main purpose of export subsidies is to improve the potential of Turkish exports in processed agricultural commodities. Under the WTO commitments, 44 agricultural product groups are eligible to receive export subsidies. However, only 16 product groups were granted export support in 2010 due to budget constraints including fresh and processed fruit and vegetables, derived food products, poultry meat and eggs (see table 3.4). The subsidies are determined at 10-20 per cent of the export values, and apply to between 14 and 100 per cent of the eligible product exports. The export subsidies are provided to exporters as reductions in their payments such as taxes, the cost of social insurance premiums, telecommunications and energy. Furthermore, producers have the right to benefit from export credits and these credits are offered to all sectors (OECD, 2011a; OECD, 2011b).

Product	Rate (USD per tonne)	Share of exported quantity eligible for the subsidy (%)
Cut flower (fresh)	205	37
Vegetables, frozen (excluding potatoes)	79	27
Vegetables (dehydrated)	370	20
Fruits (frozen)	78	41
Preserves, pastes	75	51
Honey	65	32
Homogenised fruit preparations	63	35
Fruit juices (concentrated)	150	15
Olive oil	80	100
Prepared and preserved fish	200	100
Poultry meat (excluding edible offal)	186	14
Eggs	15[1]	65
Preserved poultry meat products	250	40
Chocolate and other food preparations containing chocolate	119	48
Biscuits, waffles	119	18
Macaroni, vermicelli	66	32

Note:

1. [1] per 1 000 pieces.

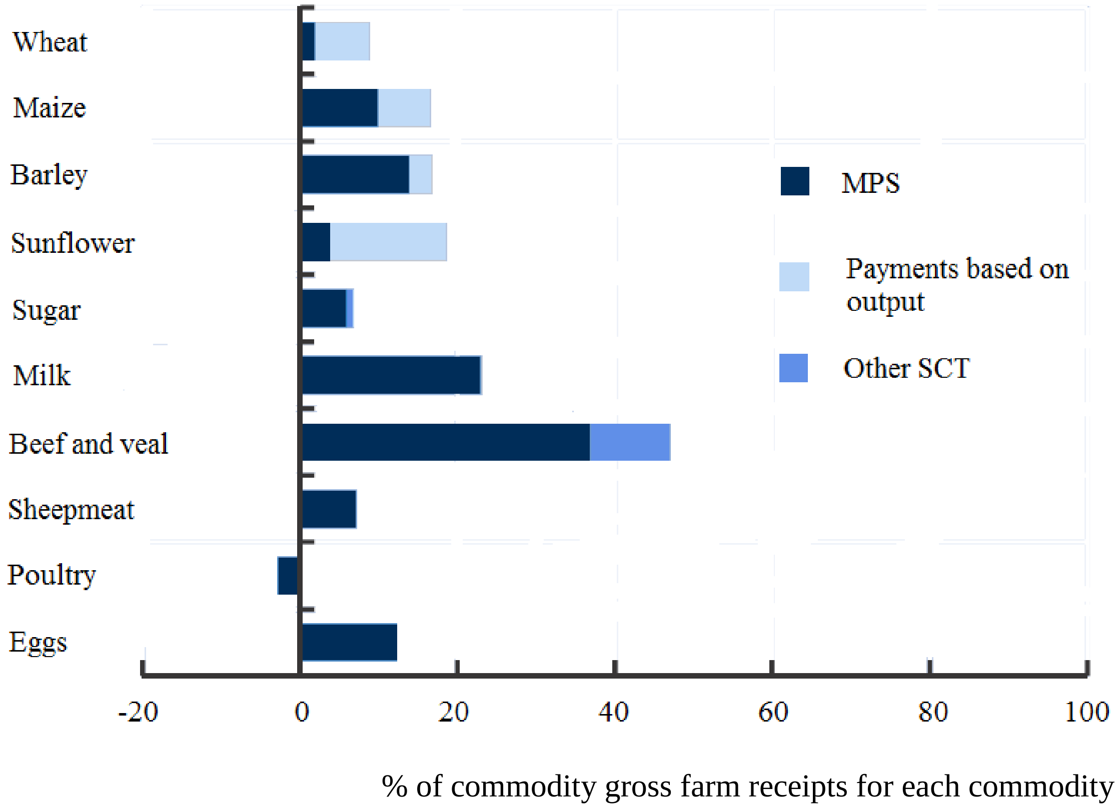
Table 3.4 Export Subsidy Rates, 2010.

Source: Author [based on data from OECD (2011b)].

3.3.4. Total Support to the Agricultural Sector

Agricultural support estimates for Turkey are given in table 3.5. According to recent OECD figures, the Producer Support Estimate (PSE) in 2011 was 22 per cent (18 per cent in the EU-27) and the Total Support Estimate (TSE) was 2.45 per cent of GDP (0.70 per cent in the EU-27). In a longer term perspective, the PSE rose by 4 percentage points from 1986-1988 to 2008-2010, which is higher than the average of OECD countries (OECD, 2013a).

The most production and trade distorting policies (based on commodity output and variable input use - without constraints) are calculated as 99 per cent of the producer support in 1986-1988, while it was 85 per cent in 2010-2012. During 2010-2012, the prices received by producers in domestic market were approximately 19 per cent greater than in the world market. Also, general services support supplied to agriculture was 4.2 per cent in 2010-2012 and the share of total support in GDP stayed around 2.54 per cent in 2010-2012 with little difference from the period 1986-1988 (OECD, 2013a).



Note:

1. MPS: Market Price Support, SCT: Single Commodity Transfers.

Figure 3.1 Producer Single Commodity Transfers by Commodity, 2010-2012.
Source: OECD (2013a).

In 2010-2012, milk and beef obtained the highest share in Market Price Support (MPS) (24 and 36 per cent, respectively) while poultry (-5 per cent) had the minimum. Also, the highest payments based on output were for sunflower with 16 per cent (see figure 3.1). The support level rose in 2012 by reason of higher budgetary payments (especially from a rise in concessional loans and payments for enhancement in livestock), and also the growth in the payment amounts. Finally, an increase occurred in the share of single commodity transfers (SCT) from 78 per cent to 85 per cent of producer support between the period 1986-1988 and 2010-2012 (OECD, 2013a).

	1986-88	2010-12	2010	2011	2012p
Producer Support Estimate (PSE)	**4**	**30 529**	**32 327**	**29 357**	**29 904**
Support based on commodity output	3	25 192	28 085	24 211	23 280
Market Price Support (MPS)	3	22 767	25 975	21 776	220 555
Payments based on output	0	2 425	2 110	2 434	2 730
Payment based on input use	1	2 654	1 826	2 499	3 636
Based on variable input use	1	674	369	568	1 085
Based on on-farm services	0	22	22	22	22
Percentage PSE	**20**	**24**	**26**	**22**	**22**
Producer NPC	**1.21**	**1.19**	**1.28**	**1.19**	**1.09**
Producer NAC	**1.26**	**1.31**	**1.36**	**1.29**	**1.29**
General Services Support Estimates (GSSE)	**0**	**1 364**	**1 557**	**2 390**	**144**
GSSE as a share of TSE (%)	7.2	4.2	4.6	7.5	0.5
Consumer Support Estimate (CSE)	**-3**	**-16 554**	**-24 655**	**-17 236**	**-7 771**
Percentage CSE	-19	-16	-24	-17	-7
Consumer NPC	1.26	1.21	1.34	1.21	1.08
Consumer NAC	1.24	1.20	1.32	1.21	1.08
Total support Estimate (TSE)	**4**	**31 893**	**33 884**	**31 747**	**30 048**
Percentage TSE (expressed as share of GDP)	3.71	2.54	3.08	2.45	2.10
GDP deflator 1986-88 = 100	100	441 574	406 815	442 926	474 982

Note:

1. p: Provisional, NPC: Nominal Protection Coefficient, NAC: Nominal Assistance Coefficient.

Table 3.5 Estimates of Support to Agriculture in Turkey (Million TL).

Source: OECD (2013a).

3.4. Summary

The agricultural support instruments in Turkey include direct income support, deficiency payments, compensatory payments, transition payments, animal husbandry support scheme, agricultural insurance support scheme, investment incentives, and rural development programmes and projects. With five-year plans, Turkish agricultural policies have concentrated on accessibility and stability in food supply, improving output and yield, augmenting self-sufficiency, taking advantage of export capability, supplying steady and sustainable income levels in the sector and encouraging rural development. The Turkish agricultural sector is financed by central budget and state-owned banks. Ziraat bank is the main provider of loans, payments and credits. Some of the payments are for the products having domestic supply shortage (deficiency payments), causing income losses (compensatory payments), and being cultivated as alternative crops (transition payments). Supports to the agriculture sector are also made by development programmes and projects such as ARIP and IPARD.

Agricultural trade policies include tariffs, sanitary and phytosanitary measures, and export subsidies. Tariffs are the major trade policy instrument and the tariff protection level in the agriculture sector is higher than in non-agricultural sectors. Tariff rates, especially on dairy and meat products, sugar, cereals and preparation of vegetables, and fruit and nuts, are particularly high. Export subsidies aim to improve agricultural exports in processed commodities. According to WTO commitments, 44 agricultural product groups are eligible to receive export subsidies. However, only 16 product groups were granted in 2010 due to budget constraints. Overall, the reforms are applied with the purpose of improving agriculture, but total support to the agricultural sector varies each year and is higher than in the EU and OECD countries. This creates a heavily protected sector and may cause distortions.

The next chapter analyses Turkish agricultural trade in the Euro-Mediterranean region. It focuses on the importance of Turkish agriculture in the Euro-Mediterranean area and discusses relationships in the region in terms of the trade agreements.

Chapter 4 . Agricultural Trade in the Euro-Mediterranean Region

4.1. Introduction

In previous chapters, the progress of the Turkish economy and agriculture sector have been summarised in relation to economic structure, agricultural production, trade and agricultural policies. It is clear that agriculture is a crucial sector for Turkey. It is also the main sector in almost every Mediterranean country, and trade in agricultural and food products is important because of continuing global liberalisation and wealth creation. Turkey is a strong trade partner and producer in terms of agriculture in the Euro-Mediterranean region. For Turkey, this region is also very significant. The agricultural trade statistics of Turkey show that 40 per cent of Turkish agri-food exports is with the Euro-Mediterranean countries. The proportion of total agricultural trade for Turkey is 34 per cent with the region. These numbers emphasise that the Euro-Mediterranean region is the major trade partner of Turkey. Some other countries or country groups are also crucial partners for Turkey, such as the USA and BRICS countries, but the Euro-Mediterranean countries' share is bigger and Turkey has signed various free trade agreements with these countries to compete in global trade. Therefore, the Euro-Mediterranean region is chosen in order to analyse the agricultural trade flows and the determinants of Turkish agricultural exports. To that end, this chapter first provides an overview of the Mediterranean basin and agriculture in section 4.2. Section 4.3 discusses agricultural trade in the Mediterranean region. Section 4.4 examines trade agreements in the Mediterranean region and section 4.5 discusses Euro-Mediterranean agricultural trade policies in detail. Finally, section 4.6 explains Turkish agricultural trade with the Union for Mediterranean Countries and section 4.7 summarises.

4.2. The Mediterranean Basin and Agriculture

The Mediterranean Basin comprises lands around the Mediterranean Sea and this extensive area covers temperate and tropical zones. Particular ecological circumstances in the region affect Mediterranean agriculture and, consequently, a large number of different products and quality are cultivated (Lobianco and Roberto, 2006).

Agriculture is a crucial sector in this region in social and economic terms. For many Mediterranean countries, it is a key source of income and employment. The total population of the region, except Mediterranean coastal EU members, was nearly 304 million in 2012. More than half of the population is accounted for by Egypt and Turkey (approximately 81 million and 74 million, respectively). The rural share of the total population is high in Mauritania with 58 per cent in 2012, followed by Egypt with 56 per cent, Bosnia and Herzegovina with 51 per cent and Slovenia, which is an EU member, with 50 per cent (WB, 2013).

The GDP of each country shows how significant agriculture is economically in the region. The share of agriculture in GDP differs by country, but on the whole is quite high. In 2009, the highest share was in Syria with 21 per cent, followed by Albania (20.7 per cent) and Morocco (16.4 per cent), while the lowest was 1.7 per cent in France (WB, 2013). According to 2012 estimates, Albania had the highest with 20 per cent and followed by Syria (16.5 per cent) and Morocco (15.1 per cent). France did not lose her position in having the lowest agricultural share in GDP with 2 per cent in 2012 (CIA, 2013).

4.3. Agricultural Trade in the Mediterranean Region

Countries in the Mediterranean region can be divided into two groups. One comprises the Member States of the EU (Cyprus, France, Greece, Italy, Malta, Slovenia, and Spain) on the northern side and the other is the Mediterranean Partner Countries (MPCs) (Albania, Algeria, Bosnia and Herzegovina, Croatia[5], Egypt, Israel, Jordan, Lebanon, Mauritania, Monaco, Montenegro, Morocco, Syria, the Palestinian Authority, Tunisia, and Turkey) on the southern and eastern sides. Total trade (imports and exports) in the MPCs[6] was EUR 636.3 billion in 2012, and the first three major trade partners of the MPCs were the EU-27 with 41.5 per cent, the USA with 8.4 per cent and China with 7 per cent. Within the EU-27, France, Germany and Italy are the most important trade partners for the MPCs. Also, MPCs imported 41 per cent of their products from the EU-27, while exporting 42.3 per cent of their products to the EU-27 (Kavallari, 2009; EUROPA, 2013b).

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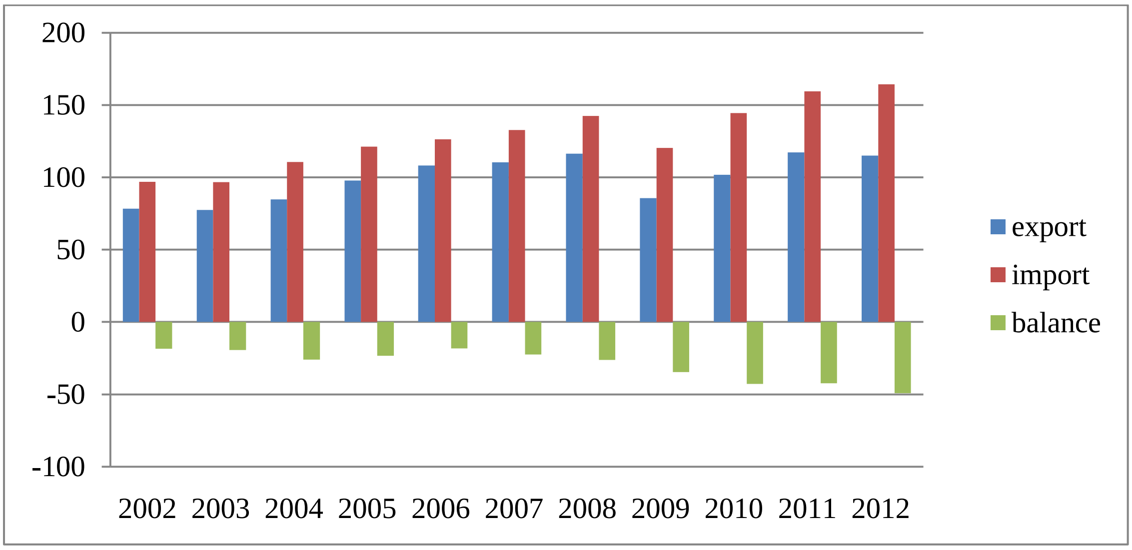
[5] Croatia joined the EU on 1 July 2013.
[6] Monaco is not included.

According to the European Commission (2013c), although the MPCs are important trade partners for the EU-27, they are less important than the BRIC (Brazil, Russia, India, China) (26.5 per cent), the USA (14.3 per cent) and EFTA (11.4 per cent). In 2012, the MPCs had just a 4.8 per cent share of EU-27 trade and the EU-27 bought 4.1 per cent of its imported products from MPCs, whilst exported 5.5 per cent of its products to the MPCs. Therefore, the EU markets can be seen as a centre of attraction for the MPCs.

There is heterogeneity within the MPCs since some countries have a high share in trade with the EU-27 while others have a much lower proportion. For instance, in 2012, Montenegro and Bosnia and Herzegovina exported 74 and 69 per cent of their exports to the EU-27, whilst for Algeria it was just 1.2 per cent. Similar differences exist for imports.

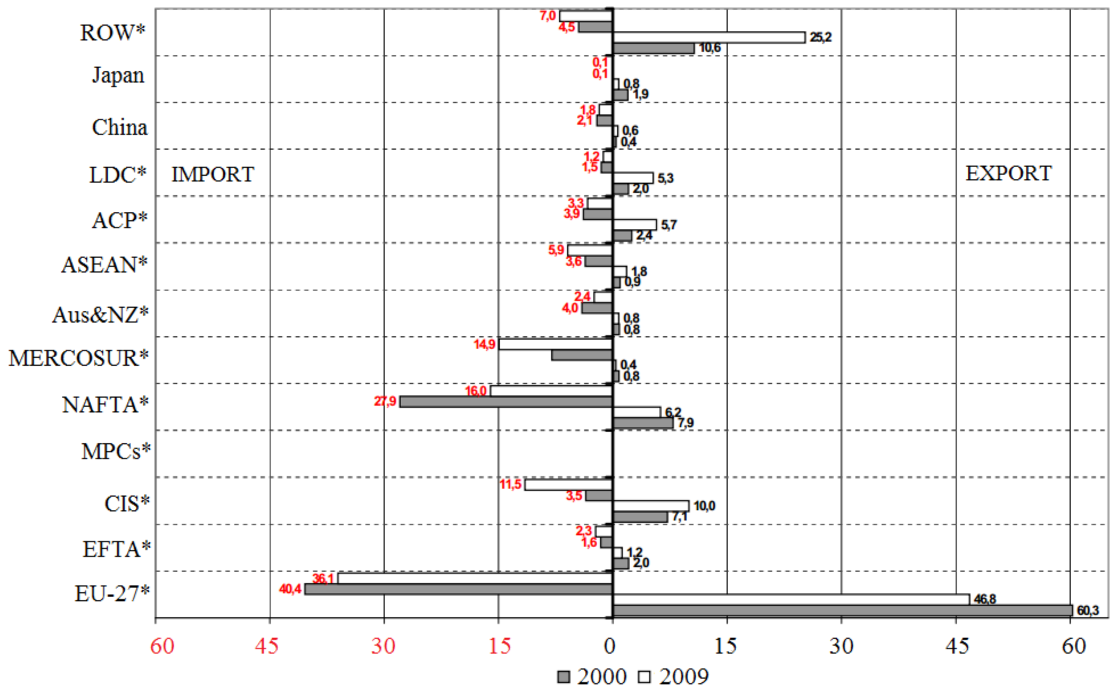


Note:

1. Data is deflated by GDP deflator for the EU obtained from USDA database, (2005=100).

Figure 4.1 MPCs' Trade with the EU-27 in Constant Prices (Billion €), 2002-2012.
Source: Author [based on data from EUROPA (2013c)].

Although the value of MPCs trade with the EU-27 increased from EUR 175 billion to EUR 279 billion between 2002 and 2012, a reduction occurred in 2009 due to the 2008/2009 world economic crisis (see figure 4.1). This decrease was observed especially in exports (from EUR 116 billion to EUR 85 billion), but there is still a growth of EUR 67 billion in the total volume of imports from the EU-27 by the MPCs from 2002 to 2012. After 2009, the trade values between MPCs and the EU-27 continued to increase and reached EUR 279 billion in 2012 (EUROPA, 2013c).



Import € Mio- 2000: 17.646; 2009: 27.191 Export € Mio- 2000: 7.455; 2009: 14.472

Notes:

1. *: excluding all intra-trade.
2. Mauritania and Monaco are excluded from the MPCs while Ceuta and Melilla, and Gibraltar are included.

Figure 4.2 MPCs: Agricultural Trade by Origin and Destination (%), 2002-2009.
Source: EUROPA (2010a).

Food and agricultural products constitute only a small part of total Euro-Mediterranean trade. The most significant trade partner for the MPCs is the EU-27 because almost half of their agricultural exports are delivered to EU-27 countries. In terms of imports, the EU-27 is also the main trade partner for MPCs, and NAFTA is the second most important with a share of 16 per cent. Since 2000, the EU's share of the MPCs' agricultural trade has fallen slightly. In 2009, 46.8 per cent of MPCs exports were exported to the EU-27, while this amount was 60.3 per cent in 2000 (see figure 4.2). Between 2000 and 2009, a similar reduction to the EU's share in the MPCs' exports occurred in imports from 40.4 per cent to 36.1 per cent (EUROPA, 2010a).

Agricultural trade between the EU-27 and MPCs highlights a specialisation in three main products, namely cereals, dairy, and edible fruits and vegetables. The most important MPCs' imports are cereals (21.3 per cent) and dairy products (9.4 per cent). In addition, particularly final products are imported from the EU-27. MPCs' exports to the EU-27 are much more distinct (see table 4.1). Almost 60 per cent of agricultural commodities are fresh or processed fruit and vegetables (EUROPA, 2013a). The most significant products among them are citrus fruits (especially oranges), walnuts (entirely from Turkey) and tomatoes. Furthermore, 66 per cent of Tunisian exports are from olive oil, 27 per cent of exports from Morocco are fish and seafood products, and in terms of fruits, Turkey accounts for 42 per cent of exports (Jacquet et al., 2007; Kavallari, 2009). The specialisation in fruits and vegetables for MPCs reflects comparative advantages, especially for tomatoes, oranges and olive oil (Nilsson, Lindberg and Surry, 2007). However, they have always been one of the most delicate goods in WTO trade negotiations because of the strong competition between MPCs and Mediterranean coastal EU countries (EUROPA, 2007). This competition between the countries originates from producing similar products and creates simultaneous trade between partner countries for the same kind of goods. This 'two-way' trade helps countries to specialise in differentiated products and with their liberalisation process. When there is an increase in the share of differentiated goods, a larger trade volume generally occurs. Table 4.1 gives exports and imports of agricultural commodities between Mediterranean partner and EU-27 countries. We can see the exchange of similar products belonging to same categories in the table, such as "live trees and other plants", "oil seeds and oleaginous fruits" and "animal or vegetable fats and oils".

Furthermore, in terms of MPCs' imports, cereals reached EUR 3,006 million in 2011, more than double that of 2002, while vegetables, fruits and nuts exports increased nearly EUR 1 billion during this decade. Generally, trade of other commodities between these two groups did not change greatly. The main markets for MPCs' exports are Germany, France and the Netherlands, and the biggest exporter is Turkey, accounting for more than half of the total MPCs' agricultural exports to the EU in 2009, followed by Morocco and Israel (Kavallari, 2009).

Value: Mio Ecu / €	MPCs Exports to EU-27		MPCs Imports from EU-27	
	2002	**2011**	**2002**	**2011**
01 - Live animals	19	10	381	771
02 - Meat and edible meat offal	27	40	243	677
04 - Dairy produce	41	17	1 190	1 332
05 - Products of animal origin	125	133	37	57
06 - Live trees and other plants	225	157	99	134
07 - Edible vegetables, roots & tubers	957	1 267	330	435
08 - Edible fruits & nuts	1 851	2 123	264	380
09 - Coffee, tea, mate & spices	64	72	61	110
10 – Cereals	152	249	1 272	3 006
11 - Products of the milling industry	12	17	308	162
12 - Oil seeds & oleaginous fruits	206	258	216	480
13 - Lacs, gums, resins & other veg. saps	28	24	39	54
14 - Vegetable products n.e.s.	18	16	1.8	2.0
15 - Animal or vegetable fats & oils	110	254	501	416
16 - Preparations of meat	27	27	115	105
17 - Sugars & sugar confectionery	297	424	797	412
18 - Cocoa & cocoa preparations	31	33	252	483
19 - Preps. of cereals, flour, starch, etc.	90	152	443	809
20 - Preps. of vegetables, fruits, nuts & plants	689	935	299	373
21 - Miscellaneous edible preparations	178	293	534	834
22 - Beverages, spirits & vinegar	132	181	688	795
23 - Residues and waste from food industry	47	78	268	481
24 - Tobacco & tobacco products	231	157	424	817
Other WTO products outside chapters 1-24	453	304	852	981
Total Agricultural Products	**6 008**	**7 220**	**9 613**	**14 108**
- Commodities	735	607	1 650	3 455
- Confidential trade	8.4	3.1	150	61
- Final products	4 266	5 244	4 328	6 527
- Intermediate	956	1 290	3 007	3 365
- Other products	43	75	479	699
Total All Products	**93 181**	**121 596**	**112 362**	**166 134**
% Prod. agri. / all products	7.0	4.9	9.4	7.0

Note:

1. Mauritania and Monaco are excluded from the MPCs while Ceuta and Melilla, and Gibraltar are included.
2. Data is deflated by GDP deflator for the EU obtained from USDA database, (2005=100).

Table 4.1 Agricultural Trade Statistics between MPCs and EU-27 in Constant Prices, 2002-2011.

Source: Author [based on data from EUROPA (2013a)].

4.4. Trade Agreements in the Euro-Mediterranean Region

Regional, bilateral and multilateral trade agreements are held by the majority of countries and each takes a long process which can result in ambiguous consequences. In these negotiations, agriculture is a key sector with special treatment and therefore there is potential for more ambiguity. Trade agreements in the region commenced with the Global Mediterranean Policy in 1976 which was modified to revive economic collaboration and integration after Spain, Greece and Portugal became members of the EU (Petit, 2006). In 1995, 12 Mediterranean countries (Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, the Palestinian Authority, Syria, Tunisia, and Turkey) and 15 EU members met in Barcelona and aimed to create a common area of calm, constancy, and shared prosperity in the Euro-Mediterranean region by generating a Euro-Mediterranean Free Trade Area (EMFTA) by 2010 (EUROPA, 2010b). The general objective of this process in the Barcelona Declaration is:

"Turning the Mediterranean region into an area of dialogue, exchange and co-operation guaranteeing peace, stability and prosperity requires strengthening of democracy, and respect for human rights, sustainable and balanced economic and social development, measures to combat poverty and promotion of greater understanding between cultures which are all essential aspects of the partnership."

The Barcelona Process was designed on the basis of three main grounds: a "political and security partnership", an "economic and financial partnership", and a "social, cultural and human partnership" (La Grò, 2003). According to La Grò (2003), the Barcelona Process commenced with the aim of stabilising the relations between Mediterranean countries and the EU in relation to the EU's eastern enlargement. Another consideration was to generate constancy and better welfare for the area in order that the immigration streams from Southern Mediterranean to Europe could be averted. Also, it aimed to re-determine the EU's position in the Mediterranean region after the Cold War[7].

With the formation of Union for the Mediterranean, the Barcelona Process was altered in 2008. Today, the partnership consists of 28 EU and 15 Mediterranean countries

[7] The Cold War, dated from 1947 to 1991, was a political and military tension between the Western bloc (dominated by the USA) and the Eastern bloc (dominated by the Soviet Union).

(Southern Mediterranean: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Monaco, the Palestinian Authority, Syria, Tunisia, and Turkey; Balkans: Albania, Bosnia-Herzegovina, Montenegro, Mauritania). The integration procedure has progressed but all countries in the Union are not at the same level in completing trade agreements. For example, the application level of agreements for Tunisia (1995), Israel (1995), Morocco (1996), and the Palestinian Authority (1997) are highly developed while Albania (2009), Lebanon (2006), Algeria (2005) and Croatia (2005) are comparatively new in terms of confirmation and implementation. Agreements with Bosnia and Herzegovina, Montenegro and Serbia have been signed, but not yet entered into (see table 4.2) (IEMed, 2010). At the same time, the Doha Development Agenda may extend universal trade liberalisation and occasion additional modifications in Euro-Mediterranean Trade arrangements. Nevertheless, postponements in the Barcelona Process demonstrate the existing complications and severe arguments over some particular sectors, particularly agriculture (EUROPA, 2006b).

The liberalisation of agriculture is significant on account of two main rationales. First, agriculture is the keystone for a large majority of the Mediterranean economies and having an opportunity of freer trade with crucial trading partners provides an incentive for the region. In spite of the increase in agricultural trade in recent years, more could be achieved in agricultural trade if the protection level of the important trading partners were decreased. Secondly, non-EU Mediterranean countries may have a comparative advantage in agriculture vis-a-vis EU members. Hence, the possibility of trade expansion in the area may be unfavourable for Southern EU countries, especially in fruit and vegetable products (Nilsson, Lindberg and Surry, 2007). However, the rate of trade liberalisation in the agricultural sector has been very slow for more than a decade, since the sector has not been encompassed in the free trade zone. Also, the financial supplies[8] apportioned among MPCs are very limited in comparison to the resources transferred to the new EU members to assist in their improvement. Thus, heavy structural restrictions arise inside the MPCs (Petit, 2006).

[8] The European Commission, the European Investment Bank, the InfraMed Infrastructure Fund and the World Bank contribute to the Union for the Mediterranean.

Med Country	Start of Negotiations	Agreement Concluded	Entry into Force
Algeria	June 1997	December 2001	September 2005
Egypt	March 1995	June 1999	June 2004
Israel	December 1993	September 1995	June 2000
Jordan	July 1995	April 1997	May 2002
Lebanon	November 1995	January 2002	April 2006
Morocco	December 1993	November 1995	March 2000
Palestinian A.	May 1996	December 1996	July 1997
Syria	March 1998	Oct. 2004/Dec. 2008	-
Tunisia	December 1994	June 1995	December 1997
Turkey*	July 1959	September 1963	January 1996
Albania	January 2003	June 2006	April 2009
Bosnia & H.	November 2005	June 2008	-
Croatia	November 2000	October 2001	February 2005
Montenegro	Oct. 2005/Jul. 2006	October 2007	-
Mauritania	1978	1995	-
Libya	1978	2000	-

Note:

1. *Turkey shall be governed by the Customs Union Agreement (January 1996) until its accession to the EU.

Table 4.2 Euro-Mediterranean Association Agreements.

Source: Author [based on data from IEMed (2010) and EUROPA (2011)].

The EU has endeavoured to accelerate the Barcelona Process and the main aim is to further liberalise agricultural trade. A fresh approach, not covering sensitive products, has been tendered which gives prominence to agricultural trade liberalisation. While this situation gives researchers a challenge to evaluate possible economic risks for the sensitive products, nearly all Mediterranean countries have other multilateral, regional and bilateral trade agreements which makes economic evaluation more complicated (Petit, 2006). For example, the Agadir Agreement (2007) among Tunisia, Morocco, Jordon and Egypt, several free trade agreements signed by Israel and Turkey with Southern Mediterranean countries, and the WTO agreement (Petit, 2006; EUROPA, 2010b).

The major objectives for the future were determined at the 8th Union for the Mediterranean Ministerial Conference in 2009. The most important is to alter the Association Agreements and South-South Agreements to Euro-Mediterranean Free Trade Area by instigating further liberalisation negotiations on agricultural, processed agricultural and fisheries productions with the rest of Southern Mediterranean countries particularly relating to tariff and non-tariff trade barriers (EUROPA, 2010b).

4.5. Euro-Mediterranean Agricultural Trade Policies

The trade liberalisation policies are controlled by two bilateral instruments which are the result of negotiations between the EU and MPCs in the Mediterranean basin. The instruments are the bilateral Euro-Mediterranean Association Agreements (EMAA) and the European Neighbourhood Policy (ENP), and the regional aspect is intimately connected with bilateral negotiations. The EMAA, completed between 1998 and 2005, aims to remove tariffs and constraints on exchange of products, free trade applications, and develop private sector and internal marketing. Regarding the ENP (2003), it aims to obtain a better economic cooperation and integration between the MPCs and the EU and free movement of goods, services, capital and people. Apart from these instruments, trade policies also depend on the future of the WTO multilateral process. The MPCs have been interested in the existing WTO negotiations and the majority of them are members or candidate members. However, they have not embraced a general unified policy in the Doha round of negotiations (Zukrowska *et al*., 2008).

The Euro-Mediterranean Agreements have retained and improved only north-south connections and have showed a hub-and-spoke character. Thus, they have no organisational structure for south-south integration. Consequently, there is a need to create a real connection between the EU and the MPCs in terms of equality and mutuality. Since the Barcelona Agreement is functioned by the EU institutions, the adjudication process is governed by the EU instead of a co-decision procedure. The difficulty for the Euro-Mediterranean Free Trade Area in the proper sense is future south-south integration (Gavin, 2005).

Each one of the MPCs has acted to apply the WTO Agreement on Agriculture which makes a point of decreasing export subsidies, import duties and domestic support on agricultural commodities. They have obeyed diverse paths in evolving distinct policies to be able to integrate their agri-food sector into the freer trade market. For example, Israel employs these three commitments of the WTO Agreement to encourage its sector, whilst others have chosen more restricted methods to assist their agricultural sectors (García-Álvarez-Coque, 2006). However, there are still limitations on trade in agricultural products and barriers to liberalisation and the achievement of a truly Free Trade Area.

Free trade should provide a comparative advantage to the South Mediterranean countries on various commodities, especially in winter. However, many products face restrictions by reason of the CAP. The EU countries in the Mediterranean region worry about competing against MPCs' products especially fruits and vegetables. Consequently, tariffs in the EU market differ by produce, season and country of origin, and usually higher tariffs are applied to imported products which compete with local ones. Also, non-tariff barriers are exerted to protect EU Mediterranean countries such as quotas on agricultural imports. Some competitive commodities (cucumbers, figs, and grapes) which can be excessively produced by the MPCs are not under the preferential treatment. Furthermore, some characteristic products of the area which can be cost effective were not covered in the agreement, such as figs, cactus plants and pomegranates (Awwad, 2003).

Time quotas applied to the MPCs may cause the countries to select unsuitable products for the region. This leads to demand for more water and agrochemical-intensive applications. However, this condition is against environmentally and friendly agricultural production which is a principle of the agreement, and this system has not been implemented yet in the South Mediterranean countries. Therefore, while EU members have an increasing organic farming sector, MPCs farmers cannot benefit from it due to higher production costs, information deficiency on organic agriculture, and lack of suitable technologies (Awwad, 2003).

It is apparent that agricultural trade relations in the Mediterranean region are not clear and certain. In spite of the numerous trade agreements which are overlapping in some instances, trade flows are constructed on a north-south axis and controlled by the EU. The complexity and uncertainty must be eliminated by forthcoming reforms of the agricultural policies in the Euro-Mediterranean partnership to solve these obstacles and to create a freer trade area in the Mediterranean region.

4.6. Turkey in the Euro-Mediterranean Area

In terms of culture and geography, Turkey is at the crossroads of Europe, Asia, the Middle East, and the Mediterranean, and has an increasing significance as an economic and geopolitical power. There is an intense and enduring connection between Turkey and the EU. This relation started with Turkey's application for EU membership (then the European Economic Community) in 1959; Turkey signed an Association Agreement with the EU four years later. Following the CU Agreement which came into effect in January 1996, Turkey began to conclude free trade agreements with its trade partners (La Grò, 2003). At present, 19 FTAs are signed by Turkey, excluding 11 FTAs with Central and Eastern European countries which were subsequently abolished due to their EU membership. These agreements are with Albania, Bosnia and Herzegovina, Chile, EFTA, Egypt, Georgia, Israel, Jordan, Kosovo, Lebanon, Macedonia, Mauritius, Montenegro, Morocco, the Palestinian Authority, Republic of Korea, Serbia, Syria and Tunisia. A FTA was signed with Lebanon on 24 November 2010 but will enter into force after the necessary ratification processes are completed by Lebanon[9]. As to the FTA with Kosovo, signed on 27 September 2013, it will also come into force as soon as the necessary ratification processes are completed by both countries. Between 2002 and 2012, the overall rate of increases in exports and imports were 551 per cent and 280 per

[9] Turkey completed the ratification process on 20 April 2013.

cent, when trade with 15 countries[10], whose FTAs entered into force before 2013, is examined (RTME, 2013).

At the present time, the Barcelona Agreement constitutes the ENP which is directed at neighbour countries of the EU hoping for membership, yet the neighbours are also ambitious to attempt economic and political reformations (Kavallari, 2009). Turkey is a good example, but it encounters numerous political and economic difficulties to EU accession and this process may take until 2019. In spite of the delays and unclear progress, Turkey features in the Euro-Mediterranean movement of the EU. Also, it has been supporting the Euro-Mediterranean Partnership since its establishment. Within the scope of the membership arrangement, Turkey has a particular location between Northern Mediterranean countries (EU members) and the Southern Mediterranean countries (most of them were the colonies of some EU members) (La Grò, 2003; Greenhalgh and Karden, 2009). Besides having a good location in the region, Turkey has cultural similarities to most of the MPCs arising from sharing a common religion. This may affect consumers' preferences for agri-food products in these countries and hence might be expected to increase Turkish agricultural exports to the MPCs. Consequently, Turkey stands to gain from the future trade liberalisation in the Euro-Mediterranean area and this area is the second most significant market after the EU.

Turkey has signed FTAs with the MPCs and this condition might exist because of being a candidate for EU membership. In addition, Turkey has been a member of the Economic Cooperation Organisation (ECO) since 1992. Other members are Afghanistan, Azerbaijan, Iran, Kazakhstan, the Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan (Kavallari, 2009). Finally, another important agreement to be addressed is the EFTA. Turkey signed the agreement on December 1991 with the EFTA countries of Iceland, Liechtenstein, Norway, and Switzerland (EFTA, 1991).

Turkey also plays a crucial role in the region in terms of agricultural production. According to FAO (2013), Turkey is the biggest agricultural commodity exporter among MPCs. In the Euro-Mediterranean region, Turkey is ranked as the first producer in tomatoes and walnuts, while the second after the EU-27 in olive oils, figs, and potatoes. Turkey also provides nearly half of the MPCs' exports of agricultural products to the EU, followed by Morocco (20 per cent) and Israel (20 per cent) (Kavallari, 2009).

[10] Kosovo, Lebanon, Mauritius and Republic of Korea are excluded.

In Turkey, the cereals production (including rice) was 33.6 million tonnes in 2009, while the level of fruit and vegetables production was around 26.8 million tonnes which is equivalent to about 60 per cent of EU-27 fruit and vegetables production. For other crops, Turkey is also very competitive in world terms, especially in chickpeas, lentils, cotton, some qualities of sugar, tobacco and olive oil. However, tariff protection levels along with other import restrictions are high in livestock products (EUROPA, 2010c).

Turkey is an important agricultural exporter and her major trade partners are the EU-27, Mediterranean and Gulf region countries. Turkey has an agricultural trade surplus with these countries, especially with the EU-27 (1.3 billion Euros in 2010). However, lower preferences on agricultural products offered to Turkey are still a serious problem in bilateral relations (EUROPA, 2010c).

To sum up, Turkey plays a pivotal role in the area and this situation reveals a necessity for explicitly designed policies in the region. Moreover, the obstacles encountered in the bilateral liberalisation should be addressed to create a general economic improvement in Euro-Mediterranean countries.

4.7. Summary

This chapter discusses Euro-Mediterranean agriculture, the importance of agricultural trade for the Mediterranean countries, especially Turkey, trade agreements and policies in the region. It summarises that trade increasingly links countries in the Mediterranean region, and that agriculture is the main sector in almost every Mediterranean country. Therefore, forming trade agreements is important in terms of competing in global trade and economic liberalisation is in progress under the Union for the Mediterranean.

Furthermore, Turkey plays a crucial role in the Euro-Mediterranean region in terms of agricultural production. To increase exports in agricultural products, Turkey has also signed various agreements with the countries in the area. In this study, trade in Turkish agricultural products is the centre of the analysis. To investigate the determinants of Turkish agricultural exports in the Euro-Mediterranean region, the next chapter reviews some of the literature on the gravity model and empirical gravity models will be developed.

Chapter 5 . The Gravity Model in International Trade and Its Applications

5.1. Introduction

Previous chapters review agricultural trade between Turkey and the Euro-Mediterranean area and show Turkey's important role in terms of agricultural trade and her position in the Mediterranean region. In this thesis, trade patterns and the determinants of Turkish agricultural export flows to the Euro-Mediterranean countries are the focus of analysis. To this end, a gravity model is developed and empirically estimated due to its success in explaining international trade. In application of the gravity model, the main factors affecting a country's trade performance are the economic conditions of countries and transportation costs. Other important factors employed in this study are the similarity of size index for each country pair, relative factor endowments, common religion, the Turkish population living in the importer country, and membership in a free trade agreement. In the following sections, we will examine the econometric model and the factors influencing Turkish agricultural export flows to the Euro-Mediterranean countries in more detail.

This chapter is organised as follows. A background to the gravity model and its theoretical framework are introduced in section 5.2. This is followed in section 5.3 by a description of the core variables employed in gravity models. Section 5.4 discusses the hypotheses to be tested. Section 5.5 discusses the econometric model specifications used to examine the potential empirical determinants of agricultural trade flows between Turkey and the Euro-Mediterranean countries, and describes the data. The empirical models, including the hypotheses tests with panel data, are addressed in section 5.6. Finally, section 5.7 presents and discusses the results.

5.2. A Review of the Gravity Model

Modelling international trade flows has been extensively examined over the last three decades. Much of this research relates to trade flows and has used ex ante and/or ex post analysis. Ex ante analysis employs sector-specific or economy-wide models in general. Computable general equilibrium (CGE) and partial equilibrium models have been widely applied for simulating trade flows. On the other hand, ex post studies for modelling trade flows have been mainly based on the gravity model (Kavallari, 2009). Gravity models have been used in numerous studies to explain changes in trade volume between two countries, or country groups, over time. A large recent literature either provides modelling developments and refinements or tries to clarify policy impacts on trade.

The gravity model has been used widely to observe trade flows and has proved a successful econometric approach. The main idea behind it comes from Newton's gravity principle in physics which was applied to international trade by Tinbergen (1962). Newton's Law of Universal Gravitation proposed that two objects attract each other in proportion to their mass and in inverse proportion to their distance. The attractive force between two objectives i and j is shown by:

$$F_{ij} = G \frac{M_i M_j}{D_{ij}^2} \tag{5.1}$$

where F_{ij} is the attractive force, M_i and M_j denote the masses, D_{ij} is the distance between the two objects and G is a simple proportionality constant.

The gravity model was adopted to examine bilateral trade flows between countries by substituting the objects' masses by the economic size of countries. Therefore, the equation shows the relation between the economic sizes of two countries and the distance separating them. Initial explanations on this gravity trade model were presented by Linnemann (1966). He also incorporated population as a quantification of the economies' size which is now applied widely - the "augmented gravity model". The gravity model was an *ad hoc* model when first applied to international trade by Tinbergen (1962), because he borrowed the model from the Newton's gravity principle in physics and did not provide strong theoretical justification. In the late 1970s, theoretical clarification founded on economics, as opposed to physics, was first provided by Anderson (1979). He stated that the properties of expenditure systems can be used to obtain the gravity equation. In his study, the gravity model is derived by assuming Cobb-Douglas preferences. Subsequently, Krugman (1979), Bergstrand (1985; 1989), Helpman and Krugman (1985) and Deardorff (1998) introduced alternative foundations for the gravity model. Bergstrand (1989) employed monopolistic competition[11] in order to provide a theoretical foundation of the gravity model, while earlier Anderson (1979) had adopted a "product differentiation by place of origin"[12] approach. Helpman and Krugman (1985) also adopted the monopolistic competition approach by assuming increasing returns to scale. The literature develops a variety of gravity models and demonstrates its success in explaining determinants of trade patterns (see for example, Bergstrand, 1989; Harrigan, 2001; Evenett and Keller, 2002; Anderson and Van Wincoop, 2003).

In the augmented gravity model of trade, the export volume between pairs of countries, or country groups, is a function of their incomes, populations, geographical distance and a set of dummies to represent other factors. The trade flows equation is formulated as:

$$X_{ij} = \beta_0 Y_i^{\beta_1} Y_j^{\beta_2} N_i^{\beta_3} N_j^{\beta_4} D_{ij}^{\beta_5} A_{ij}^{\beta_6} u_{ij} \qquad (5.2)$$

where X_{ij} indicates the volume of exports from country i to country j, Y_i (Y_j) is income (GDP) of the exporter (importer), N_i (N_j) is exporter (importer) population, D_{ij} is the geographical distance between the two countries' capital (or economic centres), A_{ij} represents the other factors affecting the trade volume, and u_{ij} denotes an error term.

The multiplicative gravity model assumes a linear relationship between logged trade flows and economic factors by taking natural logarithms of equation (5.2) and this is the main gravity model used by many researchers to analyse the factors affecting trade flows:

$$ln\, X_{ij} = ln\, \beta_0 + \beta_1 ln\, Y_i + \beta_2\, ln\, Y_j + \beta_3\, ln\, N_i + \beta_4\, ln\, N_j + \beta_5 ln\, D_{ij} + \beta_6\, ln\, A_{ij} + ln\, u_{ij} \qquad (5.3)$$

[11] According to this approach, products are differentiated among producing firms.
[12] This is the Armington (1969) assumption in which each country specialises in producing only one product.

The variable for geographical distance is a proxy for transportation costs and there are different ways to measure bilateral distances in kilometres. A simple and common method is to employ direct distance which is calculated using latitudes and longitudes between the two major economic centres, the two most significant cities in terms of population or the capital cities. Another technique is the weighted distance which also calculates the distance between the largest cities of the two countries, but these are weighted by the share of the city's population in the entire country. Some studies also use distances between major seaports (Clark, Dollar and Micco, 2004; Blonigen and Wilson, 2006). It is assumed that the trade volume between trading partners is inversely proportional to their distance. This negative effect on bilateral trade is because long distances induce higher transport time, communication and costs and also increase product prices and thus diminish competitiveness. Studies such as Anderson (1979) and Bergstrand (1985; 1989) showed the negative impact of distance on bilateral trade flows.

In the model, the exporter and importer countries' GDP is supposed to have a positive effect on bilateral trade flows. GDP is a proxy for the economic size which generally determines a country's level of trade. Thus, countries with larger income tend to trade more, whereas smaller ones trade less. Research has shown that GDP variables have a positive and significant effect on trade flows (Tinbergen, 1962; Linnemann, 1966; Aitken, 1973; Bergstrand, 1985; Bergstrand, 1989).

The population variable is a proxy for the market size of a country. Its impact on bilateral trade flows is ambiguous. A majority of researchers justify a negative relationship between population and trade flows because a larger population denotes a larger domestic market and a more varied or a larger volume of products to fulfil home demand, and consequently less dependency on international specialisation (Linnemann, 1966; Aitken, 1973; Bikker, 1987; Endoh, 1999). However, Brada and Mendez (1983) showed that its effect is positive and statistically significant.

Regarding gravity model applications in the literature, few studies focus on Turkey. Sayan (1998), for example, looked at the determinants of trade flows in the Black Sea Economic Cooperation (BSEC) zone and a number of Middle East countries using panel data. Lejour and Mooij (2005) examined the possible trade impact of Turkish accession to the EU and calculated that the weighted average of bilateral trade between

Turkey and EU in all economic areas could rise by 34 per cent if Turkey were an EU member. Flam (2003) also indicated a greater growth (46 per cent) in total trade volume for Turkey after accession. Nowak-Lehmann *et al.* (2007b) investigated the sector-specific trade flows between Turkey and EU utilising panel data from 1988 to 2002. The study focused on the effect of increasing the CU between Turkey and the EU and the application of the CAP to Turkey. They also conducted simulations to measure the likely impact of the agricultural goods' inclusion into the CU which has not materialised yet.

Atici and Guloglu (2006) analysed Turkish fresh and processed fruit and vegetable exports to the EU using panel data from 1995 to 2001 for 13 EU countries, and economic size, EU population and Turkish population in the EU were important factors influencing Turkish exports. Erdem and Nazlioglu (2008) obtained similar results in their analysis covering 1996-2004: Turkey's agricultural exports to the EU were positively related to economic size, the importer population, the Turkish population in the EU member states and the CU agreement. However, Antonucci and Mazocchi (2006) analysed Turkish trade patterns over 1967-2001 and discovered that there is no evidence of supplementary trade between Turkey and the EU, even though Turkey and the EU have had the CU agreement since 1996. Finally, Atici *et al.* (2011) studied the results of Turkey's full integration into EU in terms of agricultural exports and found that income and population increased bilateral trade, while distance and protection levels have negative effects.

As for the Euro-Mediterranean area, a number of studies (Peridy, 2005; Emlinger, Lozza and Jacquet, 2006; Fazio, 2006; Kandogan, 2008; Karlaftis, Kepaptsoglou and Tsamboulas, 2009) focused on trade liberalisation employing gravity models. Peridy (2005) performed a quantitative evaluation of the EU-Mediterranean partnership and examined its implications for the new regional policy of ASEAN countries, and agreements increased the exports of Mediterranean countries to the EU by 20-27 per cent. Emlinger, Lozza and Jacquet (2006) studied the impediments of Mediterranean countries to access the EU market and compared this with the other EU countries by considering the relative impact of diverse trade costs. Fazio (2006) investigated the structure and dimension of economic integration between countries in the Euro-Mediterranean region. The author also identified the existence of trade blocs, observed their progress over time and calculated bilateral trade potentials for the forthcoming partners in the EMFTA. Kandogan (2008) introduced a modified triple-indexed gravity model to compute the trade creation and diversion impacts of preferential trade agreements in the Euro-Mediterranean area. Bensassi, Márquez-Ramos and Martínez-Zarzoso (2010) also studied the effects of preferential trade agreements on international trade and concluded that new FTAs have positive and significant effects on the exports of Mediterranean countries to the EU partners. Finally, Karlaftis, Kepaptsoglou and Tsamboulas (2009) developed a model to investigate FTA impacts on trade flows in the Mediterranean basin and found that FTAs affect the trade flows but comparatively little, considering other factors such as transport costs.

In some studies, cross sectional data have been used (derived from one year or an average of a period) (Aitken, 1973; Bergstrand, 1985; Oguledo and Macphee, 1994; Breuss and Egger, 1999; Buch and Piazolo, 2001; Porojan, 2001; Soloaga and Winters, 2001; Augier, Gasiorek and Lai Tong, 2005; Kucera and Sarna, 2006). However, most studies use panel data to examine trade flows (Zhang and Kristensen, 1995; Egger, 2002; Egger, 2004; Baltagi, Egger and Pfaffermayr, 2003; Filippini and Molini, 2003; Kurihara, 2003; Matyas, Konya and Harris, 2004; Carrere, 2004; Martinez-Zarzoso and Novak-Lehmann, 2004; Lampe, 2008; Hatab, Romstad and Huo, 2010; Teweldemedhin and Schalkwyk, 2010). Gravity models that use cross-sectional data have been criticised for producing inconsistent results. Furthermore, Matyas (1997), Cheng and Wall (1999), Breuss and Egger (1999), Egger (2000) and Nowak-Lehmann *et al.* (2007b) argue that panel data provide numerous advantages[13], such as the opportunity of catching connections among variables in time and monitoring individual impacts between trading partners.

5.3. Explanatory Variables

In many empirical studies of the gravity model, distance, GDP and population are used as explanatory variables. However, some researchers also include a wide range of other variables affecting the bilateral trade flows. Kepaptsoglou, Karlaftis and Tsamboulas (2010) claim that over 50 distinct explanatory variables are employed in empirical studies related with modelling trade flows between 1999 and 2010, including transport costs, labour costs, exchange rate, price changes, regional agreements, economic

[13] They will be discussed in more detail in section 5.6.

development, geographical connection, social and cultural connection, and trade policy changes. Table 5.1 summarises the most commonly-used variables in gravity models. In early studies, consensus was not reached in terms of which explanatory variables should be included. Many researchers prefer some particular variables for the purpose of their study and exclude others and this may cause omitted variable bias[14] (Anderson and Van Wincoop, 2003; Greene, 2008).

In our study, all the variables in table 5.1 can be included. There are also some other potential variables suitable for our study, such as farm subsidies, taxation, fertilisers consumption, climate change and water usage. However, considering the data availability and following the literature, the most suitable explanatory variables are chosen to empirically examine the factors that influence Turkey's agricultural exports to its Euro-Mediterranean partners. These are the exporter's (Turkey) and importer's economic size, geographical distance between Turkey and the importer country, the similarity of size index for each country pair, relative factor endowments, common religion, the Turkish population living in the importer country, and membership in a free trade agreement.

[14] In creation of a regression model, omitted variable bias occurs if one or more significant determinants are omitted because of ignorance or data unavailability. The omitted variable may bias the effect of other determinants in an Ordinary Least Squares (OLS) regression due to the misspecification.

Variable \ Reference	(Anderson, 1979)	(Bergstrand, 1985; Bergstrand, 1989)	(McCallum, 1995)	(Deardorff, 1998)	(Endoh, 1999)	(Rose, 2000)	(Soloaga and Winters, 2001)	(Anderson and Van Wincoop, 2003)	(Egger, 2002)	(Glick and Rose, 2002)	(Fukao, Okubo and Stern, 2003)	(Baltagi, Egger and Pfaffermayr, 2003)	(Kang and Fratianni, 2006)	(Melitz, 2007)	(Lee and Park, 2007)	(Iwanow and Kirkpatrick, 2007)	(Nowak-Lehmann *et al.*, 2007a)	(Kepaptsoglou *et al.*, 2009)
Adjacency		X						X										
Colony						X				X			X	X	X	X		
Common Border						X	X		X	X			X	X	X	X		
Common Currency						X				X			X	X	X			
Common Language					X	X	X		X	X			X	X	X	X		
Distance	X	X	X	X	X	X	X	X		X		X	X	X	X	X		
Exchange Rate		X				X											X	
Free Trade Agreements						X	X			X				X	X	X		X
GDP					X	X	X		X	X		X	X	X	X	X	X	
GDP per capita						X			X	X	X	X	X		X	X	X	
Land Area							X			X								
National Income	X	X	X	X				X										
Population	X	X			X		X									X		
Price				X				X										
Similarity in Size Index									X			X						
Tariffs											X				X			X
Transportation Cost				X													X	X

Table 5.1 Explanatory Variables Mostly Used in the Literature on Gravity Models.

5.4. Hypotheses

The hypotheses H1 to H7, relating to these explanatory variables, are specified as:

Hypothesis 1 (H1): An increase in the sum of the trading partners' income augments bilateral trade flows.

The empirical model postulates that bilateral trade flows are in direct proportion to the economic sizes of the trading countries. Therefore, a higher incidence of bilateral trade should be achieved between countries with higher GDP (income) since they are able to produce and trade more compared to the poorer countries. In our case, Turkey should have a larger volume of trade flow with richer countries such as the USA, Germany and the UK while having lower trade flows with the poorer countries (e.g. Syria, Tunisia and Malta). Consequently, as can be seen from other studies, such as Rose (2000), Egger (2002) and Melitz (2007) (see table 5.1 for more studies), GDP is a major determinant in investigating bilateral trade flows and is anticipated to have a positive effect.

Hypothesis 2 (H2): An increase in the transportation costs among trading countries will reduce bilateral trade flows.

Distance is a crucial variable influencing trade flows in inverse proportion. A larger distance between two countries causes higher transportation costs and communication expenses and impedes the bilateral trade flows. Therefore, distance has a negative effect on the trade flows.

Hypothesis 3 (H3): Similarity in size of two countries increases bilateral trade flows.

A country's openness and specialisation in production rise when the size similarity increases. A similarity of size index ($SGDP$) is used as a method to detect intra-industry trade patterns between two trading countries. A similarity in size creates two-way trade for differentiated goods. When there is an increase in the share of differentiated goods, a larger trade volume usually occurs. Therefore, a similarity in country size becomes an important determinant of the trade volume (Helpman, 1987). The expected effect of $SGDP$ on the bilateral trade flows is positive.

Hypothesis 4 (H4): Differences in agricultural land per capita (relative factor endowments, RFE) result in a positive effect on bilateral trade flows.

The factor proportions (Heckscher-Ohlin) theory states that a country is better off exporting the goods that use relatively abundant factors (capital, labour, and land) (Jones, 1956). The differences in the factor endowments determine the comparative advantage. For example, if a country has abundant land, the country produces goods requiring a high ratio of land to capital and labour. Thus, the country has a comparative advantage in land-intensive goods and exports more land-intensive goods. According to theory, the differences in relative factor endowments increase trade between two countries. However, Linder (1961) developed a counter hypothesis which says trade volume decreases when there is an increase in the differences in relative factor endowments. He clarifies trade with regards to the similarity of demand features between two countries. In order to analyse bilateral trade flows under these theoretical models, many researchers use GDP per capita as a capital factor, such as Breuss and Egger (1999), Baltagi, Egger and Pfaffermayr (2003), Stack (2009) and Stack and Pentecost (2011a), but results are unclear. A measure of relative factor endowments is included in our analysis: in particular, we use agricultural land per capita as a factor instead of GDP per capita.

Hypothesis 5 (H5): A common main religion indicates similarity in cultural values and norms which might be expected to increase bilateral trade between partners.

Few empirical studies investigate the association between religion and trade in the literature and suggest that sharing a common religion fosters trade (De Groot *et al.*, 2004; Guo, 2004; Guo, 2007; Helble, 2007; Kandogan, 2007; Helpman, Melitz and Rubinstein, 2008).

Hypothesis 6 (H6): Similar taste and preferences raise bilateral trade flows.

An increase in population results in demand augmentation. The demand for Turkish goods will also rise when the Turkish population living in the Euro-Mediterranean countries rises. This increase in demand may happen because of similar tastes and preferences to the Turkish population. More demand for Turkish agri-food products in the Euro-Mediterranean countries may lead to an increase in Turkish exports to this region. Therefore, taste and preference similarities in two trading partners are considered capable of promoting trade between them. It appears that only Atici and Guloglu (2006) and Erdem and Nazlioglu (2008) have tested this hypothesis and revealed its positive effect on trade flows.

Hypothesis 7 (H7): FTA membership results in a positive influence on bilateral trade flows.

The impact of FTAs has been widely analysed in gravity models but results are ambiguous. Some studies show trade creation and diversion (Peridy, 2005; Kalirajan, 2007) while others do not (Endoh, 1999; Baier and Bergstrand, 2007).

5.5. Econometric Model Specification

The linear form of the gravity model equation for trade used in this thesis is expressed as:

$$AX_T^t = \beta_0 + \beta_1 TGDP_{Ti}^t + \beta_2 SGDP_{Ti}^t + \beta_3 DIS_{Ti} + \beta_4 RFE_{Ti}^t$$

$$+\beta_5 FTA_{Ti}^t + \beta_6 RLG_{Ti} + \beta_7 TP_i + \varepsilon_{Ti}^t \qquad (5.4)$$

where:

- i represents the Euro-Mediterranean country i, T is Turkey and t is for time.

- AX_T^t is the log of the total value of Turkey's agricultural exports to Euro-Mediterranean country i ('000 US$).

- $TGDP_{Ti}^t$ is the logarithm of the sum of the GDP for Turkey and Euro-Mediterranean country i ('000 US$).

$$TGDP_{Ti}^t = \ln(GDP_T^t + GDP_i^t) \tag{5.5}$$

  This is a proxy for the economic size and its coefficient is expected to be positive.

- $SGDP_{Ti}^t$ is the log of the similarity of size index for each country pair ($SIMIND_{Ti}^t$) from the GDP shares of Turkey and Euro-Mediterranean country i. Following Helpman (1987):

$$SGDP_{Ti}^t = ln(SIMIND_{Ti}^t) \tag{5.6}$$

  where

$$SIMIND_{Ti}^t = 1 - [GDP_T^t/(GDP_T^t + GDP_i^t)]^2 - [GDP_i^t/(GDP_T^t + GDP_i^t)]^2$$

  and $0 \leq SIMIND_{Ti}^t \leq 0.5$: when $SIMIND_{Ti}^t = 0.5$ there is similarity in country size, and as $SIMIND_{Ti}^t \rightarrow 0$ there is extensive dissimilarity in country size. The sign of the $SGDP$ variable is expected to be positive.

- DIS_{Ti} is the log of the geographical distance between Turkey and Euro-Mediterranean country i in kilometres, which is measured using latitudes and longitudes between the two capital cities. It is a proxy for transportation costs and its coefficient is expected to be negative.

- RFE_{Ti}^t is the measure of relative factor endowments, given by:

$$RFE_{Ti}^t = |lnALPC_T^t - lnALPC_i^t| \tag{5.7}$$

It is the absolute difference in the logged values of agricultural land per capita (ALPC) levels (1000 ha) following Helpman and Krugman (1985) and is expected to be positively related to the export flow.

- FTA_{Ti}^{t} is a dummy variable for being a member of a free trade agreement[15] between Turkey and Euro-Mediterranean country i (=1 if the country i has a FTA with Turkey, and =0 otherwise). Its coefficient's sign is uncertain.

- RLG_{Ti} is a common religion variable in log form which is expected to have a positive effect on trade flows. In particular, it is the percentage of the Muslims in the population of country i to evaluate the influence of common religion, because 99 per cent of the Turkish population is Muslim.

- TP_i is a dummy variable for the Turkish population living in the Euro-Mediterranean country i (=1 if it is higher than 2 per cent of the total population of country i following Atici and Guloglu (2006), and =0 otherwise). Its coefficient is expected to be positive due to parallel tastes and preferences of the Turkish people.

- ε_{Ti}^{t} is an error term with the usual properties.

This study uses a balanced panel dataset covering the period 1969-2010 for 30 Euro-Mediterranean countries. These countries are Austria, Belgium-Luxemburg, Bulgaria, Cyprus, Czechoslovakia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Malta, the Netherlands, Poland, Portugal, Romania, Spain, Sweden and the UK, all from the EU, and Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia from the Mediterranean region[16]. Nominal agricultural export data are extracted from Standard International Trade Classification Revision 4 (SITC Rev. 4) of

[15] All countries have been analysed in this study are the member of the Union for the Mediterranean (Euro-Mediterranean Partnership) excluding Libya, but its status is observer state. Furthermore, each free trade agreement includes agricultural products, but has different protocol to follow for the concessions on them. According to these protocols between Turkey and Euro-Mediterranean country i, different tariff reductions are made on different agricultural products considering product quantities. An example of the protocols is presented in the Appendix 5.4 in detail.

[16] Some countries could not be included in the sample due to unavailable data for most of the years of the sample period. These are four EU countries (Estonia, Latvia, Lithuania and Slovenia) and seven Mediterranean countries (Albania, Bosnia and Herzegovina, Croatia, Mauritania, Monaco, Montenegro, and the Palestinian Authority).

the UNCOMTRADE and TURKSTAT databases, and expressed in real terms based on United States GDP deflator (2005=100), sourced from the United States Department of Agriculture (USDA) database . The data for real GDP (2005 USD) is also obtained from the USDA database. Agricultural land data is from the FAOSTAT database[17]. FTA data is from the Republic of Turkey Ministry of Economy website. The distance variable data are from CEPII database and the Turkish population in the Euro-Mediterranean countries is from the Turkish Ministry of Labour and Social Security. Due to the lack of data, the Turkish population living in Euro-Mediterranean country i is available only for 2010 and therefore treated as constant throughout the period. Finally, the religion data is obtained from the Pew Research Center database for 2010.

5.6. Empirical Models

Panel data contains observations on the same cross section for the same individuals (or countries in our case) which are observed over multiple time periods. “Longitudinal data” and “repeated measures” are the other terms utilised for this type of data (Cameron and Trivedi, 2005). The advantages of employing panel data over cross section or time series data are discussed by Baltagi (2005) and Gujarati (2003):

- Panel data indicates that countries are heterogeneous. Panel data estimation techniques can control the heterogeneity by allowing for country-specific variables while cross section and time series studies cannot.
- Panel data provides more informative data and observations by uniting cross section and time series data. It also generates more variability and less collinearity among the variables. Since the number of observations in panel data is higher than in cross section and time series data, the degrees of freedom are higher, and more efficient and reliable parameter estimations are achieved.
- Panel data is more successful to examine the dynamic of adjustment. It can demonstrate the amounts of changes over time by analysing the repeated cross sections whilst cross sectional distributions cover a large number of changes.

[17] The data for 2010 is the repetition of 2009 data.

- Panel data is more useful to describe and calculate concurrently the effects of time varying and cross sectional variables which cannot be simply detected in pure cross section and time series data.
- Some variables are not easy to compute or collect and therefore cannot be included. Omitting the variables causes bias in estimation results and panel data can reduce the possible bias by controlling the state and time invariant variables. However, time series and cross section studies cannot.
- Panel data allows us to build and analyse more complicated behavioural models.

Nonetheless, panel data has some constraints (Baltagi, 2005):

- Problems may arise in data collection and design in panel data. Missing and unbalanced data by reason of insufficient accessibility are the primary difficulties that researchers face.
- Measurement errors may occur while using panel data. These errors comprise defective responses, unsuitable reporters and storing information wrongly.
- Selectivity issues may occur because the sample is not selected randomly from the population.

The structure of the panel data model is indicated as below (Baltagi, 2005):

$$y_{it} = \alpha + X_{it}'\beta + \varepsilon_{it} \qquad i = 1, \dots, N \qquad t = 1, \dots, T \tag{5.8}$$

The subscript i represents countries which are cross sectional units while the subscript t represents time series observations. The term α is the intercept coefficient, β is the slope coefficients, X_{it} is the explanatory variables and ε_{it} is an error term which follows the assumption $E(\varepsilon_{it}) = 0$ and $Var(\varepsilon_{it}) = \sigma_{\varepsilon}^2$.

The variations of the intercept across cross sectional observations and time span are examined in two different ways. These are the one-way error component model in which the intercept changes across only cross sectional or only time observations, and the two-way error component model in which the intercept changes across both, for fixed and random effects models (Erlat, 2006). In next two sections, these models are explained under certain assumptions in panel data analysis after discussing a simple pooled model.

5.6.1. Pooled Model

The pooled model is the simplest estimation approach and ignores individual and time dimensions of the data which are simply pooled together. The panel regression model in equation (5.8) can be defined as a pooled model which indicates constant coefficients for all individuals in all time periods. The model can be estimated by OLS when the assumptions of the best linear unbiased estimator (BLUE) are held and the OLS estimate is "pooled OLS" when it is applied to a pooled model. It is assumed that the errors have zero mean ($E(\varepsilon_{it}) = 0$), they are uncorrelated over individuals and time ($cov(\varepsilon_{it}, \varepsilon_{js}) = E(\varepsilon_{it}, \varepsilon_{js}) = 0$) and homoskedastic ($var(\varepsilon_{it}) = E(\varepsilon_{it}^2) = \sigma_\varepsilon^2$). Also, they are uncorrelated with the explanatory variables ($cov(\varepsilon_{it}X_{it}) = 0$) (Cameron and Trivedi, 2005; Hill, Griffiths and Lim, 2011). The pooled OLS estimator is inefficient and biased results can occur due to the assumptions ignoring individual and time effects (Jahnson and Di Nardo, 1997).

5.6.2. One-way Error Component Model

The one-way error component model is widely used in the empirical analyses of panel data. Equation (5.8) is employed to analyse the model and α is assumed to remain constant over time while it is specific to the cross sectional observation. Furthermore, the error component structure, ε_{it} , can be rewritten as follows (Baltagi, 2005):

$$\varepsilon_{it} = \mu_i + v_{it} \tag{5.9}$$

where μ_i is a time invariant individual specific effect which is unobservable and, v_{it} is a remainder disturbance which changes over individuals and time. There are two methods to estimate the panel data model under different assumptions about individual effects. These are fixed and random effects models.

5.6.2.1. The Fixed Effects Model

In this model, the individual specific effects (μ_i) are considered as fixed parameters to be regressed, independent with the remainder disturbances (v_{it}) which are stochastic identically distributed error terms, $IID(0,\ \sigma_v^2)$. X_{it} are also considered independent of the remainder disturbances for all individuals and time. The fixed effects model is a suitable method when a particular set of N individuals (or countries) are the focus (Baltagi, 2005). The fixed effects model can be estimated by the WITHIN transformation or the Ordinary Least Square Dummy Variables (LSDV).

Following Baltagi (2005), the WITHIN transformation is obtained by pre-multiplying the model by Q and the estimator is acquired by applying OLS to the outcome of the transformed model:

$$Qy = QX\beta + Qv \tag{5.10}$$

The Q-matrix eliminates the individual effects and the OLS estimator can be written as:

$$\tilde{\beta} = (X'QX)^{-1}Q'Qy \text{ and } \mathrm{var}(\tilde{\beta}) = \sigma_v^2(X'QX)^{-1} = \sigma_v^2(\tilde{X}'\tilde{X})^{-1} \tag{5.11}$$

When the simple regression is averaged over time, it gives:

$$\bar{y}_{i.} = \alpha + \beta\bar{X}_{i.} + \mu_i + \bar{v}_{i.} \tag{5.12}$$

and subtracting the average from the simple regression gives:

$$y_{it} - \bar{y}_{i.} = \beta(X_{it} - \bar{X}_{i.}) + (v_{it} - \bar{v}_{i.}) \tag{5.13}$$

An arbitrary limitation is applied, that is $\sum \mu_i = 0$, on the dummy variable coefficients to avert the dummy trap or perfect multicollinearity. Furthermore, any time invariant variable such as sex, race and religion cannot be explained by the fixed effects estimator because the Q transformation removes them.

The LSDV method also estimates an intercept for each individual by adding a dummy variable for each cross sectional observation and represents an equivalent estimator to the WITHIN estimator. The R^2 obtained from this method is generally quite high due to the dummy variables added for each cross sectional unit. However, the LSDV intercept undergoes an important loss of degrees of freedom and the possibility of multicollinearity among the independent variables due to excessive dummies (Wooldridge, 2002).

5.6.2.2. The Random Effects Model

The fixed effects model has many parameters and suffers from the loss of degrees of freedom. To prevent this problem, the random effects model can be used by assuming μ_i is random. The random effects model is more suitable than the fixed effects model if the individuals (N) are chosen at random from a large population. In this situation, the individual error components (μ_i) are not correlated with the remainder disturbance (v_{it}) and X_{it} are independent of the μ_i and v_{it} for all individuals and time. In addition, $\mu_i \sim IID(0, \sigma_\mu^2)$ and $v_{it} \sim IID(0, \sigma_v^2)$ (Baltagi, 2005).

Classical OLS estimation is not an appropriate method to estimate the random effects model because serial correlation in the error components can be significant. The estimators obtained will be inefficient if the correlation cannot be accounted for and OLS is used. Generalized least squares (GLS) is the most convenient technique to solve this problem in order to estimate the random intercepts and is predicated on the orthogonality assumption that there is no correlation between the unobserved effects and the explanatory variables. As a result, GLS is unbiased and consistent (Gujarati, 2003).

To obtain the GLS estimator, the variance-covariance matrix Ω is required and is calculated following (Baltagi, 2005):

$$\begin{aligned} \Omega &= E(\varepsilon\varepsilon') = Z_\mu E(\mu\mu')Z'\mu + E(vv') \\ &= \sigma_\mu^2(I_N \otimes J_T) + \sigma_v^2(I_N \otimes I_T) \end{aligned} \tag{5.14}$$

where I and J are the identity and unitary elements matrices respectively and $\otimes$ is the Kronecker product operator. The variance is homoskedastic for all individuals and time:

$$
\begin{aligned}
\operatorname{var}(\varepsilon_{it}) &= \sigma_\mu^2 + \sigma_v^2 \\
\operatorname{cov}(\varepsilon_{it,}\varepsilon_{js}) &= \sigma_\mu^2 + \sigma_v^2 && \text{for } i = j, t = s \\
&= \sigma_\mu^2 && \text{for } i \neq j, t \neq s \\
&= 0 && \text{otherwise}
\end{aligned}
$$

The Ω^{-1}, which is required to obtain the GLS estimator, is an $NT \times NT$ matrix. Changes are made in equation (5.14) by replacing J_T and I_T with $T\bar{J}_T$ and $E_T + J_T$ respectively, as suggested by Wansbeek and Kapteyn (1982; 1983) and Ω can be rewritten as:

$$
\begin{aligned}
\Omega &= T\sigma_\mu^2(I_N \otimes \bar{J}_T) + \sigma_v^2(I_N \otimes E_T) + \sigma_v^2(I_N \otimes \bar{J}_T) \\
&= \left(T\sigma_\mu^2 + \sigma_v^2\right)(I_N \otimes \bar{J}_T) + \sigma_v^2(I_N \otimes E_T) \\
&= \left(T\sigma_\mu^2 + \sigma_v^2\right)P + \sigma_v^2 Q
\end{aligned}
\tag{5.15}
$$

The Ω^{-1} matrix is:

$$\Omega^{-1} = \frac{1}{\sigma_1^2}P + \frac{1}{\sigma_v^2}Q \tag{5.16}$$

and

$$\Omega^{-1/2} = \frac{1}{\sigma_1}P + \frac{1}{\sigma_v}Q \tag{5.17}$$

where $\sigma_1^2 = T\sigma_\mu^2 + \sigma_v^2$ and GLS can be calculated as weighted least squares by pre-multiplying equation (5.8) by $\sigma_v\Omega^{-1/2} = Q + (\sigma_v/\sigma_1)P$ and applying OLS on the transformed regression. In this situation, $y^* = \sigma_v\Omega^{-1/2}y$ possesses a typical element $y_{it} - \theta\bar{y}_i$, where $\theta = 1 - (\sigma_v/\sigma_1)$ and $0 \leq \theta \leq 1$ (Baltagi, 2005). Therefore, the transformed equation becomes:

$$y_{it} - \theta\bar{y}_i = \alpha(1 - \theta) + (X_{it} - \theta\bar{X}_i)\beta + \varepsilon_{it} \tag{5.18}$$

According to Wooldridge (2002), the time averages are indicated by the bar as in the fixed effects model and a fraction of the time averages are deducted from the variables. This transformation permits us to estimate time invariant explanatory variables and unobserved effects are uncorrelated with the explanatory variables. Also, the random effects model estimator is similar to the fixed effects estimator by reason of the weight of subtraction from the variables when $\theta \rightarrow 1$.

There are different types of analyses for the variance-type estimators of the variance components. Wallace and Hussain (1969) propose that the true error term (ε) should replace the OLS residual. Nonetheless, the OLS estimates are unbiased and consistent in the random effects model, although they are not efficient. Amemiya (1971) recommends substituting the LSDV disturbances for the OLS ones. Finally, Swamy and Arora (1972) suggest employing WITHIN and BETWEEN[18] methods respectively to obtain the variance components estimates.

5.6.3. Two-way Error Component Model

The two-way error component model can be obtained as expanding the one-way error component model. The error component structure, ε_{it} , is estimated by incorporating a time specific effect:

$$\varepsilon_{it} = \mu_i + \lambda_t + v_{it} \qquad i = 1, \dots, N; \qquad t = 1, \dots, T \tag{5.19}$$

where μ_i indicates the unobserved individual specific effect, λ_t indicates the unobserved time specific effect and v_{it} is the remainder stochastic error term. The term λ_t is individual invariant and explains the time specific effect not embraced in the regression (Baltagi, 2005).

[18] BETWEEN estimation technique works like the OLS for the cross section data and it takes the time average for each variable and then analyses the regression as a cross section model. It is not explained in detail because it disregards features of panel data and does not represent the time effect on variables.

5.6.3.1. The Fixed Effect Model

According to Baltagi (2005), the two-way fixed effects error component model estimates μ_i and λ_t as fixed parameters and the remainder disturbance is stochastic with $v_{it} \sim IID(0, \sigma_v^2)$. Furthermore, it is assumed that X_{it} are independent of v_{it} for all individuals and time. Under these circumstances, the inference is conditional on the specific individuals and time periods. Large N or T causes excessive dummy variables so a large loss in degrees of freedom and multicollinearity. The fixed effects estimator (β) can be obtained by employing the WITHIN transformation instead of inverting a large matrix:

$$Q = E_N \otimes E_T = I_N \otimes I_T - I_N \otimes \bar{J}_T - \bar{J}_N \otimes I_T + \bar{J}_N \otimes \bar{J}_T \quad (5.20)$$

where $E_N = I_N - \bar{J}_N$ and $E_T = I_T - \bar{J}_T$. The terms μ_i and λ_t effects can be removed with this transformation given by Wallace and Hussain (1969). Furthermore, the restriction, $\sum_i \mu_i = 0$, is invoked to evade the dummy variable trap.

It is important to note that the WITHIN estimator cannot explain the impacts of time and individual invariant variables due to the transformation. As a result, if the two-way fixed effects model is the most appropriate model, OLS gives biased and inconsistent regression coefficients due to omitting both individual and time dummies. The one-way fixed effects estimator omits just the time dummies. Hence, the one-way fixed effects estimator also experiences omission bias if these dummy variables are statistically significant (Baltagi, 2005).

5.6.3.2. The Random Effects Model

In the two-way random effects model, $\mu_i \sim IID(0, \sigma_\mu^2)$, $\lambda_t \sim IID(0, \sigma_\lambda^2)$ and $v_{it} \sim IID(0, \sigma_v^2)$ are not correlated with each other and X_{it} are independent of μ_i, λ_t and v_{it} for all individuals and time. Therefore, the variance covariance matrix is (Baltagi, 2005):

$$\Omega = E(\varepsilon\varepsilon') = Z_\mu E(\mu\mu')Z_\mu' + Z_\lambda E(\lambda\lambda')Z_\lambda' + \sigma_v^2 I_{NT} \quad (5.21)$$
$$= \sigma_\mu^2(I_N \otimes J_T) + \sigma_\lambda^2(J_N \otimes I_T) + \sigma_v^2(I_N \otimes I_T)$$

The error terms are homoskedastic for all individuals and time, and

$$var(\varepsilon_{it}) = \sigma_\mu^2 + \sigma_\lambda^2 + \sigma_v^2$$
$$cov(\varepsilon_{it}, \varepsilon_{js}) = \sigma_\mu^2 \quad \text{for} \quad i = j, \quad t \neq s$$
$$= \sigma_\lambda^2 \quad \text{for} \quad i \neq j, \quad t = s$$
$$= 0 \quad \text{otherwise}$$

In this case, Ω^{-1} is obtained by substituting J_N for $N\bar{J}_N$, I_N for $E_N + \bar{J}_N$, J_T for $T\bar{J}_T$ and I_T for $E_T + \bar{J}_T$. Thus,

$$\Omega = \sum_{i=1}^{4} \lambda_i Q_i \quad (5.22)$$

$$\sigma_v \Omega^{-1/2} = \sum_{i=1}^{4} \left(\sigma_v / \lambda_i^{1/2}\right) Q_i \quad (5.23)$$

$y^* = \sigma_v \Omega^{-1/2} y$ has a typical element $y_{it} - \theta_1 \bar{y}_{i.} - \theta_2 \bar{y}_{.t} + \theta_3 \bar{y}_{..}$, where $\theta_1 = 1 - (\sigma_v / \lambda_2^{1/2})$, $\theta_2 = 1 - (\sigma_v \lambda_3^{1/2})$ and $\theta_3 = \theta_1 + \theta_2 + \left(\sigma_v / \lambda_4^{1/2}\right) - 1$. Therefore, the GLS estimator can be used by this transformation (Baltagi, 2005).

When the true error terms are replaced by OLS or WITHIN residuals, biased results occur in the estimates of the variance components as in the one-way error component model. However, the corrections in the degrees of freedom, which are suggested by Wallace and Hussain (1969) and Amemiya (1971), ensure that the estimates are unbiased. Moreover, Swamy and Arora (1972) note that three least squares regressions (WITHIN, BETWEEN individuals and BETWEEN time-periods) should be used and the variance components estimated from the corresponding mean square errors of the regressions (Baltagi, 2005).

5.6.4. Tests for Fixed Effects

In the one-way error component model, the joint significance of the dummy variables can be tested using an F-test which is a simple Chow test. The hypothesis is:

$$H_0: \mu_1 = \mu_2 = \cdots = \mu_{N-1} = 0$$

The restricted residual sum of squares (RRSS) is from the Pooled OLS model and the unrestricted residual sum of squares (URSS) is from the LSDV regression. The WITHIN transformation can also be applied using its residual sum of squares as the URSS if N is large.

$$F_0 = \frac{(RRSS - URSS)/(N-1)}{URSS/(NT-N-K)} \tag{5.24}$$

Under the null (H_0), F is distributed with $(N-1, NT-N-K)$ degrees of freedom (Baltagi, 2005).

In the two-way error component model, the joint significance of the dummy variables can also be tested using the F-test. The null hypothesis is:

$$H_1: \mu_1 = \cdots = \mu_{N-1} = 0 \qquad \text{and} \qquad \lambda_1 = \cdots = \lambda_{T-1} = 0$$

In this case, the RRSS is obtained from the Pooled OLS while the URSS is from the WITHIN regression.

$$F_1 = \frac{(RRSS - URSS)/(N+T-2)}{URSS/(N-1)(T-1)-K} \sim F_{(N+T-2),(N-1)(T-1)-K} \tag{5.25}$$

Another test is performed for the presence of individual effects considering time effects. Here, the null hypothesis is:

$$H_2: \mu_1 = \cdots = \mu_{N-1} = 0 \qquad \text{and} \qquad \lambda_t \neq 0 \qquad \text{for} \qquad t = 1, \ldots, T-1$$

In this case, the RRSS is from the regression with only time dummies and the URSS is still from the WITHIN regression. Also, the F-statistic (F_2) is distributed with $N-1,(N-1)(T-1)-K$ degrees of freedom under H_2. It is crucial to realise that F_2 is different from F_0 in equation (5.24) in testing $\mu_i = 0$ due to the differences in the hypotheses. In this test, the hypothesis (H_2) assumes that $\lambda_t \neq 0$ for $t = 1, \dots \dots, T-1$ whilst H_0 is that $\lambda_t = 0$.

In the same way, the presence of time effects can also be tested considering individual effects. The null hypothesis is:

$$H_3: \lambda_1 = \cdots = \lambda_{T-1} = 0 \quad \text{and} \quad \mu_i \neq 0 \quad \text{for} \quad i = 1, \dots, N-1$$

The RRSS is acquired from the one-way fixed effects regression (WITHIN) whereas the URSS is from the two-way fixed effects regression (WITHIN) in this test. Finally, the F-statistic is $F_3 \sim F_{(T-1),(N-1)(T-1)-K}$ under H_3hypothesis (Baltagi, 2005).

5.6.5. Tests for Random Effects

5.6.5.1. The Breusch-Pagan Test

Lagrange multiplier (LM) tests have been widely applied to test for random effects, heteroskedasticity, serial correlation and cross sectional dependence in panel data models. Breusch and Pagan (1980) suggested a different type of the LM-test for the random two-way error component model and the null hypothesis is:

$$H_0: \sigma_\mu^2 = \sigma_\lambda^2 = 0$$

Under this hypothesis, LM is distributed asymptotically as a χ_k^2. The LM-test is easy to calculate after running OLS regression since it only entails use of OLS residuals$(\tilde{\varepsilon})$:

$$LM = LM_1 + LM_2$$

where

$$LM_1 = \frac{NT}{2-(T-1)}\left[1 - \frac{\tilde{\varepsilon}\prime(I_N \otimes J_T)\tilde{\varepsilon}}{\tilde{\varepsilon}\prime\tilde{\varepsilon}}\right]^2 \quad (5.26)$$

and

$$LM_2 = \frac{NT}{2-(N-1)}\left[1 - \frac{\tilde{\varepsilon}'(J_N \otimes I_T)\tilde{\varepsilon}}{\tilde{\varepsilon}'\tilde{\varepsilon}}\right]^2 \quad (5.27)$$

Furthermore, LM_1 is obtained when the hypothesis, $H_0^a\colon \sigma_\mu^2 = 0$, is tested. It is distributed asymptotically as χ_1^2 under H_0^a. Therefore, it assumes that there are no random individual effects if the hypothesis (H_0^a) is accepted. In a similar way, LM_2 is used to test the hypothesis, $H_0^b\colon \sigma_\lambda^2 = 0$, and is distributed asymptotically as χ_1^2 under H_0^b and assumes that the time effects do not exist if the hypothesis (H_0^b) is accepted (Baltagi, 2005).

5.6.5.2. Honda Test

Honda (1985) suggests an alternative test to the Breusch-Pagan test which assumes the alternative hypothesis is two-sided when the variance components are non-negative. In the Honda test, the appropriate alternative hypothesis is one-sided which is $\sigma_\mu^2 \geqq 0$ and $\sigma_\lambda^2 \geqq 0$ and at least one of them should hold. According to Honda (1985), the Breush-Pagan test is robust to non-normality. Therefore, LM_1 and LM_2 can be changed as:

$$HO_1 = \sqrt{LM_1} \quad (5.28)$$

$$HO_2 = \sqrt{LM_2} \quad (5.29)$$

which are distributed asymptotically as $N(0,1)$, and Honda's test is more powerful (Baltagi, 2005).

5.6.6. Hausman Specification Test

In the error component model, one of the significant assumptions is that $E(\mu_i|X_{it}) = 0$ which means there is no correlation between the explanatory variables (X_{it}) and the individual random effects (μ_i). However, these individual effects are unobserved so the assumption may not hold. In this circumstance, the assumption, $E(\varepsilon_{it}|X_{it}) = 0$, does not hold and GLS cannot coherently estimate the random effects model due to bias and inconsistency (Erlat, 2006). However, WITHIN transformation can be employed to deal with this problem because it removes the μ_i and the WITHIN estimator remains unbiased and consistent. Hausman (1978) proposes a test to test the strength of this assumption by comparing the GLS and WITHIN estimators which are consistent under the null hypothesis $E(\varepsilon_{it}|X_{it}) = 0$. However, they possess distinct probability limits when the null hypothesis does not hold. The WITHIN estimator is consistent if the hypothesis holds or not, but the GLS estimator is BLUE, consistent and asymptotically efficient under the null hypothesis while it is inconsistent if the hypothesis does not hold (Baltagi, 2005).

According to Erlat (2006), inference in the Hausman test does not offer a test between the fixed and random effects models. If μ_i in the random effects model are correlated with the explanatory variables, the WITHIN estimator is employed, but it does not imply that μ_i is fixed. Rather, it implies that the GLS estimator is not consistent, but the WITHIN is consistent and the GLS estimator should be replaced by the WITHIN estimator. In case of no correlation between μ_i and the explanatory variables, the GLS estimator should be employed. Thus, the choice is not between two models, but between estimators for the same model which is the random effects model.

5.6.7. Heteroskedasticity and Serial Correlation

In a standard error component model, ε_{it} may suffer from heteroskedasticity and/or serial correlation.

5.6.7.1. Heteroskedasticity

It is assumed that the error terms are homoskedastic with the same variance across individuals and time as in the standard error component model. It means that the variance of the error terms is constant under the homoskedasticity assumption. When the variance of the disturbances alters between cross sectional units and the difference is not explained by the explanatory variables, the homoskedasticity assumption collapses and this is the basis of the heteroskedasticity. Several tests have been developed for heteroskedasticity in time. Some can, however, imply the existence of heteroskedasticity without testing the assumption which is the variance of the disturbances is not conditional on the variables. Therefore, the LM-statistic is applied to determine heteroskedasticity invalidating general OLS estimates (Wooldridge, 2002; Erlat, 2006). For this aim, the hypothesis is written as:

$$H_0: var(v|X_i) = \sigma^2$$

and the LM-statistic is:

$$LM_h = \frac{T}{2}\sum_{i=1}^{N}\left[\frac{\hat{\sigma}_{vi}^2}{\hat{\sigma}_v^2} - 1\right]^2 \tag{5.30}$$

where $\hat{\sigma}_{vi}^2 = \sum_{t=1}^{T} v_{it}^2/T$ and $\hat{\sigma}_v^2 = \sum_{i=1}^{N}\sum_{t=1}^{T} v_{it}^2/NT = \sum_{i=1}^{N}\hat{\sigma}_{vi}^2/N$. It is asymptotically distributed as χ_{N-1}^2.

The solution of the heteroskedasticity issue in the random effects model was first presented by Mazodier and Trognon (1978). The first case in the one-way error component model is that μ_i are heteroskedastic, $\mu_i \sim (0, \omega_i^2)$, for all individuals but $v_{it} \sim IID(0, \sigma_v^2)$. The second case is that μ_i are homoskedastic, $\mu_i \sim IID(0, \sigma_\mu^2)$, while $v_{it} \sim (0, \omega_i^2)$. Therefore, heteroskedasticity in the disturbances is treated first individually and then together. Furthermore, an identification problem occurs in the case of the two-way error component model when both individual and time disturbances have heteroskedastic variances (Baltagi, 2005; Erlat, 2006).

Estimation in the fixed effects model is simple under heteroskedasticity. The variances are estimated based on the WITHIN residuals and OLS is employed to attain the estimated generalised least squares (EGLS) estimator which is heteroskedasticity corrected (Erlat, 2006).

5.6.7.2. Serial Correlation

The presence of serial correlation causes consistent but inefficient regression coefficients and biased standard errors in a panel data model. Therefore, a number of tests for serial correlation have been developed. It is assumed that v_{it} are generated by a stationary first-order autoregressive scheme [AR(1)] (Erlat, 2006):

$$v_{it} = \rho v_{i,t-1} + \gamma_{it} \quad (5.31)$$

where $\gamma_{it} \sim IID(0, \sigma_\gamma^2)$ and $|\rho| < 1$. The LM-test proposed by Baltagi and Li (1995) is suitable for the fixed effects model. It employs the WITHIN disturbances ($\tilde{v}_{it}$) and is asymptotically distributed as χ_1^2. The LM-statistic can be written as (Erlat, 2006):

$$LM_\rho = \frac{NT^2}{T-1}\left[\frac{\sum_{i=1}^{N}\sum_{t=2}^{T}\tilde{v}_{it}\tilde{v}_{i,t-1}}{\sum_{i=1}^{N}\sum_{t=1}^{T}\tilde{v}_{it}^2}\right]^2 \quad (5.32)$$

In the random effects model, it can also be used because the within transformation removes the μ_i. However, the source of autocorrelation arises from the μ_i and the v_{it} and the hypothesis, $H_0: \sigma_\mu^2 = 0, \rho = 0$, should be tested. The LM-test has been suggested by Baltagi and Li (1995) as:

$$LM_{\mu\rho} = \frac{NT^2}{2(T-1)(T-2)}[E^2 - 4EF + 2TF^2] \quad (5.33)$$

where $E^2 = [2(T-1)/NT]LM_\mu$ and $F^2 = [(T-1)/NT^2]LM_\rho$. $LM_{\mu\rho}$ comprises LM-test for $H_0: \sigma_\mu^2 = 0|\rho = 0$ and $H_0: \rho = 0|\sigma_\mu^2 = 0$, and is asymptotically distributed as χ_2^2 under the hypothesis H_0 (Erlat, 2006).

5.7. Econometric Results

A gravity model is estimated based on equation (5.4) to obtain the statistical significance of the determining factors of Turkish agricultural export flows. This section reports the results employing pooled, fixed effects and random effects models. Before discussing the estimation results, time series graphs, the descriptive statistics and correlation matrix of the dependent and independent variables are shown to summarise the data and detect possible problems.

The dataset represents a balanced panel of 30 Euro-Mediterranean countries over 42 years for 1969-2010. There are 1260 observations and the list of countries is shown in Appendix 5.1. The variables are Turkish agricultural exports to other Euro-Mediterranean countries (AX), total GDP ($TGDP$), similarities of size index ($SGDP$), relative factor endowments (RFE), geographical distance (DIS), free trade agreement (FTA), common religion (RLG) and Turkish population living in the Euro-Mediterranean countries (TP). Table 5.2 shows the descriptive statistics, namely mean, standard deviation, and minimum and maximum values.

Variables	Mean	Std. Dev.	Min	Max
$\boldsymbol{AX}$	17.17	1.82	6.47	20.78
$\boldsymbol{TGDP}$	6.11	0.77	4.67	8.17
$\boldsymbol{SGDP}$	-1.44	0.81	-4.24	-0.69
$\boldsymbol{DIS}$	7.42	0.54	6.28	8.18
$\boldsymbol{RFE}$	0.89	0.74	0.002	3.34
$\boldsymbol{FTA}$	0.27	0.45	0.0	1.0
$\boldsymbol{RLG}$	1.78	2.11	2.30	4.60
$\boldsymbol{TP}$	0.7	0.46	0.0	1.0

Table 5.2 Descriptive Statistics.

The data are also shown in Appendix 5.3 in figures 5.1, 5.2, 5.3 and 5.4. Figure 5.1 shows Turkish agricultural exports to other Euro-Mediterranean countries (AX) and there is an upward trend for each country in spite of fluctuations. Figure 5.2 shows total GDP ($TGDP$) and again there is an upward and stable trend for each country. Figure 5.3 shows the similarities of size index ($SGDP$). For some countries such as Italy, Jordan, Spain and Tunisia there is an upward trend, while others, including Austria, Bulgaria, Denmark and Greece, the trend is downwards. Similarly, relative factor endowments (RFE) in figure 5.4 show no common trends. For example, Algeria, Austria, France and Germany have a downward trend, whereas Cyprus, Greece, Israel and Morocco have an upward trend. As noted in section 5.4 and 5.5, $SGDP$ shows similarity in country size and countries with upward trends have more similarity with Turkey, while the ones with downward trends are less so. This situation is also similar for RFE which shows the differences in agricultural land per capita between Turkey and country i. Therefore, when the differences increase (decrease) between countries, the graph is upward (downward) trended.

In order to detect possible problems in the data, we first examine the multicollinearity which is particularly important in regression analysis. It can occur due to common trends among the regressors and its presence reduces statistical reliability and causes biased estimates. Table 5.3 shows pairwise correlation coefficients of the variables and there is little evidence of multicollinearity.

Variables	AX	$TGDP$	$SGDP$	DIS	RFE	FTA	RLG	TP
AX	1							
$TGDP$	0.64	1						
$SGDP$	0.24	0.27	1					
DIS	-0.02	0.34	0.41	1				
RFE	-0.11	-0.14	-0.41	-0.10	1			
FTA	0.28	0.52	0.23	0.12	-0.16	1		
RLG	0.14	-0.18	-0.38	-0.20	0.19	-0.21	1	
TP	0.15	0.17	-0.10	-0.23	0.14	0.11	-0.11	1

Table 5.3 Correlation Matrix.

Multicollinearity can be also detected by the Variance Inflation Factor (VIF). When it is examined for the model, the mean $\text{VIF} < 2$ and the general ground rule is that multicollinearity might be an issue if the $\text{VIF} > 5$. From table 5.4, it is clear that multicollinearity is not a problem. Finally, STATA 11 is used to perform the analyses.

Variable	VIF	1/VIF
$\boldsymbol{TGDP}$	1.64	0.611
$\boldsymbol{SGDP}$	1.59	0.628
$\boldsymbol{DIS}$	1.45	0.689
$\boldsymbol{RFE}$	1.25	0799
$\boldsymbol{FTA}$	1.42	0.704
$\boldsymbol{RLG}$	1.23	0.811
$\boldsymbol{TP}$	1.21	0.828
Mean VIF	1.40	

Table 5.4 The Variance Inflation Factor.

Furthermore, it is important to consider heteroskedasticity and serial correlation problems which might arise in the panel data. Therefore, the Breusch-Pagan LM-test and Baltagi and Li LM-test are applied to test the possibility of heteroskedasticity and serial correlation respectively. According to test results, the null hypotheses of both tests are rejected for all models and the tests confirm the presence of heteroskedasticity and serial correlation (see LM_h and LM_ρ in table 5.5). Therefore, the standard errors and t-statistics need to be treated with caution. As a consequence of heteroskedasticity and serial correlation, White's period robust variance covariance matrix is employed to fix these problems. The corrected standard errors are displayed for pooled, fixed effects and random effects models in table 5.5.

As noted in section 5.6.4., the F-test (Chow test) is applied to decide whether the results of the pooled model are suitable and the test uses URSS from the fixed effects model (WITHIN). According to the test result (see table 5.6), the null hypothesis of no country effects is rejected ($F_0 = 19.31$). Therefore, the pooled estimators are not efficient and the fixed effects model is more appropriate. Thus, the pooled model is inadequate to explain the determinants of Turkish agricultural exports to the Euro-Mediterranean countries and the results of the pooled model will not be discussed further.

An F-test is also employed to test the joint significance of the dummy variables in the two-way fixed effects model. In accordance with the test's outcome (F_1), there are time or individual effects. Therefore, the next step is to determine the presence of individual effects considering time effects. For this, the F-test employs the RRSS from the one-way fixed effects model with time effects and the URSS from the two-way fixed effects model. The result (F_2) shows that there are individual effects. Similarly, the existence of time effects can be tested allowing for the individual effects. In this case, the RRSS is from the one-way fixed effects model with individual effects while the URSS is obtained from the two-way fixed effects model. The computed F_3-statistic demonstrates that the two-way fixed effects model provides more reliable results since there are both individual and time effects.

Regarding the random effects model, it is expected to be the most appropriate to examine the determinants of Turkish agricultural trade flows for three reasons. First, the WITHIN estimator cannot explain time invariant variables such as distance and dummies. Second, the fixed effects model has many parameters and suffers from the loss of degrees of freedom. Third and according to Baltagi (2005), the random effects model is an appropriate specification when the countries under the study are randomly chosen from a large population. In this study, the intention was to include all Euro-Mediterranean countries in the analysis, but some countries could not be included due to unavailable data for most of the years in the sample period. Thus, the countries under study were not predetermined and they were randomly chosen. Therefore, the Breusch and Pagan Lagrange Multiplier and Honda tests are applied to see whether random individual and time effects exist. The results of the tests in table 5.6 show that there are significant random individual and time effects.

Variables	Pooled OLS	One-way Fixed Effects	Two-way Fixed Effects	One-way Random Effects	Two-way Random Effects
$Constant$	11.825*** (0.51)	4.489* (2.37)	6.908 (6.75)	11.960*** (2.45)	11.947*** (2.44)
DIS	-1.156*** (0.29)	-	-	-1.066*** (0.30)	-1.227*** (0.38)
TP	0.483 (0.27)	-	-	0.109 (0.32)	-0.155 (0.35)
FTA	-0.328 (0.13)	-0.009 (0.18)	0.277 (0.28)	-0.069 (0.16)	0.269 (0.26)
$TGDP$	1.826*** (0.15)	1.715*** (0.32)	1.260 (1.15)	1.668*** (0.25)	1.921*** (0.31)
RFE	0.582 (0.17)	1.197 (0.98)	1.695 (1.16)	0.351 (0.34)	0.429 (0.33)
RLG	0.267*** (0.68)	-	-	0.248*** (0.09)	0.259*** (0.09)
$SGDP$	0.724*** (0.20)	0.361 (0.56)	0.202 (0.60)	0.689** (0.31)	0.674** (0.33)
LM_h	699.276***	1013.219***	1083.089***	998.551***	1058.759***
LM_ρ	-	464.668***	459.703***	473.052***	473.374***
R^2	0.60	0.36	0.59	0.39	0.59
N	1260	1260	1260	1260	1260

Notes:

1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. (-) indicates that the variables as been dropped.
3. Robust standard errors are given in the parentheses.
4. N is the number of observations.

Table 5.5 Estimation Results with Robust and Clustered Standard Errors.

	Statistic	p-value
F_0	19.306**	0.00
F_1	9.205**	0.00
F_2	20.659**	0.00
F_3	1.728**	0.00
LM	2011.103**	0.00
HO	23.139**	0.00
$Hausman$	24.440	0.99

Note:

1. Asterisks indicate (5%) ** level of statistical significance.

Table 5.6 The Results of Statistical Tests.

Furthermore, one of the important assumptions in the error component model is that there is no correlation between explanatory variables and these unobservable random effects. The Hausman test tests the validity of this assumption. If the assumption is not violated, the GLS estimator should be employed otherwise the WITHIN estimator should be used. The Hausman test in table 5.6 confirms that the GLS estimator is preferred which implies that the random effects model is consistent and efficient. In the light of these tests, the two-way random effects model is preferred.

The empirical results for the two-way random effects model in table 5.5 demonstrate that an increase in $TGDP$, $SGDP$ and RLG, and a decrease in DIS are all related to an increase in Turkish agricultural exports. This is consistent with hypotheses H1, H2, H3 and H5 while it does not provide any support for hypotheses H4, H6 and H7. Also, the R^2 value shows that the explanatory variables explain about 59 per cent of the variation in Turkey's agricultural exports to the Euro-Mediterranean countries.

The coefficients of the main explanatory variables in the model [distance (DIS) and sum of GDPs ($TGDP$)] are highly significant and their signs are as predicted. The similarity of size index ($SGDP$) also has a positive and significant coefficient at the 5 per cent level. For the dummy variables, the coefficient of sharing the same main religion (RLG) is statistically significant while the coefficients of the Turkish population living in the importer country (TP) and FTA are insignificant as is the coefficient of the RFE variable.

As expected, the sum of GDPs ($TGDP$) positively affects Turkish agricultural exports and a 1 per cent rise in total GDP will increase Turkish agricultural exports (AX) to the Euro-Mediterranean countries around 2 per cent. Egger (2002), Egger and Pfaffermayr (2004), Erdem and Nazlioglu (2008), Wang, Wei and Liu (2010) and Stack and Pentecost (2011b) find a positive relationship between income and bilateral trade flows and the findings here are consistent with their findings. The empirical results also reveal that distance has a negative impact on Turkish agricultural exports. Its coefficient is 1.227 suggesting that a 1 per cent decrease in distance between Turkey and the importer country leads to a 1.2 per cent increase in Turkish agricultural exports. This inverse effect of distance supports Bergstrand (1985; 1989), Martinez-Zarzoso and Nowak-Lehmann (2003), Martinez-Zarzoso (2003), Bussiere, Fidrmuc and Schnatz (2005), and Lee and Park (2007).

The positive and significant coefficient of $SGDP$ indicates that size similarity is a positive determinant of Turkish agricultural exports to the Euro-Mediterranean countries and a 1 per cent increase in similarity of size index raises Turkish agricultural exports by about 0.7 per cent. The result is consistent with many empirical studies such as Egger (2001), Baltagi, Egger and Pfaffermayr (2003), Wang, Wei and Liu (2010) and Stack and Pentecost (2011b). The religion dummy has a positive and statistically significant effect at the 1 per cent level on Turkish agricultural exports. Sharing the same religion causes an increase in the export level due to the similarity in cultural values and norms. Fratianni and Kang (2006), and Linders and Groot (2006) are two studies which find significance of common religion.

Common tastes and preferences of Turkish people are expected to influence Turkish agricultural exports positively. However, the results show that there is no support for this hypothesis. Its coefficient has a negative sign and is statistically insignificant. Relative factor endowments (RFE) also do not have a significant effect on Turkish agricultural exports according to the two-way random effects results, but its coefficient carries a positive sign as expected. Finally, the coefficient of FTA variable has a positive sign, but it is statistically insignificant. As noted in the previous chapter, the effect of being a member of a free trade agreement is ambiguous. Our result does not support the notion that free trade agreements between Turkey and the Euro-Mediterranean countries boost Turkish agricultural exports.

5.8. Conclusion

This chapter started with a review of the theoretical foundation of the gravity model, its development and its applications in trade flow analysis. The gravity model has provided for a useful econometric approach in investigating the determinants of trade flows. Hypotheses were determined with regard to the explanatory variables chosen to empirically examine the factors that influence Turkey's agricultural exports to its Euro-Mediterranean partners. Traditional panel data estimation techniques were then discussed.

According to test results, the two-way random effects model is preferred and this model is used to test the hypotheses of the factors effecting Turkish agricultural exports to the selected Euro-Mediterranean countries. Estimated results show that total GDP positively affects Turkish agricultural exports, while distance has a negative impact. Size similarity and sharing the same religion are positive determinants of Turkish agricultural exports to the Euro-Mediterranean countries. The relative factor endowments are expected to influence Turkish agricultural exports positively, but the results show that there is no support for the hypothesis, although its coefficient is positive. Common tastes and preferences of Turkish people are also anticipated to have a positive effect on Turkish agricultural exports, but the results do not overlap with the expectation because its coefficient has a negative sign and is statistically insignificant. Finally, the free trade agreement variable has a positive sign but is statistically insignificant and there is little evidence that free trade agreements between Turkey and the Euro-Mediterranean countries increase Turkish agricultural exports.

In this chapter, we obtained estimation results using traditional panel regression models. However, recent literature shows that a more thorough analysis of the data is required before estimating the empirical model to obtain accurate and meaningful results. To this end, stationarity analysis must be undertaken. If the likely non-stationary of the data is ignored, spurious regressions may occur. In the next chapter, we apply stationarity tests to address this problem and we discuss the results of preliminary analysis of the data employed in the estimation model. Conditional on appropriate findings, we re-estimate our model.

Chapter 6 . Non-stationary Data in Macro Panels

6.1. Introduction

In chapter 5, we applied the traditional panel data estimation techniques to our gravity model and obtained the estimation results in order to see the statistical significance of the determinants of Turkish agricultural export flows. However, the empirical trade literature shows that the specification and appropriate estimation may considerably impact on the results of gravity models. Traditional panel data models are employed by many researchers, but likely non-stationarity of the data has been largely ignored in gravity studies and spurious results may arise due to this disregard. Also, the possible endogeneity problem cannot be accounted for by the standard estimators; and cross sectional correlation is another potential problem. Cointegration techniques, which are used in the next chapter, are generally applied to solve these issues. Beforehand however, stationarity analysis is necessary to see whether panel cointegration analysis is appropriate.

Several panel unit root tests have been developed recently, but their conclusions are often inconsistent [e.g. Costantini and Lupi (2005); Basile, Costantini and Destefanis (2006); Gengenbach (2009)]. Therefore in this chapter, we use further data analysis and in particular some of the more popular panel unit root tests to seek a consensus. The chapter is structured as follows: first individual time series unit root tests (the ADF-, the DF-GLS and the KPSS-tests) are conducted; second, cross section dependency is tested; and finally, pane unit root tests (the Choi-, the PS-,the MP-, the PANIC-, the $CIPS^{*}$- and the HK tests) are conducted.

6.2. Stationarity Tests

An analysis of the data that features in empirical gravity models has largely been disregarded, notwithstanding that the literature on unit root and co-integration tests is well-developed. Therefore, before proceeding to the econometric analysis and further investigations, it is crucial to test the data for stationary/non-stationary, using appropriate unit root tests for the individual time series and panel data sets employed in this study.

A stochastic process (random process) is a collection of random variables which represents the development of random values over time. The process is stationary when the mean and the variance of the time series are constant over time, and the covariance is independent of time. The time series is identified as non-stationary when these qualifying conditions are not met (Gujarati, 2003). Therefore, the next sections provide an analysis of stationarity to choose the most appropriate estimation technique to apply to the data.

6.2.1. Unit Root Tests for Individual Time Series

Individual unit root tests are the starting point to investigate stationarity properties and there are numerous unit root tests which can be employed to individual time series. The tests can be divided into two classes, namely with null hypotheses of non-stationarity or of stationarity. Commonly-used unit root tests with the null of non-stationarity are the Dickey-Fuller (DF) test (1979), the Augmented Dickey-Fuller (ADF) test (1984), the Phillips-Perron (PP) test (1988), Schmidt and Phillips (SP) test (1992), the Ng-Perron (NP) test (1995), and the Elliot, Rothenberg and Stock Point Optimal (ERS) and the Generalised Least Squared Dickey Fuller tests (1996). Tests with the null hypothesis of stationarity are the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test (1992), Leybourne and McCabe (LC) test (1994), and Arellano and Pantula test (1995).

There is no comprehensive comparison of all these tests, but it appears that some of them have limitations. For example, the PP-test suffers severely from size distortion and low power problems. It mostly rejects the null hypothesis and its power decreases when deterministic terms are included to the test regressions. Also, it disregards the possibility of serial correlation in test regressions. Perhaps the most fruitful approach is to start with the ADF-test, and then to continue with the efficient unit root test of Elliot, Rothenberg and Stock (1996) which is the DF-GLS test. A final step is to apply the KPSS-test for the purpose of confirmatory analysis. The ADF- and DF-GLS tests follow a unit root process which means a variable contains a unit root under the null, while KPSS assumes no unit root process in the series. The ADF-test is an easier, less complex and is most widely used unit root test, although it has some criticism about its power. The DF-GLS test is more efficient and has considerably better power, so it meets the potential deficits of the ADF-test.

The testing procedure is as follows. The ADF- and DF-GLS tests are first employed. In the case of no unit root process for some series, the KPSS-test will be applied. The ADF- and the DF-GLS tests primarily examine the stationarity, but the individual time series data is also tested by the KPSS-test to seek confirmation to obtain robust test results. The variables tested are agricultural exports (AX), total GDP ($TGDP$), GDP similarity ($SGDP$) and relative factor endowments (RFE). Some variables do not require unit root tests due to being time invariant across cross section or dummies, viz. distance (DIS), common religion (RLG), Turkish population living in the Euro-Mediterranean country i (TP) and free trade agreement (FTA).

6.2.1.1. The Augmented Dickey Fuller (ADF) Unit Root Test

The common method to test for a unit root is to examine the ρ-coefficient in the autoregressive (AR) model:

$$Y_t = \rho Y_{t-1} + e_t \qquad t = 1, 2, \dots, \mathrm{T} \qquad \text{and} \qquad -1 \le \rho \le 1 \tag{6.1}$$

where Y_t is the variable of interest, t is the time index and e_t is a sequence of independent normal random errors with mean zero and variance σ^2 (white noise). The relation between the observations Y_t and Y_{t-1} is unitary when $|\rho| = 1$. This means the time series is non-stationary. However, if $|\rho| < 1$, Y_t is a stationary stochastic process. Dickey and Fuller (1979) proposed a unit root test with critical values (τ-statistic) and the test assumes that the error term is not correlated. The regression model (6.1) can be rewritten as:

$$\begin{aligned} Y_t - Y_{t-1} &= \rho Y_{t-1} - Y_{t-1} + e_t \\ \Delta Y_t &= (\rho - 1) Y_{t-1} + e_t \\ &= \delta Y_{t-1} + e_t \end{aligned} \tag{6.2}$$

where Δ is the first difference operator and $\delta = (\rho - 1)$. The null hypothesis of unit root is $\delta = 0$, which is the same as $|\rho| = 1$. For the constant and constant and trend forms, the regression can be written as:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + e_t \tag{6.3}$$

and

$$\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + e_t \tag{6.4}$$

where α and β are parameters. Therefore, by imposing the constraints $\alpha = 0$ and $\beta = 0$ equation (6.4) corresponds to a random walk without drift, while the constraint that $\beta = 0$ corresponds to a random walk with drift. Finally, it is a random walk with drift around a stochastic trend when $\alpha \neq 0$ and $\beta \neq 0$. In the case where the error term is serially correlated, Said and Dickey (1984) developed a parametric amendment for higher order correlation by augmenting the basic autoregressive unit root test. They include p times lagged difference terms of the dependent variable to the right hand side of the test regression. This is called the Augmented Dickey Fuller (ADF) test:

$$\Delta Y_t = \delta Y_{t-1} + \gamma_p \sum_{p=1}^{m} \Delta Y_{t-p} + e_t \tag{6.5}$$

where

$$\sum_{p=1}^{m} \Delta Y_{t-p} = (Y_t - Y_{t-1}) + (Y_t - Y_{t-2}) + \cdots + \left(Y_t + Y_{t-p}\right) \tag{6.6}$$

The ADF-test is conducted under the null hypothesis of a unit root against the alternative hypothesis:

$$H_0 : \delta = 0$$
$$H_A : \delta < 0$$

When applying the ADF-test, the lag length p and inclusion of deterministic components has to be determined. Deterministic components can be without constant and trend, with constant only or with constant and trend. Lag length is an important practical issue in the application of the ADF-test because the test will be biased by reason of the remaining serial correlation in the errors if the p is too small and the power of the test will suffer otherwise (p is too large) (Harris and Sollis, 2003).

Therefore, the Schwert Criteria (1989) is used to choose the optimal lag length. It sets an upper bound p_{max} for p and it is calculated as follows (Wang and Zivot, 2006):

$$p_{max} = \left[12\left({}^{t}/_{100}\right)^{1/4}\right] \quad (6.7)$$

If the test statistics computed are less than the critical values for the DF-test, then the null hypothesis of unit root is rejected ($\delta = 0$). The test statistic is:

$$t_{\delta} = \frac{\delta}{SE(\delta)} \quad (6.8)$$

where SE is the standard error of δ. All three forms of deterministic components are included in tests and STATA 11 is used to perform the ADF-test.

The ADF-test results are presented in Appendix 6.1.1. All tables have three test models depending upon the inclusion of deterministic components. The first test is for random walk only which is without constant and trend ('no constant' column in the tables 6.A.1, 6.A.2, 6.A.3 and 6.A.4 in Appendix 6.1.1). The second test is for random walk with drift around a stochastic trend, which is with constant and trend ('trend column in the tables in Appendix 6.1.1). The third and last test is for random walk with drift which means the deterministic component is constant only ('drift' column in the tables in Appendix 6.1.1). In the tables 6.A.1, 6.A.2, 6.A.3 and 6.A.4, in the first case (no constant) for agricultural exports (AX), GDP similarity ($SGDP$) and total GDP ($TGDP$), all individual series are non-stationary. For relative factor endowments (RFE), seven data series are stationary at the 5 per cent level of significance - Belgium-Luxemburg, Czechoslovakia, Denmark, France, Hungary, the Netherlands and Poland. In the second case (trend) for AX, all series fail to reject the null of a unit root except Greece and Lebanon. For $SGDP$, Bulgaria, Egypt and Syria do not have unit roots, while for $TGDP$, only Belgium-Luxemburg is stationary. For RFE, Lebanon and Morocco reject the null of a unit root. The third case (drift) shows that 10 AX series are stationary - Algeria, Austria, Cyprus, Greece, Jordan, Lebanon, Libya, Portugal, Spain and Syria. For $SGDP$, Belgium-Luxemburg, Cyprus, Egypt, Ireland, Jordan and Syria do not have a unit root, while only Italy is stationary for $TGDP$. Finally, the test shows 10 data series are stationary for RFE at the 5 per cent significance level - Algeria, Austria, Czechoslovakia, France, Hungary, Italy, Morocco, the Netherlands, Poland and Romania.

6.2.1.2. The Generalised Least Square Dickey Fuller (DF-GLS) Unit Root Test

Elliott, Rothenberg and Stock (1996) proposed an efficient test to determine if an individual time series has a unit root by modifying the ADF-test. The modification is performed using a GLS rationale and the test is called the Generalised Least Square Dickey Fuller (DF-GLS) unit root test. The DF-GLS test has a better performance compared to the ADF-test in terms of small sample size and power. In the DF-GLS test, the time series is altered by a GLS regression before applying the ADF-test and the DF-GLS test is performed under two possible alternative hypotheses. These are Y_t is stationary around a linear trend or Y_t is stationary without a linear time trend. Under the first alternative hypothesis, the de-trended series is tested via the following regression model:

$$\Delta Y_t^* = \alpha + \delta Y_{t-1}^* + \sum_{j=1}^{k} \gamma_j \Delta Y_{t-j}^* + e_t \tag{6.9}$$

where

$$Y^* = Y_t - \left(\hat{\beta}_0 + \hat{\beta}_1 t\right) \tag{6.10}$$

The estimators $\hat{\beta}_0$ and $\hat{\beta}_1$ are used to eliminate the trend from Y_t (by de-trending) and they are estimated by OLS:

$$\tilde{Y}_t = \beta_0 X_t + \beta_1 Z_t + \epsilon_t \tag{6.11}$$

where

$$\begin{aligned} &\tilde{Y}_1 = Y_1 \\ &\tilde{Y}_t = Y_t - \alpha^* Y_{t-1} \qquad t = 2, \dots, T \\ &X_1 = 1 \\ &X_t = 1 - \alpha^* \qquad t = 2, \dots, T \\ &Z_1 = 1 \\ &Z_t = t - \alpha^*(t-1) \end{aligned} \tag{6.12}$$

and

$$Z_t = (1, t)' \tag{6.13}$$

$$\alpha^* = 1 + \left({}^{\bar{c}}/_{T}\right)$$

α^* is defined according to two alternative hypotheses as noted. Therefore, $\bar{c} = -13.5$ under the linear trend case (constant and trend) and $\bar{c} = -7$ for the demeaned case (only constant) in which Z is removed from the GLS regression and Y^* is calculated as $Y^* = Y_t - \beta_0$. The DF-GLS test is a modified Dickey-Fuller t test and is performed under the null of a unit root against the alternative hypothesis:

$$H_0: \delta = 0$$

$$H_A: \delta < 0$$

The 5 per cent and 10 per cent critical values for the demeaned case are obtained from Cheung and Lai (1995, p.413). The 1 per cent critical values for the linear trend case are from Elliott, Rothenberg and Stock (1996, p.825) and the 1 per cent critical values for the demeaned case are the same as the DF-test without constant and trend critical values. Regarding the choice of lag length, the Schwert Criteria (1989) is employed to set the maximum lag length (p_{max}) using the method proposed in equation (6.7) and the optimal lag order is specified by Ng and Perron (2001) Modified Akaike Information Criterion (MAIC):

$$MAIC(p) = ln(\widehat{rmse}^2) + \frac{2\{\tau(p)+p\}}{T-p_{max}} \tag{6.14}$$

where

$$\tau(p) = \frac{1}{\widehat{rmse}^2}\hat{\delta}_0^2 \sum_{t=p_{max}+1}^{T} \tilde{Y}_t^2 \tag{6.15}$$

and

$$\widehat{rmse} = \frac{1}{(T-p_{max})} + \sum_{t=p_{max}+1}^{T} \hat{\epsilon}_t^2 \tag{6.16}$$

Ng and Perron (2001) demonstrated that the MAIC enhances size power for the DF-GLS test and is generally preferred in applications. The DF-GLS test is applied using STATA 11 and the test results are shown for each variable in tables 6.B.1, 6.B.2, 6.B.3 and 6.B.4 of Appendix 6.1.2. As mentioned before, there are two types of tests that are conducted, linear trend and demeaned cases. For the demeaned case, the DF-GLS test did not identify any series as stationary. For the linear trend case, it identified Belgium-Luxemburg, Germany and Ireland as stationary at the 5 per cent significance level for AX, while none of the data series for $SGDP$ is stationary. Also, there are eight stationary data series for $TGDP$ - Belgium-Luxemburg, Denmark, Greece, Ireland, Lebanon, the Netherlands, Spain and Tunisia. Finally, only Belgium-Luxemburg does not have a unit root in RFE. Overall, the DF-GLS test identifies 12 stationary data series.

The results obtained from ADF- and DF-GLS tests are not identical, although some series are detected as stationary by both tests. The literature suggests that the DF-GLS test is more powerful than the ADF-test in detecting unit roots and that it is also an efficient unit root test. However, it is necessary to examine the data series further in case we reject a unit root by mistake, because this causes more problems than incorrectly failing to reject the hypothesis of unit root in the series. Therefore, the KPSS-test is now employed as the confirmatory analysis.

6.2.1.3. The Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) Unit Root Test

Most unit root tests have a null hypothesis of non-stationarity but the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test (1992) follows a different method by having the opposite null and it is usually employed as a confirmatory analysis. The KPSS-test assumes that the series is stationary and its model is written as follows:

$$Y_t = \beta_t + r_t + e_t \tag{6.17}$$

where β_t is a deterministic component for time trend, e_t is a stationary process and r_t is a random walk computed by:

$$r_t = r_{t-1} + \epsilon_t \qquad \epsilon_t \sim IID(0, \sigma_\epsilon^2) \tag{6.18}$$

The KPSS-test may be conducted under the two different cases. The first assumption is that the series is stationary around a trend (linear trend case), while the second one is that the series is stationary with a random walk (demeaned case) using the constraint

$\beta = 0$. The residuals from the OLS regression of Y_t are used to calculate the LM-test statistic:

$$LM = \frac{\sum_{t=1}^{T} S_t^2}{\hat{\sigma}_e^2} \tag{6.19}$$

where $\hat{\sigma}_e^2$ is the residual variance from the regression of Y_t and S_t is the partial sum of the residuals (e_t) given by:

$$S_t = \sum_{i=1}^{T} e_i \qquad t = 1,2,\ldots,T \tag{6.20}$$

As in the other unit root tests, the choice of lag length is important to obtain accurate results. Therefore, an automatic lag order selection routine, proposed by Newey and West (1994), is used. Also, the quadratic spectral kernel is employed to calculate the denominator of the LM-statistic because Andrews (1991) and Newey and West (1994) show that it is more precise than the Barlett kernel which is employed by Kwiatkowski *et al.* (1992). Hobijn, Franses and Ooms (1998) show that using the automatic lag order selection and the quadratic spectral kernel together gives the best performance in small samples in Monte Carlo simulations. Finally, the critical values for the test statistic are obtained from Kwiatkowski *et al.* (1992, p. 166).

The KPSS-test results, which were obtained using STATA 11, are presented in Appendix 6.1.3. The data series are tested under the linear trend case and the demeaned case, as in the DF-GLS test. In the linear trend case, the results for AX show that seven data series fail to reject the stationary null - Cyprus, Czechoslovakia, Malta, the Netherlands, Romania, Sweden and Syria. For $SGDP$, the test fails to reject for eight data series - Finland, France, Germany, Greece, Israel, Lebanon, Tunisia and the UK. The test identifies 22 data series as stationary for $TGDP$ - Austria, Belgium-Luxemburg, Bulgaria, Cyprus, Czechoslovakia, Denmark, Egypt, Greece, Hungary, Ireland, Israel, Jordan, Libya, Malta, Morocco, the Netherlands, Poland, Romania, Spain, Sweden, Syria and Tunisia. For RFE, Belgium-Luxemburg, Cyprus, Finland, Greece and Syria data series fail to reject the null of stationary. In the demeaned case, for $SGDP$ and $TGDP$, the KPSS-test cannot detect any series as stationary. For AX, Denmark, Hungary, Jordan, Lebanon and Libya are stationary at the 5 per cent significance level while only Tunisia is stationary for RFE.

The ADF-, the DF-GLS and the KPSS-test results indicate a contradiction among the tests. For example, only the Belgium-Luxemburg series is found to be stationary in common for $TGDP$ under the linear trend case when the ADF-test and DF-GLS test combination are examined. The combination of the ADF-test and the KPSS-test shows that three series (Jordan, Lebanon and Libya) for AX and one series (Belgium-Luxemburg) for $TGDP$ are stationary in the linear trend case. Also, for the DF-GLS test and the KPSS-test combination, Belgium-Luxemburg, Denmark, Greece, Ireland, the Netherlands, Spain and Tunisia are the series having stationarity in the linear trend case. Overall, when ADF-, DF-GLS and KPSS-test results are combined, common outcomes reveals that only the Belgium-Luxemburg data series is stationary out of 120 individual time series data. The rest are non-stationary in at least one of the unit root tests applied.

This lack of consensus suggests that the individual unit root tests are insufficient to produce a decisive conclusion. However, it is important to note that the DF-GLS test is more efficient than the ADF-test and the KPSS-test, and Maddala and Kim (1999) claim that employing efficient unit root tests give better results than employing confirmatory tests. Thus, applications of panel unit root tests are required to increase the power of unit root tests in defining the order of integration. Furthermore, since the gravity model employs panel data, it is necessary to test the panel data before continuing further investigations. The next section discusses panel unit root tests and provides presents results.

6.2.2. Panel Unit Root Tests

Over the last decade, the literature on unit root and co-integration tests has increased substantially, but preliminary analysis of data used in empirical gravity models has largely been ignored. Before proceeding to the econometric analysis, it is important to test the data for stationary/non-stationary. This section discusses these stationarity tests to facilitate the appropriate estimation techniques.

Much of the recent time series literature on the application of panel data has focused on the asymptotics of macro panels (with a large number of units N and large time dimension T) instead of micro panels (with large N and small T). Combining cross section and time series data increases the number of observations and therefore increases the power of unit root tests. Moreover, using panel data can prevent the spurious regression problem (Baltagi, 2005). Before explaining each individual test, the general framework of panel unit root tests, which is similar to individual unit root tests, is presented.

Consider:

$$Y_{it} = \rho_i Y_{i,t-1} + u_{it} \tag{6.21}$$

where $i = 1, \dots, N, t = 1, \dots, T$ and $-1 \leq \rho \leq 1$. Y_{it} is the variable of interest and u_{it} is an $IID(0, \sigma_u^2)$ error term. The observations Y_i are stationary when $|\rho| < 1$. However, if $|\rho| = 1$, Y_i series becomes non-stationary. Standard unit root tests and those for panel data have two important differences. First, heterogeneity is a problem with panel data because the unit root hypothesis is tested for many individuals in a specific model instead of for a particular individual series. Panel data are heterogeneous[19] when individuals are described by distinct factors. After the seminal works by Levin and Lin (1992; 1993) and Quah (1994), panel unit root tests proposed by Im, Pesaran and Shin (2003), Maddala and Wu (1999), Choi (2001) and Hadri (2000) have focused on the heterogeneous specification of the alternative hypothesis. If heterogeneity is present and the null hypothesis of a unit root is rejected, then all individuals in a subgroup of the panel under the alternative hypothesis are stationary. However, in the homogeneous case, all series in the panel are assumed stationary. The panel unit root tests described in the following sections assume the heterogeneity in the alternative hypothesis.

A second concern is the presence of cross sectional dependency. A number of panel unit root tests have been developed and they can be divided into two groups. The first, which is called first generation panel unit root tests, assumes that the cross sections of the panel are independent, while the second, called the second generation panel unit root tests, assumes cross sectional dependency. For the first generation tests, the popular ones are by Maddala and Wu (1999), Harris and Tzavalis (1999), Breitung (2001), Hadri (2000), Levin, Lin and James Chu (2002) and Im, Pesaran and Shin (2003).

[19] In a heterogeneous panel data model, all parameters vary across individuals while they are all common in a homogenous panel data model.

Although these first generation tests have been widely applied, the hypothesis of cross sectional independency is often restrictive and unrealistic. Therefore, researchers have presented second generation tests, and in particular those of Chang (2002), Choi (2002), Phillips and Sul (2003), Moon and Perron (2004), Bai and Ng (2004), Breitung and Das (2005), Pesaran (2007), Pesaran, Smith and Yamagata (2008) and Hadri and Kurozumi (2012). Testing for cross sectional dependency is essential before employing appropriate panel unit root tests.

6.2.2.1. Testing for Cross Section Dependence in Panel Data

In previous literature on panel data, researchers have considered that dependence of errors was only in spatial models. However, they realised cross-sectionally independent errors and homogenous slopes are not the real case for individuals in standard panels after an increase in data availability. The studies show that in panel data models, important cross section dependence may occur in the errors due to the existence of common shocks and unobserved factors. The strong interdependencies among individuals may arise from the growing economic and financial integration among countries in recent years. Also, social norms, bandwagon effect and neighbourhood pressure may affect the individual preferences in responding to the common shocks and unobserved factors in the same way. Naturally, the effect of cross sectional dependency depends on various determinants and ignoring it may affect the consistency and efficiency of the estimated parameters. Cross section dependency may also lead to some problems in application of panel unit root tests. If we apply the first generation panel unit root tests to the cross-sectionally dependent panels, we may be confronted by significant size distortions (De Hoyos and Sarafidis, 2006; Chudik and Pesaran, 2013). Thus, testing for cross section dependence is crucial in panel data models before employing the panel unit root tests.

A simple test to check cross sectional dependency adopts Breush and Pagan (1980) and Pesaran (2004) LM-tests. The Breusch and Pagan LM-test is based on the average of the squared correlation of the residuals across cross sectional units and is valid when $T > N$. The test is computed as Guloglu and Ivrendi (2010):

$$CD_{LM1} = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \qquad (6.22)$$

where $\hat{\rho}_{ij}$ is the sample estimate of the cross sectional correlation of the residuals. The CD_{LM1}-statistic[20] is asymptotically distributed as $\chi^2_{N(N-1)/2}$ and the null hypothesis is no cross section dependence:

$$H_0: \rho_{ij} = \rho_{ji} = 0 \quad \text{for} \quad i \neq j$$
$$H_A: \rho_{ij} = \rho_{ji} \neq 0 \quad \text{for some} \quad i \neq j$$

The test statistic in table 6.1 shows that the correlations among cross sectional residuals are significant. According to the CD_{LM1}-test, the null hypothesis of no cross sectional dependence is strongly rejected. Thus, the second generation unit root test allowing for cross section dependence should be applied to the data.

Various second generation panel unit root tests have been proposed. Choi (2002) uses a two-way error component model where the cross sections behave homogeneously to the single common factor, so it is a restricted factor model in the context of heterogeneous panels. Phillips and Sul (2003) suggest an orthogonalization procedure to asymptotically remove the common factors and develop a range of unit root tests depending on the orthogonalized data. The best implemented statistic in their simulation is a combination of p-values of individual unit root tests. Moon and Perron (2004) developed a panel unit root test which proposes pooling de-factored data and estimating the factors by principal components. Two statistics have been suggested to test the null hypothesis, assuming N and T tend to infinity, and they also show that the test has good asymptotic power features when the deterministic trends are absent. Bai and Ng (2004) test the stationarity in the common and idiosyncratic components individually and they apply principal components to the first-differenced data and combine results from an individual ADF-test by averaging p-values. Pesaran (2007) deals with cross section dependence using a method based on the mean of individual ADF-statistics in the panel.

[20] Pesaran (2004) develops an alternative version of the CD_{LM1}-test where both N and T are large, and under the null of no cross section dependence, $CD_{LM2} \sim N(0,1)$. Pesaran (2004) also suggests an alternative statistics for $N > T$ which differs from the CD_{LM1}-test. This statistic (CD) is built on the correlation coefficients across cross sectional units. It is also distributed as standard normal under the null hypothesis of no cross section dependence. In this study, $T = 42$ and $N = 30$ ($T > N$), and therefore it is clear that the CD_{LM1}-test is more suitable.

Here, the cross dependence is removed by an augmentation in the ADF-regressions with the cross section averages of lagged levels and first-differences of the individual series. Further, Hadri and Kurozumi (2012) suggest a simple test following Pesaran (2007) to test the null hypothesis of stationarity in heterogeneous panel data with cross section dependence where serial correlation exists.

In the following section, the panel unit root tests of Choi (2002), Phillips and Sul (2003), Moon and Perron (2004), Bai and Ng (2004), Pesaran (2007) and Hadri and Kurozumi (2012) are applied to check whether the time varying variables in the model are stationary under cross sectional dependency.

6.2.2.2. Choi (2002) Test

Choi (2002) employs a two-way error component model to test the unit root hypothesis where cross-sectional correlations are removed and a deterministic trend is admitted. The error component model is:

$$\varepsilon_{it} = \mu_i + \lambda_t + v_{it} \qquad i = 1, \dots, N; \qquad t = 1, \dots, N \tag{6.23}$$

where μ_i is the unobserved individual effect, λ_t is the unobserved time effect, v_{it} is a random component where:

$$v_{it} = \sum_{j=1}^{p_i} \alpha_{ij} v_{i,t-1} + e_{it} \tag{6.24}$$

and e_{it} is independent and identically distributed (IID) across individuals with mean zero and variance, σ^2. Only one common factor is considered and each individual is influenced equally by the single common factor which is represented by the time effect (λ_t). To remove the common components (μ_i and λ_t), Choi follows a two-step procedure. The first is to demean the series following Elliott, Rothenberg and Stock (1996) and the second is to remove the cross sectional means from the demeaned series. Choi (2002) extends Elliott, Rothenberg and Stock (1996) in a panel context because the estimation of the constant term employing GLS gives better finite sample properties for unit root tests when v_{it} is non-stationary or nearly I(1). When v_{it} is stationary, OLS gives a fully efficient estimator of the constant term. Since the standard ADF-test is less powerful than the DF-GLS test, the Choi test compounds the p-values obtained from DF-GLS tests for each individual. Choi proposes three tests:

$$P_m = -\frac{1}{\sqrt{N}}\sum_{i=1}^{N}[ln(p_i) + 1] \quad (6.25)$$

$$Z = -\frac{1}{\sqrt{N}}\sum_{i=1}^{N}\Phi^{-1}(p_i) \quad (6.26)$$

$$L^* = \frac{1}{\sqrt{\pi^2 N/3}}\sum_{i=1}^{N} ln\left(\frac{p_i}{1-p_i}\right) \quad (6.27)$$

where p_i is the p-value which is the significance level of the DF-GLS statistic and Φ^{-1} is the cumulative distribution function of the standard normal distribution. The tests are performed under the unit root null hypothesis against the alternative hypothesis:

$$H_0: \sum_{j=1}^{p_i} \alpha_{ij} = 1 \qquad \text{for all } i$$
$$H_A: \sum_{j=1}^{p_i} \alpha_{ij} < 1 \qquad \text{for some } i$$

The P_m-test, which is a transformed Fisher's (1932) inverse chi-square test, rejects the null hypothesis if the statistic value is larger than the critical value (1.64 for the 5 per cent significance level). The Z- and L^*-tests, which are a modification of George's (1977) logit test, reject the null if the test statistic is lower than the critical value (-1.64 for the 5 per cent significance level). The tests have a normal distribution as N and T tend towards infinity.

The table 6.1 shows the results of the Choi tests under constant, and constant and trend models. In both cases, all three tests show that the null hypothesis of unit root is rejected for AX. For $SGDP$, the test fails to reject the null in the constant case while it indicates the opposite in the constant and trend case, and we conclude that there is a unit root in the series. RFE also has a unit root. For $TGDP$, the test statistics do not reject the null hypothesis of a unit root, except for the P_m-statistic in the constant case.

Choi	Constant Model					
Variable	P_m	**p-value**	Z	**p-value**	L^*	**p-value**
AX	14.845***	0.00	-9.191***	0.00	-10.565***	0.00
$TGDP$	3.759***	0.00	-0.777	0.22	-0.960	0.17
$SGDP$	-4.254	1.00	4.718	1.00	4.305	1.00
RFE	0.429	0.33	-0.664	0.25	-0.716	0.24
	Constant and Trend Model					
Variable	P_m	**p-value**	Z	**p-value**	L^*	**p-value**
AX	15.312***	0.00	-8.669***	0.00	-9.859***	0.00
$TGDP$	0.029	0.49	0.656	0.74	0.734	0.77
$SGDP$	4.885***	0.00	-4.891***	0.00	-4.539***	0.00
RFE	-1.461	0.93	3.183	0.99	3.931	1.00
	CD_{LM1}	**p-value**				
	1792.819***	0.00				

Notes:

1. Asterisks indicate (1%) *** level of statistical significance.
2. For Choi test, the Matlab codes are available from Christophe Hurlin: http://www.runmycode.org/CompanionSite/site.do?siteId=109.
3. The lag length of the ADF regressions is set to 4.
4. The Cross section dependency test CD_{LM1} was performed in STATA 11.

Table 6.1 Choi Test Results.

6.2.2.3. Phillips and Sul (2003) Test

Phillips and Sul (2003) also propose a general test that eliminates cross sectional dependency in a panel data model and is based on the meta analysis of Maddala and Wu (1999) and Choi (2001). To explain their method, assume a simple dynamic linear heterogeneous model for balanced panel data:

$$y_{it} = \rho_i y_{i,t-1} + u_{it} \qquad i = 1, \dots, N; \qquad t = 1, \dots, T \qquad (6.28)$$

where the error term (u_{it}) has a common factor structure:

$$u_{it} = \gamma_i f_t + e_{it} \tag{6.29}$$

Like the Choi test, there is only one common factor in the error term (u_{it}). However, the common factor has a heterogeneous specification in the PS-test, contrary to the Choi test. This is a significant difference between the PS- and Choi tests. Also, the idiosyncratic errors (e_{it}) are $IID\ N(0, \sigma_i^2)$, the factor loadings (γ_i) are non-stochastic, and the common factor (f_t) is IID as $N(0, 1)$ across time. To eliminate cross section dependence, the PS-test uses an orthogonal projection matrix, Q_t, which is based on a moment-based method. The procedure removes the common factor by pre-multiplying the data by Q_t and the de-factored data are employed to compute the test statistic. The PS-test combines the p-values obtained from the ADF-regressions with the de-factored data and gives a series of test statistics. Phillips and Sul (2003) refer to the tests as Fisher type P-test, inverse normal Z-test and G-tests. The first two statistics are defined as:

$$P = -2 \sum_{i=1}^{N-1} ln(p_i) \tag{6.30}$$

$$Z = \frac{1}{\sqrt{N}} \sum_{i=1}^{N-1} \Phi^{-1}(p_i) \tag{6.31}$$

where p_i denotes the p-values of the ADF-tests from de-factored data and $\Phi^{-1}(.)$ is the inverse cumulative distribution function of the standard normal distribution. For fixed N and as T goes to infinity, the P-test follows a $\chi^2_{2(N-1)}$ distribution and the Z-test follows a standard normal distribution. Regarding the G-statistics, the G^{++}_{OLS} and G^{++}_{EMU} test for a homogeneous root in the panel. Phillips and Sul (2003) argue that the G^{++}_{EMU} statistic has a little better property than the G^{++}_{OLS} in terms of size and power. Also, they show that the G-test has less power compared to P- and Z-tests. Monte Carlo experiments of the PS-test show that their performance is good in small samples. Like the Choi test, the PS-test is performed under the null hypothesis of unit root against the alternative hypothesis of stationarity. The results of the PS-test are given in table 6.2. Only the Z-test is used in this study because the P- and Z- tests are similar and are better than the G-tests. For all series, the Z-test strongly indicates that the unit root hypothesis cannot be rejected at the 5 per cent significance level, except AX in the constant and trend model.

PS	Constant Model		Constant and Trend Model	
Variable	***Z***	**p-value**	***Z***	**p-value**
$\boldsymbol{AX}$	25.921	0.99	91.283***	0.01
$\boldsymbol{TGDP}$	20.602	0.99	16.011	0.99
$\boldsymbol{SGDP}$	11.657	1.00	15.761	0.99
$\boldsymbol{RFE}$	21.862	0.99	10.662	1.00

Notes:
1. Asterisks indicate (1%) *** level of statistical significance.
2. The test was performed in GAUSS and its code can be obtained from Donggyu Sul: http://www.utdallas.edu/~d.sul/papers/Recent%20Working%20Papers1.htm.
3. The lag length of the ADF-regressions is chosen based on the top-down method which chooses the largest lag length and decreases the number of lag at each step by checking until the model significantly becomes worse.

Table 6.2 PS-test Results.

6.2.2.4. Moon and Perron (2004) Test

Moon and Perron (2004) propose a similar test to that of Phillips and Sul (2003). They employ a factor structure to model cross section dependency and assume that the errors consist of common factors and idiosyncratic errors. The MP-test allows for more than one factor where the number of common factors is not determined a priori. The errors in the MP-test are:

$$u_{it} = \gamma_i' f_t + e_{it} \tag{6.32}$$

where f_t is a $K \times 1$ vector of unobserved common factors, γ_i indicates the $K \times 1$ vector of factor loadings, and e_{it} denotes the idiosyncratic errors which is IID. Also, f_t and e_{it} are assumed stationary and invertible infinite representations. The unit root null hypothesis of the MP-test against the heterogeneous alternative is:

$$H_0: \Phi_i = 1 \qquad \text{for all } i$$
$$H_A: \Phi_i < 1 \qquad \text{for some } i$$

The testing procedure follows two steps. The first step is to de-factor the series by estimating projection matrix onto the space orthogonal to the factor loadings so as to remove common factors, where the unbiased pooled autoregressive estimator is:

$$\rho^*_{pooled} = \frac{tr(Y_{-1}Q_\beta Y') - NT\lambda_e^N}{tr(Y_{-1}Q_\beta Y'_{-1})} \tag{6.33}$$

where $tr(.)$ is the trace operator, Y_{-1} is the matrix of lagged observed data, Q_β is the projection matrix, and λ_e^N denotes the cross-sectional average of one-side long run variance of the idiosyncratic components. The second step is to calculate two panel unit root test statistics:

$$t_a^* = \frac{\sqrt{N}T\left(\hat{\rho}^*_{pool} - 1\right)}{\sqrt{\frac{2\hat{\Phi}_e^4}{\omega_e^4}}} \tag{6.34}$$

$$t_b^* = \sqrt{N}T\left(\hat{\rho}^*_{pool} - 1\right)\sqrt{\frac{1}{NT^2}\sum_{t=2}^{T} Y'_{t-1}Q_{\Lambda_K}Y_{t-1}}\left(\frac{\hat{\omega}_e}{\Phi_e^2}\right) \tag{6.35}$$

where $\hat{\omega}_e^2$ is the cross sectional average of the estimated long run covariance and $\hat{\Phi}_e^4$ is the cross sectional average of $\omega_{e,i}^4$. Under the null hypothesis, the MP-test assumes that T and N tend towards infinity and N/T tends to zero, and the statistics have a standard normal distribution. By simulation, Moon and Perron (2004) show that the MP-test statistics have a good power and size properties, particularly when $T \geq 300$. They also note that the number of cross sections (N) must be at least 20 to obtain an accurate number of common factors (k), otherwise it is overestimated. However, the MP-test has no power where heterogeneous deterministic trends are observed in the series.

The number of the common factors (k) needs to be estimated and Moon and Perron (2004) follow Bai and Ng (2002) who consider eight different information criteria to estimate k, and the information criteria BIC_3 is preferred in small samples. The Quadratic Spectral Kernel function, which is used to estimate $\hat{\omega}_{e,i}^2$, is chosen to calculate t_a^* and t_b^*. The bandwidth parameter is determined by the Newey West (1994) non-parametric bandwidth. Table 6.3 presents the MP-test results along with those for a model containing deterministic trends. The null hypothesis of unit root in the panel is strongly rejected for all series in the constant case. This rejection is not as strong in the constant and trend case where $TGDP$ and RFE fail to reject the null, although the MP-test lacks power when time trends are included. Both t_a^* and t_b^* give consistent results.

MP		Constant Model				
Variable	$\widehat{k}$	t_a^*	p-value	t_b^*	p-value	$\widehat{\rho}_{pooled}^*$
AX	4	-37.521***	0.00	-14.959***	0.00	0.654
$TGDP$	5	-11.116***	0.00	-6.213***	0.00	0.901
$SGDP$	3	-8.737***	0.00	-4.728***	0.00	0.926
RFE	3	-9.121***	0.00	-5.978***	0.00	0.918
		Constant and Trend Model				
Variable	$\widehat{k}$	t_a^*	p-value	t_b^*	p-value	$\widehat{\rho}_{pooled}^*$
AX	3	-14.999***	0.00	-10.871***	0.00	0.759
$TGDP$	5	0.949	0.89	0.893	0.81	1.011
$SGDP$	4	-7.292***	0.00	-5.604***	0.00	0.909
RFE	2	0.365	0.64	0.339	0.63	1.005

Notes:

1. Asterisks indicate (1%) *** level of statistical significance.
2. The Matlab codes are available from Christophe Hurlin: http://www.runmycode.org/CompanionSite/site.do?siteId=111.

Table 6.3 MP-test Results.

6.2.2.5. Bai and Ng (2004) Test

Bai and Ng (2004) develop a factor analytic model to test stationarity:

$$Y_{it} = D_{it} + \gamma_i' F_t + E_{it} \qquad i = 1, \dots, N; \qquad t = 1, \dots, T \tag{6.36}$$

where D_{it} is a heterogeneous deterministic component which contains either a constant or a linear trend, F_t is a *k*-vector common factor, γ_i is a vector of factor loading and E_{it} is an idiosyncratic component. The procedure identifies non-stationarity when at least one of the common factors or the idiosyncratic component is non-stationary, or both.

Bai and Ng focus on testing them separately and call this testing procedure PANIC (Panel Analysis of Non-stationarity in Idiosyncratic and Common Components). It is similar to Moon and Perron's (2004) approach. Both approaches first de-factor the series and then propose test statistics dependent on the de-factored data. The PANIC-test differs from the MP-test in focusing on the estimated idiosyncratic components and common factors separately, whereas the MP-test directly examines the existence of a unit root based only on estimated idiosyncratic components.

Bai and Ng (2004) propose an appropriate transformation of Y_{it} to obtain consistent estimates of the unobserved components. In the case of a deterministic linear trend, demeaned first differences are employed, otherwise first differences are used. When the consistent estimated idiosyncratic components $(\hat{e}_{it})$ and common factors $(\hat{f}_t)$ are obtained by computing the principal components of the (differenced or de-trended) data, $\hat{f}_t$ and $\hat{e}_{it}$ are re-cumulated to eliminate the impact of likely excessive differencing, that is:

$$\hat{F}_t = \sum_{s=2}^{t} \hat{f}_s \tag{6.37}$$

and

$$\hat{E}_{it} = \sum_{s=2}^{t} \hat{e}_{is} \tag{6.38}$$

For the common factors, Bai and Ng (2004) employ the ADF-test if there is only one factor. When there is more than one common factor, they employ the modified version of Stock and Watson (1988) common trend tests. Regarding the idiosyncratic components, they suggest a Fisher-type test following Maddala and Wu (1999) and Choi (2001). The test statistic[21] is:

$$P_{\hat{E}}^{c} = \frac{1}{\sqrt{4N}}\left[-2\sum_{i=1}^{N} \log p\,(i) - 2N\right] \tag{6.39}$$

where $p(i)$ is the p-value of the ADF-test on the estimated residual for each individual, and the superscript c denotes the constant only model. The test statistic $P_{\hat{E}}^{c}$ has a standard normal limiting distribution.

[21] $P_{\hat{E}}^{\tau}$-statistic is for the linear trend model. The ADF-statistic with linear trend is proportional to the reciprocal of a Brownian bridge but critical values are not presented. Therefore, the $P_{\hat{E}}^{\tau}$-test is not analysed in this study due to the necessity of simulating critical values.

Bai and Ng (2004) present two statistics to test the non-stationarity of the common factors in case of more than one common factor. The two modified test statistics are MQ_f and MQ_c. The first removes non-stationary components which are assumed finite order VAR processes. The second employs a non-parametric correction for serial correlation of arbitrary form. These statistics have a nonstandard limiting distribution and critical values are provided by Bai and Ng (2004).

The PANIC-test results are presented in table 6.4. The BIC_3 criterion is used to estimate the number of common factors and the maximum number of common factors is five. According to the criterion, there is more than one common factor for all variables and the numbers of common factors are five for $SGDP$ and four for AX while it is three for other variables. The number of the common stochastic trends for the MQ_f- and MQ_c-tests is the same as the number of common factors. Therefore, there are at least three independent non-stationary common factors in the series. The results for the idiosyncratic components and the common factors show that the PANIC-test fails to reject the null hypothesis of non-stationarity for all variables at a 5 per cent significance level. From simulations, Bai and Ng show that their tests have a good performance in small samples ($N = 40$ and $T = 100$). Jang and Shin (2005) also reach a similar inference for the PANIC-test even when $N = 25$ and $T = 50$, and they identity that the power of the PANIC-test is a little better than PS- and MP-tests.

Variable	$\hat{k}$	P_C^E	**p-value**	MQ_c	MQ_f
AX	4	-1.124	0.55	4	4
$TGDP$	3	-0.449	0.67	3	3
$SGDP$	5	-0.181	0.43	5	5
RFE	3	-3.141	0.99	3	3

Notes:

1. k is the estimated number of common factors. P_C^E is a standardised statistic (Choi, 2001) on idiosyncratic components. N = 30 and T = 42.
2. Matlab codes are provided by Christophe Hurlin: http://www.runmycode.org/CompanionSite/site.do?siteId=100.

Table 6.4 PANIC-test Results.

6.2.2.6. Pesaran (2007) Test

Pesaran (2007) incorporates cross sectional dependency and augments the ADF-regression with lagged cross section averages and its first difference rather than focusing on the deviation from the estimated factor. Like the PS-test, assume a simple dynamic linear heterogeneous model:

$$y_{it} = (1-\rho_i)\mu_i + \rho_i y_{i,t-1} + u_{it} \qquad i = 1, \dots, N; \qquad t = 1, \dots, T \qquad (6.40)$$

where the error term (u_{it}) has a common factor structure:

$$u_{it} = \gamma_i f_t + e_{it} \qquad (6.41)$$

where f_t indicates an unobserved common factor which is assumed to be stationary and independently distributed for all i and t. The term γ_i indicates the corresponding factor loading and e_{it} is the idiosyncratic error term. Differencing (6.40) and substituting (6.41) gives:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \gamma_i f_t + e_{it} \qquad (6.42)$$

where $\alpha_i = (1-\rho_i)\mu_i$ and $\beta_i = (\rho_i - 1)$ and $\Delta y_{it} = y_{it} - y_{i,t-1}$. Pesaran (2007) augments (6.42) with lagged cross section averages and first differences and obtained a cross sectionally ADF-equation (CADF):

$$\Delta y_{it} = a_i + b_i y_{i,t-1} + c_i \bar{y}_{t-1} + d_i \Delta\bar{y}_t + e_{it} \qquad (6.43)$$

where $\bar{y}_{t-1} = \sum_{i=1}^{N} y_{i,t-1}$, $\Delta\bar{y}_t = \sum_{i=1}^{N} \Delta y_{it}$ and e_{it} is the regression error. The null hypothesis of a panel unit root test is:

$$H_0: \rho_i = 1 \qquad \text{for all } i$$
$$H_A: \rho_i < 1 \qquad \text{for some } i$$

When the $CADF_i$-statistics are calculated, the mean of the t-statistics yield the $CIPS$ ($\overline{CADF}$)-statistic:

$$CIPS = N^{-1} \sum_{i=1}^{N} CADF_i \tag{6.44}$$

Pesaran (2007) suggests using a truncated version of this test to mitigate undue effects of extreme results. Therefore,

$$CIPS^* = N^{-1} \sum_{i=1}^{N} CADF_i^* \tag{6.45}$$

where

$$CADF_i^* \begin{cases} CADF_i \\ -K_1 \\ K_2 \end{cases} \quad \text{if} \quad \begin{cases} -K_1 < CADF_i < K_2 \\ CADF_i \leq -K_1 \\ CADF_i \geq K_2 \end{cases} \tag{6.46}$$

where K_1 and K_2 are sufficiently large positive constants so that $Pr[-K_1 < CADF_i < K_2]$ is adequately large. Critical values for the test statistics, and K_1 and K_2 from stochastic simulation are supplied by Pesaran (2007).

An advantage of this test is that it is simple and intuitive. It is also applicable to different N and T. The $CIPS^*$-test results are shown in table 6.5 for the constant only and for the constant and linear trend models. For the constant only model, the nulls are rejected for AX and $TGDP$, but for $SGDP$ and RFE, the nulls are not rejected. When a deterministic trend is included in the test equations, $TGDP$, $SGDP$ and RFE are integrated of order one but agricultural exports (AX) is stationary. Thus, non-stationarity is generally detected in all variables except (AX).

$CIPS^{*}$		Constant Model		Constant and Trend Model	
Variables	p	$CIPS^{*}$	**p-value**	$CIPS^{*}$	**p-value**
AX	2	-2.71***	0.00	-2.86***	0.00
$TGDP$	1	-2.41***	0.00	-2.39	0.37
$SGDP$	1	-1.04	1.00	-2.18	0.84
RFE	1	-1.56	0.89	-2.40	0.37

Notes:
1. Asterisks indicate (1%) *** level of statistical significance.
2. The critical values for the $CIPS^{*}$ test are obtained from Pesaran (2007), Table II(b) and Table II(c).
3. The lag lengths (p) are the nearest integer of the average values and are selected according to Hannan and Quinn's Information Criterion (HQIC) with a maximum lag length set to 5.

T**able 6.5** $CIPS^{*}$-test Results.

6.2.2.7. Hadri and Kurozumi (2012) Test

The null hypothesis in $CIPS^{*}$-, PS-, Choi-, MP- and PANIC-tests is a unit root and the alternative is stationarity. Hadri and Kurozumi (2012) reverse these hypotheses by accepting that there is no common unit root in any individual series. Thus, the alternative hypothesis is that the panel data have a common unit root. Following Pesaran (2007), Hadri and Kurozumi (2012) propose a stationary test which considers the cross section dependency using two techniques. First, they augment the KPSS-test (1992) statistic by the cross sectional average of the observations. The regression equation is:

$$y_{it} = \alpha_i + \beta_i t + \phi_{i1} y_{i,t-1} + \cdots + \phi_{ip} y_{i,t-p} + \psi_{i0}\bar{y}_t + \cdots + \psi_{ip}\bar{y}_{i,t-p} + v_{it} \quad (6.47)$$

where $\bar{y}_t$ denotes the cross sectional average of the observations:

$$\bar{y}_t = N^{-1}\sum_{i=1}^{N} y_{it} \quad (6.48)$$

The test statistic follows Hadri (2000) to remove the cross section dependency and is:

$$Z_A = \frac{\sqrt{N}(\overline{ST} - \xi)}{\zeta} \quad (6.49)$$

where $\overline{ST}$ is the average of the KPSS-test statistics across i:

$$\overline{ST} = N^{-1}\sum_{i=1}^{N} ST_i \tag{6.50}$$

and $\xi = \frac{1}{6}$ and $\zeta^2 = \frac{1}{45}$ for the constant case, and $\xi = \frac{1}{15}$ and $\zeta^2 = \frac{11}{6300}$ for the constant and trend case. An estimation of the long run variance is built from the residuals (v_{it}):

$$\hat{\sigma}_{iSPC}^2 = \frac{\hat{\sigma}_{v_i}^2}{\left(1-\hat{\phi}_i\right)^2} \tag{6.51}$$

where

$$\hat{\phi}_i = min\left\{1 - \frac{1}{\sqrt{T}}, \sum_{j=1}^{p} \phi_{ij}\right\} \tag{6.52}$$

and

$$\hat{\sigma}_{v_i}^2 = \frac{1}{\sqrt{T}}\sum_{t=1}^{T} v_{it}^2 \tag{6.53}$$

The test statistic, Z_A^{SPC}, is:

$$Z_A^{SPC} = \frac{1}{\hat{\sigma}_{iSPC}^2 T^2}\sum_{t=1}^{T}(s_{it}^{\omega})^2 \tag{6.54}$$

where s_{it}^{ω} states the cumulative sum of residuals:

$$s_{it}^{\omega} = \sum_{t=1}^{T} \hat{v}_{it} \tag{6.55}$$

The second technique proposed by Hadri and Kurozumi (2012) adds an extra lag of y_t. The null distribution of the test statistics is asymptotically standard normal and the test statistic is:

$$Z_A^{LA} = \frac{1}{\hat{\sigma}_{iLA}^2 T^2}\sum_{t=1}^{T}(s_{it}^{\omega})^2 \tag{6.56}$$

where

$$\hat{\sigma}_{iLA}^2 = \frac{\hat{\sigma}_{v_i}^2}{\left(1-\tilde{\phi}_{i1}-\cdots-\tilde{\phi}_{ip}\right)^2} \tag{6.57}$$

Table 6.6 shows the results for both Z_A^{SPC}- and Z_A^{LA}-tests under constant, and constant and trend models. The null hypothesis of stationarity is rejected for all variables under the constant and trend case. However, with a constant, only $SGDP$ has a unit root at the 5 per cent significance level. The other variables fail to reject the null for both statistics.

HK		**Constant Model**		
Variable	$\boldsymbol{Z_A^{SPC}}$	**p-value**	$\boldsymbol{Z_A^{LA}}$	**p-value**
$\boldsymbol{AX}$	-1.417	0.92	-1.914	0.97
$\boldsymbol{TGDP}$	-0.418	0.66	0.557	0.29
$\boldsymbol{SGDP}$	40.156***	0.00	42.129***	0.00
$\boldsymbol{RFE}$	-0.543	0.71	0.674	0.25
		Constant and Trend Model		
Variable	$\boldsymbol{Z_A^{SPC}}$	**p-value**	$\boldsymbol{Z_A^{LA}}$	**p-value**
$\boldsymbol{AX}$	6.911***	0.00	6.149***	0.00
$\boldsymbol{TGDP}$	8.192***	0.00	14.669***	0.00
$\boldsymbol{SGDP}$	19.479***	0.00	21.599***	0.00
$\boldsymbol{RFE}$	8.599***	0.00	9.224***	0.00

Notes:
1. Asterisks indicate (1%) *** level of statistical significance.
2. The number of lags is determined using the method of Kwiatkowski *et al*. (1992) which is $T^{1/2} \approx 7$.
3. The GAUSS codes were obtained from Eiji Kurozumi by 'Personal Communication'.

Table 6.6 HK-test Results.

6.3. Summary and Conclusion

In this chapter, unit root tests for individual time series were first performed. The ADF-, the DF-GLS and the KPSS-test results indicate a contradiction among the tests. For example, in the linear trend case the ADF-test shows two series are stationary for agricultural exports (AX) while the KPSS-test shows seven series are stationary. The DF-GLS test gives three series as stationary. When the ADF- and the DF-GLS tests are combined, only one series is stationary in common for $TGDP$ under the linear trend case. The ADF- and the KPSS-test combination shows that three series for AX in the demeaned case and one series for $TGDP$ in the linear trend case are stationary. Also, for the DF-GLS test and the KPSS-test combination, seven series for $TGDP$ and one series for RFE are stationary in the linear trend case. According to the combination of all tests, only one series is stationary out of 120 individual time series data. The rest are non-stationary in at least one of the unit root tests applied. This lack of consensus suggests that the individual unit root tests are insufficient to produce a decisive conclusion. After this preliminary investigation of the data, panel unit root tests were employed for each variable to increase the power of unit root tests in defining the order of integration.

Table 6.7 gives a summary of the panel unit root tests. For the export variable (AX) the PS-test, PANIC-test and the HK-test under the constant, and the constant and trend cases present evidence of a unit root. Conversely, the $CIPS^*$-, Choi- and MP-tests indicate stationarity as does the HK-test with a constant. For $SGDP$, the results of all panel unit root tests imply non-stationarity under the constant case except for the MP-test. Also, $CIPS^*$-, PS- and HK-tests indicate that $SGDP$ has a unit root under the constant and trend case. According to all tests with constant and trend models, $TGDP$ has a unit root, while the MP-test, the $CIPS^*$-test and the HK-test with a constant, imply stationarity. For RFE, the MP- and the HK-tests with a constant indicate stationarity. All other tests suggest non-stationarity. Overall, the dataset comprises a mixture of stationary and non-stationary variables, but the panel unit root tests are less ambiguous than conventional unit root tests on the individual series. Also, there is some evidence that all the variables are integrated of order one. Therefore, in the following chapter the panel cointegration tests and the estimation techniques will be discussed.

Constant Model					
Tests	**Null**	***AX***	***SGDP***	***TGDP***	***RFE***
CIPS*	Unit Root	I(0)	I(1)	I(0)	I(1)
PS	Unit Root	I(1)	I(1)	I(1)	I(1)
Choi	Unit Root	I(0)	I(1)	I(1)	I(1)
MP	Unit Root	I(0)	I(0)	I(0)	I(0)
PANIC	Unit Root	I(1)	I(1)	I(1)	I(1)
HK	Stationary	I(0)	I(1)	I(0)	I(0)
Constant and Trend Model					
Tests	**Null**	***AX***	***SGDP***	***TGDP***	***RFE***
CIPS*	Unit Root	I(0)	I(1)	I(1)	I(1)
PS	Unit Root	I(0)	I(1)	I(1)	I(1)
Choi	Unit Root	I(0)	I(0)	I(1)	I(1)
MP	Unit Root	I(0)	I(0)	I(1)	I(1)
PANIC	Unit Root	-	-	-	-
HK	Stationary	I(1)	I(1)	I(1)	I(1)

Notes:
1. I (0) and 1(1) indicate stationarity and non-stationarity (unit root) respectively.
2. The second column gives the null hypothesis for each panel unit root tests.

Table 6.7 General Overview of the Panel Unit Root Tests.

Chapter 7 . Panel Cointegration Estimation

7.1. Introduction

After analysing the standard and panel unit root tests in the previous chapter, panel cointegration analysis will be addressed in this chapter. The aim is to investigate whether there is a long run relationship among the variables because spurious regression can be a serious problem when analysing non-stationary series. Spurious correlation has been known as a problem since Yule (1926). A simple OLS regression, even when dependent and independent variables are uncorrelated with each other, can produce statistically significant t-statistics and a high R^2 which suggests a significant relationship. When the dependent variable and some or all independent variables are non-stationary in the regression, meaningful results may not rise. Granger and Newbold (1974) called it "spurious regression".

In this study, the results of panel unit root tests in Chapter 6 generally show that the panel data series are non-stationary. Therefore, spurious regression may constitute a problem in our model. The exception to the spurious problem is where the variables cointegrate. To eliminate the likely spurious problem, we will closely examine cointegration regression and cointegration tests in the panel data in this chapter. Therefore, the panel cointegration literature is first discussed and then panel cointegration tests are performed. In the following section, panel cointegration estimation techniques are applied using the gravity model developed in Chapter 5 and estimation results are presented.

7.2. Panel Cointegration

In panel data series, the analysis of long run relationships using cointegration techniques is a recent development following seminal works by Pedroni (1995; 1997), McCoskey and Kao (1998) and Kao (1999). However, the beginning of the developments in cointegration techniques started with Engle and Granger (1987), Phillips and Ouralis (1990), Phillips (1991) and Johansen (1991; 1995).

Two series have a long run relationship when they generally trend in the same direction (downward or upward) and their combination is a cointegrated series (Greene, 2008, p.756). In a regression, the spurious problem for non-stationary variables disappears if the variables are cointegrated, and OLS estimators are super-consistent in cointegrated regressions. Consequently, it is important to test whether the variables are cointegrated. For this purpose, different cointegration tests are used.

As in panel unit root tests, panel cointegration tests are divided into two categories according to cross section dependence. First generation panel cointegration tests neglect cross sectional dependency, while second generation tests consider it. First generation tests can also be subdivided into two approaches. These are residual-based and system approaches. The residual-based approach proposes that there is a maximum of one cointegration vector in the model. Proponents of the residual-based approach include McCoskey and Kao (1998), Kao (1999), Pedroni (1999; 2001b; 2004), and Westerlund (2005b). By contrast, the system approach admits more than one cointegration vector and this type of panel cointegration tests are developed by Larsson, Lyhagen and Löthgren (2001), Groen and Kleibergen (2003) and Breitung (2005). It is important to consider cross section dependence because ignoring it can cause bias. Therefore, some researchers focus on the second generation panel cointegration tests: Westerlund (2007; 2008), Westerlund and Edgerton (2007), Gengenbach, Urbain and Westerlund (2008), Bai and Carrioni-Silvestre (2009), and Banerjee and Carrioni-Silvestre (2011).

McCoskey and Kao (1998) developed a residual-based test for panel data by improving the LM test of Harris and Inder (1994) and Shin (1994). The test is similar to the locally best unbiased invariant (LBUI) test which is a moving average unit root test for time series. The null hypothesis is cointegration in the series. Westerlund (2005b) showed that a drawback of McCoskey and Kao's test is size distortion in small samples and Westerlund (2005a; 2006a; 2006b) and Westerlund and Edgerton (2007) proposed new tests to deal with this problem.

Pedroni (1999; 2001b; 2004) and Kao (1999) presented residual-based tests for the null hypothesis of no cointegration. These tests extend Engle-Granger (1987) and Phillips and Ouliaris (1990) for individual time series. These tests are Dickey-Fuller type tests and according to Gutierrez (2003), Pedroni's (1999) test has less power than Kao's (1999) test in homogenous panels[22] with a modest time dimension (T). Gutierrez also compared these tests with that of Larsson, Lyhagen and Löthgren (2001) and found that their test has a lower power than the Pedroni and Kao tests. Larsson, Lyhagen and Löthgren (2001) developed a likelihood-based test in the heterogeneous panel models which is different from the residual-based one. The test allows for more than one cointegration vector in the model and is built on the average of the individual rank trace statistics following Johansen (1995). From Monte Carlo simulation to explore power, their test needs a large time dimension for a good power without considering the size of cross sectional dimension. The test is advanced by Groen and Kleibergen (2003) whose study permitted cross sectional correlation.

Westerlund (2005b) developed another residual-based test to test a long run equilibrium relationship among variables where cointegration is the null. It is called the CUSUM-test which is an improved version of Xiao (1999) and Xiao and Phillips (2002) for individual time series. The test focuses on calculating the change in the residuals. When the panel series are cointegrated, the residuals in the regression must be stationary and the change in the residuals shows equilibrium errors. However, if there is a large change in the residuals, the null is rejected. Two residual-based panel cointegration tests were also developed by Westerlund (2005a) for the null of no cointegration. These nonparametric tests are constructed on the variance ratio statistics and there is no need for the correction of the serial correlations in the residuals.

Westerlund (2006b) improved the McCoskey and Kao (1998) test and considered unknown structural breaks in the deterministic components. This is an LM-test for panel

[22] All parameters are common in a homogenous panel data model while in a heterogeneous panel data model they vary across individuals.

cointegration under the null hypothesis of cointegration. The test has a size distortion problem in small samples and a reasonable power through Monte Carlo simulations. Westerlund (2006a) developed another technique to overcome the size distortions in his LM-test where the sample was first divided into two separate groups in which observations are numbered as even and odd. The LM-test was then applied to both groups and the test results were integrated by employing the Bonferroni principle[23], as in Choi (2004). Monte Carlo simulations showed that this method considerably diminishes the size distortions.

Using second generation panel cointegration tests, Westerlund and Edgerton (2007) developed a bootstrap[24] test which takes into account the cross sectional dependence and is an improved version of McCoskey and Kao's (1998) LM-test. The sieve approach[25], which is used in this study, has the null hypothesis of cointegration. Simulation results indicate that the test performs well in limited samples. Furthermore, Westerlund (2007) presented four error correction based cointegration tests for the null of no cointegration. This develops the cointegration test for individual time series of Banerjee, Dolado and Mestre (1998). It examines the value of the error correction term in the error correction model and if it is not zero (which means that the hypothesis of no error correction is rejected), the null hypothesis of no cointegration is rejected. Also, the cross section dependency is dealt with by a bootstrap technique. According to simulation results, the tests have good size and power properties compared to first generation residual-based panel cointegration tests.

Westerlund (2008) also proposed another panel cointegration test allowing for cross section dependency. It is important to consider dependency amongst the cross sectional units while analysing the long run relationship in the model. However, Westerlund's test has another significant property that distinguishes it from other panel cointegration

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[23] The Bonferroni principle is an informal statement of a statistical theorem, the Bonferroni correction. When you search for a particular event in a specific set of data, you may assume that this kind of event occurs although the data is fully random and the number of happenings of the event will increase when the size of data increases. These happenings are called bogus. The Bonferroni correction theorem allows avoidance of most of the bogus more positive responses to a search in the data. For further information about the Bonferroni principle, see Rajaraman and Ullman (2012).

[24] Bootstrap is a general statistical method which assigns measures of accuracy to sample estimates. It can be used in estimating the bias, the variance, the prediction error, or some other such measure, of an estimator, test statistic, or other interests. See Efron and Tibshirani (1994) for more information.

[25] In the sieve approach, the time series dependence of the disturbances are approximated by a finite order autoregressive model (Westerlund and Edgerton, 2007).

tests. In particular, it allows the regressors to be stationary. Westerlund (2008) presented two panel cointegration statistics based on the Durbin-Hausman principle. The statistics test the null hypothesis of no cointegration and both tests have a standard normal distribution. Monte Carlo estimations showed that the tests have better power and small sample properties than the other cointegration tests.

Gengenbach, Urbain and Westerlund (2008) proposed two panel cointegration tests based on the conditional error correction representation under the null of no error correction. Although the tests do not depend on the common factor critique[26] of Kremers *et al.* (1992) and a step-by-step procedure is not followed, they are more ineffective than the residual-based tests due to the weak exogeneity assumptions on the regressors in the error correction model.

Westerlund and Edgerton (2008) developed a panel cointegration test from LM-based unit root tests, such as Schmidt and Phillips (1992), Ahn (1993) and Amsler and Lee (1995). The test has two different versions (the t-test and the coefficient[27]) for the null hypothesis of no cointegration and permits heteroskedasticity and serial correlation. The test also takes into account cross section dependency and unknown structural breaks. The breaks in constant and slope of the cointegrated regression can be positioned at different dates for each unit. The test has a limiting distribution which is normal and is free from nuisance parameters under the null. Banerjee and Carrion-i-Silvestre (2011) developed a similar panel cointegration test to that of Westerlund and Edgerton (2008) under the null of no cointegration by admitting cross section dependence and structural breaks in the parameters. This study is an extension of Banerjee and Carrion-i-Silvestre (2004) in which dependency is produced by employing a factor model[28] following Bai and Ng (2004). Banerjee and Carrion-i-Silvestre (2011) accept that the common factors of the independent variables are free from the dependent variables, whilst Westerlund and Edgerton (2008) permit common factors only in the cointegration residuals. Monte Carlo studies showed that both tests have a better performance with large time samples.

[26] This is a critique made by Kremer *et al.* (1992) about common factor restrictions. When a specific type of parameter restriction is provided, the autoregressive model can be seen as a restricted form of a dynamic model. This may cause a loss of power in the test.
[27] The coefficient version ($Z_{\phi}(N)$) is calculated using the least square estimates of ϕ_i which is the coefficient of the augmented test regression.
[28] A factor model is a linear equation and assumes that for individual i, the observable X_i is generated by: $X_i - \mu = LF_i + \epsilon_i$ whereμ is a $px1$ vector of variable means. L is factor loadings, F_i is a standardised unobserved variables and ϵ_i is idiosyncratic errors.

After reviewing the panel cointegration tests in the literature, we now analyse whether there is a long run relationship between our dependent variable (AX) and independent variables ($TGDP$, $SGDP$ and RFE). As in the stationary tests, DIS, TP, RLG and FTA do not require panel cointegration tests because they are time invariant or dummies. Due to the existence of cross sectional dependency in our model, second generation panel cointegration tests are employed and in particular Westerlund's (2007) error correction based test and Westerlund's (2008) Durbin-Hausman test where the null hypothesis of these tests is no cointegration. Thus, to provide the robustness of the analysis, Westerlund and Edgerton's (2007) LM-bootstrap test, which accept the null as cointegration, is also employed.

7.2.1. Westerlund (2007) Error Correction Based Test

Westerlund (2007) developed four error correction based panel cointegration tests with no cointegration as a null. The tests are built on structural dynamics instead of residual ones. Hence, the power of the tests has no restrictions arising from common factors as in the residual-based cointegration tests. The null is tested by testing if the error correction term is zero in a conditional error correction model. The general form of the error correction model is:

$$\Delta y_{it} = \delta_i' d_t + \alpha_i\left(y_{i,t-1} - \beta_i' x_{i,t-1}\right) + \sum_{j=1}^{p_i} \alpha_{ij}\Delta y_{i,t-j} + \sum_{j=-q_i}^{p_i} \gamma_{ij}\,\Delta x_{i,t-j} + e_{it} \quad (7.1)$$

where $t = 1, \dots, T$ and $i = 1, \dots, N$. The term d_t comprises the deterministic components and δ_i' is the associated vector of parameters. The deterministic components consist of three different cases. In the first, $d_t = 0$ and there are no deterministic terms. When $d_t = 1$, there is only a constant term in the model. The third case is $d_t = (1, t)'$ and the deterministic components contain constant and trend terms (Persyn and Westerlund, 2008). Equation (7.1) can be rearranged so that the error correction parameter α_i can be estimated by least squares:

$$\Delta y_{it} = \delta_i' d_t + \alpha_i y_{i,t-1} + \lambda_i' x_{i,t-1} + \sum_{j=1}^{p_i} \alpha_{ij}\Delta y_{i,t-j} + \sum_{j=-q_i}^{p_i} \gamma_{ij}\Delta x_{i,t-j} + e_{it} \quad (7.2)$$

where $\lambda_i' = -\alpha_i\beta_i'$ and α_i indicates the speed of error correction for re-establishing the equilibrium. For cointegration to exist between the variables, there should be error correction where $\alpha_i < 0$. If there is no error correction ($\alpha_i = 0$), there is no cointegration. Westerlund (2007) proposed four tests: two are referred to as group mean statistics and the other two as panel statistics. The null hypothesis of no cointegration for the group mean tests is:

$$H_0: \alpha_i = 0 \qquad \text{for all } i$$
$$H_a: \alpha_i < 0 \qquad \text{for at least one } i$$

The alternative hypothesis is determined according to the assumption made about the homogeneity of α_i and the tests do not assume that all the α_is are identical (Persyn and Westerlund, 2008). This implies that there is cointegration for at least one individual unit when the null hypothesis is rejected. The group mean tests are computed as (Westerlund, 2007):

$$G_\tau = \frac{1}{N}\sum_{i=1}^{N}\frac{\hat{\alpha}_i}{SE(\hat{\alpha}_i)} \tag{7.3}$$

and

$$G_\alpha = \frac{1}{N}\sum_{i=1}^{N}\frac{T\hat{\alpha}_i}{\hat{\alpha}_i(1)} \tag{7.4}$$

where $SE(\hat{\alpha}_i)$ is the standard error of $\hat{\alpha}_i$, $\alpha_i(1) = 1 - \sum_{j=1}^{p_i}\alpha_{ij}$ and $\hat{\alpha}_i(1)$ is the resultant semi-parametric kernel estimator of $\alpha_i(1)$.

The null and the alternative hypotheses for these panel statistics are:

$$H_0: \alpha_i = 0 \qquad \text{for all } i$$
$$H_a: \alpha_i = \alpha < 0 \qquad \text{for all } i$$

where it is assumed that all the α_is are identical and the rejection of the null shows that the panel is cointegrated as a whole. The panel statistics are formulated as:

$$P_\tau = \frac{\hat{\alpha}}{SE(\hat{\alpha})} \quad (7.5)$$

and

$$P_\alpha = T\hat{\alpha} \quad (7.6)$$

These tests consider the cross section dependency by bootstrapping and all tests are normally distributed. From equations (7.3) and (7.5), G_τ and P_τ statistics are calculated using the standard error of $\hat{\alpha}_i$ which is estimated in a standard way. The G_α and P_α statistics are obtained using the adjusted standard errors for heteroscedasticity proposed by Newey and West (1994) (Persyn and Westerlund, 2008). Westerlund (2007) also argued that the G_α and P_α tests have possibly greater power than the G_τ and P_τ tests when the time dimension is considerably greater than the number of individuals $(T > N)$.

The results of applying Westerlund's error correction based tests to our data are shown in table 7.1, for the constant, and the constant and trend cases. For completeness, the asymptotic p-values without bootstrapping do not consider cross section dependency. However, the robust p-values provide the bootstrap results and they are more appropriate for our study. Therefore, we only consider the robust p-values based on 500 bootstrap replications. In the constant model, the group mean statistics G_τ and G_α reject the null of no cointegration at the 1 per cent level, while the panel statistics P_τ and P_α reject the null at the 5 and 10 per cent levels. In the constant and trend model, only the group mean G_τ statistic rejects the null hypothesis, whereas the rest fails to reject. When the deterministic component trend term is not included, results show that the whole panel is cointegrated. In the case of a trend component, there is cointegration for at least one cross sectional unit. It is important to employ other panel cointegration test due to the lack of strong evidence for cointegration and we apply Westerlund's (2008) Durbin-Hausman test in the next section.

Constant Model				
Statistic	**Value**	**z-value**	**p-value**	**Robust p-value**
G_τ	-3.142	-5.28	0.00***	0.00***
G_α	-11.955	-0.77	0.22	0.00***
P_τ	-13.429	-2.75	0.01***	0.03**
P_α	-8.908	-1.21	0.11	0.08*
Constant and Trend Model				
Statistic	**Value**	**z-value**	**p-value**	**Robust p-value**
G_τ	-3.236	-3.35	0.00***	0.01***
G_α	-10.899	3.15	0.99	0.31
P_τ	-12.118	1.46	0.93	0.47
P_α	-7.731	3.19	0.99	0.71

Notes:

1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The Bartlett kernel window width set according to $4(T/100)^{2/9} \approx 3$.
3. The tests are employed using STATA 11 with the "xtwest" command (Persyn and Westerlund, 2008).
4. The lag and lead lengths are selected as 1 due to preventing over-parametrization and so the short run dynamics are held fixed.
5. The robust critical values are computed using 500 bootstraps.

Table 7.1 Westerlund (2007) Error Correction Model Panel Cointegration Test Results.

7.2.2. Westerlund (2008) Durbin-Hausman Test

Westerlund (2008) developed a panel cointegration test while applying the Fisher effect[29]. This test admits the cross sectional dependence and permits the regressors to be stationary. Westerlund also examined the small sample size problem and proposed two panel cointegration tests. These tests allow for common factors which were estimated by principal components. The Durbin-Hausman principle is used as a basis and to rectify the common factors, defactored residuals are used. Like Westerlund's (2007) error correction based test, the Durbin-Hausman panel cointegration test sets the null hypothesis as no cointegration. The test is based on the model:

[29] The Fisher effect is also called the Fisher hypothesis (Irving Fisher, 1930) where the real interest rate is independent of monetary measures such as nominal interest rate and the expected inflation rate.

$$y_{it} = \alpha_i + \beta_i x'_{it} + \varepsilon_{it} \tag{7.7}$$

$$\varepsilon_{it} = F_t \lambda'_i + u_{it} \tag{7.8}$$

$$\hat{u}_{it} = \rho_i \hat{u}_{i,t-1} + z_{it} \tag{7.9}$$

where F_t is $K \times 1$ vector of common factors and λ_i is a conformable vector of factor loadings which determines the level of dependency. To examine the long run relationship using Durbin-Hausman cointegration tests, it is necessary to investigate whether the idiosyncratic disturbance u_{it} is integrated of order one or not. To this end, after equation (7.7) is estimated by OLS, common factors are estimated by implementing the principal components method to the residuals obtained from the OLS estimation. The test can be applied as a stationarity test for the de-factored and first-differenced residuals. This method is effective when u_{it} is stationary, which means there is cointegration between variables in the panel.

The two panel cointegration tests proposed by Westerlund (2008) are called panel and group mean tests, as in Westerlund's (2007) error correction based test. The panel test DH_p is built on the null and alternative hypothesis as:

$$H_0: \rho_i = 1 \quad \text{for all } i$$
$$H_a: \rho_i = \rho \quad \text{and} \quad \rho_i < 1 \quad \text{for all } i$$

On the other hand, the null and alternative hypothesis of the group mean test DH_g is:

$$H_0: \rho_i = 1 \quad \text{for all } i$$
$$H_a: \rho_i < 1 \quad \text{for at least some } i$$

Rejection of the null implies that at least some individual units are cointegrated. However, if the null hypothesis of the panel test is rejected, there is evidence for cointegration in the whole panel. To obtain the Durbin-Hausman tests, the kernel estimator is defined as:

$$\widehat{\omega}_i^2 = \frac{1}{T-1}\sum_{j=-M_i}^{M_i}\left(1-\frac{j}{M_i+1}\right)\sum_{t=j+1}^{T}\hat{z}_{it}\hat{z}_{i,t-j} \qquad (7.10)$$

where $\hat{z}_{it}$ is the residuals from OLS estimates of equation (7.9), and M_i is a bandwidth parameter specifying the number of auto-covariances of $\hat{z}_{it}$ so as to estimate the kernel statistics. Two variance ratios can be obtained as:

$$\hat{S}_i = \widehat{\omega}_i^2/\hat{\sigma}_i^4 \qquad (7.11)$$

and

$$\hat{S}_n = \widehat{\omega}_n^2/(\hat{\sigma}_n^2)^2 \qquad (7.12)$$

where

$$\widehat{\omega}_n^2 = \frac{1}{n}\sum_{i=1}^{n}\widehat{\omega}_i^2 \qquad (7.13)$$

$$\hat{\sigma}_n^2 = \frac{1}{n}\sum_{i=1}^{n}\hat{\sigma}_i^2 \qquad (7.14)$$

where $\hat{\sigma}_i^2$ signifies the corresponding contemporaneous variance estimate. Therefore, the DH_p and DH_g statistics are calculated as:

$$DH_p = \hat{S}_n(\tilde{\rho}-\hat{\rho})^2\sum_{i=1}^{n}\sum_{t=2}^{T}\hat{u}_{i,t-1}^2 \qquad (7.15)$$

$$DH_g = \sum_{i=1}^{n}\hat{S}_i(\tilde{\rho}_i-\hat{\rho}_i)^2\sum_{t=2}^{T}\hat{u}_{i,t-1}^2 \qquad (7.16)$$

The results of using these test statistics are reported in table 7.2 and they indicate that the null hypothesis of no cointegration is rejected at the 1 per cent significance level for both statistics. Therefore, there is cointegration for some cross sectional units and also the whole panel. Westerlund's error correction based test (2007) and Durbin-Hausman test (2008) give similar results, although the error correction based test gives constant and constant and trend models separately. The panel cointegration test proposed by Westerlund and Edgerton (2007) is applied in the next section to obtain more evidence on the long run relationship amongst the variables.

DH_g	p-value	DH_p	p-value
17.174***	0.00	16.288***	0.00

Notes:

1. Asterisks indicate (1%) *** level of statistical significance.
2. The IC_2 information criterion is used with maximum number of common factors defined as 2.
3. The bandwidth selection M is made by choosing the largest integer less than $4(T/100)^{2/9}$ as suggested by Newey and West (1994).
4. The test is applied using the program GAUSS and the codes were obtained from Joakim Westerlund by 'Personal Communication'.

Table 7.2 Westerlund (2008) Durbin-Hausman Panel Cointegration Test Results.

7.2.3. Westerlund and Edgerton (2007) LM-Bootstrap Test

Westerlund's error correction based test (2007) and Durbin-Hausman test (2008) assume no cointegration as the null hypothesis and cointegration as the alternative. By contrast, Westerlund and Edgerton (2007) reversed the hypotheses with the null of cointegration and the alternative of no cointegration. They improved a panel cointegration test under the assumption of cross section dependency following McCoskey and Kao's (1998) LM-test. The test allows correlation to exist both within and between individual units and an advantage is that it decreases considerably size distortions. Also, the test has a good performance due to using bootstrapping techniques which are applied by a sieve approach. The null hypothesis of cointegration and the alternative is:

$$H_0: \sigma_i^2 = 0 \qquad \text{for all } i$$
$$H_a: \sigma_i^2 > 0 \qquad \text{for some } i$$

When the scalar variable y_{it} is examined as in equation (7.7), it is assumed that its disturbance ε_{it} consists of the following components:

$$\varepsilon_{it} = u_{it} + \sum_{j=1}^{t} e_{ij} \qquad (7.17)$$

where e_{ij} is IID with mean zero and variance σ_i^2. The next steps require bootstrapping the LM-test. Thus,

$$\sum_{j=0}^{\infty} \rho_{ij} w_{i,t-j} = \xi_{it} \tag{7.18}$$

where ξ_{it} are mean zero errors $(IID\ \forall t)$ and $w_{it} = (u_{it}, \Delta x_{it}')'$. The term ρ_{ij} is estimated by employing $\widehat{w}_{it}$ as a part of the bootstrap procedure where the residuals are calculated as:

$$\hat{\xi}_{it} = \sum_{j=0}^{p_i} \hat{\rho}_{ij} \widehat{w}_{i,t-j} \tag{7.19}$$

Westerlund and Edgerton (2007) obtained $w_{it}^* = \left(u_{it}^*, \Delta x_{it}^{*\prime}\right)'$ through ξ_{it}^* which is chosen from the empirical distribution. When ignoring cross section dependency, the LM-test proposed by McCoskey and Kao (1998) is:

$$LM_N^+ = \frac{1}{NT^2} \sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{\omega}_i^{-2} S_{it}^2 \tag{7.20}$$

where $\widehat{\omega}_i^2$ is the estimated long term variance of u_{it} and S_{it} is the partial sum process of ε_{it}. To admit cross section dependency, the LM-test is computed with y^* and x^* which are the bootstrap samples generated by:

$$y_{it}^* = \hat{\alpha}_i + x_{it}^{*\prime} \hat{\beta}_i + \varepsilon_{it}^* \tag{7.21}$$

and

$$x_{it}^* = \sum_{j=1}^{t} \Delta x_{ij}^* \tag{7.22}$$

In equation (7.21), $\hat{\alpha}_i$ and $\hat{\beta}_i$ are estimated from the Fully Modified OLS (FMOLS) of α_i and β_i. This process is replicated many times so that the bootstrap distribution and the critical values can be generated.

The results of applying these procedures to our data are reported in table 7.3 for constant and constant and trend models. The asymptotic test results reject the null hypothesis of cointegration. However, these results are obtained under the assumption of cross sectional independence. When we examine the bootstrapped results where cross sectional dependence is admitted, the p-values fail to reject the null of cointegration in both deterministic components; and cointegration exists between the variables.

Summarising the results so far, empirical findings indicate significant evidence supporting the presence of panel cointegration between variables. We can conclude that there is a long run relationship between agricultural exports (AX) and the explanatory variables ($SGDP$, $TGDP$ and RFE). Overall, the results support the estimation of the gravity model using panel cointegration estimation techniques. In the following section panel cointegration estimation techniques are investigated further.

	Constant Model	
LM-Statistic	**Bootstrap p-value**	**Asymptotic p-value**
62.216	0.07*	0.00***
	Constant and Trend Model	
LM-Statistic	**Bootstrap p-value**	**Asymptotic p-value**
16.451	0.12	0.00***

Notes:
1. Asterisks indicate (1%) *** and (10%) * levels of statistical significance.
2. The bootstrap based on 2000 replications.
3. The test is applied using the program GAUSS and the codes were obtained from Joakim Westerlund by 'Personal Communication'.
4. The Yule-Waler equations are employed to provide the invertibility for sieve estimation.

Table 7.3 Westerlund and Edgerton (2007) LM-Bootstrap Panel Cointegration Test Results.

7.3. Panel Cointegration Estimation and Inferences

In the previous section, the application of panel cointegration tests has shown evidence of a cointegration relationship. In this section, the long run parameters will be estimated using panel cointegration estimators. There are a number of estimation techniques of panel cointegration parameters in the panel time series literature. They have developed in a similar way to the panel unit root and panel cointegration tests. Some of the methods [bais-corrected OLS (Chen, McCoskey and Kao, 1999), Dynamic OLS (DOLS) (Kao and Chiang, 2001) and Fully Modified OLS (FMOLS) (Pedroni, 2001a)] assume cross section independency in the panel (first generation), while others [panel DOLS (Mark and Sul, 2003), two-step (Breitung, 2005), Dynamic SUR (DSUR) (Mark, Ogaki and Sul, 2005), CCE mean group (Pesaran, 2006) and CupFM (Bai and Kao, 2006)] take into account correlation between cross section units (second generation).

However, a small number of studies have applied second generation panel cointegration estimation methods [Kim (2007), Cavalcanti, Mohaddes and Raissi (2011) and Herzer, Strulik and Vollmer (2012)]. Researchers generally prefer to employ DOLS and FMOLS despite their weakness relating to cross sectional dependency. Chen, McCoskey and Kao (1999) note that the bias-corrected OLS estimator does not generally provide any improvement to the OLS estimator, and FMOLS and DOLS estimators may be better for estimating cointegrated panels. Kao and Chiang (2001) showed that the DOLS estimator performs better compared to the FMOLS estimator, even though both have the small sample bias. The main issue regarding these estimators is cross sectional dependency and ignoring it may cause biased estimates. Therefore, first generation estimators will not be discussed further.

Regarding second generation techniques, Mark and Sul (2003) proposed an improved version of the DOLS estimator developed by Saikkonen (1991) and Stock and Watson (1993). They consider individual heterogeneity with individual specific time trends and fixed effects, and time specific trends, but the cointegrating vector is assumed homogeneous between individuals. Panel DOLS deals with cross section dependency by presenting a common time effect to a certain extent and removes the likely endogeneity between the dependent variable and the regressors. Simulation results show that the estimator has good finite sample properties. Another panel cointegration estimation technique is proposed by Breitung (2005). It is an asymptotically efficient two-step estimator which extends Ahn and Reinsel (1990). The estimator is built on a cointegrated $VAR(p)$ model and follows two steps where individual specific and long run parameters are estimated in the first and the second steps, respectively. The endogeneity problem is addressed in the second step. The two-step estimator has a normal distribution and simulation results suggest that it performs well in small samples. Furthermore, Mark, Ogaki and Sul (2005) developed the Dynamic Seemingly Unrelated Regression (DSUR) estimator that provides simultaneous estimation for multiple cointegrating regressions. It manages likely endogeneity between equilibrium errors and cross-equations and is suitable when the cross section is smaller than the time series. Pesaran (2006) proposed a panel cointegration estimator which is based on a multifactor error structure, called the Common Correlated Effects Mean Group (CCEMG) estimator. He suggested that the factor estimates can be approached using the cross sectional average of the dependent and independent variables which augments standard panel regressions. Following the process, standard panel regressions can be run. Simulation results show that the estimator performs well in small samples and overcomes possible autocorrelation. Bai, Kao and Ng (2009) developed two methods where the slope parameters and the stochastic trends are simultaneously estimated. The subsequent estimators are the Continuous Updated Fully Modified (CUP-FM) and the Continuous Updated Bias-Corrected (CUP-BC) estimators. The estimators are effective in the presence of the stationary factors. Bai, Kao and Ng (2009) showed that the estimators are consistent, asymptotically normal and unbiased. According to Monte Carlo simulations, they also perform well in small samples.

In this study, the panel DOLS estimator (Mark and Sul, 2003) and two-step estimator (Breitung, 2005) techniques will be used to estimate panel cointegration parameters. Time invariant (DIS, TP and RLG) and dummy (FTA) variables are not included in the panel cointegration regression due to collinearity. Therefore, the model which will be estimated is:

$$AX_T^t = \gamma_0 + \gamma_1 TGDP_{Ti}^t + \gamma_2 SGDP_{Ti}^t + \gamma_3 RFE_{Ti}^t + \varepsilon_{Ti}^t \tag{7.23}$$

Using this model, the panel DOLS estimator will be employed first, then the two-step estimator will be applied to check for robustness.

7.3.1. The Panel DOLS Estimator

Mark and Sul (2003) developed the DOLS estimator proposed by Saikkonen (1991) and Stock and Watson (1993) taking Kao and Chiang (2001) as a starting point. The panel DOLS removes cross section dependency in a limited form by including a common time effect and performs well in Monte Carlo simulations in terms of small sample properties. Mark and Sul's method accepts that every individual unit conforms to the triangular representation[30] which is:

[30] It is a representation introduced by Phillips (1991) for a cointegrated system. For example, consider a bivariate cointegrated system for $X_t(x_{1t}, x_{2t})'$ with cointegrating vector $\beta = (1, -\beta_2)'$. Hence, the triangular representation: $x_{1t} = \beta_2 x_{2t} + \varepsilon_t$ where $\varepsilon_t \sim I(0)$ and $x_{2t} = x_{2t-1} + \epsilon_t$ where $\epsilon_t \sim I(0)$. For more information, see Phillips (1991).

$$y_{it} = \alpha_i + \lambda_i t + \theta_t + \beta' x_{it} + \varepsilon_{it} \quad (7.24)$$

where $t = 1, \dots, T$, $i = 1, \dots, N$ and $(1, -\beta')$ is a cointegrating vector between y_{it} and x_{it} and is identical in all individual units. The term α_i is an individual specific effect, $\lambda_i t$ is an individual specific linear trend, θ_t is a common time specific factor, and ε_{it} is an idiosyncratic error term, which is independent across individuals, likely dependent across time periods. The panel DOLS includes p_i leads and lags of Δx_{it} so as to eliminate possible endogeneity bias. To this end, ε_{it} is projected onto the leads and lags as follows:

$$\begin{aligned}\varepsilon_{it} &= \sum_{s=-p_i}^{p_i} \delta'_{i,s} \Delta x_{i,t-s} + \varepsilon^*_{it} \\ &= \delta'_i z_{it} + \varepsilon^*_{it}\end{aligned} \quad (7.25)$$

where ε^*_{it} is a projection error which is orthogonal to the entire leads and lags of Δx_{it}, and $\delta'_i z_{it}$ is a vector of projection dimensions. Therefore, equation (7.24) can be modified to:

$$y_{it} = \alpha_i + \lambda_i t + \theta_t + \beta' x_{it} + \delta'_i z_{it} + \varepsilon^*_{it} \quad (7.26)$$

Equation (7.26), which is the panel DOLS regression, is consistently estimated as relying on sequential limits and the vector of slope coefficients β in the equation is consistent and normally distributed. The estimation of equation (7.26) is appropriate in small to modest N.

The panel DOLS estimator is convenient and easy to estimate. The estimation results and their interpretations will be presented later. However, the panel DOLS estimator may not capture the entire cross sectional correlation existing in the data. This is an issue particularly when the correlation stays between the idiosyncratic error (ε_{it}) and the leads and lags of Δx_{it}. Therefore, Breitung's (2005) two-step estimator will be discussed next to obtain robust results.

7.3.2. The Two-Step Estimator

Breitung (2005) proposed a parametric approach grounded for a cointegrated $VAR(p)$ model to estimate cointegrated panels. He suggested a two-step estimator following Ahn and Reinsel (1990). A significant property of the estimator is to capture heterogeneity and likely simultaneous correlation among cross section units. The two-step estimator can also deal with dynamic effects, unlike the panel DOLS.

To instigate the two-step estimator, the Vector Error Correction Model (VECM) is presented as follows as a cointegrated $VAR(1)$:

$$\Delta y_{it} = \alpha_i \beta' y_{i,t-1} + \epsilon_{it} \quad (7.27)$$

where ϵ_{it} is the error term which is white noise with $E(\epsilon_{it}) = 0$ and positive definite covariance matrix $\sum_i E\left(\epsilon_{it}\epsilon_{jt}\right)$. The matrix of cointegrating vectors β is assumed to be identical across cross section units, while the short run parameters, α_i and Σ_i, differ across cross section units. The first step of the two-step estimator provides the individual specific short run parameters to be generated from distinct models for each cross section unit where the restriction for common cointegration vectors across cross section units is temporarily neglected. In the second step, the VECM model is transformed and run by the pooled regression:

$$\hat{q}_{it} = \beta' y_{i,t-1} + \hat{\vartheta}_{it} \quad (7.28)$$

where $\hat{q}_{it}$ and $\hat{\vartheta}_{it}$ are obtained from the short run parameters (α_i and Σ_i). The endogeneity issue is addressed in this stage. The long run parameters are normally distributed and Monte Carlo simulations show that the estimator performs well in mitigating small sample bias.

7.3.3. Estimation Results

The panel DOLS (Mark and Sul, 2003) and the two-step (Breitung, 2005) cointegration estimators are applied to estimate our gravity model. Time invariant (DIS, TP and RLG) and dummy (FTA) variables are not included in the panel cointegration regression due to collinearity. Therefore, only the regressors $TGDP$, RFE and $SGDP$ are incorporated in the analysis. The programmes RATS and GAUSS are used to perform panel DOLS and the two-step estimations, respectively. The estimation results of the long run relations between the independent variables ($TGDP$, RFE and $SGDP$) and the dependent variable (AX) are presented in table 7.4 and t-statistics are in parentheses.

Variables	PDOLS[1]	PDOLS[2]	PDOLS[3]	PDOLS[4]	Two-Step
	1.392***	1.383***	1.260	0.557	1.556***
$\boldsymbol{TGDP}$	(5.91)	(4.83)	(0.73)	(0.28)	(15.84)
	0.698	0.882	-1.486	-0.942	1.266***
$\boldsymbol{RFE}$	(0.69)	(0.84)	(-1.65)	(-1.01)	(3.59)
	0.08	0.146	0.920	1.114	0.446
$\boldsymbol{SGDP}$	(0.11)	(0.19)	(0.76)	(0.89)	(1.54)

Notes:

1. Asterisks indicate (1%) *** level of statistical significance.
2. The superscripts express as follows: (1) individual effects, (2) individual and common time effects, (3) individual effects and heterogeneous trends, (4) individual effects, common time effects and heterogeneous trends. The common time effects deal with cross section dependency.
3. The program code for panel DOLS was obtained from the RATS: http://www.estima.com/forum/viewtopic.php?f=8&t=734.
4. The code of two-step estimator was obtained from Jörg Breitung: http://www.ect.uni-bonn.de/mitarbeiter/joerg-breitung/two-step-estim-panel-data.

Table 7.4 Panel Cointegration Estimation Results.

For the panel DOLS regression, four different models are presented. In the first, there are no time trend and common effects (individual effect). In the second, the model contains only common time effects without a time trend. In the third, the model is with only heterogeneous time trend, while in the last the heterogeneous time trend is with common time effects. The coefficient (and elasticity) of RFE in all models is statistically insignificant, while the coefficients of $TGDP$ are significant in the first and second models only, although they have their expected signs in all models. For the third (individual effects and heterogeneous trends) and fourth (individual effects, common time effects and heterogeneous trends) cases, RFE has a negative sign although it is expected to have a positive impact on Turkish agricultural exports (AX). When a heterogeneous time trend is excluded in the model (the first and second models), the coefficient of RFE is positive as expected. Also, the coefficients of $SGDP$ have a positive sign in all cases as expected, but they are statistically insignificant. The panel DOLS regressions are estimated with two leads and two lags according to the Schwarz criterion. Panel DOLS estimation results show that Turkish agricultural exports are highly affected by the total GDP ($TGDP$) and these results are consistent with other empirical studies [Herrmann and Jochem (2005), Bussière, Fidrmuc and Schnatz (2008), Fidrmuc (2009), Stock and Pentacost (2011b) and Geldi (2012)]. According to the results from the first and second models, relative factor endowments (RFE) have a positive effect on Turkish agricultural exports, with elasticity estimates of 0.70 and 0.88, respectively, although these are not significant. For the similarity of size index ($SGDP$), the interpretation is similar. Although the panel DOLS estimation results are not significant, they show that Turkish agricultural exports and the similarity of size index have a positive relation, with an elasticity ranging from 0.08 to 1.11.

Using the two-step regression, the coefficients of $TGDP$ and RFE are statistically significant and their signs are as expected. $SGDP$ is also correctly signed but is statistically insignificant. The two-step regression results show that a 1 per cent growth in total GDP causes almost 2 per cent increase in Turkish agricultural exports (last column, Table 7.4). The elasticity of RFE is 1.27 which implies that a 1 per cent increase in relative factor endowments should augment Turkish agricultural exports to the Euro-Mediterranean countries by 1.27 per cent. The coefficient of $SGDP$ also suggests a positive effect on Turkish agricultural exports, although it is not significant.

7.4. Summary and Conclusion

It is important to apply panel cointegration tests to determine the most appropriate estimation technique and analyse the possible long run relationship between the dependent variable and independent variables. Accordingly in this chapter, panel cointegration tests were reviewed.

We then used second generation panel cointegration tests, namely Westerlund (2007) error correction based test, Westerlund (2008) Durbin-Hausman test and Westerlund and Edgerton (2007) LM-bootstrap test. Our results showed much evidence for the existence of panel cointegration between variables and we conclude that there is a long run relationship between agricultural exports (AX) and the explanatory variables ($SGDP$, $TGDP$ and RFE). This conclusion is supported by panel cointegration estimates of our gravity model where the panel DOLS and two-step estimator techniques were applied.

The results show that total GDP positively affects Turkish agricultural exports although in two models of the panel DOLS estimators ('individual effects and heterogeneous trends' and 'individual effects, common time effects and heterogeneous trends') they are statistically insignificant. The panel DOLS results show that size similarity is also a positive determinant of Turkish agricultural exports to the Euro-Mediterranean countries. The two-step estimator also shows that it has a positive effect on Turkish agricultural exports, but they are all insignificant. Relative factor endowments have a positive effect on Turkish agricultural exports in most results. However, it is only significant in the two-step estimation technique.

Overall, a comparison of the results between standard panel data estimators in Chapter 5 and panel cointegration estimators shows only slightly differences between the estimates (see table 7.5): the signs of the variables are robust and almost all the signs are as expected. The magnitude of the coefficients for total GDP, the similarity of size index and relative factor endowments are not considerably different from each other. The difference between standard estimation techniques and cointegration estimation methods is small. Thus, any bias from using standard techniques, such as the two-way random effects model, where unit roots are ignored appears small.

Variables	Two-way Random Effects	PDOLS[1]	PDOLS[2]	PDOLS[3]	PDOLS[4]	Two-step
$Constant$	11.947***	-	-	-	-	-
	(4.89)					
DIS	-1.227***	-	-	-	-	-
	(-3.23)					
TP	-0.155	-	-	-	-	-
	(-0.44)					
FTA	0.269	-	-	-	-	-
	(1.04)					
$TGDP$	1.921***	1.392***	1.383***	1.260	0.557	1.556***
	(6.20)	(5.91)	(4.826)	(0.73)	(0.28)	(15.84)
RFE	0.439	0.698	0.882	-1.486	-0.942	1.266***
	(1.30)	(0.69)	(0.84)	(-1.65)	(-1.01)	(3.59)
RLG	0.259***	-	-	-	-	-
	(2.87)					
$SGDP$	0.674***	0.08	0.146	0.920	1.114	0.446
	(2.04)	(0.11)	(0.19)	(0.76)	(0.89)	(1.54)

Notes:

1. Asterisks indicate (1%) *** level of statistical significance. t-statistics are in parentheses.
2. Two-way random effects results are robust.
3. The superscripts express as follows: (1) individual effects, (2) individual and common time effects, (3) individual effects and heterogeneous trends, (4) individual effects, common time effects and heterogeneous trends. The common time effects deal with cross section dependency.
4. (-) indicates that the variables as been dropped.

Table 7.5 A Comparison of the Estimation Results.

Chapter 8 . Conclusions

8.1. Introduction

The Turkish economy is one of the emerging market economies in the process of rapid growth and industrialisation. It is working towards being a largely developed country by involving itself in the agreements with the EU and the Union for Mediterranean. Turkey is one of the world's leading producers in agricultural products and agriculture is an important sector in its economy. Emerging markets like Turkey are becoming key trading centres in the world. Therefore, this research explores the determining factors of Turkish agricultural export flows to the Euro-Mediterranean countries.

To this end, the thesis employs recently developed econometric methods in estimating a gravity model. The analysis uses panel data covering the period 1969-2010 for 30 Euro-Mediterranean countries, encompassing the periods both before and after the signing of the Euro-Mediterranean Partnership (1995). In addition to performing estimation using traditional panel methods of fixed and random effects models, panel unit root and panel cointegration tests are conducted to examine the likely long run relationship between determining factors and agricultural export flows. The broad objectives of this study are:

- Investigating the behaviour of Turkish agri-food trade.
- Giving an overview of agricultural trade in the Euro-Mediterranean region.
- Finding out whether the existing trade agreements have resulted in benefits in terms of Turkish agricultural exports.
- Modelling trade in agri-food products between Turkey and the Euro-Mediterranean countries using panel data.
- Examining and applying panel cointegration tests and estimation techniques to the empirical analysis.

This chapter provides a summary of the study, and a discussion of the key results. We also discuss policy implications, the limitations of the study and suggest areas for further research.

8.2. An Overview of the Study

The Turkish economy has undergone a globalisation process over the past two decades as a result of an intense trade network, financial flows and production relations, although it has experienced serious instability and high inflation which makes it difficult to calculate fundamental growth. This liberalisation process started with an application for EU membership (then the European Economic Community) in 1959 and four years later Turkey signed an Association Agreement with the EU. Following the Customs Union Agreement which came into effect in January 1996, Turkey began to conclude free trade agreements (FTAs) with her trade partners (La Grò, 2003). To gain from any future trade liberalisation, Turkey has entered into relations with Mediterranean area countries which are the second most significant market for Turkey after the EU. In 1995 12 Mediterranean countries (Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, the Palestinian Authority, Syria, Tunisia, and Turkey) and 15 EU members met in Barcelona to create a common area of “calm, constancy, and shared prosperity" in the Euro-Mediterranean region and they set-up a Euro-Mediterranean Free Trade Area (EMFTA) by 2010 (EUROPA, 2010b). However, this trade liberalisation has had a slow impact on the agricultural sector in Turkey.

Agricultural trade is a crucial part of the Turkish economy and there has been an upward trend in both agricultural imports and exports for several decades. Turkey has a positive agricultural trade balance in spite of an overall trade deficit. Agriculture is also the keystone for a large majority of Mediterranean economies and having freer trade with crucial trading partners provides a motivation for the region. Turkey is the largest agricultural commodity exporter among the MPCs. In the Euro-Mediterranean region, she is ranked as the largest producer of tomatoes and walnuts, and the second largest after the EU-27 in olive oils, figs, and potatoes. At the same time, Turkey provides nearly half of the MPCs’ exports of agricultural products to the EU (Kavallari, 2009; FAO, 2013).

In this study, we examined empirical evidence of the trade pattern and the determining factors of Turkish agricultural export flows to the Euro-Mediterranean countries. A gravity model is described and estimated using balanced panel data covering the period 1969-2010 for 30 Euro-Mediterranean countries. Gravity models have been used in numerous studies to observe trade flows since the 1960s and to explain changes in trade volume between two countries, or country groups, over time. A large body of recent literature either provides modelling developments and refinements or tries to clarify policy impacts on trade.

This study uses a balanced panel dataset covering 42 years for 30 Euro-Mediterranean countries. These countries are Austria, Belgium-Luxemburg, Bulgaria, Cyprus, Czechoslovakia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Malta, the Netherlands, Poland, Portugal, Romania, Spain, Sweden and the UK, all from the EU, and Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia from the Mediterranean region. After determining the hypotheses and explanatory variables which are geographical distance (DIS), total GDP ($TGDP$), similarity of size index ($SGDP$), relative factor endowments (RFE), free trade agreements (FTA), religion (RLG) and Turkish population living in the Euro-Mediterranean country (TP), traditional panel data estimation techniques were first used. Results show that the two-way random effects model is preferred. However, recent literature shows that a more thorough analysis of the data is required before estimating the empirical model to obtain accurate and meaningful results. To this end, stationarity analysis was performed to avoid possible spurious regressions. The data was tested using both unit root tests for the individual time series and panel unit root tests. The ADF-, DF-GLS and KPSS- tests were employed for the individual time series and then the Choi, Phillips and Sul, Moon and Perron, Bai and Ng, Pesaran and Hadri and Kurozumi panel unit root tests were applied to check whether the time varying variables in the model are stationary under cross sectional dependency. We conclude that there is much evidence that the panel series contain unit roots, and panel data cointegration analysis was therefore performed to analyse the long run relations between agricultural export flows and the explanatory variables. In particular, the second generation panel cointegration tests - Westerlund (2007) error correction based test, Westerlund (2008) Durbin-Hausman test and Westerlund and Edgerton (2007) LM-bootstrap test - were employed. Long run equilibrium models were estimated using the panel cointegration estimation techniques specifically, panel DOLS and two-step estimation methods.

8.3. Main Findings

After large fluctuations in the economy due to several crises, Turkey has experienced rapid growth with the help of globalisation. The agricultural sector is very important in the Turkish economy with high shares in GDP and employment. Also, Turkey is a leading agricultural producer in the Euro-Mediterranean region, and the EU-27 and the MPCs are key export markets for Turkey. The agricultural trade balance also reflects the importance of agriculture, because it is significantly positive. The liberalisation of agriculture in Turkey is very important to promote successful economic development and better integration to the world economy.

In this thesis, an empirical gravity model has been specified to examine the determinants of Turkish agricultural exports in the Euro-Mediterranean region. This study focused on similarity of size index, relative factor endowments, free trade agreements, religion and Turkish population living in a Euro-Mediterranean country, as well as the classical variables of size and distance. Initial results were obtained from traditional panel data estimation techniques. To determine the most suitable estimation technique for panel data, some hypothesis tests are performed, namely F-tests, Breusch-Pagan LM-test, Honda test, and Hausman test. Results from these tests suggest a preference for the two-way random effects model over other models. The estimation of the two-way random effects model shows that effects of distance, total GDP, similarity of size index and common religion are as expected. They are highly significant and their signs are as predicted. For the effect of total GDP on Turkish agricultural exports, the elasticity is 1.92 suggesting that a 1 per cent increase in total GDP will augment Turkish agricultural exports to the Euro-Mediterranean countries by nearly 2 per cent. Similarly, size similarity is a positive determinant of Turkish agricultural exports and a 1 per cent rise in similarity of size index leads to an increase in Turkish agricultural exports by 0.7 per cent. Common religion also has a positive effect on Turkish agricultural exports, with an elasticity estimate of 0.26. The results also reveal that geographical distance has a negative effect on Turkish agricultural exports and a 1 per cent decrease in distance between Turkey and the importer partner will increase Turkish agricultural exports by

1.2 per cent. These results are consistent with many empirical studies in the literature. Regarding relative factor endowments, the elasticity is positive but does not have a statistically significant impact on Turkish agricultural exports. The Turkish population living in a Euro-Mediterranean country, as a proxy for common taste and preferences of Turkish people in export markets, is not statistically significant and its elasticity is negative. This determinant was tested only by Atici and Guloglu (2006) and Erdem and Nazlioglu (2008) and both found that it had a significant positive effect on Turkish agricultural exports. Free trade agreements show a positive impact on Turkish agricultural exports, but the coefficient is insignificant and so there is no support for the notion that free trade agreements between Turkey and the Euro-Mediterranean countries enhance Turkish agricultural exports.

After obtaining estimation results using traditional panel estimation methods, we examined recent literature that shows that testing likely non-stationarity of the data is essential. Accordingly, we applied the most commonly-used stationarity tests, which consider the cross section dependency. Results from both standard and panel unit root tests indicate that our data comprises a mixture of stationary and non-stationary variables. However, there is sufficient evidence to suggest that all the variables in our analysis are I(1) and we proceeded on that basis. Then and to avoid the spurious regression problem, the long run relationship between Turkish agricultural exports and the time variant explanatory variables ($TGDP$, $SGDP$ and RFE) was investigated using the second generation panel cointegration tests and estimation techniques. The panel cointegration test results show that there is a meaningful long run relationship between agricultural exports and the explanatory variables. Therefore, panel DOLS and the two-step estimation techniques were employed to re-estimate our gravity model.

The panel DOLS results show that total GDP positively affects Turkish agricultural exports. Two models of the panel DOLS estimators (individual effects and individual and common time effects) give statistically significant results. The two-step estimator also shows that GDP has a positive effect on Turkish agricultural exports. Relative factor endowments have a positive impact on Turkish agricultural exports in most results, but are only significant under the two-step estimation technique. Similarly, in all results the similarity of size index has a positive effect, but is insignificant. Furthermore, the signs of the variables are robust and almost all are as expected. The magnitudes of the coefficients for total GDP are not markedly different. Elasticity estimates vary from 0.56 to 1.92. Likewise, the magnitudes of the coefficients for relative factor endowments and size similarity are quite close to each other and range from 0.44 to 1.49 and 0.08 to 1.11, respectively. Comparing the results between the standard panel data estimator (two-way random effects model) and panel cointegration estimators (panel DOLS and two-step method) showed that there is little difference between them. Thus, there is no strong evidence obtained from the overall results to suggest standard estimation techniques produce biased results because of ignoring non-stationarity in the panel series. This conclusion has implications for studies of panel data elsewhere.

8.4. Policy Implications

Following the main findings obtained from the gravity model estimations, some policy implications can be suggested for consideration. These are fifth-fold:

- First, the estimation results show that there is a negative relationship between geographical distance and Turkish agricultural exports. The decrease in exports due to distance shows that Turkey should pay attention to trade more with geographically close countries.
- Second, there is a positive relationship between similarity in size of two countries and Turkish agricultural exports. It shows that an increase in the share of differentiated goods results in a larger trade volume. Therefore, Turkey should consider the existence of intra-industry trade with its trading partner to increase its agricultural exports.
- Third, total GDP increases Turkish agricultural exports according to the results. Turkey should focus on the countries with high GDP (richer countries) to obtain a larger volume of trade flow.
- Fourth, the results show that a common main religion increases Turkish agricultural exports. Thus, Turkey may find it easier to export more to those countries which have similar cultural values and norms.
- Fifth, free trade agreements between Turkey and Euro-Mediterranean countries do not support Turkish agricultural exports according to our empirical results. This may arise from the government interventions in the agriculture sector and

trade restrictions which hinder the development of Turkish agricultural trade. To see the significant effects of free trade agreements, Turkey should reduce high tariffs and remove export subsidies in the hope that trading partners will act likewise. Also, an increase in deficiency payments and the abolition of the direct income supports show that agricultural policies applied by Turkey are moving in the opposite direction to the CAP reforms; and the CU agreement between Turkey and the EU exclude agriculture from the treaty. Thus, Turkey should consider more implementing the CAP reforms, and the EU and Turkey should produce policies towards a free movement of agricultural products. Last, but not least, to gain more from the FTAs in the Euro-Mediterranean region, an imbalance in the distribution of financial resources and high protection levels should be reduced; and the EU and Mediterranean countries should eliminate the obstacles by forthcoming reforms of the agricultural policies to create a freer trade area in the region. These attempts can substantially help Turkey in the process of agricultural liberalisation.

8.5. Limitations and Areas for Further Research

Some Euro-Mediterranean countries were excluded in the estimation of the gravity model due to unavailable data series including agricultural export, GDP and agricultural land per capita for four EU countries (Estonia, Latvia, Lithuania and Slovenia) and seven Mediterranean countries (Albania, Bosnia and Herzegovina, Croatia, Mauritania, Monaco, Montenegro, and the Palestinian Authority). Also, the agricultural land data for the year 2010 is a repetition of the 2009 data. Another further data issue arises from the Turkish population in the Euro-Mediterranean countries which is available only for 2010 and therefore is treated as constant throughout the period.

Political, historical and economical events may have affected the structure of agricultural exports from Turkey. For example, the financial crisis of 2001 resulted in a significant detrimental effect on the structure of the Turkish economy; and military coups were experienced in 1960 and 1980, and their effects were felt in subsequent years. We do not admit structural breaks consequent upon these events and this omission could have caused significant changes in the results. Their inclusion would be an interesting area for future research. Furthermore, an investigation of causality among the variables would be an interesting topic for the further research. The assumed causality in our gravity models stems from theory but panel cointegration analysis could be used to substantial this hypothesis empirically, and this is particularly important for the export-GDP relationship. A similar study would also be interesting which examines the determinants of Turkish agricultural trade (import and export) with the other country groups such as Eastern-European countries, the Commonwealth of Independent States (CIS), BRICS (Brazil, Russia, India, China and South Africa) countries and Latin America.

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APPENDICES

Appendix to Chapter 5

5.1: Country List and Abbreviation

ALG	Algeria	**LIB**	Libya
AUS	Austria	**MAL**	Malta
BEL	Belgium-Luxemburg	**MOR**	Morocco
BUL	Bulgaria	**NET**	Netherlands
CYP	Cyprus	**POL**	Poland
CZE	Czechoslovakia	**POR**	Portugal
DEN	Denmark	**ROM**	Romania
EGY	Egypt	**SPA**	Spain
FIN	Finland	**SWE**	Sweden
FRA	France	**SYR**	Syria
GER	Germany	**TUN**	Tunisia
GRE	Greece	**UK**	United Kingdom
HUN	Hungary		
IRE	Ireland		
ISR	Israel		
ITA	Italy		
JOR	Jordan		
LEB	Lebanon		

5.2: Regression Output of STATA 11

5.2.1. Variance Infilation Factor (VIF)

Variable	VIF	1/VIF
tgdp	1.64	0.610776
sgdp	1.59	0.627618
dst	1.45	0.689939
fta	1.42	0.704264
rfe	1.25	0.798759
rlg	1.23	0.810705
tp	1.21	0.828106
Mean VIF	1.40	

5.2.2. Pooled OLS Results

Source	SS	df	MS
Model	2511.65948	7	358.808497
Residual	1659.20536	1252	1.3252439
Total	4170.86484	1259	3.31283942

Number of obs	=	1260
F(7, 1252)	=	270.75
Prob > F	=	0.0000
R-squared	=	0.6022
Adj R-squared	=	0.6000
Root MSE	=	1.1512

ax	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dst	-1.156569	.0729037	-15.86	0.000	-1.299596	-1.013542
tp	.048319	.0777696	0.62	0.535	-.1042542	.2008922
fta	-.3280261	.0869022	-3.77	0.000	-.4985162	-.157536
tgdp	1.826779	.0539317	33.87	0.000	1.720973	1.932586
rfe	.0582051	.049242	1.18	0.237	-.0384009	.154811
rlg	.267354	.0170734	15.66	0.000	.2338584	.3008497
sgdp	.7239145	.0508237	14.24	0.000	.6242055	.8236235
_cons	11.82511	.514672	22.98	0.000	10.8154	12.83483

5.2.3. One-Way Fixed Effects Model Results

```
Fixed-effects (within) regression               Number of obs      =      1260
Group variable: ident                           Number of groups   =        30

R-sq:  within  = 0.3580                         Obs per group: min =        42
       between = 0.2947                                        avg =      42.0
       overall = 0.2990                                        max =        42

                                                F(4,1226)          =    170.92
corr(u_i, Xb)  = -0.3956                        Prob > F           =    0.0000

------------------------------------------------------------------------------
          ax |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         dst |  (omitted)
          tp |  (omitted)
         fta |  -.0084865    .088587    -0.10   0.924    -.1822855    .1653124
        tgdp |   1.715369   .0882775    19.43   0.000     1.542178    1.888561
         rfe |   1.197261   .2514872     4.76   0.000     .7038685    1.690654
         rlg |  (omitted)
        sgdp |   .3613487   .1978919     1.83   0.068    -.0268957     .749593
       _cons |   4.489154   .7825106     5.74   0.000     2.953946    6.024362
-------------+----------------------------------------------------------------
     sigma_u |  1.3183641
     sigma_e |  .96351353
         rho |  .65183631   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(29, 1226) =    19.35            Prob > F = 0.0000
```

5.2.4. Two-Way Fixed Effects Model Results

```
Fixed-effects (within) regression               Number of obs      =      1260
Group variable: ident                           Number of groups   =        30

R-sq:  within  = 0.3943                         Obs per group: min =        42
       between = 0.1081                                        avg =      42.0
       overall = 0.1721                                        max =        42

                                                F(45,1185)         =     17.14
corr(u_i, Xb)  = -0.5034                        Prob > F           =    0.0000

------------------------------------------------------------------------------
          ax |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         dst |  (omitted)
          tp |  (omitted)
         fta |   .2774383   .1194701     2.32   0.020     .0430418    .5118348
        tgdp |   1.259825   .4421508     2.85   0.004     .3923395    2.127311
         rfe |    1.69477   .2883582     5.88   0.000      1.12902    2.260519
         rlg |  (omitted)
        sgdp |   .2022164   .2097385     0.96   0.335    -.2092839    .6137167
       year2 |  -.4784753   .2465758    -1.94   0.053    -.9622491    .0052985
       year3 |  -.2046797   .2490608    -0.82   0.411    -.6933291    .2839696
       year4 |  -.0654659   .2552221    -0.26   0.798    -.5662033    .4352716
       year5 |   .2432167   .2609472     0.93   0.351    -.2687532    .7551867
       year6 |   .0829911   .2689314     0.31   0.758    -.4446438     .610626
       year7 |   -.151118   .2790732    -0.54   0.588    -.6986508    .3964147
       year8 |  -.0348154   .2983951    -0.12   0.907     -.620257    .5506261
       year9 |   .2420205   .3081253     0.79   0.432    -.3625115    .8465525
      year10 |   .3472504   .3152753     1.10   0.271    -.2713096    .9658105
      year11 |   .0332926   .3186645     0.10   0.917     -.591917    .6585021
      year12 |   .4083214   .3182628     1.28   0.200    -.2160999    1.032743
      year13 |   .4262475   .3283789     1.30   0.195    -.2180213    1.070516
      year14 |   .5653223   .3402979     1.66   0.097    -.1023311    1.232976
      year15 |   .6296495   .3534235     1.78   0.075    -.0637561    1.323055
      year16 |    .456262   .3693383     1.24   0.217    -.2683678    1.180892
      year17 |   .1337778   .3813999     0.35   0.726    -.6145166    .8820723
      year18 |   .3584911   .3993093     0.90   0.369     -.424941    1.141923
      year19 |   .5912861   .4217175     1.40   0.161    -.2361101    1.418682
      year20 |   .7665457   .4343218     1.76   0.078    -.0855799    1.618671
      year21 |   .5250701    .437402     1.20   0.230    -.3330986    1.383239
      year22 |   .4821343   .4619153     1.04   0.297    -.4241287    1.388397
      year23 |   .8199935   .4647911     1.76   0.078    -.0919118    1.731899
      year24 |   .7666518   .4828205     1.59   0.113    -.1806265     1.71393
      year25 |   .5297168   .5016659     1.06   0.291    -.4545356    1.513969
      year26 |   .7495215   .4951298     1.51   0.130    -.2219072     1.72095
      year27 |   .6760225   .5338218     1.27   0.206    -.3713188    1.723364
      year28 |   .6009752   .5558018     1.08   0.280    -.4894902    1.691441
      year29 |   .5348341   .5798803     0.92   0.357    -.6028724    1.672541
      year30 |   .4510318   .5959606     0.76   0.449    -.7182237    1.620287
      year31 |   .4084523   .5943718     0.69   0.492    -.7576862    1.574591
      year32 |   .1722323   .6181415     0.28   0.781    -1.040542    1.385006
      year33 |   .2478502   .6073649     0.41   0.683    -.9437803    1.439481
      year34 |   .0513107   .6254942     0.08   0.935    -1.175889     1.27851
      year35 |   .1869678   .6423459     0.29   0.771    -1.073294     1.44723
      year36 |   .3098296   .6741131     0.46   0.646    -1.012759    1.632418
      year37 |   .4142842    .700227     0.59   0.554    -.9595386    1.788107
      year38 |   .3781275   .7276588     0.52   0.603    -1.049516    1.805771
      year39 |   .3772531   .7494488     0.50   0.615    -1.093141    1.847648
      year40 |   .5330256   .7537225     0.71   0.480    -.9457538    2.011805
      year41 |   .5473394   .7373996     0.74   0.458     -.899415    1.994094
      year42 |   .5398116    .763043     0.71   0.479    -.9572542    2.036877
       _cons |   6.908221   2.498845     2.76   0.006     2.005566    11.81088
-------------+----------------------------------------------------------------
     sigma_u |  1.6174957
     sigma_e |  .95192927
         rho |  .74274543   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(29, 1185) =    20.70            Prob > F = 0.0000
```

5.2.5. One-Way Random Effects Results

```
Random-effects GLS regression                   Number of obs      =      1260
Group variable: ident                           Number of groups   =        30

R-sq:  within  = 0.3514                         Obs per group: min =        42
       between = 0.7604                                        avg =      42.0
       overall = 0.5856                                        max =        42

Random effects u_i ~ Gaussian                   Wald chi2(7)       =    770.05
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000
theta              = .75908005
```

ax	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dst	-1.065529	.2355961	-4.52	0.000	-1.527289	-.6037691
tp	.0109254	.2633867	0.04	0.967	-.505303	.5271537
fta	-.0694684	.0865165	-0.80	0.422	-.2390376	.1001008
tgdp	1.668148	.0807412	20.66	0.000	1.509898	1.826398
rfe	.3509197	.138626	2.53	0.011	.0792178	.6226217
rlg	.2475835	.0583628	4.24	0.000	.1331945	.3619724
sgdp	.6892527	.1299061	5.31	0.000	.4346414	.943864
_cons	11.96024	1.764439	6.78	0.000	8.502	15.41847
sigma_u	.59893003					
sigma_e	.96351353					
rho	.27870718	(fraction of variance due to u_i)				

5.2.6. Two-Way Random Effects Results

```
Random-effects GLS regression                   Number of obs      =      1260
Group variable: ident                           Number of groups   =        30

R-sq:  within  = 0.3839                         Obs per group: min =        42
       between = 0.7435                                        avg =      42.0
       overall = 0.5904                                        max =        42

Random effects u_i ~ Gaussian                   Wald chi2(48)      =    839.48
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000
```

ax	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dst	-1.226796	.2551825	-4.81	0.000	-1.726945	-.7266477
tp	-.1553638	.2751263	-0.56	0.572	-.6946014	.3838738
fta	.2693801	.1135601	2.37	0.018	.0468064	.4919537
tgdp	1.920828	.1870351	10.27	0.000	1.554246	2.28741
rfe	.4299896	.1402815	3.07	0.002	.155043	.7049363
rlg	.2590841	.0589378	4.40	0.000	.1435682	.3746001
sgdp	.6741794	.1307055	5.16	0.000	.4180014	.9303574
year2	-.5256802	.2492267	-2.11	0.035	-1.014155	-.0372048
year3	-.2838189	.2496317	-1.14	0.256	-.7730881	.2054503
year4	-.1885041	.2506793	-0.75	0.452	-.6798265	.3028183
year5	.0834208	.2516493	0.33	0.740	-.4098027	.5766443
year6	-.1234327	.2529783	-0.49	0.626	-.619261	.3723957
year7	-.4075775	.2546675	-1.60	0.110	-.9067166	.0915617
year8	-.3581474	.2582034	-1.39	0.165	-.8642167	.1479219
year9	-.1208501	.2599067	-0.46	0.642	-.6302579	.3885576
year10	-.045294	.2611159	-0.17	0.862	-.5570718	.4664838
year11	-.3702538	.2616948	-1.41	0.157	-.8831662	.1426586
year12	-.0094967	.2613514	-0.04	0.971	-.5217361	.5027427
year13	-.0283412	.2632186	-0.11	0.914	-.5442401	.4875578
year14	.0492182	.2651635	0.19	0.853	-.4704927	.5689292
year15	.0706987	.2677399	0.26	0.792	-.4540619	.5954593
year16	-.1301649	.2713518	-0.48	0.631	-.6620046	.4016749
year17	-.4792649	.2740604	-1.75	0.080	-1.016413	.0578835
year18	-.2903862	.2783382	-1.04	0.297	-.8359191	.2551467
year19	-.0878216	.2841823	-0.31	0.757	-.6448086	.4691655
year20	.0451141	.2868367	0.16	0.875	-.5170755	.6073038
year21	-.1924726	.2879364	-0.67	0.504	-.7568176	.3718724
year22	-.2822039	.2943429	-0.96	0.338	-.8591054	.2946977
year23	.0456308	.2949007	0.15	0.877	-.5323641	.6236256
year24	-.0423475	.2995203	-0.14	0.888	-.6293965	.5447016
year25	-.311853	.304853	-1.02	0.306	-.9093538	.2856478
year26	-.0899741	.3024646	-0.30	0.766	-.6827938	.5028456
year27	-.2002336	.3162303	-0.63	0.527	-.8200337	.4195664
year28	-.3115744	.3226671	-0.97	0.334	-.9439904	.3208416
year29	-.4091605	.3305564	-1.24	0.216	-1.057039	.2387182
year30	-.5173408	.3366272	-1.54	0.124	-1.177118	.1424363
year31	-.5633109	.336214	-1.68	0.094	-1.222278	.0956564
year32	-.8296052	.3442476	-2.41	0.016	-1.504318	-.1548924
year33	-.7478286	.3403513	-2.20	0.028	-1.414905	-.0807524
year34	-.9749544	.3459046	-2.82	0.005	-1.652915	-.2969937
year35	-.8698118	.3510147	-2.48	0.013	-1.557788	-.1818357
year36	-.7922166	.3623232	-2.19	0.029	-1.502357	-.0820762
year37	-.7154085	.3717639	-1.92	0.054	-1.444052	.0132353
year38	-.8123311	.3807286	-2.13	0.033	-1.558545	-.0661169
year39	-.8485413	.3889721	-2.18	0.029	-1.610913	-.0861699
year40	-.7039753	.3900489	-1.80	0.071	-1.468457	.0605065
year41	-.6790014	.3839742	-1.77	0.077	-1.431577	.0735743
year42	-.7210918	.3928263	-1.84	0.066	-1.491017	.0488335
_cons	11.94655	1.782188	6.70	0.000	8.453529	15.43958
sigma_u	.59937091					
sigma_e	.95192927					
rho	.28389543	(fraction of variance due to u_i)				

5.2.7. Hausman Test for Two-Way Error Component Model

	Coefficients			
	(b) within	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
fta	.2774383	.2693801	.0080582	.0371108
tgdp	1.259825	1.920828	-.6610027	.4006435
rfe	1.69477	.4299896	1.26478	.2519356
sgdp	.2022164	.6741794	-.471963	.1640315
year2	-.4784753	-.5256802	.0472048	.
year3	-.2046797	-.2838189	.0791392	.
year4	-.0654659	-.1885041	.1230382	.0479393
year5	.2432167	.0834208	.159796	.0690366
year6	.0829911	-.1234327	.2064238	.0912475
year7	-.151118	-.4075775	.2564594	.1141329
year8	-.0348154	-.3581474	.323332	.1495682
year9	.2420205	-.1208501	.3628707	.1654984
year10	.3472504	-.045294	.3925445	.1766833
year11	.0332926	-.3702538	.4035463	.1818321
year12	.4083214	-.0094967	.4178181	.1816222
year13	.4262475	-.0283412	.4545887	.1963382
year14	.5653223	.0492182	.5161041	.2132861
year15	.6296495	.0706987	.5589508	.2307022
year16	.456262	-.1301649	.5864269	.2505573
year17	.1337778	-.4792649	.6130428	.2652486
year18	.3584911	-.2903862	.6488773	.2863141
year19	.5912861	-.0878216	.6791076	.3115864
year20	.7665457	.0451141	.7214315	.326129
year21	.5250701	-.1924726	.7175427	.3292616
year22	.4821343	-.2822039	.7643381	.3559887
year23	.8199935	.0456308	.7743627	.3592553
year24	.7666518	-.0423475	.8089993	.3786862
year25	.5297168	-.311853	.8415698	.3984136
year26	.7495215	-.0899741	.8394956	.3920059
year27	.6760225	-.2002336	.8762561	.4300746
year28	.6009752	-.3115744	.9125496	.4525501
year29	.5348341	-.4091605	.9439946	.4764384
year30	.4510318	-.5173408	.9683726	.4917836
year31	.4084523	-.5633109	.9717631	.4901408
year32	.1722323	-.8296052	1.001838	.5134127
year33	.2478502	-.7478286	.9956788	.5030439
year34	.0513107	-.9749544	1.026265	.5211459
year35	.1869678	-.8698118	1.05678	.5379563
year36	.3098296	-.7922166	1.102046	.5684632
year37	.4142842	-.7154085	1.129693	.5933881
year38	.3781275	-.8123311	1.190459	.6201073
year39	.3772531	-.8485413	1.225794	.6406046
year40	.5330256	-.7039753	1.237001	.6449492
year41	.5473394	-.6790014	1.226341	.6295411
year42	.5398116	-.7210918	1.260903	.6541576

```
                  b = consistent under Ho and Ha; obtained from xtreg
   B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

            chi2(45) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                     =       24.44
          Prob>chi2 =      0.9947
          (V_b-V_B is not positive definite)
```

5.2.8. Pooled OLS Results with Robust and Clustered Standard Errors

```
Linear regression                                      Number of obs =    1260
                                                       F(  7,    29) =   31.57
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.6022
                                                       Root MSE      =  1.1512

                                 (Std. Err. adjusted for 30 clusters in ident)
```

ax	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
dst	-1.156569	.2968176	-3.90	0.001	-1.763629	-.5495091
tp	.048319	.2658136	0.18	0.857	-.4953309	.5919689
fta	-.3280261	.1325773	-2.47	0.019	-.5991772	-.056875
tgdp	1.826779	.1517531	12.04	0.000	1.516409	2.137149
rfe	.0582051	.1699342	0.34	0.734	-.2893495	.4057596
rlg	.267354	.0682576	3.92	0.001	.1277515	.4069566
sgdp	.7239145	.2031564	3.56	0.001	.3084129	1.139416
_cons	11.82511	2.089935	5.66	0.000	7.550717	16.09951

5.2.9. One-Way Fixed Effects Results with Robust and Clustered Standard Errors

```
Fixed-effects (within) regression               Number of obs      =      1260
Group variable: ident                           Number of groups   =        30

R-sq:  within  = 0.3580                         Obs per group: min =        42
       between = 0.2947                                        avg =      42.0
       overall = 0.2990                                        max =        42

                                                F(4,29)            =     29.88
corr(u_i, Xb)  = -0.3956                        Prob > F           =    0.0000

                                 (Std. Err. adjusted for 30 clusters in ident)
```

ax	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
dst	(omitted)					
tp	(omitted)					
fta	-.0084865	.1819112	-0.05	0.963	-.3805367	.3635636
tgdp	1.715369	.3239736	5.29	0.000	1.052769	2.37797
rfe	1.197261	.979382	1.22	0.231	-.8057998	3.200322
rlg	(omitted)					
sgdp	.3613487	.5579579	0.65	0.522	-.7798033	1.502501
_cons	4.489154	2.374173	1.89	0.069	-.3665744	9.344883
sigma_u	1.3183641					
sigma_e	.96351353					
rho	.65183631	(fraction of variance due to u_i)				

5.2.10. Two-Way Fixed Effects Results with Robust and Clustered Standard Errors

```
Fixed-effects (within) regression               Number of obs      =      1260
Group variable: ident                           Number of groups   =        30

R-sq:  within  = 0.3943                         Obs per group: min =        42
       between = 0.1081                                        avg =      42.0
       overall = 0.1721                                        max =        42

                                                F(29,29)           =         .
corr(u_i, Xb)  = -0.5034                        Prob > F           =         .

                                  (Std. Err. adjusted for 30 clusters in ident)
```

ax	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
dst	(omitted)					
tp	(omitted)					
fta	.2774383	.2783585	1.00	0.327	-.2918687	.8467452
tgdp	1.259825	1.153669	1.09	0.284	-1.099694	3.619344
rfe	1.69477	1.158291	1.46	0.154	-.6742008	4.06374
rlg	(omitted)					
sgdp	.2022164	.5954781	0.34	0.737	-1.015673	1.420106
year2	-.4784753	.2030119	-2.36	0.025	-.8936813	-.0632693
year3	-.2046797	.2141236	-0.96	0.347	-.6426117	.2332522
year4	-.0654659	.2291537	-0.29	0.777	-.5341378	.4032061
year5	.2432167	.3300882	0.74	0.467	-.4318895	.918323
year6	.0829911	.2873805	0.29	0.775	-.5047681	.6707503
year7	-.151118	.3348458	-0.45	0.655	-.8359546	.5337185
year8	-.0348154	.4744185	-0.07	0.942	-1.00511	.9354794
year9	.2420205	.4563346	0.53	0.600	-.6912886	1.17533
year10	.3472504	.5805856	0.60	0.554	-.8401805	1.534681
year11	.0332926	.6208502	0.05	0.958	-1.236489	1.303074
year12	.4083214	.6174549	0.66	0.514	-.8545156	1.671158
year13	.4262475	.7045175	0.61	0.550	-1.014653	1.867148
year14	.5653223	.6687941	0.85	0.405	-.8025151	1.93316
year15	.6296495	.6773541	0.93	0.360	-.7556952	2.014994
year16	.456262	.678847	0.67	0.507	-.9321359	1.84466
year17	.1337778	.6990851	0.19	0.850	-1.296012	1.563567
year18	.3584911	.7833001	0.46	0.651	-1.243537	1.96052
year19	.5912861	.8479193	0.70	0.491	-1.142904	2.325476
year20	.7665457	.9089104	0.84	0.406	-1.092385	2.625476
year21	.5250701	.9047717	0.58	0.566	-1.325396	2.375536
year22	.4821343	.9862503	0.49	0.629	-1.534974	2.499243
year23	.8199935	.9993287	0.82	0.419	-1.223863	2.86385
year24	.7666518	1.09089	0.70	0.488	-1.46447	2.997773
year25	.5297168	1.160924	0.46	0.652	-1.844639	2.904073
year26	.7495215	1.141876	0.66	0.517	-1.585877	3.08492
year27	.6760225	1.264343	0.53	0.597	-1.90985	3.261894
year28	.6009752	1.302768	0.46	0.648	-2.063485	3.265436
year29	.5348341	1.355948	0.39	0.696	-2.238392	3.30806
year30	.4510318	1.375899	0.33	0.745	-2.362997	3.265061
year31	.4084523	1.417514	0.29	0.775	-2.490689	3.307593
year32	.1722323	1.476964	0.12	0.908	-2.848498	3.192963
year33	.2478502	1.452318	0.17	0.866	-2.722474	3.218174
year34	.0513107	1.516454	0.03	0.973	-3.050185	3.152807
year35	.1869678	1.554977	0.12	0.905	-2.993317	3.367253
year36	.3098296	1.654437	0.19	0.853	-3.073874	3.693533
year37	.4142842	1.709575	0.24	0.810	-3.082189	3.910757
year38	.3781275	1.78986	0.21	0.834	-3.282547	4.038802
year39	.3772531	1.844704	0.20	0.839	-3.39559	4.150096
year40	.5330256	1.853885	0.29	0.776	-3.258595	4.324646
year41	.5473394	1.808819	0.30	0.764	-3.15211	4.246789
year42	.5398116	1.877513	0.29	0.776	-3.300133	4.379756
_cons	6.908221	6.752219	1.02	0.315	-6.901617	20.71806
sigma_u	1.6174957					
sigma_e	.95192927					
rho	.74274543	(fraction of variance due to u_i)				

5.2.11. One-Way Random Effects Results with Robust and Clustered Standard Errors

```
Random-effects GLS regression                   Number of obs      =      1260
Group variable: ident                           Number of groups   =        30

R-sq:  within  = 0.3514                         Obs per group: min =        42
       between = 0.7604                                        avg =      42.0
       overall = 0.5856                                        max =        42

Random effects u_i ~ Gaussian                   Wald chi2(7)       =    129.48
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

                                 (Std. Err. adjusted for 30 clusters in ident)
```

ax	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
dst	-1.065529	.3001799	-3.55	0.000	-1.653871	-.4771872
tp	.0109254	.3193004	0.03	0.973	-.6148918	.6367426
fta	-.0694684	.1633886	-0.43	0.671	-.3897042	.2507674
tgdp	1.668148	.2505379	6.66	0.000	1.177103	2.159193
rfe	.3509197	.3360241	1.04	0.296	-.3076754	1.009515
rlg	.2475835	.0922787	2.68	0.007	.0667206	.4284463
sgdp	.6892527	.3143431	2.19	0.028	.0731516	1.305354
_cons	11.96024	2.444727	4.89	0.000	7.16866	16.75181
sigma_u	.59893003					
sigma_e	.96351353					
rho	.27870718	(fraction of variance due to u_i)				

5.2.12. Two-Way Random Effects Results with Robust and Clustered Standard Errors

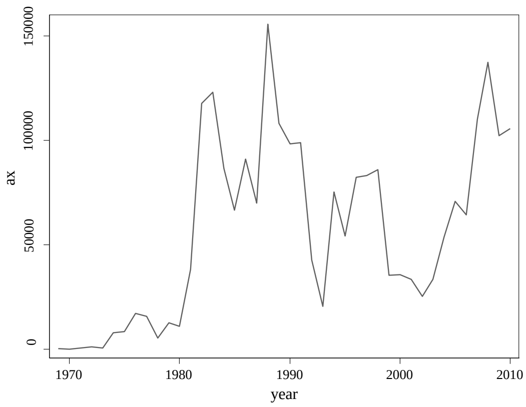
```
Random-effects GLS regression                   Number of obs      =      1260
Group variable: ident                           Number of groups   =        30

R-sq:  within  = 0.3839                         Obs per group: min =        42
       between = 0.7435                                        avg =      42.0
       overall = 0.5904                                        max =        42

Random effects u_i ~ Gaussian                   Wald chi2(29)      =         .
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =         .

                                  (Std. Err. adjusted for 30 clusters in ident)
```

ax	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
dst	-1.226796	.3768601	-3.26	0.001	-1.965428	-.4881639
tp	-.1553638	.353958	-0.44	0.661	-.8491087	.5383811
fta	.2693801	.254902	1.06	0.291	-.2302187	.7689788
tgdp	1.920828	.3049236	6.30	0.000	1.323189	2.518467
rfe	.4299896	.3318142	1.30	0.195	-.2203543	1.080334
rlg	.2590841	.0968849	2.67	0.007	.0691933	.448975
sgdp	.6741794	.3310773	2.04	0.042	.0252798	1.323079
year2	-.5256802	.1897975	-2.77	0.006	-.8976764	-.1536839
year3	-.2838189	.196146	-1.45	0.148	-.668258	.1006201
year4	-.1885041	.1661572	-1.13	0.257	-.5141662	.137158
year5	.0834208	.2185121	0.38	0.703	-.3448552	.5116967
year6	-.1234327	.2583262	-0.48	0.633	-.6297427	.3828774
year7	-.4075775	.2550396	-1.60	0.110	-.9074459	.0922909
year8	-.3581474	.3430277	-1.04	0.296	-1.030469	.3141746
year9	-.1208501	.2637945	-0.46	0.647	-.6378778	.3961775
year10	-.045294	.3279253	-0.14	0.890	-.6880158	.5974277
year11	-.3702538	.4061716	-0.91	0.362	-1.166335	.4258279
year12	-.0094967	.3806026	-0.02	0.980	-.7554641	.7364707
year13	-.0283412	.4980653	-0.06	0.955	-1.004531	.9478489
year14	.0492182	.3866233	0.13	0.899	-.7085494	.8069859
year15	.0706987	.3681705	0.19	0.848	-.6509023	.7922997
year16	-.1301649	.3475283	-0.37	0.708	-.8113077	.550978
year17	-.4792649	.3349655	-1.43	0.152	-1.135785	.1772554
year18	-.2903862	.3865331	-0.75	0.452	-1.047977	.4672048
year19	-.0878216	.3238735	-0.27	0.786	-.7226019	.5469588
year20	.0451141	.3359837	0.13	0.893	-.6134019	.7036302
year21	-.1924726	.3415772	-0.56	0.573	-.8619516	.4770065
year22	-.2822039	.3418982	-0.83	0.409	-.9523121	.3879044
year23	.0456308	.3196955	0.14	0.887	-.580961	.6722225
year24	-.0423475	.3422859	-0.12	0.902	-.7132155	.6285205
year25	-.311853	.3339174	-0.93	0.350	-.966319	.342613
year26	-.0899741	.344058	-0.26	0.794	-.7643153	.5843672
year27	-.2002336	.3390956	-0.59	0.555	-.8648489	.4643816
year28	-.3115744	.3311097	-0.94	0.347	-.9605376	.3373887
year29	-.4091605	.333787	-1.23	0.220	-1.063371	.24505
year30	-.5173408	.3880374	-1.33	0.182	-1.27788	.2431986
year31	-.5633109	.3684615	-1.53	0.126	-1.285482	.1588603
year32	-.8296052	.381906	-2.17	0.030	-1.578127	-.0810832
year33	-.7478286	.3786439	-1.98	0.048	-1.489957	-.0057002
year34	-.9749544	.3745621	-2.60	0.009	-1.709083	-.240826
year35	-.8698118	.3863706	-2.25	0.024	-1.627084	-.1125394
year36	-.7922166	.4098144	-1.93	0.053	-1.595438	.0110049
year37	-.7154085	.4180453	-1.71	0.087	-1.534762	.1039452
year38	-.8123311	.4192851	-1.94	0.053	-1.634115	.0094526
year39	-.8485413	.4395288	-1.93	0.054	-1.710002	.0129193
year40	-.7039753	.4330776	-1.63	0.104	-1.552792	.1448412
year41	-.6790014	.4269664	-1.59	0.112	-1.51584	.1578374
year42	-.7210918	.4361906	-1.65	0.098	-1.57601	.1338261
_cons	11.94655	2.444068	4.89	0.000	7.156269	16.73684
sigma_u	.59937091					
sigma_e	.95192927					
rho	.28389543	(fraction of variance due to u_i)				

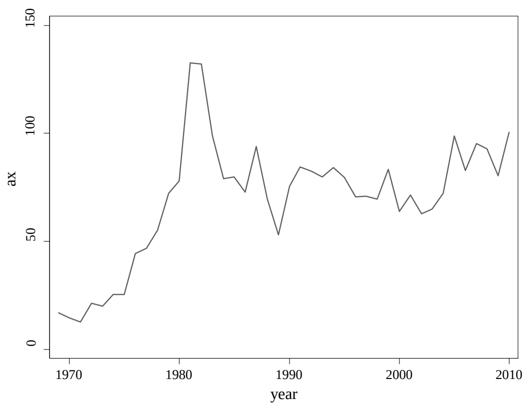
5.3: Time Series Graphs

Figure 5.1 Turkish Agricultural Export (AX) to Euro-Mediterranean Countries (1969-2010).

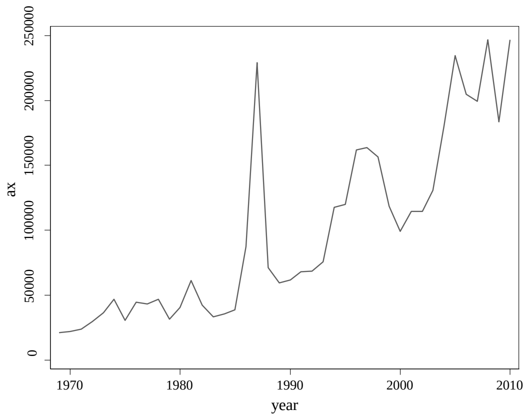
Algeria



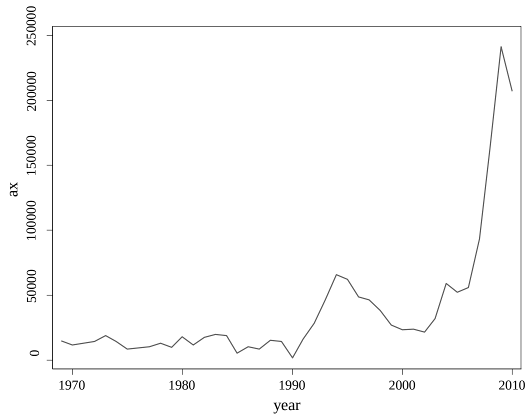
Austria



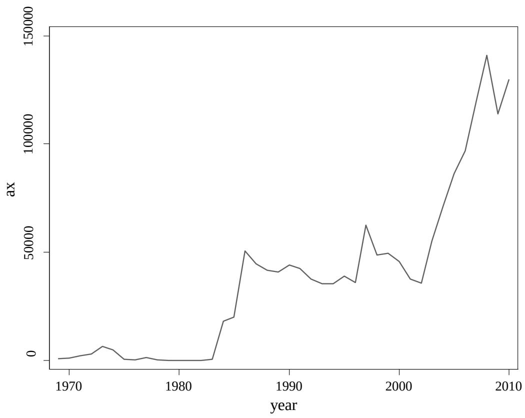
Belgium-Luxemburg



Bulgaria

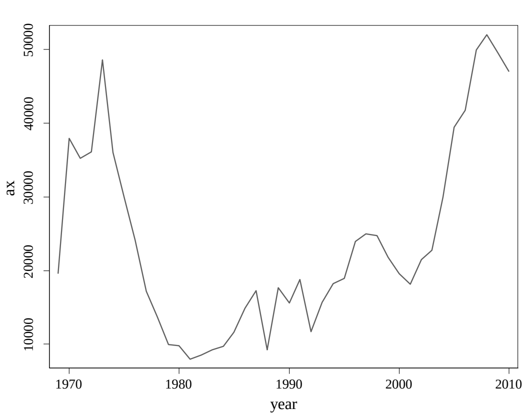


Cyprus

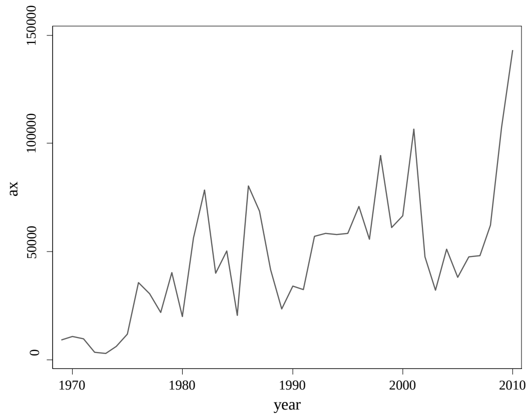


Czechoslovaki

Denmark

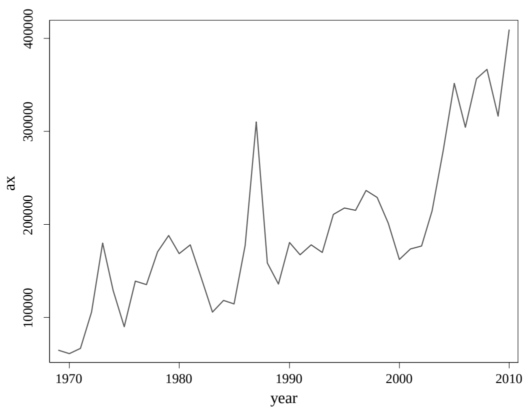


Egypt

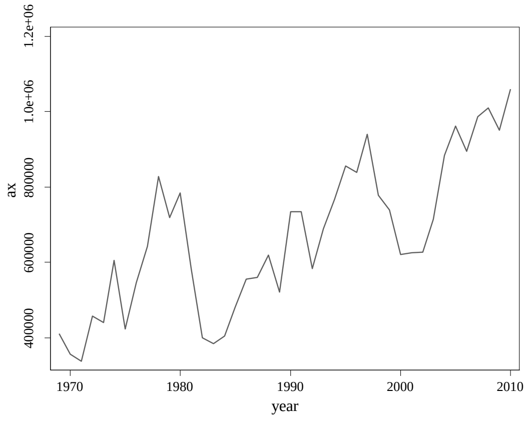


Finland

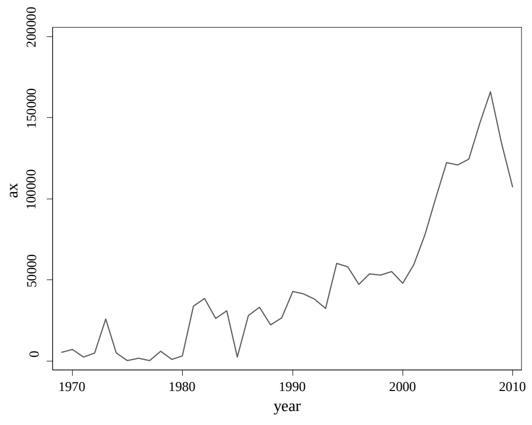
France



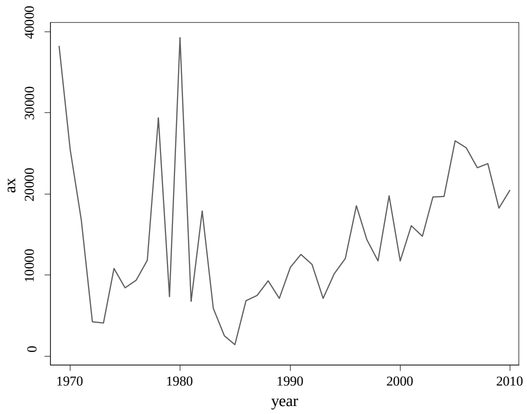
Germany



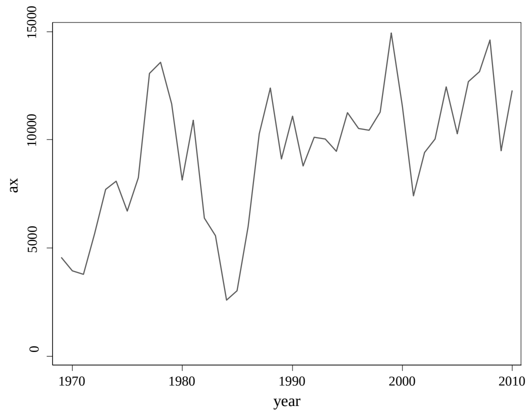
Greece



Hungary



Ireland



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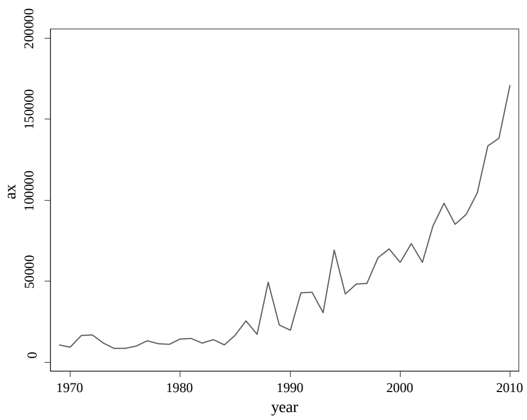
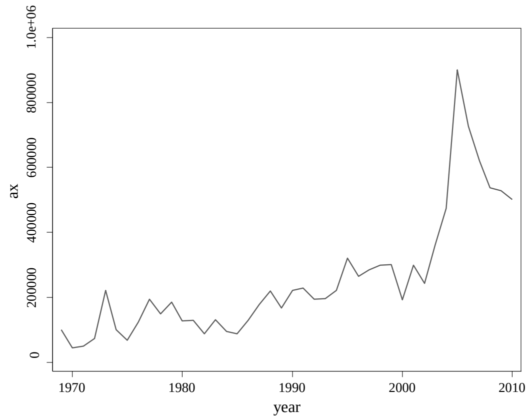


Italy



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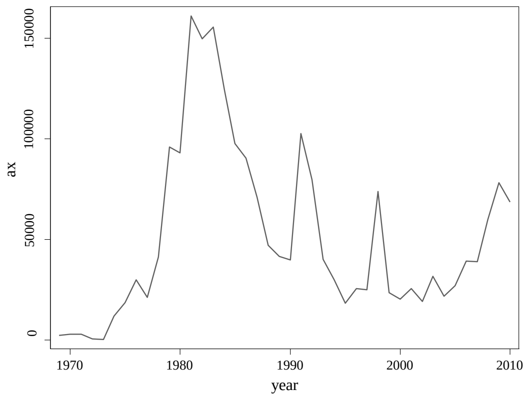
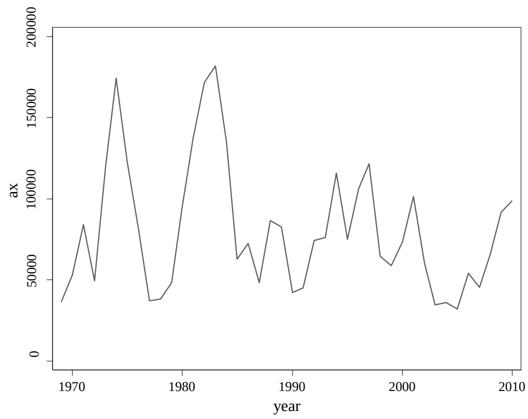
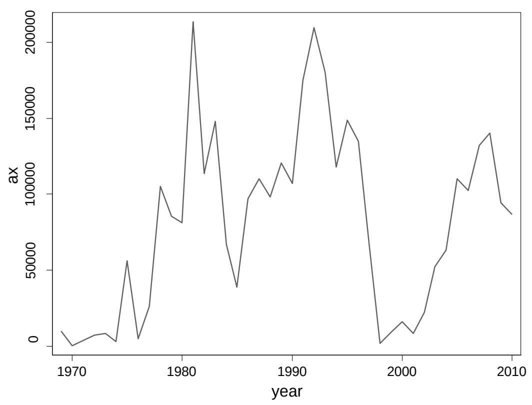


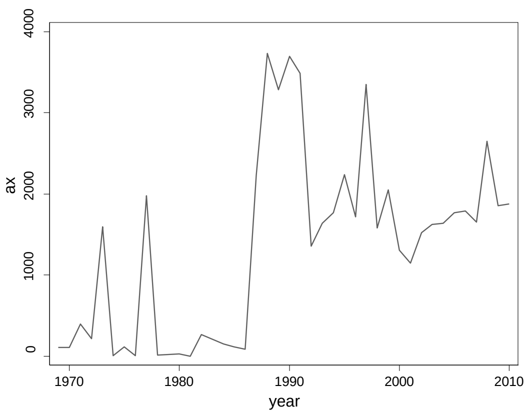
Lebanon



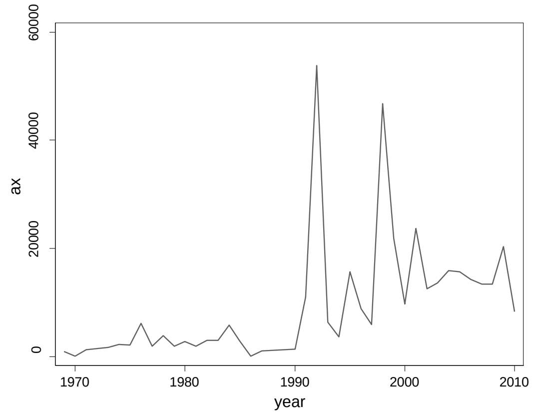
Libya



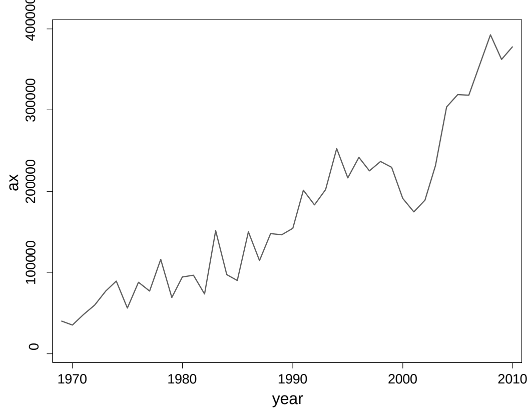
Malta



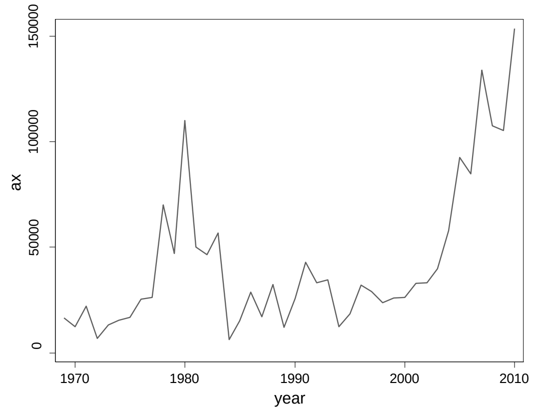
Morocco



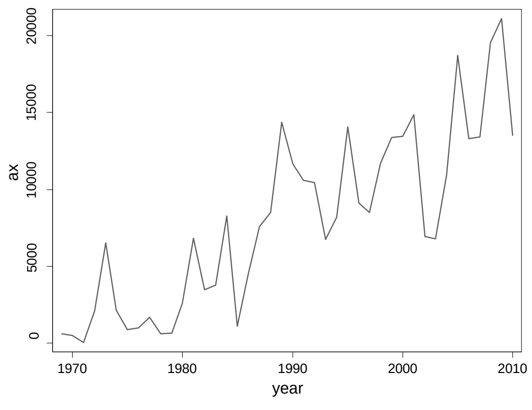
Netherlands



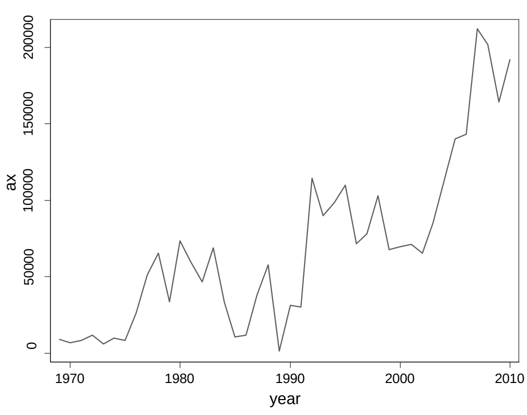
Poland



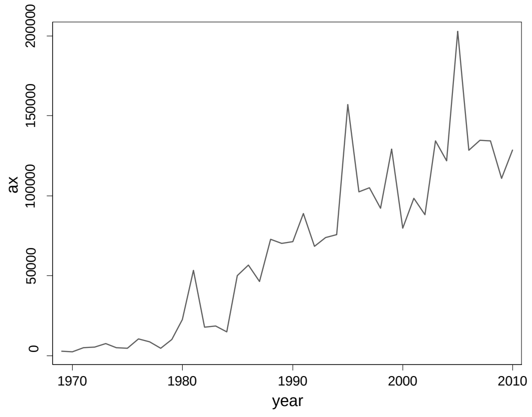
Portugal



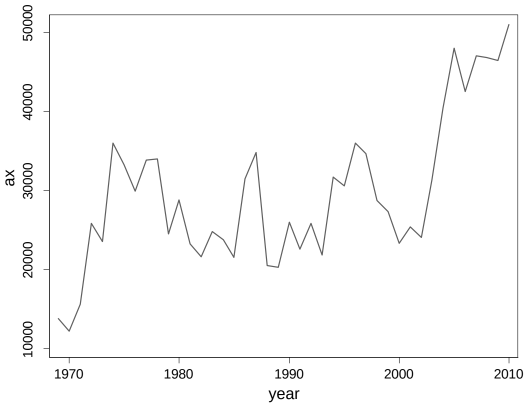
Romania



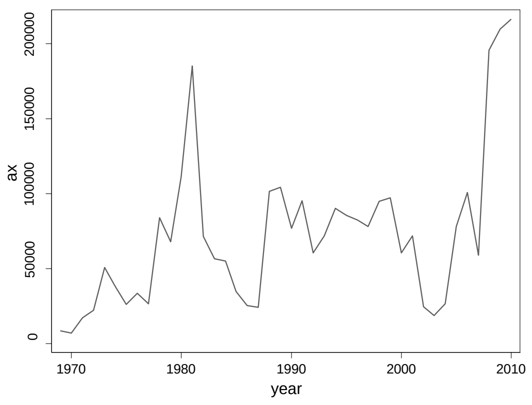
Spain



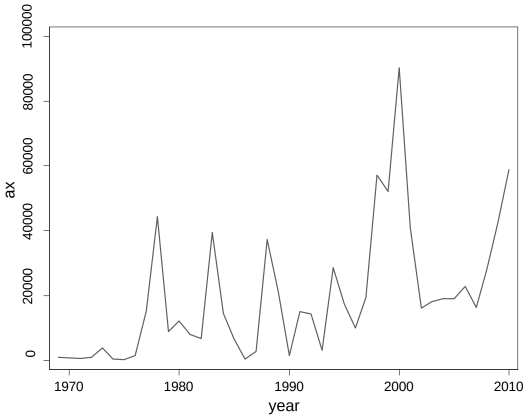
Sweden



Syria



Tunisia



UK

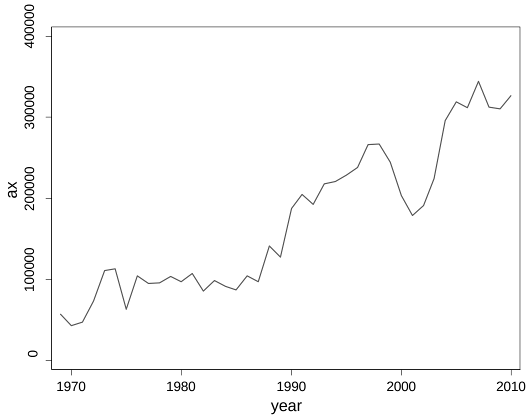
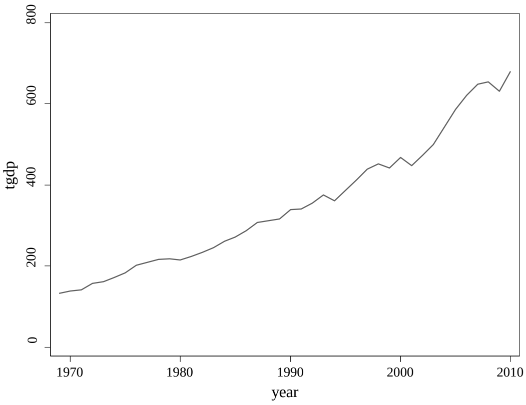
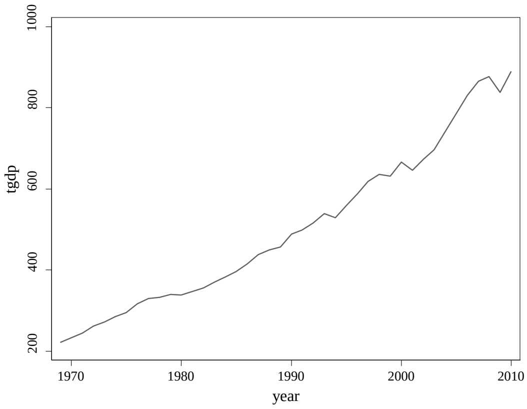


Figure 5.2 Total GDP ($TGDP$) (1969-2010).

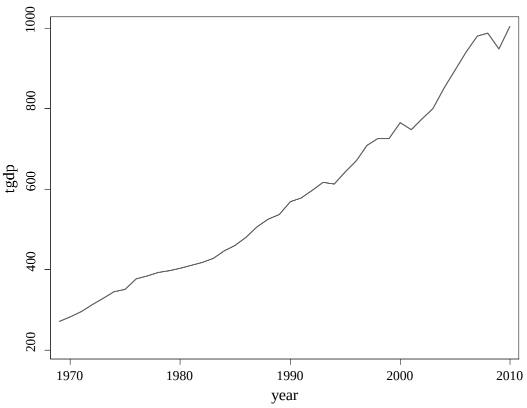
Algeria



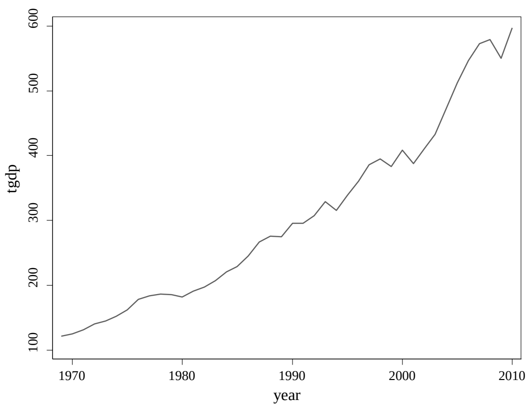
Austria



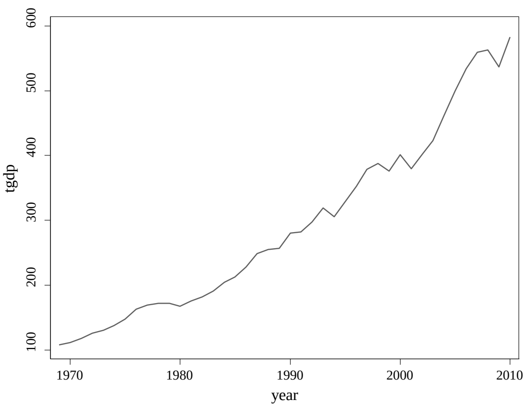
Belgium-Luxemburg



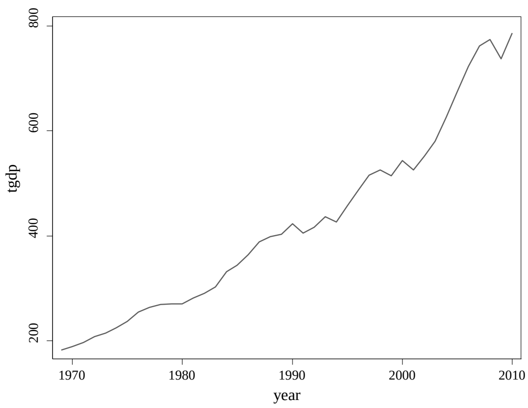
Bulgaria



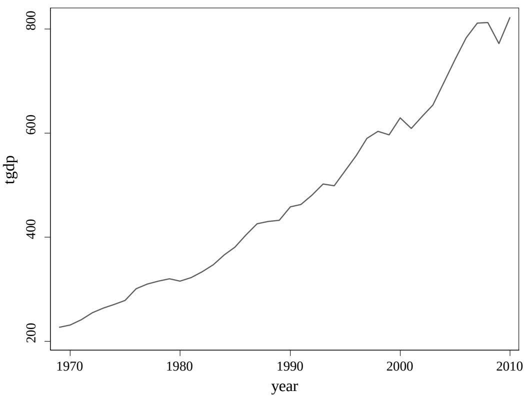
Cyprus



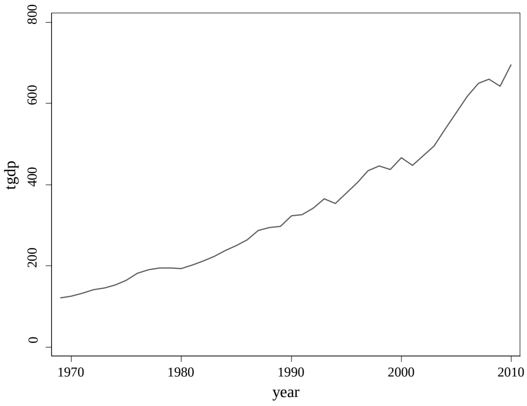
Czechoslovakia



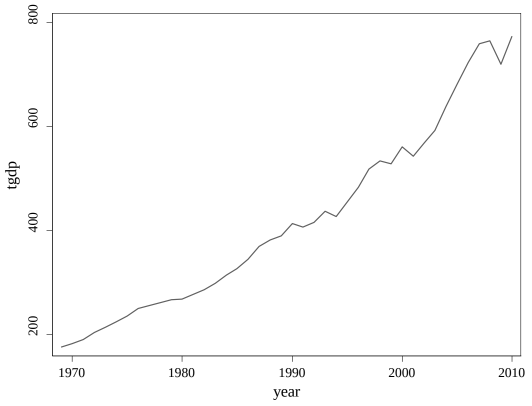
Denmark



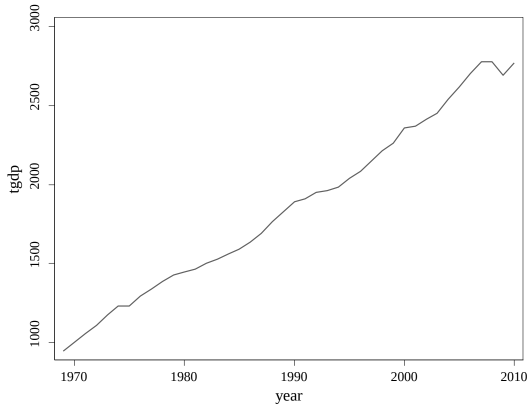
Egypt



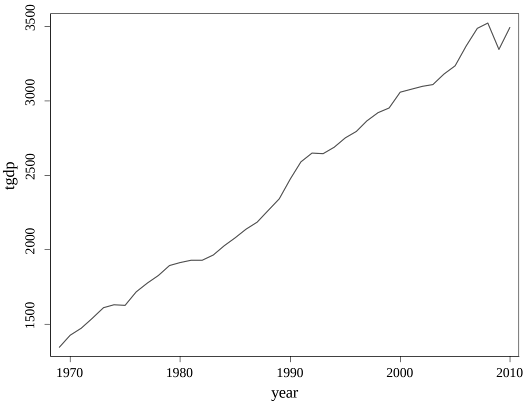
Finland



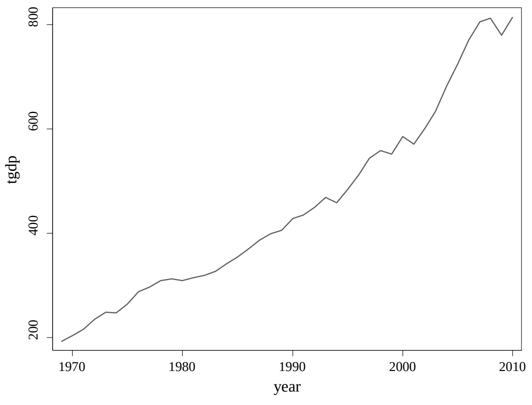
France



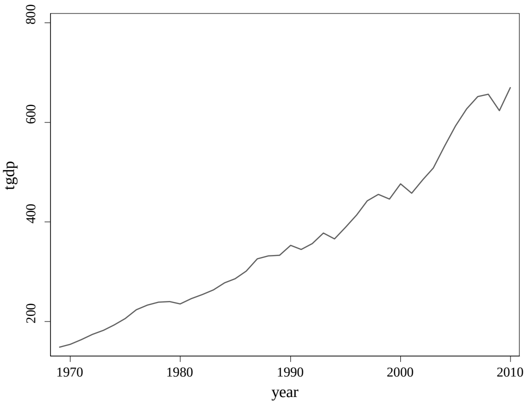
Germany



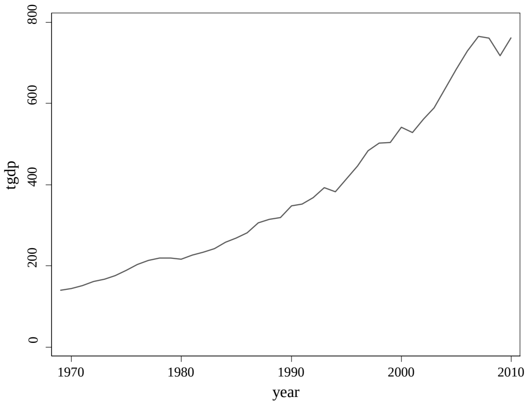
Greece



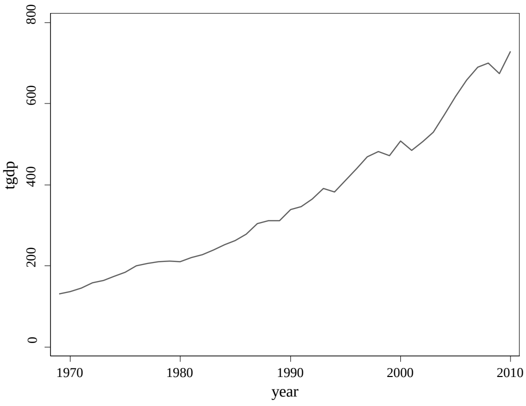
Hungary



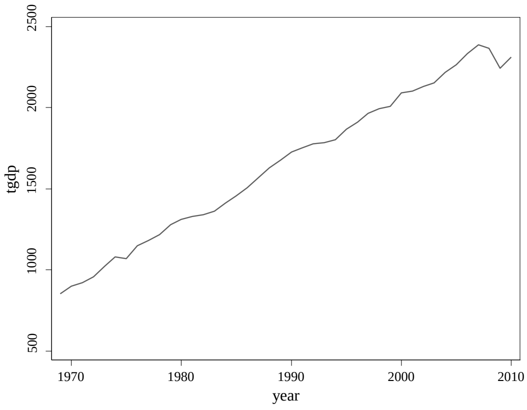
Ireland



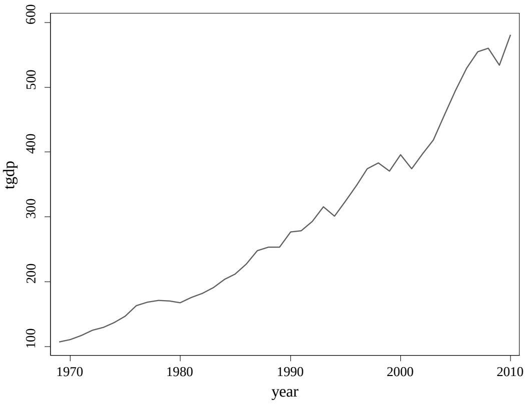
Israel



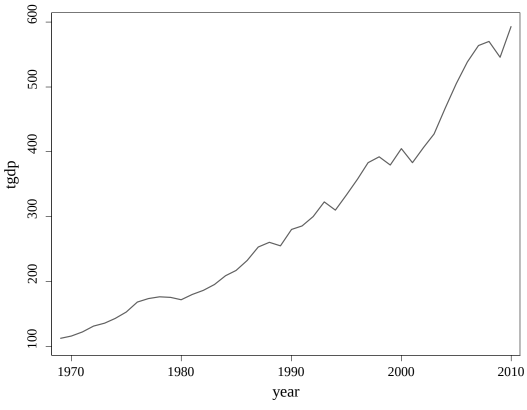
Italy



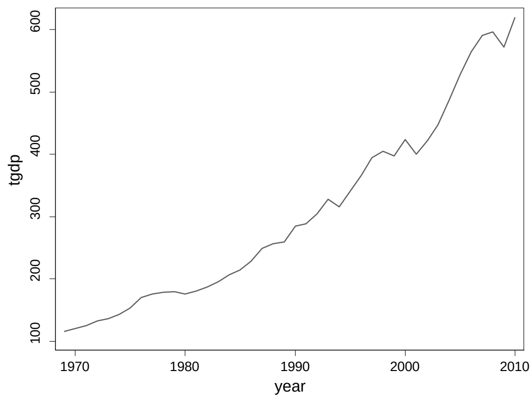
Jordan



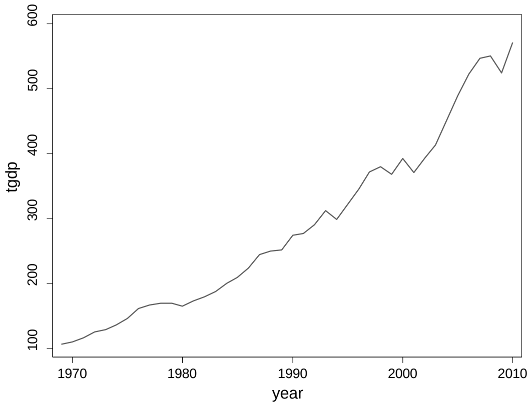
Lebanon



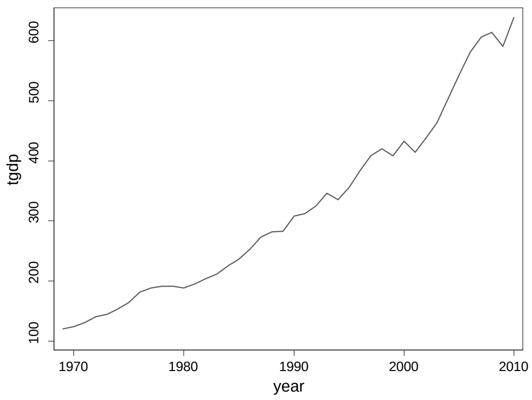
Libya



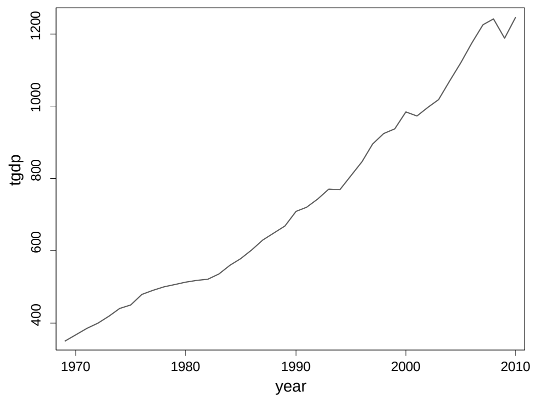
Malta



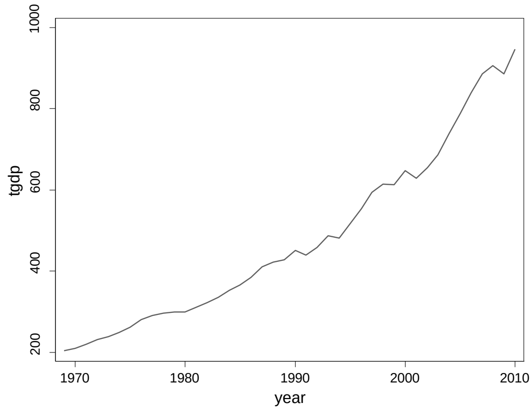
Morocco



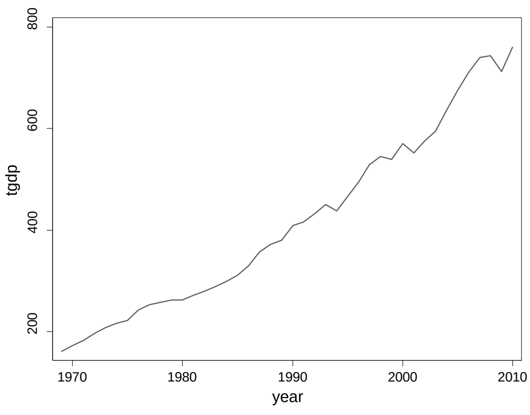
Netherlands



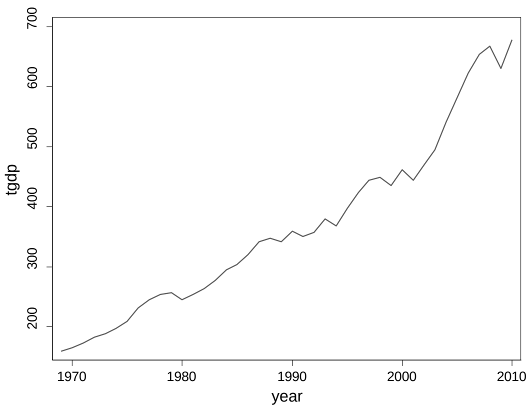
Poland



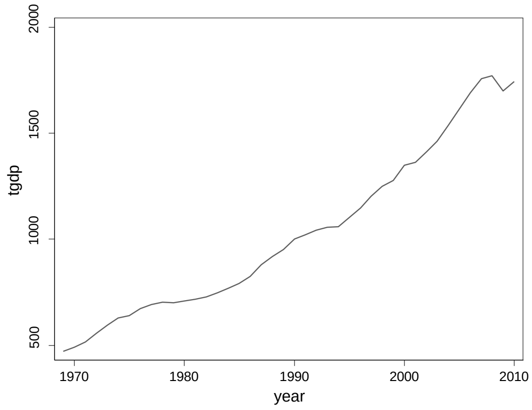
Portugal



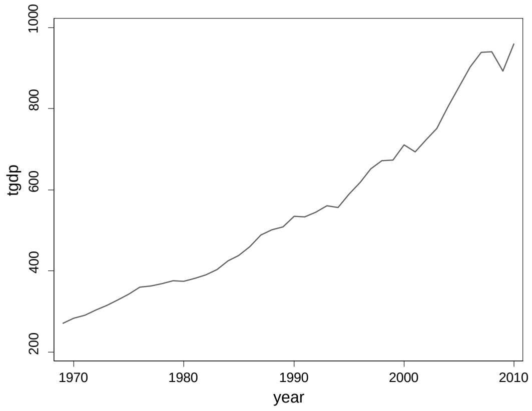
Romania



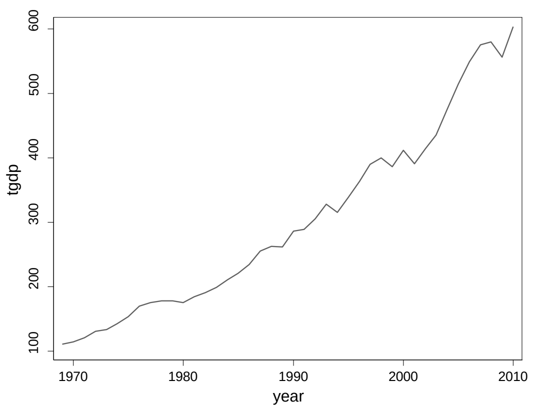
Spain



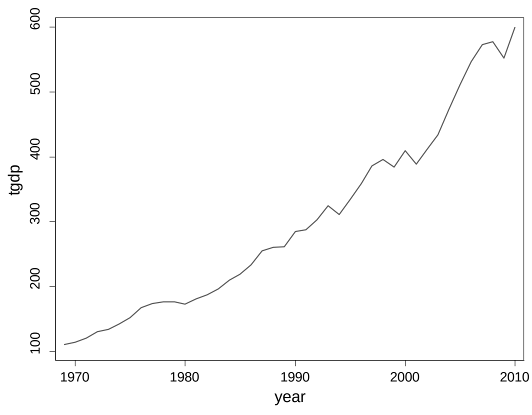
Sweden



Syria



Tunisia



UK

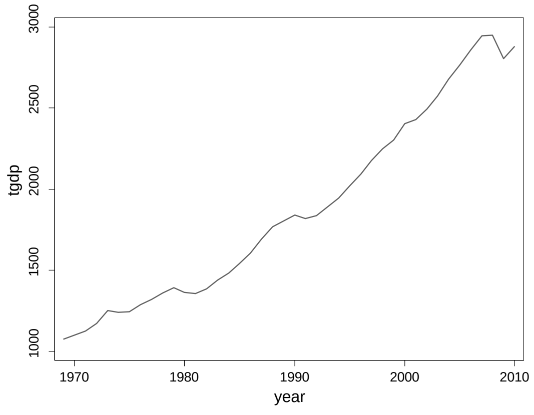
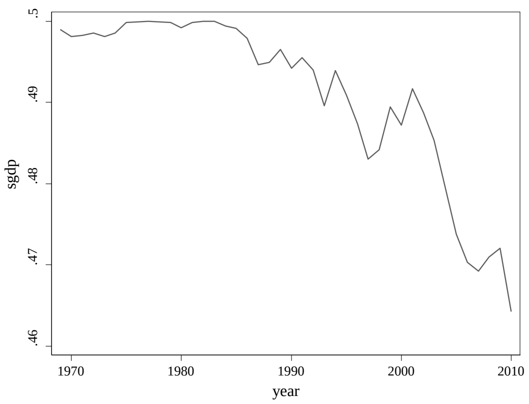


Figure 5.3 Similarity of Size Index ($SGDP$) (1969-2010).

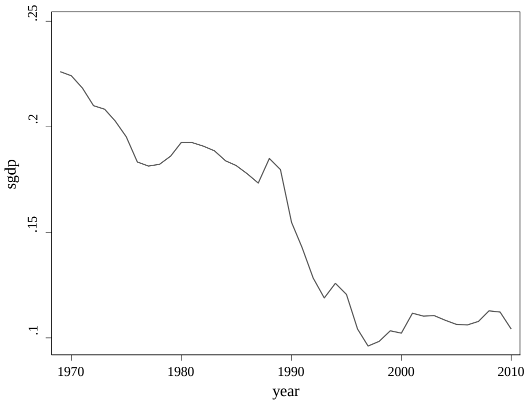
Algeria

Austria

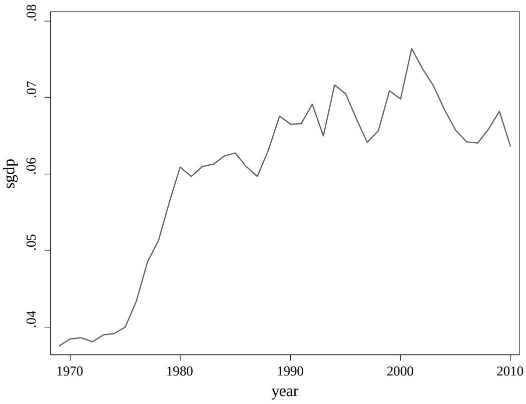


Belgium-Luxemburg

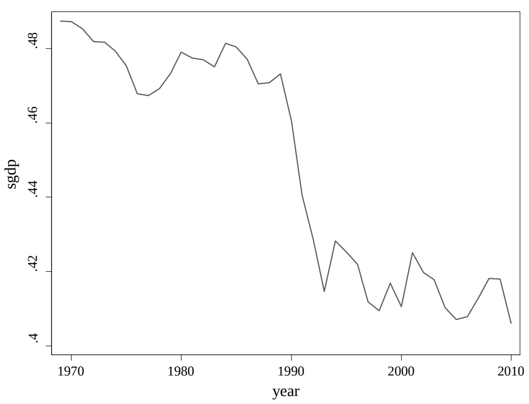
Bulgaria



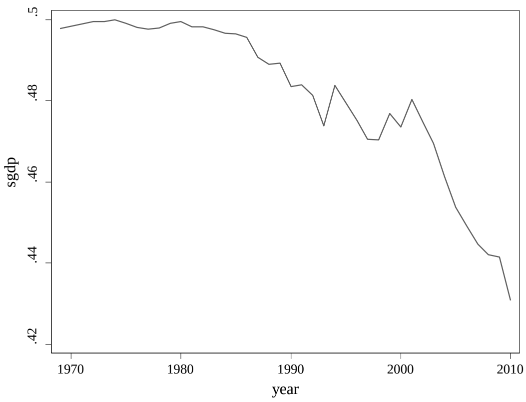
Cyprus



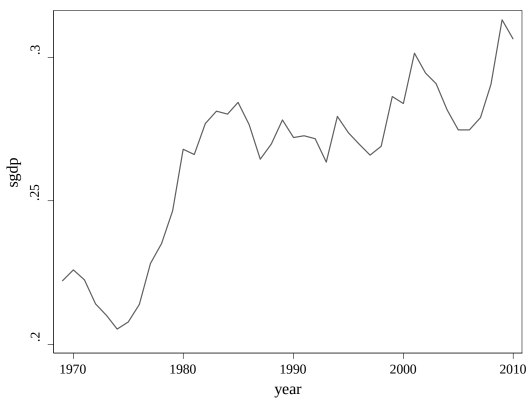
Czechoslovakia



Denmark

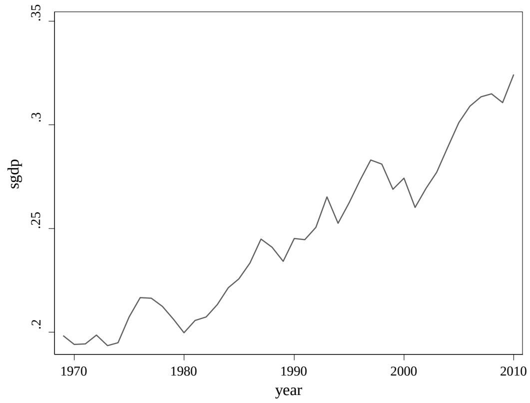


Egypt

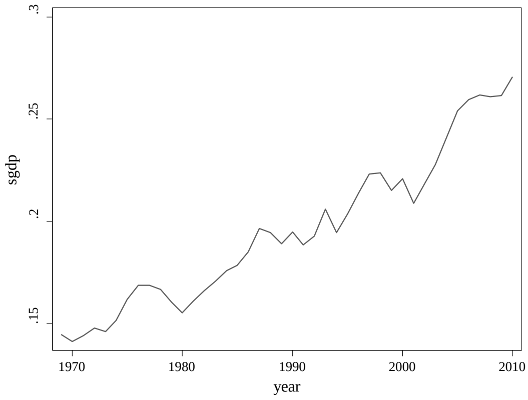


Finland

France



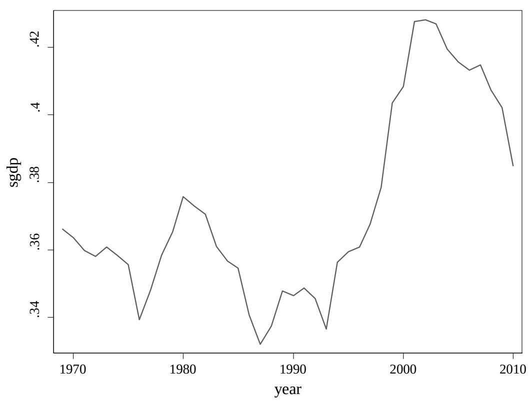
Germany



Greece

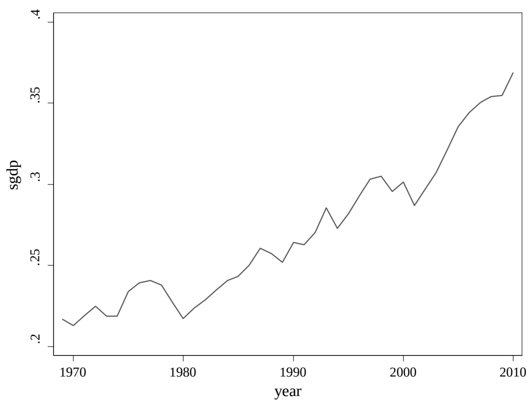
Hungary

Ireland

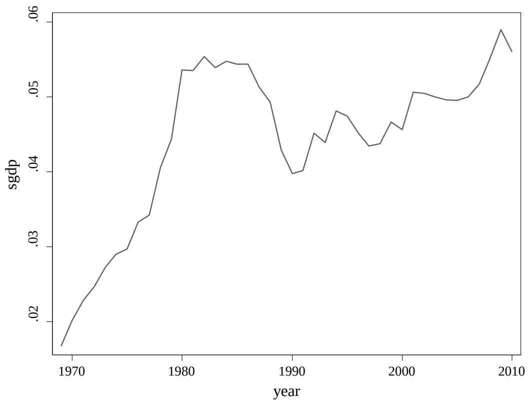


Israel

Italy



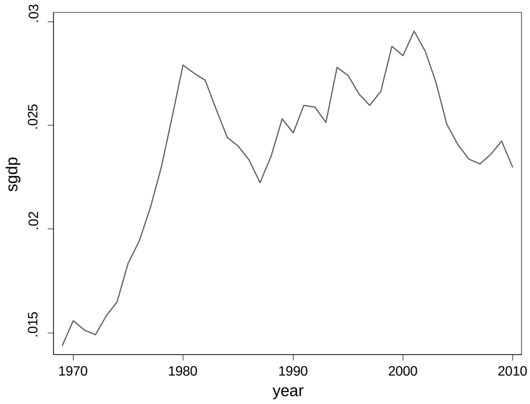
Jordan



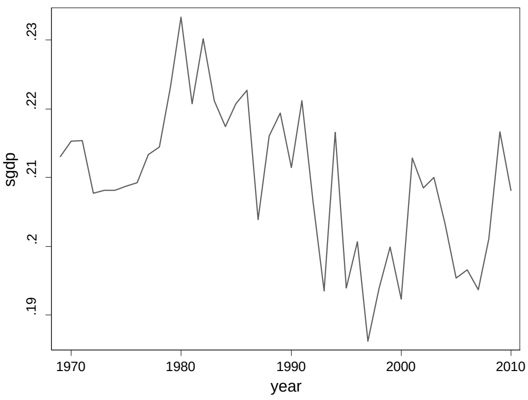
Lebanon

Libya

Malta



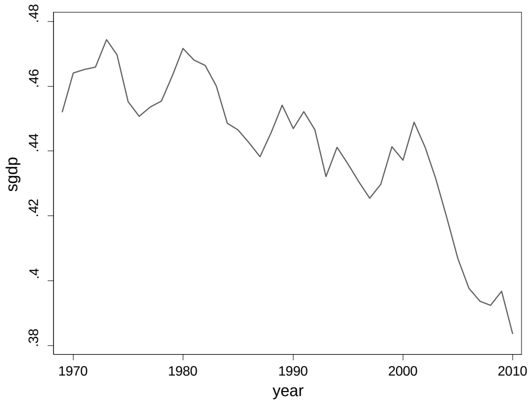
Morocco



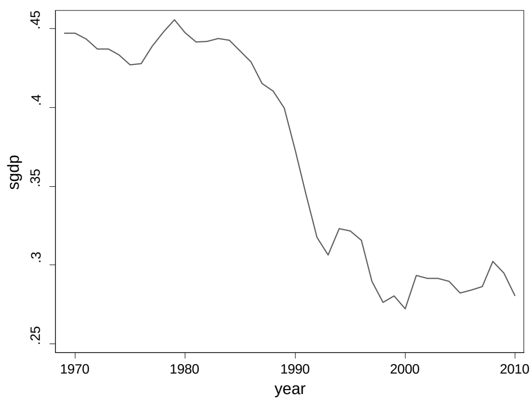
Netherlands

Poland

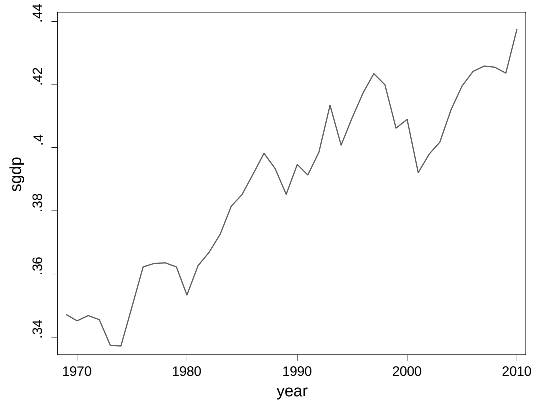
Portugal



Romania

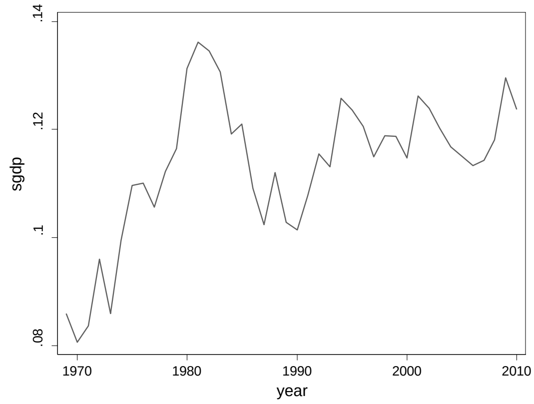


Spain

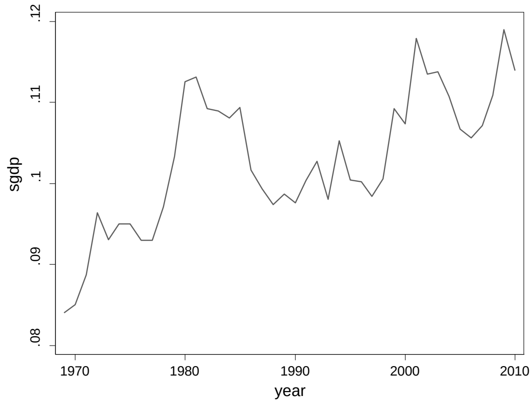


Sweden

Syria



Tunisia



UK

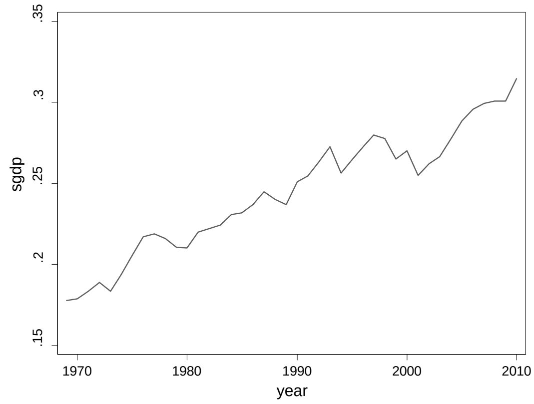
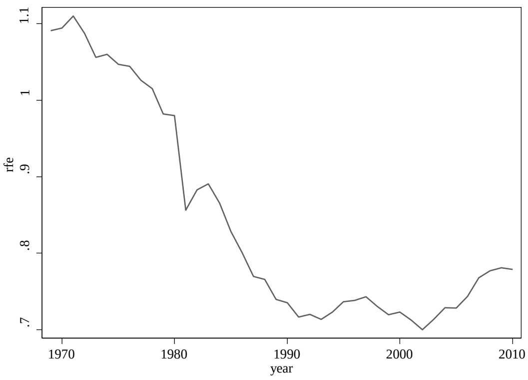


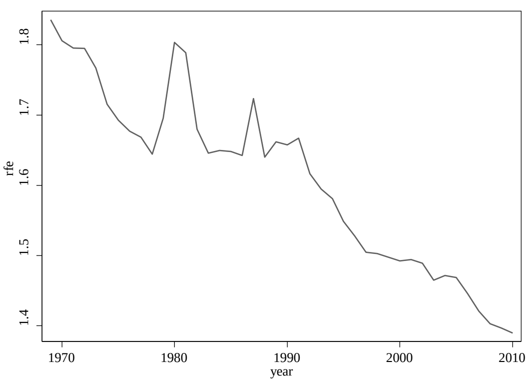
Figure 5.4 Relative Factor Endowments (RFE) (1969-2010).

Algeria

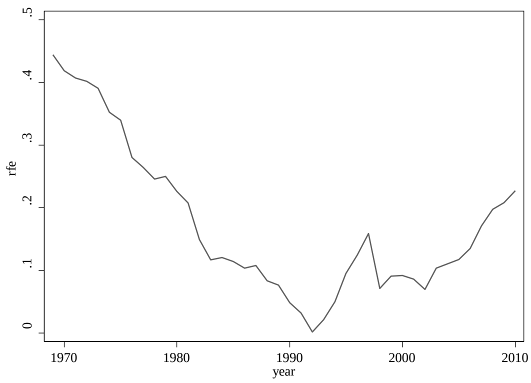


Austria

Belgium-Luxemburg



Bulgaria



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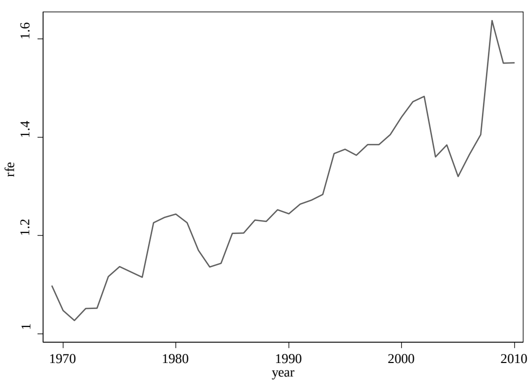

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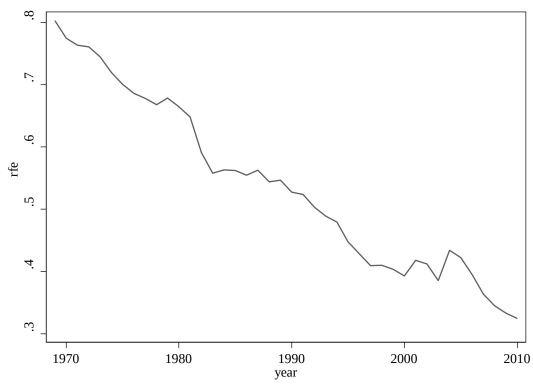

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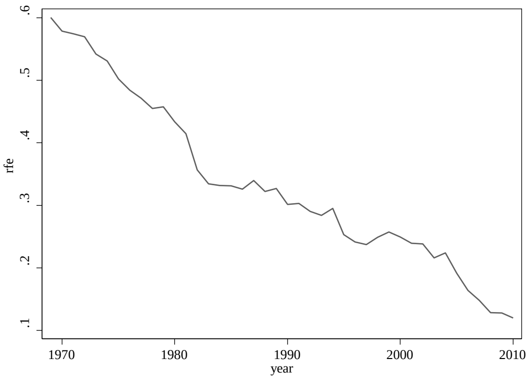

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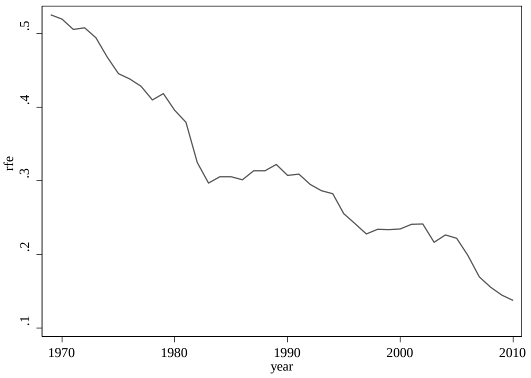

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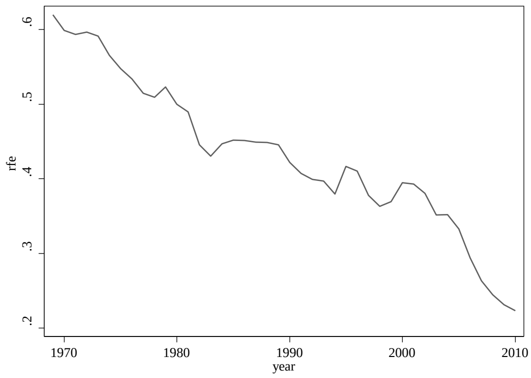

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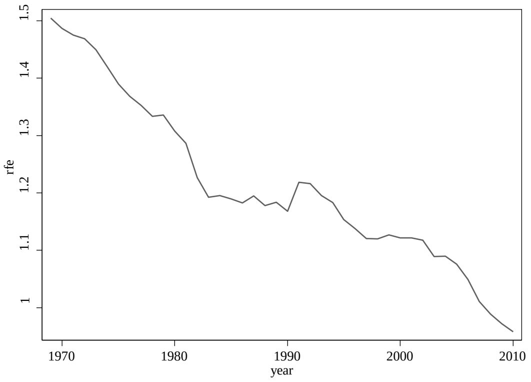

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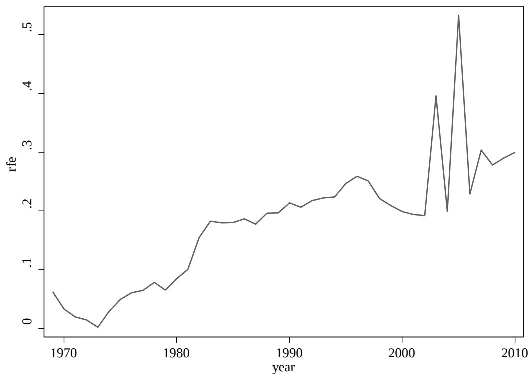

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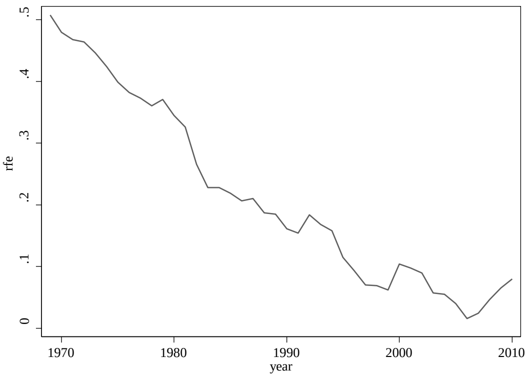

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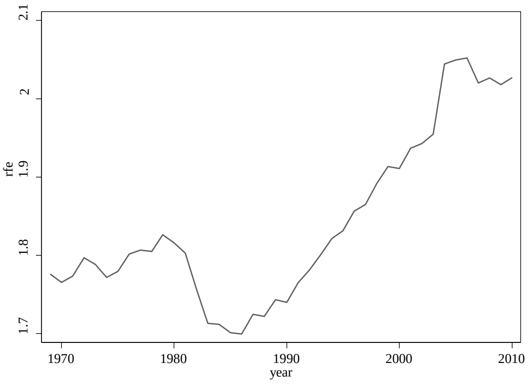

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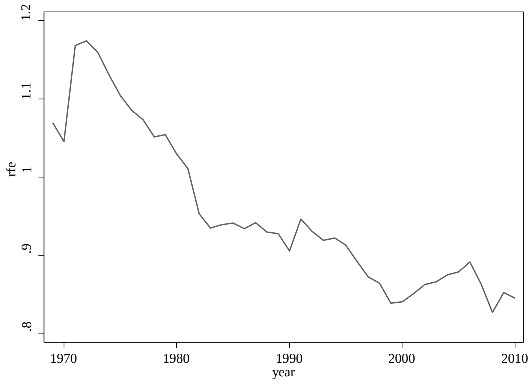
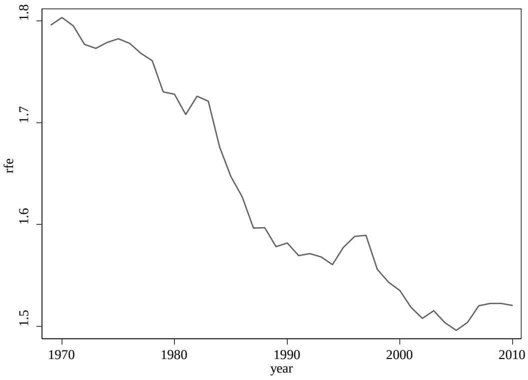


Jordan

Lebanon

Libya



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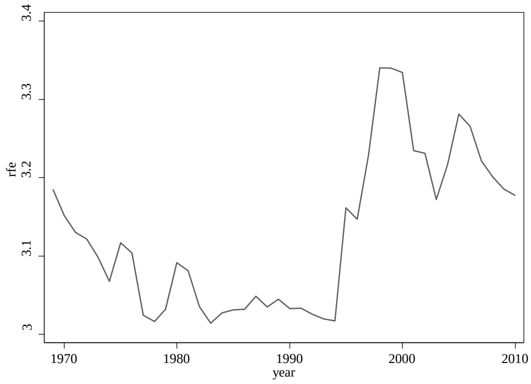
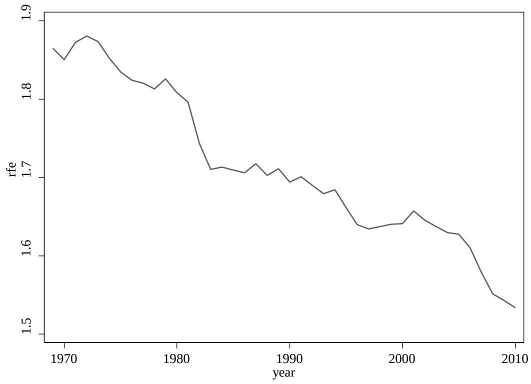


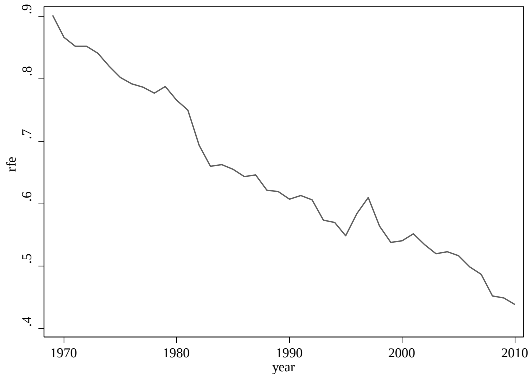
Morocco

Netherlands



Poland

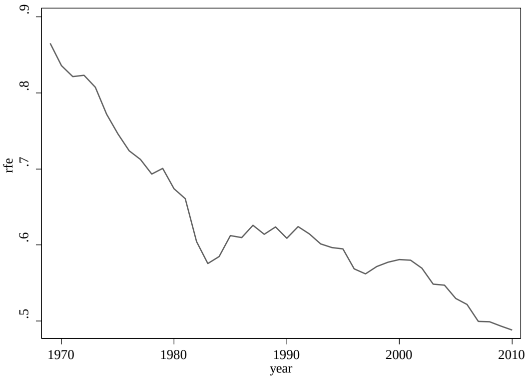
Portugal



Romania

Spain

Sweden



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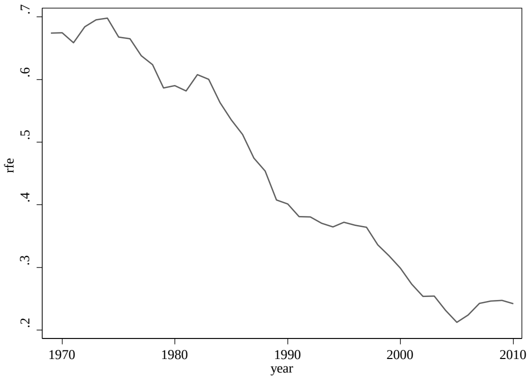
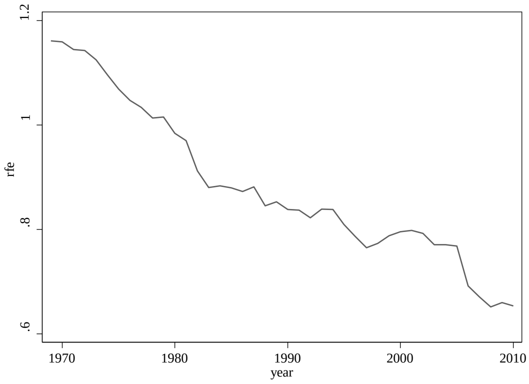


Tunisia

UK



5.4: The Protocol between Turkey and Egypt on Agricultural Products

PROTOCOL II[31]

(Referred to in Article 10[32])

EXCHANGE OF CONCESSIONS IN BASIC AGRICULTURAL, PROCESSED AGRICULTURAL AND FISHERY PRODUCTS BETWEEN THE REPUBLIC OF TURKEY AND THE ARAB REPUBLIC OF EGYPT

1. The products originating in the Republic of Turkey listed in Table A to this Protocol shall be imported into the Arab Republic of Egypt according to the conditions established in this Table and attached to this Protocol.

2. The products originating in the Arab Republic of Egypt listed in Table B to this Protocol shall be imported into the Republic of Turkey according to the conditions established in this Table and attached to this Protocol.

3. The Parties shall grant preferential treatment to each other as regards the products listed in Table A and Table B of this Protocol in compliance with the provisions of Protocol III concerning the definition of the concept of 'Originating Products' and methods of administrative co-operation

[31] The full document, Protocol II, can be found in http://www.economy.gov.tr/upload//60C30A25-ADA3-E293-3A3F07818A151FF5/4.%20Protocol%20II.pdf. Also other agreements and protocols between Turkey and other Euro-Mediterranean countries can be found in the Republic of Turkey Ministry of Economy web page:
http://www.economy.gov.tr/index.cfm?sayfa=tradeagreements&bolum=fta&region=0

[32] Article 10 can be found in the Agreement Establishing a Free Trade Agreement between the Republic of Turkey and the Arab Republic of Egypt from http://www.economy.gov.tr/upload//605EB5B0-D814-B27C-ADADE4C7D5DC5868/2.%20Turkey-Egypt%20Agreement.pdf.

Table A to Protocol II

Imports into the Arab Republic of Egypt of the following products originating in the Republic of Turkey shall be subject to the concessions set out below.

CN Code	**Product Description**	**Quantity (tonnes)**	**Tariff Reduction from MFN Duties (%)**
0802.21 **0802.22**	Hazelnuts or filberts (Corylus spp)	2,000	100
0804.20	Figs	500	100
0809.20	Cherries (including sour cherries	500	100
0813.10	Dried apricots	500	100
1507.90.91	Soya-bean oil, semi-refined in bulk	10,000	100
1512.11	Crude sunflower or safflower oil	20,000	100
1512.19.91	Sunflower seed oil, semi-refined in bulk	20,000	100
1515.21	Crude maize (corn) oil and its fractions	10,000	100
1517	Margarine; edible mixtures or preparations of animal or vegetable fats or oils or of fractions of different fats or oils of this chapter, other than edible fats or oils or their fractions of heading 1516	1,000	100
1704	Sugar confectionery (including white chocolate), not containing cocoa	2,000	15
1806	Chocolate and other food preparations containing cocoa	1,000	15
1902	Pasta, whether or not cooked or stuffed (with meat or other substances) or otherwise prepared, such as spaghetti, macaroni, noodles, lasagne, gnocchi, ravioli, cannelloni; couscous, whether or not prepared	1,000	15
1905	Bread, pastry, cakes, biscuits and other bakers' wares, whether or not containing cocoa; communion wafers, empty cachets of a kind suitable for pharmaceutical use, sealing wafers, rice paper and similar products	1,000	15
2001.10	Cucumber and gherkins, prepared or preserved by vinegar or acetic acid	1,000	15
2008	Fruit, nuts and other edible parts of plants, otherwise prepared or preserved, whether or not containing added sugar or other sweetening matter or spirit, not elsewhere specified or included	500	15
2009	Fruit juices (including grape must) and vegetable juices, unfermented and not containing added spirit, whether or not containing added sugar or other sweetening matter	500	15
2012.10	Active yeasts	3,000	15

Table B to Protocol II

Imports into the Republic of Turkey of the following products originating in the Arab Republic of Egypt shall be subject to the concessions set out below.

CN Code	Product Description	Quantity (tonnes)	Tariff Reduction from MFN Duties (%)
Chapter 3	Fish and crustaceans, molluscs and other aquatic invertebrates (excl. 0301)	Unlimited	50
0602	Other live plants (including their roots), cuttings and slips; mushroom spawn (excl. 0602.90.91, 99)	Unlimited	100
0603	Cut flowers and flower buds of a kind suitable for bouquets or for ornamental purposes, fresh, dried, dyed, bleached, impregnated or otherwise prepared	15	100
0701.90	Other potatoes, fresh or chilled	400	100
0703.20	Garlic, fresh or chilled	100	100
0705	Lettuce (Lactuca sativa) and chicory (Cichorium spp.), fresh or chilled	600	100
0706	Carrots, turnips, salad beetroot, salsify, celeriac, radishes and similar edible roots, fresh or chilled	600	100
0709	Other vegetables, fresh or chilled (excl. 0709.90.31, 39)	600	100
0710	Vegetables (uncooked or cooked by steaming or boiling in water), frozen (excl. 0710.80.10)	600	100
0711	Vegetables provisionally preserved (for example, by sulphur dioxide gas, in brine, in sulphur water or in other preservative solutions), but unsuitable in that state for immediate consumption (excl. 0711.20, 40)	600	100
0712	Dried vegetables, whole, cut, sliced, broken or in powder, but not further prepared	600	100
0804.10	Dates, fresh or dried	5,000	100
0804.50	Guavas, mangoes and mangosteens, fresh or dried	1,000	100
0810.10	Strawberries, fresh	200	100
0909	Seeds of anise, badian, fennel, coriander, cumin or caraway; juniper berries	100	100
0910	Ginger, saffron, turmeric (curcuma), thyme, bay leaves, curry and other spices	100	100
1006.20	Husked (brown) rice	30,000	100
1006.30	Semi-milled or wholly milled rice, whether or not polished or glazed	10,000	50
1202	Groundnuts, not roasted or otherwise cooked	500	100
1704	Sugar confectionery (including white chocolate), not containing cocoa	2,000	15 (*)

CN Code	Product Description	Quantity (tonnes)	Tariff Reduction from MFN Duties (%)
1806	Chocolate and other food preparations containing cocoa	1,000	15 (*)
1902	Pasta, whether or not cooked or stuffed (with meat or other substances) or otherwise prepared, such as spaghetti, macaroni, noodles, lasagne, gnocchi, ravioli, cannelloni; couscous, whether or not prepared	1,000	15 (*)
1905	Bread, pastry, cakes, biscuits and other bakers' wares, whether or not containing cocoa; communion wafers, empty cachets of a kind suitable for pharmaceutical use, sealing wafers, rice paper and similar products	1,000	15 (*)
2001.10	Cucumber and gherkins, prepared or preserved by vinegar or acetic acid	1,000	15
2008	Fruit, nuts and other edible parts of plants, otherwise prepared or preserved, whether or not containing added sugar or other sweetening matter or spirit, not elsewhere specified or included	500	15
2009	Fruit juices (including grape must) and vegetable juices, unfermented and not containing added spirit	500	15
2102.10	Active yeasts	3,000	15 (*)

(*) For products falling under the HS Codes 1704, 1806, 1902, 1905 and 2102.10 the ad valorem duties will be abolished and reductions will be made from the duties on agricultural component.

Appendix to Chapter 6

6.1: Stationarity Test Results

6.1.1 ADF Stationary Test Results

AX	no constant	trend	drift
ALG	0.174	-2.647	-2.763***
AUS	0.502	-3.303*	-3.425***
BEL	3.035	-2.248	0.016
BUL	1.716	-1.154	0.740
CYP	2.860	-1.271	-3.612***
CZE	1.624	-1.992	1.640
DEN	1.105	-2.851	-0.444
EGY	1.163	-1.796	-1.237
FIN	2.023	-0.822	-1.343*
FRA	1.601	-1.365	1.153
GER	1.368	-2.599	0.123
GRE	1.996	-4.513***	-4.815***
HUN	0.791	-1.299	-0.340
IRE	0.634	-2.713	-0.611
ISR	2.312	-1.981	-0.115
ITA	1.800	-2.595	1.550
JOR	-0.200	-1.677	-2.255**
LEB	-0.084	-5.366***	-1.898**
LIB	0.181	-1.869	-1.848**
MAL	0.636	-1.944	-1.423*
MOR	0.577	-2.233	-0.859
NET	2.095	-1.773	-1.425*
POL	0.820	-0.612	-0.036
POR	0.980	-1.687	-2.647***
ROM	1.493	-2.170	-0.281
SPA	-0.056	-2.107	-3.628***
SWE	0.956	-0.188	0.886
SYR	0.530	-3.152	-2.600***
TUN	1.777	-2.020	-0.744
UK	1.745	-3.163	-0.700

Notes:

1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The lag length is calculated as 9. The test was performed in STATA 11.
3. The asymptotic critical values are for no constant: -2.650 (1%), -1.950 (5%) and -1.602 (%10), for trend:-4.325 (1%), -3.576 (5%) and -3.226 (%10), and for drift: -2.539 (1%), -1.729 (5%) and -1.328 (%10).

Table 6.A.1: ADF-test Results for the Variable Agricultural Export (AX).

$SGDP$	no constant	trend	drift
ALG	0.882	-3.248*	-1.475*
AUS	0.467	0.878	1.358
BEL	0.957	1.029	-1.991**
BUL	1.266	-3.977**	-0.624
CYP	0.117	-2.158	-2.701***
CZE	1.197	-3.284*	-0.480
DEN	0.912	-0.163	1.478
EGY	-1.045	-4.346***	-2.567***
FIN	1.673	-3.314*	0.015
FRA	-1.907*	-2.530	0.175
GER	-1.870*	-1.015	1.445
GRE	1.512	-3.078	-0.719
HUN	1.748	-3.029	-0.276
IRE	-0.214	-2.886	-2.362**
ISR	-0.447	-2.164	-1.400*
ITA	-1.407	-2.189	1.204
JOR	-0.526	-3.348*	-2.271**
LEB	0.521	-1.337	-1.513*
LIB	-0.346	-3.013	-1.618*
MAL	0.244	-1.078	-1.628*
MOR	0.216	-2.259	-1.387*
NET	-1.215	-1.637	-1.185
POL	0.662	-1.496	-1.326
POR	1.091	0.749	1.358
ROM	1.501	-3.266*	-0.673
SPA	-1.634*	-1.616	-1.306
SWE	1.217	-1.114	-0.214
SYR	-0.574	-4.934***	-3.798***
TUN	-0.490	-3.003	-1.539*
UK	-1.613*	-2.004	-0.659

Notes:

1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The lag length is calculated as 9. The test was performed in STATA 11.
3. The asymptotic critical values are for no constant: -2.650 (1%), -1.950 (5%) and -1.602 (%10), for trend:-4.325 (1%), -3.576 (5%) and -3.226 (%10), and for drift: -2.539 (1%), -1.729 (5%) and -1.328 (%10).

Table 6.A.2: ADF-test Results for the Variable Similarity of Size Index ($SGDP$).

$TGDP$	no constant	trend	drift
ALG	2.304	-1.573	-0.329
AUS	2.367	-2.780	0.029
BEL	2.369	-3.818**	0.183
BUL	1.956	-2.041	-0.061
CYP	1.813	-1.740	-0.352
CZE	1.513	-1.998	-0.174
DEN	1.978	-2.150	-0.080
EGY	1.665	-1.317	-0.670
FIN	2.127	-2.390	-0.169
FRA	2.063	-1.224	-1.472*
GER	1.616	-0.229	-1.117
GRE	2.996	-1.272	1.723
HUN	2.675	-1.578	0.591
IRE	1.924	-2.667	0.745
ISR	1.763	-2.045	-0.243
ITA	0.842	0.041	-2.731***
JOR	1.948	-1.764	-0.269
LEB	1.956	-2.216	-0.031
LIB	2.014	-2.934	0.336
MAL	1.885	-1.911	-0.243
MOR	1.878	-1.961	-0.192
NET	2.001	-2.987	0.210
POL	3.696	-0.158	2.393
POR	1.643	-1.299	-0.621
ROM	2.118	-1.028	0.971
SPA	2.255	-2.862	0.413
SWE	2.601	-2.400	1.360
SYR	1.928	-1.864	-0.266
TUN	1.986	-1.952	-0.181
UK	1.400	-3.484*	0.088

Notes:

1. Asterisks indicate (5%) ** and (10%) * levels of statistical significance.
2. The lag length is calculated as 9. The test was performed in STATA 11.
3. The asymptotic critical values are for no constant: -2.650 (1%), -1.950 (5%) and -1.602 (%10), for trend:-4.325 (1%), -3.576 (5%) and -3.226 (%10), and for drift: -2.539 (1%), -1.729 (5%) and -1.328 (%10).

Table 6.A.3: ADF-test Results for the Variable Total GDP ($TGDP$).

RFE	no constant	trend	drift
ALG	-0.294	-0.770	-2.652***
AUS	-1.852*	-2.961	-3.661***
BEL	-1.986**	-2.458	1.293
BUL	-0.125	-0.891	-1.590*
CYP	1.808	-2.644	0.123
CZE	-3.076***	-0.615	-2.424**
DEN	-2.005**	-2.788	-1.459*
EGY	-1.373	-1.825	-0.660
FIN	-1.351	-2.366	-0.114
FRA	-2.799***	-3.517*	-2.305**
GER	-1.559	-2.716	-1.149
GRE	1.143	-2.197	-0.494
HUN	-3.928***	0.349	-3.915***
IRE	-0.401	-2.288	-1.022
ISR	0.603	-2.514	-0.513
ITA	-1.304	-2.122	-2.330**
JOR	0.838	-1.528	-1.088
LEB	-1.108	-3.831**	-1.709*
LIB	-1.589	-0.418	-1.580*
MAL	0.511	-1.886	-1.230
MOR	0.782	-3.921**	-4.259***
NET	-2.338**	-2.116	-1.785**
POL	-2.928***	-0.546	-2.539***
POR	-1.743*	-2.489	-1.528*
ROM	-0.956	1.477	-2.149**
SPA	-0.025	-3.039	-1.332*
SWE	-1.232	-3.379*	-1.467*
SYR	-1.501	-1.538	-1.178
TUN	0.704	-0.761	-0.881
UK	-1.475	-2.565	-1.566*

Notes:

1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The lag length is calculated as 9. The test was performed in STATA 11.
3. The asymptotic critical values are for no constant: -2.650 (1%), -1.950 (5%) and -1.602 (%10), for trend:-4.325 (1%), -3.576 (5%) and -3.226 (%10), and for drift: -2.539 (1%), -1.729 (5%) and -1.328 (%10).

Table 6.A.4: ADF-test Results for the Variable Relative Factor Endowments (RFE).

6.1.2: DF-GLS Stationary Test Results

AX	MAIC	Demeaned	MAIC	Trend
ALG	8	-0.261	1	-0.813
AUS	1	-0.199	1	-1.289
BEL	2	0.087	1	-4.628***
BUL	1	-0.839	1	-2.072
CYP	5	-0.986	2	-2.385
CZE	8	-0.523	8	-0.583
DEN	1	-0.543	1	-0.901
EGY	1	-0.205	4	-1.270
FIN	1	-1.702	4	-1.497
FRA	2	0.451	2	-2.685
GER	1	-0.920	1	-3.426**
GRE	8	-0.428	2	-3.082*
HUN	1	-1.304	1	-1.649
IRE	6	-0.458	1	-3.534**
ISR	3	1.127	2	-1.429
ITA	1	-0.134	1	-2.441
JOR	1	-0.511	1	-1.224
LEB	7	-0.937	1	-2.840
LIB	1	-1.480	1	-1.898
MAL	4	-0.906	4	-1.470
MOR	2	-0.924	2	-2.416
NET	3	1.139	2	-2.072
POL	8	0.179	1	-2.172
POR	9	0.128	7	-0.596
ROM	3	-0.138	3	-2.206
SPA	3	0.414	3	-0.887
SWE	1	-0.508	1	-3.230*
SYR	6	0.076	1	-2.377
TUN	2	-0.646	2	-2.783
UK	7	0.401	1	-1.947

Notes:
1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The test was performed in STATA 11.

Table 6.B.1: DF-GLS Test Results for the Variable Agricultural Export (AX).

$SGDP$	MAIC	Demeaned	MAIC	Trend
ALG	1	-0.733	1	-1.293
AUS	1	0.955	1	-0.992
BEL	1	-0.517	1	-0.642
BUL	1	0.097	2	-1.627
CYP	1	-0.150	1	-0.597
CZE	5	-0.285	1	-1.874
DEN	3	1.005	1	-0.302
EGY	1	-0.156	1	-1.783
FIN	1	0.376	1	-2.365
FRA	1	1.085	1	-2.342
GER	1	1.332	1	-2.996*
GRE	1	0.527	1	-1.872
HUN	1	0.218	1	-1.675
IRE	4	-0.725	1	-2.888
ISR	1	-1.278	1	-1.508
ITA	1	1.391	1	-1.974
JOR	3	-0.074	3	-1.295
LEB	2	-1.336	2	-2.242
LIB	1	-1.272	1	-1.420
MAL	1	-0.753	1	-1.097
MOR	1	-1.717	1	-2.072
NET	1	0.720	4	-1.239
POL	1	-0.990	1	-1.920
POR	1	0.389	1	-1.315
ROM	5	-0.703	1	-1.750
SPA	1	0.632	1	-2.167
SWE	1	-0.973	1	-0.534
SYR	1	-0.735	1	-1.689
TUN	4	-0.128	1	-1.798
UK	1	1.579	4	-1.486

Notes:

1. Asterisk indicates (10%) * levels of statistical significance.
2. The test was performed in STATA 11.

Table 6.B.2: DF-GLS Test Results for the Variable Similarity of Size Index ($SGDP$).

$TGDP$	MAIC	Demeaned	MAIC	Trend
ALG	3	1.079	6	-1.404
AUS	3	0.672	1	-3.147*
BEL	3	0.545	1	-3.442**
BUL	3	0.884	1	-3.162*
CYP	3	0.908	1	-3.180*
CZE	8	0.788	6	-1.242
DEN	8	0.535	1	-3.575**
EGY	3	0.936	9	-0.984
FIN	8	0.754	6	-1.652
FRA	2	0.937	1	-1.542
GER	6	0.210	1	-1.453
GRE	2	1.272	1	-3.621**
HUN	3	1.072	6	-1.757
IRE	3	0.377	1	-3.427**
ISR	3	0.720	1	-3.178*
ITA	3	0.315	1	-0.619
JOR	3	0.964	1	-3.278
LEB	3	0.995	1	-3.366**
LIB	7	0.625	1	-3.270*
MAL	3	0.940	1	-3.265*
MOR	2	1.258	1	-3.253*
NET	9	0.272	1	-3.466**
POL	8	0.860	1	-3.072*
POR	5	0.530	4	-1.780
ROM	2	1.594	6	-1.401
SPA	2	0.332	1	-3.847***
SWE	8	0.375	1	-3.034*
SYR	3	0.955	1	-3.279*
TUN	3	0.931	1	-3.346**
UK	1	1.100	1	-2.966

Notes:
1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The test was performed in STATA 11.

Table 6.B.3: DF-GLS Test Results for the Variable Total GDP ($TGDP$).

RFE	MAIC	Demeaned	MAIC	Trend
ALG	1	-0.150	1	-0.430
AUS	1	1.441	1	-1.087
BEL	1	0.442	1	-4.551***
BUL	1	0.537	1	-0.289
CYP	7	0.457	1	-2.944
CZE	1	1.341	1	-1.974
DEN	2	0.948	1	-1.386
EGY	1	-0.859	1	-1.286
FIN	1	1.539	1	-2.131
FRA	1	1.250	1	-1.796
GER	2	1.108	1	-1.487
GRE	7	0.167	1	-2.853
HUN	1	0.234	1	-1.056
IRE	1	0.067	1	-1.088
ISR	1	-1.415	1	-1.545
JOR	3	0.145	2	-1.274
LEB	1	-0.073	1	-1.561
LIB	1	0.115	1	-1.577
MAL	1	-1.657	1	-1.781
MOR	1	-0.420	1	-1.685
NET	2	0.680	1	-2.331
POL	1	0.475	1	-2.269
POR	1	1.287	2	-1.481
ROM	1	-0.370	1	-0.279
SPA	1	-1.254	1	-1.204
SWE	2	0.747	3	-1.158
SYR	2	0.007	1	-1.852
TUN	3	-0.780	3	-1.261
UK	2	0.890	1	-1.559

Notes:
1. Asterisks indicate (1%) *** levels of statistical significance.
2. The test was performed in STATA 11.

Table 6.B.4: DF-GLS Test Results for the Variable Relative Factor Endowments (RFE).

6.1.3: KPSS Stationary Test Results

AX	Trend	Demeaned
ALG	0.298***	0.880***
AUS	0.281***	0.816***
BEL	0.279***	1.500***
BUL	0.169**	1.050***
CYP	0.110	1.010***
CZE	0.107	0.575**
DEN	0.306***	0.462*
EGY	0.195**	1.030***
FIN	0.719***	1.100***
FRA	0.792***	1.240***
GER	0.575***	1.080***
GRE	0.763***	1.290***
HUN	0.176**	0.410*
IRE	0.528***	0.632**
ISR	0.187**	1.620***
ITA	0.802***	1.39***
JOR	0.255***	0.420*
LEB	0.635***	0.144
LIB	0.224***	0.433*
MAL	0.145*	1.040***
MOR	0.772***	1.090***
NET	0.124*	1.580***
POL	0.163**	0.661**
POR	0.169**	1.230***
ROM	0.069	1.110***
SPA	0.337***	1.510***
SWE	0.123*	0.741***
SYR	0.123*	0.573**
TUN	0.848***	1.020***
UK	0.739***	1.520***

Notes:

1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The test was performed in STATA 11.
3. The asymptotic critical values for demeaned case are 0.739 (1%), 0.463 (5%) and 0.347 (%10), and for the trend case are 0.216 (%1), 0.146 (%5) and 0.119 (%10).

Table 6.C.1: KPSS-test Results for the Variable Agricultural Export (AX).

$SGDP$	Trend	Demeaned
ALG	0.229***	1.100***
AUS	0.311***	1.360***
BEL	0.354***	1.200***
BUL	0.155**	1.530***
CYP	0.352***	1.230***
CZE	0.163**	1.500***
DEN	0.299***	1.440***
EGY	0.212**	1.190***
FIN	0.096	1.500***
FRA	0.084	1.610***
GER	0.073	1.610***
GRE	0.133*	1.560***
HUN	0.160**	1.500***
IRE	0.257***	0.883***
ISR	0.060	0.583**
ITA	0.211**	1.600***
JOR	0.273***	0.889***
LEB	0.142*	0.727**
LIB	0.292***	0.544**
MAL	0.287***	0.871***
MOR	0.146**	0.727**
NET	0.259***	1.540***
POL	0.191**	1.100***
POR	0.191**	1.290***
ROM	0.197**	1.510***
SPA	0.187**	1.530***
SWE	0.352***	0.498**
SYR	0.173**	0.611**
TUN	0.127*	0.882***
UK	0.200*	1.580***

Notes:

1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The test was performed in STATA 11.
3. The asymptotic critical values for demeaned case are 0.739 (1%), 0.463 (5%) and 0.347 (%10), and for the trend case are 0.216 (%1), 0.146 (%5) and 0.119 (%10).

Table 6.C.2: KPSS-test Results for the Variable Similarity of Size Index ($SGDP$).

$TGDP$	Trend	Demeaned
ALG	0.154**	1.650***
AUS	0.077	1.660***
BEL	0.057	1.670***
BUL	0.060	1.660***
CYP	0.080	1.660***
CZE	0.108	1.650***
DEN	0.043	1.670***
EGY	0.122*	1.660***
FIN	0.726***	1.660***
FRA	0.248***	1.650***
GER	0.267***	1.660***
GRE	0.097	1.650***
HUN	0.110	1.650***
IRA	0.082	1.660***
ISR	0.073	1.670***
ITA	0.366***	1.630***
JOR	0.075	1.660***
LEB	0.566***	1.660***
LIB	0.054	1.660***
MAL	0.070	1.660***
MOR	0.076	1.660***
NET	0.076	1.670***
POL	0.099	1.660***
POR	0.149**	1.670***
ROM	0.135*	1.630***
SPA	0.081	1.660***
SWE	0.096	1.660***
SYR	0.079	1.660***
TUN	0.068	1.660***
UK	0.147**	1.660***

Notes:

1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The test was performed in STATA 11.
3. The asymptotic critical values for demeaned case are 0.739 (1%), 0.463 (5%) and 0.347 (%10), and for the trend case are 0.216 (%1), 0.146 (%5) and 0.119 (%10).

Table 6.C.3: KPSS-test Results for the Variable Total GDP ($TGDP$).

RFE	**Trend**	**Demeaned**
ALG	0.388***	1.370***
AUS	0.361***	1.560***
BEL	0.120	1.560***
BUL	0.397***	0.953***
CYP	0.050	1.500***
CZE	0.229***	1.640***
DEN	0.289***	1.580***
EGY	0.284***	0.856***
FIN	0.143*	1.550***
FRA	0.242***	1.560***
GER	0.244***	1.530***
GRE	0.129*	1.480***
HUN	0.332***	1.590***
IRA	0.264**	0.472**
ISR	0.365***	1.160***
ITA	0.232***	1.440***
JOR	0.193**	1.640***
LEB	0.173**	0.926***
LIB	0.254***	1.580***
MAL	0.234***	0.769***
MOR	0.192**	0.614**
NET	0.154**	1.580***
POL	0.196**	1.530***
POR	0.295***	1.620***
ROM	0.346***	1.330***
SPA	0.249***	0.617**
SWE	0.275***	1.430***
SYR	0.140*	1.640***
TUN	0.312***	0.359*
UK	0.289***	1.560***

Notes:

1. Asterisks indicate (1%) ***, (5%) ** and (10%) * levels of statistical significance.
2. The test was performed in STATA 11.
3. The asymptotic critical values for demeaned case are 0.739 (1%), 0.463 (5%) and 0.347 (%10), and for the trend case are 0.216 (%1), 0.146 (%5) and 0.119 (%10).

Table 6.C.4: KPSS-test Results for the Variable Relative Factor Endowments (RFE).