THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURAL TRADE CAPABILITY OF TURKEY AND HER MAJOR RIVALS IN THE EUROPEAN FOOD MARKET

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CHAPTER 1

INTRODUCTION

Climate change driven by the accelerative growth of the global warming, has begun to be taken into consideration seriously after 1990s. Nowadays, the effect of climate change on agriculture, food, industry, tourism and health sectors is accepted as a common threat of the earth. Biggest institutions all over the world such as World Bank, Food and Agriculture Organization, OECD and IMF have conducted many researches on climate. Media has begun to focus on the threat of climate change more then ever.

As a consequence of global warming which is mainly the reason of climate change, many countries have taken actions in order to minimize the negative effect of it. These actions consist investing on solar energy, enlightening of the citizens in order to prevent excess usage of energy and water sources and decreasing the ratio of thermal power station where electrical power is produced by hot water, heated by coal. Since the coal is one of the most harmful ways of producing energy because of the carbon dioxide and carbon monoxide that are released in the process, governments seek alternative energy sources. However, these actions are not enough because there are no intimidating rules that can regulate the energy usage all over the world. Kyoto Protocol or the studies of United Nations are not effective.

Greenhouse gas which is the major indicator that shows how much an environment has been affected by global warming, has risen in a very accelerative trend especially after the 1990s. Turkey has begun to take the climate change as a serious threat in this period because forecasts show that the agricultural sector of

Turkey will be influenced by these alterations. Increase in food prices, water scarcity, droughts and other natural disasters lead us to study the impact of climate change on agricultural sector.

Economics of global warming has been studied in many researches and thesis across the world. After the literature review, it can be concluded that global warming and climate change have become among the most studied topics in the 2000s. However, there are very few studies that cover Turkey and her major rivals in order to test the effect of climate change on agricultural trade capability. The main aim of this study is to test effects of the climate change indicators. These are carbon dioxide emission, intensity and particulate emission damage that is determined by World Bank. This study is based on country-level data of Turkey, Netherlands, Germany, France, Spain, Belgium, Italy, Brazil, Ireland, Denmark, Poland, Argentina, United Kingdom, USA, Austria and China for the period of 1990-2008. Net agricultural trade balance (exports minus imports, divided by agricultural output) is defined as agricultural trade capability. Agricultural trade capability is affected by three sets of indicators: traditional factors, agricultural production capability factors and climate change determinants. First set of these indicators are traditional factors. They are real exchange rate, price (ratio of agricultural prices to non-agricultural prices) and agricultural output level (share of agricultural output in GDP). Secondly, agricultural production capability factors are defined as arable land, net inflows of foreign direct investment, population and agricultural machinery. And the last indicator set includes climate change determinants which are particulate emission damage, carbon dioxide emission and carbon dioxide intensity.

The effect of climate change on agricultural trade capability of Turkey and her major fifteen rivals in European food market is analyzed by panel data models:

Ordinary Least Square (OLS) and Fixed Effects Model (FEM). Two sets of these models are run separately. In set 1, all countries are analyzed for the period of 1980-2008 and in set 2; countries have been classified as: emerging and developed countries. In set 2, according to classification made in this thesis, emerging countries are Turkey, China, Brazil, Argentina and Poland.

Main findings are particulate emission damage decreases the agricultural trade capability in emerging countries and same condition is true for carbon dioxide emission as well. Emerging countries have to deal with the global warming in order not to lose competitive power in European food market. Their agricultural trade capability is negatively correlated with carbon dioxide emission. In order to handle the negative correlation, industrial development which causes rise in carbon dioxide emission has to be canalized to agricultural sector and should support the agricultural productivity. Empirical evidence reveals the opposite results for developed countries. Particulate emission damage which is the willingness to pay to avoid mortality attributable to particulate emissions in a country and carbon dioxide emission have positive influence on agricultural trade capability. This consequence shows that, developed countries do not allow to lose their competitive power in European food market resulted from negative effects of particulate emission damage and carbon dioxide emission by improving agricultural productivity. The productivity improvement is achieved by technological and industrial developments which are sectors that release higher levels of emission to the environment. The last variable included in the sample is carbon dioxide intensity. Carbon dioxide intensity is defined as kg per kg of oil equivalent energy use by World Bank. Carbon dioxide intensity supports the hypotheses that agricultural trade capability of emerging and developed countries has been influenced negatively from climate change. Intensity

increases by the energy sources like coal and since the energy output is less in contrast to oil and the level of emission released to the environment is high. This indicator becomes unfavorable for agricultural trade capability of both emerging and developed countries. Empirical findings mentioned above shows that in emerging countries including Turkey, climate change affects agricultural trade adverse. Thus, there is also another consequence of these findings. Turkey as a growing economical power has problems about its current account deficit. Exports are unfavorable for current account deficit and any reason that may decrease the export level of Turkey, leads a further increase in it. Therefore, there is also macroeconomic outcomes of the threat resulted from climate change.

The main contributions of this study are as follows: first, this study is one of the first studies that use a macroeconomic approach to test the impact of climate change on agricultural trade capability of Turkey. Second, three main topics have been considered together in this study: agriculture, international trade and climate change. Third, agricultural trade has been analyzed by adding also agricultural production capability factors that reflect agricultural infrastructure and capacity. Fourth, Turkey and fifteen major rivals of Turkey in European food market have been examined for the period of 1980-2008.

In the model, as a first step, the European food market is selected because out of top 15 destinations in agricultural export, ten countries are the European countries. As a second step, the major rivals of Turkey are determined in the European food market. Country specific characteristics have been analyzed for all the countries and two country groupings. Finally, ten different variables which represent the inputs of international trade, climate change and agricultural production have been used together in this model.

The rest of the thesis is organized as follows. Chapter two gives an overview of the concept of climate change: what it means and the approaches to climate change by the world. Then in chapter three, general trends and characteristics of agricultural sector and international trade in the world and in Turkey are highlighted. In chapter four, the literature about the effects of climate change on agriculture, international and agricultural trade, and export supply models specifically for agricultural trade has been reviewed. In chapter five, methodology and data are discussed briefly. Main empirical findings are presented and discussed in chapter six. Chapter seven provides some concluding remarks.

CHAPTER 2

CLIMATE CHANGE

Global climate change or with the most popular usage, global warming is the raise in the average temperature of the Earth because of the accelerative influence of greenhouse gas emissions that are sent to the atmosphere (Dellal and Butt, 2005). Global surface temperature has increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the last century. Increase in temperature causes many environmental problems such as the abnormalities in the hydrologic balance of the world, melting of ices, decline in the snow volume, increase in the sea level, raise in the number and harshness climate events, droughts, desertification and outbreak illnesses within (IPCC, 2007).

The Concept of Climate Change

Global warming is a human oriented catastrophic problem that challenges the whole system of the globe. People, governments, companies and institutions use energy sources in order to survive. Energy became the main resource for both consumption and production. There are costs of using energy resources to the environment. Basic energy resources like oil and electricity cannot be considered without the damage that they cause to the environment. Air pollution is on the top of damages caused by using energy. Because of the damages, especially to air, emission gas became one of the most dangerous problems of world health. As a result, it had become the most focused case when dealing with the global warming problem. All over the world, for controlling the pollution of air and environment caused by dangerous levels of emission gases, international actions have began to be established. International response to the unstable situation of climate in the world has begun with United Nations Framework Convention on Climate Change (UNFCCC) in 1992 following

the United Nations Conference on Environment and Development (UNCED) or "Earth Summit" in Rio de Janeiro (Weisser, Howells and Rogner, 2008). UNFCCC was for controlling concentration of greenhouse gas (GHG) emissions. After UNFCCC, Kyoto Protocol (KP) in 1997 has been signed in Kyoto, Japan. Kyoto Protocol has been designed to reduce the GHG levels of developing and especially developed countries to the 1990s' between 2008 and 2012 (Weisser, Howells and Rogner, 2008).

Change in climate has different impacts on the entire environment. In fact, climate change is the result of global warming. Global warming has different effects in different regions of world. It is possible that global warming with approaching threat of climate change has influences on the productivity of the land, the agricultural growth, other physical assets and also availability of these products. Negative impacts of the global warming can be observed on the regions where there is no excess need for raised temperature and positive impacts also can be observed where the other conditions for optimum productivity is satisfied except temperature (Slater, Peskett, Ludi and Brown, 2007).

Awareness of global warming and its potential damage have risen in the beginning of the 2000s. Policy makers all over the world faced the danger of climate change. Global warming was not just a weather problem. Impacts of global warming on the macro environment like economy, trade, demographic factors, health and technology have began to be discussed seriously in recent years. Governments designed special institutions in order to deal with this problem and many independent organizations like Greenpeace are also trying to deal with the causes of the global warming.

Global warming and climate change are directly related to economics. Economic impact of these concepts is not just about the increase in temperature or emission levels, but also about disasters like droughts, storms, sea level rise and floods. Governments have to protect the citizens through these natural disasters and also control the level of pollution in the air and environment in order to care the health of their citizens. All these protection actions have costs for the governments. Since protecting the citizens is the major responsibility of the governments, they need to find funds for dealing with the negative effects of these natural disasters. Besides the negative effects of these disasters to economy, they also can causes life loses. Potential danger of the disasters is not the same for all regions. It depends on the geographic conditions of the location. Impact of climate change on the economy can be diverse due to different conditions of countries. While some parts of the world face droughts, other parts can be facing floods. Some restrictions that are put to decrease the emission levels, decline the productivity of the countries which have higher rates of emission levels from the standard. Whereas, it could be an advantage for the countries like developing ones which have less emission levels in contrast to standard levels. As a result of this, there exists an additional trade potential through some specific products like agricultural products. The potential in the additional trade will be mentioned on coming parts in details.

Governments try to find solutions to the demographic issues like population and migration in order to have a less dirty environment because population is a significant part of the problem. Rising population in a specific region means high number of cars, high amount of houses which pollutes air too and high rubbish which causes raise in the level of methane gas. These challenges are associated especially to

developed countries but for the developing countries in the future, there will be a real need for some innovations in emission control and standards. All these desired innovations and standards are supported by many country-specific and independent organizations. In order to meet internationally accepted standards in emission control, governments and companies have engaged in R&D activities and clean environment projects in the last two decades (Stern, 2006). Therefore, technological investments and innovations are significant for achieving a clean environment for governments and big companies getting adapted to the new world's conditions.

Renewable energy resources or new energy resources which cause less or no emission gases can be examples for the desired innovations in the near future. However, there are some trade-offs through considering the economic effects of global warming on some countries. Every country wants to satisfy the needs of her people about health. So, governments try to make the environment of their people cleaner. However, cleaning the environment can cause some restrictions about the productivity of these countries. Developing countries use heavily electricity and oil as an input in the production. Coal is used to produce electricity. Coal and oil are the main reason of carbon dioxide. If these countries continue their production in the same way, they have to give up some controls over health conditions. So, supporting the efficient use of energy and incentives for technological developments are strongly needed for a clean environment, long term development and credible conditions (Stern, 2006). Furthermore, in order to handle these trade-offs and to satisfy the balance between developed and developing countries, there is need for some regulations and even some specific taxes for specific productions and trade patterns.

Discussion of the global warming and economy issues together for the allocation of property rights in an equal and fair manner all over the world is significant (Stern, 2006). Every country has to have equally determined standards that she has to obey. Otherwise, optimum level for desired emission standards for a better and cleaner environment will always be a dream. It is hard to accept the restrictions which will alter the common used ways such as using coal in order to produce electricity to increase the production, not to lose competitive power among the rivals for the big and powerful developed countries and it is also hard for the developing countries which have less economic power to overcome the problems coming from the trade-offs mentioned above. Additionally, there has to be an international understanding and it has to be in a mechanism which is collective and global. Mitigation of climate change can be done only by adaptation not continuing the traditional ways for production or economic growth (Stern, 2006).

Climate Change and Food

Food is the basic necessity for human being to survive and has been a major problem due to increasing population in the world. Therefore, agriculture is one of the most significant topics that have been discussed with different aspects, especially where the environment faces the danger of global warming. Climate change also has an impact on agricultural production and international trade of agricultural products. This influence alters the common trade volumes between countries about the agricultural products and also about other products which tend to be influenced by climate change. There are some negative or positive expectations through the effect of global warming. Some possible expectations are decline in crop production, short term natural extreme events derived from climate variability like floods and also additional trade potentiality or decline between different countries and regions

(Parry, Rosenzweig, Iglesias, Livermore and Fischer, 2004). The pattern of international trade tends to change between countries as a result of the impact of global warming. For instance, if a country loses her wet lands which she uses for rice production and then export of rice, she loses her competitive advantage in agricultural production and trade. As a result of the seriousness of the problem which has impacts on agricultural production, trade, health and many other significant sectors; strategies like mitigation and adaptation have begun to be discussed in order to get ready for coming problems or changing of environment as a consequence of climate change.

In the report of Slater, Peskett, Ludi and Brown (2007), it is stated that in order to deal the problems in some sectors caused by global warming like agricultural production, there is a need of regulatory authority mechanisms such as governments. Governments can adapt agriculture focused policies. Additionally, governments need to prepare the small entities like small farms and other medium level producers of agricultural sector by providing them some incentives and also supplying micro and easy credits. On the other hand, the opportunities coming with the climate change cannot be missed. There will be advantages too like the warm weather and additional lands that will be used by the help of climate change. Furthermore, governments also have to support the research and development, provide assistance for incoming change derived from climate and prepare the markets for new conditions. In the way to deal with global warming, coordination is also strongly needed. Through this way, not only governments but also intergovernmental organizations and international institutions need to consider the best for the society. For instance, monetary organizations can provide additional

funds in order to increase the production and market volume. Global warming is not a problem of a company or government; it is a threat for the whole world.

Agricultural production in different regions of world will alter as a consequence of climate change. Level of production will change and consequently, decrease in the amount of a specific product causes a rise in the prices of those products. After the change in prices of a product and additionally change in the level of production, there will be an expected change in the volume of international trade. So, there can be an increase in the international agricultural trade or at least a change in the amounts of the product that is traded or the trade balances of countries which are effective and dominant in world's agricultural sector (Gassebner, Keck and The, 2006). Impact of global warming on trade causes many differentiations on domestic supply of agricultural products by countries, balances of production between producers and consumers, and also structure of production in farms because producers will want to produce the products which face scarcity in order to gain the market share and money if the lands that they operate are available for the production of these products (Slater, Peskett, Ludi and Brown, 2007).

Climate change can influence the agricultural production through different dimensions. For instance, water scarcity, degradation of the abundant lands and change in the level of precipitation are the natural resource based problems for agriculture. Moreover, demographic impacts like migration can also effect the agricultural production because generally, rural population works in agricultural sector. If the global warming causes a downturn on agricultural output, more people will try to work in another job sector in order to survive. Furthermore, transportation costs will rise and there will be an additional need to prevent the infrastructures from

extreme natural disasters like floods and to develop new projects in order to cope with climate change.

In order to handle the pollution which has a positive influence on global warming, a new concept called carbon trading has emerged in the international market which provides incentives for reduction in emissions. Carbon trade is an incentive for achieving reduction in emissions of pollutants. An authority like government sets some boundaries for the level of emission gas and the trade concept comes then. Trade will occur due to an agreement between the companies in the country which have different emitting rates. Less polluter can sell the right of polluting to the company which needs to increase the rate of emitting in order to raise the production. In this case, the buyer is paying a charge for polluting, while the seller is being rewarded for having reduced emissions by more than was required (Rehdanz and Tol, 2005). This support mechanism sounds good when it comes to stage first but if it cannot be designed well, it can damage poor countries more. Because, poor countries cannot offer the desired money in order to expand their production, this situation restricts access of poor countries to the resources. In addition, there are expectations for volunteer organizations which are working in favor of poor countries by designing national development programs and such to help poor countries for handling the climate change problem. These organizations are significantly important for the poor countries which are incapable to achieve themselves for developing technology in order to create clean energy. When considering global warming and climate change, rational view has to be surpassed. If not, the rights of the poor will always be under threat and there will be no global and collective development.

Climate Change and Possible Scenarios for the future

There are different numbers of models or scenarios related to the concept of global warming. The models related to the global warming or agriculture are generally related to the greenhouse gas emissions, gas concentrations, temperature changes, impacts on agriculture or impacts on agricultural trade. There are four types of scenarios according to Intergovernmental Panel on Climate Change (IPCC). These scenarios have been designed by covering the economic, technologic and demographic issues. IPCC stated both positive and negative scenarios in order to figure out two conditions. There are four scenario groups called A1, A2, B1 and B2 (IPCC, 2007). According to these scenarios of IPCC, there are also sub divisions in terms of the care about environment. For instance, A1 assumes a sudden growth in the economy, an increased global population and also more technological developments. A1 scenario divides into three categories: A1FI which explains that usage of fossil intensive sources will be expected, secondly, A1T which expects the usage of non-fossil energy sources and A1B is a kind of balance between these two scenarios. Moreover, B1 scenario assumes same global population but difference in economic structures toward an information economy. Furthermore, B2 scenario describes a medium rate of growth on economy and population and focuses on local solutions for the climate change driven problems. And the last scenario, A2 is a kind of radical. It assumes a raising trend about population whereas opposite for technological development and economic growth (Parry, Rosenzweig, Iglesias, Livermore and Fischer, 2004). According to those different scenarios, the expectations for the future can be complicated. Thus, after the global crisis faced in 2008, scenario B2 is closer than other scenarios to the reality.

Rise in temperature in the world is assumed as a danger for the human and animal health whereas it also has a positive effect for the plants which need warm conditions. Likely, appropriate land amount tends to decrease as a result of global warming however; there is a beneficiary expectation through an increase for availability of land to produce cereal in North America (40%), northern Europe (16%), Russia (64%) and East Asia (10%). But, there is an expectation for all scenarios towards an increase on the extreme weather events and decrease in water or water scarcity (IPCC, 2007).

Climate change is a very dangerous phenomenon that has to be under control. Every country has a strategy in order to cope with this new concept. Through achieving new strategies for overcoming climate change related problems, countries or global institutions have to make decision through considering the situations of poor countries. For example, Poverty Reduction Strategy Papers (PRSPs), the United Nations Framework Convention on Climate Change (UNFCCC), Sector Wide Approaches (Swaps) and National Adaptation Programs of Action (NAPAS) are the organizations or studies which try to support the rights of poor. Researchers and also some scenarios claim that if the needed restrictions cannot be done, there will be 1300 million people who are at risk of hunger in the period of 2080s according to some projections made by the academicians (Slater, Peskett, Ludi and Brown, 2007).

United Nations Framework Convention on Climate Change in 1992 and the Kyoto Protocol in 1997 have been established which include the biggest economic and political powers of the world. Logic behind these meetings was to decrease the level of emission gases around the world beginning with the primary suppliers of this gas like G8 countries and other developed countries. Therefore, considering the Kyoto protocol, it has both strengths and weaknesses in it. First of all, mentioning of

the incoming danger in an international arena, focusing on the limiting carbon dioxide level of developed and rich countries and also as a call for the world in order to take their attentions for global warming were all the strengths of Kyoto whereas there were some declining ratifications on this protocol that discourages the other ratified parties. For instance, US government ratified the Kyoto Protocol but did not accept the agreements and US has no obligation in order to satisfy the conditions of protocol. However, some big cities in the states of America participated in reduction of emissions and now Seattle for example caught the desired level for emission standards (Aldy and Stavins, 2008). So, taking the decisions stated in the protocol as obligation made voluntarily by some local governments in the states. This situation explains that Kyoto Protocol cannot be accepted as an authority mechanism. It can be considered as an encouraging meeting for the countries or local governments which want to stop the undesired results of global warming.

Climate Change and the Response of the World to the Approaching Threat

Climate Change and EU

In recent years, whole world has been aware of the threat coming by the climate change. Superpowers and the biggest countries of the world, in addition, the European Union (EU) has understood that in order to prevent the negative impacts of global warming, all the parties are responsible from individual to governments and also to international organizations. European Union took the topic on his hand seriously. One of the working units of European Union like European Commission for instance arranges some campaigns in order to increase the awareness about global warming and also there are formal web sites directly managed by European Union which focus on global warming. This action could be accepted as simple and not

very helpful but the web site is fascinating and the slogan that is used, “make a pledge” is easy to memorize and keep in mind. All the plans that are done are for overcoming the danger of climate change. Climate has to change but the style of this change is really damaging for the world. The level of carbon dioxide is higher than last 650000 years (Dimas, 2006). In these scary results, individuals have one of the biggest shares of the pie. Use of private cars, energy usage by households and also the energy used to heat the homes by people show that the campaigns supported by the EU can be very helpful in order to begin fighting against global warming. EU, after joining both 1992 United Nations (UN) Climate Change Convention and 1997 Kyoto Protocol identified the desired emission levels for its member countries and for all Europe. EU had defined some limits for the industry and especially for energy sector. In addition, these arrangements are done by considering the distribution of emission allowances. The allowances help emission trading like mentioned above and this situation is in favor of decreasing the costs. Moreover, efficient energy usage by houses, buildings, industrial firms and government organizations has significance for EU.

According to European Commission (2008), the desired level for emission gas in the world is the levels of 1990s. Main aim of EU and its institutions is to decrease the temperature and make the environment better for now and also for the future generation. EU has described a strategy in March 2007 that it will reach the level that is decided in UN Negotiations at the end of 2009. On the other hand, the desired levels determined in Kyoto Protocol will be reached at the end of 2012. EU believes that countries have to decide on radical sanctions and strategies before global warming destroys the world and also before beginning to see the polar bears only on TV or papers. Furthermore, it is not hard to take action. It is certain that the

long term costs of not to take any action against global warming will be more costly than do something now. Technology and economy of the major emitters are enough and with a well designed coordination, it can be easy to take action immediately. There will be also additional advantages after deciding on precaution of climate change like health service consumptions and energy security.

As a global problem, global warming and climate change has to be considered and discussed globally. In order to solve the problem, coordination between countries is significant because the air that countries pollute is the air of everybody and every country. Collective action is required. Kyoto Protocol was one of primary acts to increase the world's awareness. Additionally, a global strategy and action plan is needed for the business environment too because companies cannot clarify their long term plans. Moreover, EU has three objectives which are related to energy in order to go back to desired emission level:

- Improving energy efficiency and a 20% decline in the energy consumption
- Rise in the shares of renewable energy in the market up to 20%.
- A 10% share for bio fuels in each EU country

EU has a system in order to improve energy efficiency called EU ETS (EU Emission Trading System). Some sectors like aviation will be cut until 2028 and this situation will lead to a decrease for about 21% in the emission at the end of 2020. There are also some big sectors which are out of EU ETS like transport (other than aviation), agriculture and waste. EU proposes that these sectors should also cut their emission levels of 2005 by 10% till 2020 because the share of these sectors is really high for about 60% (European Commission, 2008). Concept of emission trading basically improves by coordination and a collective structure. For instance, poor countries of

EU can increase the carbon level by improving their industry and production whereas rich countries like Denmark has to cut the emission levels to satisfy the balance and also has to focus on renewable energy sources and effective energy usage. Therefore, EU promotes carbon capture and storage too. Insistence of EU through fighting against global warming is very clear. Additionally, EU raised its research budget in order to discover clean deployment technologies and also supports the other countries to take action against global warming.

EU is one of the leading mechanism which wants to take the advantage of first mover and with the projects, campaigns, preventions and promotions, EU can reach its desires. Although, the endeavor achieved by EU will be encouraging for the rest of the world.

Climate Change and USA

After mentioning what EU thought about the incoming danger, there are also dispositions of other big countries and regions like USA and Asia for preventing global warming. After not taking the case of global warming as a serious problem especially at the period of Kyoto Protocol's assignment, when the countries try to catch the appropriate levels of emission in order to stop the pollution of environment, United States of America (USA) began to consider global warming as a danger. There is a United States (US) Climate Policy in order to slow the rise in emission gas, to accelerate the technological developments and increase the coordination in the international arena for declining the risks for the environment. Environmental Protection Agency (EPA) has been established in order to achieve strategies against the negative impacts of global warming. In the year of 2002, USA declared a strategy to decrease the level of emission gas derived from her economy by 18% at the end of

2012. Government itself is the main supporter of the strategy against climate change and in addition, it also helps and supports the voluntary organizations which operate to make people aware of the climate change and the possible consequences of it (EPA, 2008). There are technology and science programs in order to manage the climate change which is agreed by the officials of federal government of USA. First of all, these programs research in order to define the reason of the climate change and then secondly, they search whether the reason comes from mankind or is it a natural consequence. After making these researches, the appropriate strategy will be described. Investigators conclude how the global warming influenced the air, water resources, ecosystem and human health by the help of this research and study. Like EU, USA also has done many studies and continues to make in order to increase the awareness of her citizens and people around the world. USA has built an agency called environmental protection agency. Also, Intergovernmental Panel on Climate Change (IPCC) and United Nations Framework Convention on Climate Change (UNFCCC) are the strong activities supported by USA. Moreover, USA is a member of Asia Pacific Partnership on Clean Development and Climate with Australia, China, Japan, India and South Korea which works for creating a cleaner environment.

Climate Change and Asia (India and China)

The two biggest countries of Asia are India and China. As a result of their natural resources, especially coal, they are the biggest problems in order to cope with the danger of climate change. Both of them do not act in the same way but whatever they do about decreasing emission levels, the result is not enough. They claim some different ways in order to calculate the level of emission like emission per capita which is very beneficial for them because of their population. Nowadays, China is

accepted as the world's biggest emitter whether it tries to find new renewable energy resources in contrast to coal and also whether it tries to make technological developments. India is not very different from China and India additionally has less desire in order to negotiate about cutting the emission levels globally. By the way, it is generally assumed that the agriculture of the India will be affected very much in a negative tendency because of the hotness of the country (Economist, 2008). As developing countries, it has to be accepted that adaptation for mitigating the emission will not be easy for India. Government of India has a subsidy mechanism for the private and agricultural sector which supplies energy cheaper. It is very hard to give up this method because if India tries to increase the price of the energy, threat of inflation will come to the stage. Another threatening part of the Asian case is the fact that India and China have economies which have one of the highest growth rates in the world. So, if they continue to use the same methods for their production the negative effect of this situation will be more and more. On the other hand, the view of the US government about India is totally strict which can be summarized by the speech of George W. Bush. Ex-president, Bush pointed that if China and India do not cut their emission level, USA will not accept the conditions of the international agreements on climate change (Economist, 2008). As a superpower and also one of the biggest emitters in the world, this style is accepted as an injustice and far away from being positive. Furthermore, whether those countries like USA, India, China and Russia tend to act obdurate just after the Kyoto Protocol period, they all do more researches in order to cope with the global warming but there can be sometimes a thin line and countries can chose to give secondary importance to the climate driven issues. For instance, government of China claims that the primary importance of the country is security and in order to increase the level of security, China cannot give up

the oil expenditure in order to use it in transportation and also energy production by coal especially to use it in the development of country. Thus, the expectation through change in thoughts of the developing countries is becoming positive day by day. The Clean Development Mechanism (CDM) is an arrangement which is discovered and declared in Kyoto Protocol in order to support the reduction in emission levels in developing countries by investing on the projects like solar energy or green energy (Richerzhagen and Scholz, 2007). China and India has been successful in order to take these incentives. Suntech from China, which is a solar energy firm, is the world's third-largest manufacturer of solar cells. Solar cells provide producing energy by using the light and heat of sun. In addition, Suzlan Energy from India is now the world's fifth biggest company through producing wind tribunes (Economist, 2008).

Climate Change and Turkey

Turkey, like the other big regions and countries, faces the risk of global warming and its consequences. Mediterranean and Central Anatolia parts of Turkey possibly have the highest risk coming from the global warming. As a developing economy, Turkey has not yet achieved stability in her energy utilization and GHG emissions either as a ratio to her GDP or in per capita. Turkey is among the top 25 countries ranked according to the usage of energy sources in industrial production (Telli, Voyvoda and Yeldan, 2007). The negotiations of Turkey with EU for full membership are still continuing. Government of Turkey has to establish appropriate strategies for CO_2 emission reductions due to the pressure coming from EU. The current Turkish environmental policy instruments are mostly energy taxes, environmental impact assessments and pollution penalties. Yet, it is obvious that these instruments will not be enough under a more active environmental policy design and will need to be

expanded to include other forms of policy measures such as additional pollution taxes, emission trading and permits, and abatement investments towards reduced energy intensities. In order to cope with the negative impacts of global warming, Ministry of Agriculture and Rural Affairs (2008) has stated a strategy-plan mainly focusing on water scarcity. Additionally, State Planning Organization, Ministry of Environment and Forestry, Ministry of Energy and Resources and Ministry for Internal Affairs have supported the precautions against global warming.

All the achievements across the world are hopeful developments. From individual to governments and regions, all of them spend money and time to protect the environment and to bring it cleaner to the future generations of world.

CHAPTER 3

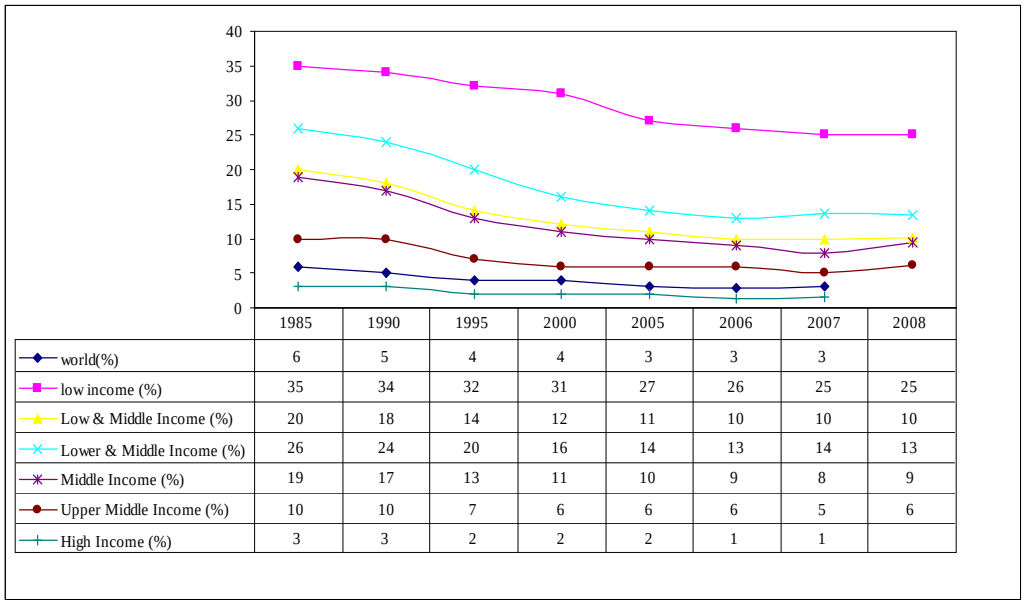
AGRICULTURE AND INTERNATIONAL TRADE

In the second chapter, an overview of the concept of global warming is given: what it means and encompasses. Additionally, chapter two provides information about the impacts of global warming on the macro issues in the world and the responses of the world to this incoming danger. Then, in this chapter, analysis of global warming through considering the concepts of international trade and agriculture included.

Before focusing on the impacts of global warming, it will be beneficial to analyze the trend in agricultural production in the world.

Agricultural Output

Agriculture and agricultural output directly related to the basic need of humanity, food. Agriculture is significant for all the countries in the world. Besides the effect of global warming on human health or the structure of the new facilities and factories, global warming has a great impact on agriculture too. Global warming as discussed in the first chapter has an influence on climate, temperatures and land quality. These examples given are directly related to the agricultural output and show the relation between agriculture and global warming.



	1985	1990	1995	2000	2005	2006	2007	2008
world(%)	6	5	4	4	3	3	3	
low income (%)	35	34	32	31	27	26	25	25
Low & Middle Income (%)	20	18	14	12	11	10	10	10
Lower & Middle Income (%)	26	24	20	16	14	13	14	13
Middle Income (%)	19	17	13	11	10	9	8	9
Upper Middle Income (%)	10	10	7	6	6	6	5	6
High Income (%)	3	3	2	2	2	1	1	

Figure 1: Share of agricultural output in GDP according to aggregate classification of countries (%)

Source: World Bank database

Figure 1 shows the share of agricultural production in global gross domestic product (GDP) for the country groups as well as the world. Share of the agriculture in GDP changes according to the country groups' GDP level. The biggest share of the agricultural output in GDP belongs to low income countries whereas high income countries have the lowest share. On the other hand, general trend in global agricultural production seems to decline from 1985 to 2008. The main reason behind this situation is the accelerative rise in the industrialization of developing countries.

Agricultural output cannot be considered by only discussing the countries or country groups. Efficiency of land, climate, external factors, government politics, reforms, labor force and labor cost, international trade agreements and many other micro or macro level factors may leave an impact on the agricultural output level. After 2000, the impact of global warming on whole world and also on agriculture is

being discussed more and more. Each country tries to develop strategies for the incoming danger. Ministries on the case of global warming have began to be established by governments that directly focus to climate change. Reform programs for agriculture has been built in the European Union (EU), like Common Agricultural Policy (CAP) adopted on 26 June 2003, which supports the production of agricultural products and offers farmers freedom in order to produce any product for the market (European Commission, 2008). Moreover, many other subsidy mechanisms are built to help the farmers in different countries. By helping farmers in a way like that, they also try to empower them in the international arena. Because, they gain additional competitive power among their rivalry and by the way, production of agricultural output which is also consisted of the desired ones for the market, make the farmers good players in the international arena while this situation also satisfies the regulatory mechanisms by inflow of foreign currencies.

Major agricultural outputs are classified as meat, cereal and fruit & vegetable in Table 1.

Table 1: Shares of Major Meat Producer Countries in the world (%)

	Time		
Countries	1999-2001	2003	2004
China	26.77	28.05	28.57
United States of America	16.01	15.34	14.95
Brazil	6.53	7.25	7.66
Germany	2.72	2.60	2.61
France	2.79	2.53	2.40
India	2.25	2.34	2.32
Spain	2.11	2.16	2.13
Mexico	1.90	1.92	1.94
Russian Federation	1.87	1.95	1.91
Canada	1.71	1.66	1.77
Argentina	1.71	1.48	1.61
Italy	1.76	1.58	1.57
Australia	1.60	1.52	1.45
Turkey	0.58	0.59	0.61
Total Share	70.30	70.97	71.49

Source: Food and Agriculture Organization (FAO) database

China and USA are the largest producer countries in meat production. The share of meat production is 29% and 15% as of 2004 respectively. However, the share of China in meat production has increased from 1999 to 2004 while the level of USA has been declining. The third largest meat producer in the world is Brazil with a share of 8%. Other 11 producers are relatively lower and have fewer shares for the period 1999-2004. The total shares of these largest 14 countries make up to 70% of total meat production in the world. Turkey has relatively smaller (0.6%) share in global meat production and there is a slight increase in meat production from 1999 to 2004.

Table 2: Shares of Major Cereal Producer Countries in the world (%)

	Time		
Countries	1999-2001	2003	2004
China	20.16	18.03	18.20
United States of America	16.05	16.73	17.14
India	11.42	11.19	10.23
Russian Federation	3.22	3.14	3.36
France	3.04	2.63	3.11
Indonesia	2.90	3.02	2.88
Brazil	2.41	3.23	2.81
Canada	2.37	2.41	2.32
Germany	2.23	1.89	2.25
Bangladesh	1.82	1.96	1.81
Ukraine	1.39	0.94	1.81
Viet Nam	1.63	1.81	1.73
Argentina	1.75	1.63	1.51
Turkey	1.45	1.48	1.50
Total Share	71.85	70.09	70.65

Source: Food and Agriculture Organization (FAO) database

China and USA are the largest producer countries in cereal production like observed in the production of meat. The share of cereal production is 18% and 17% as of 2004 respectively. The third largest cereal producer in the world is India with a share of 10%. Share of China, USA and India in the production of cereal has decreased from

1999 to 2004. Other 11 producers are relatively lower and have fewer shares for the period 1999-2004. The total shares of these largest 14 countries make up to 70% of total cereal production in the world. Turkey has relatively smaller (1.5%) share in global cereal production and there is a slight increase in meat production from 1999 to 2004.

Table 3: Shares of Major Fruit & Vegetable Producer Countries in the world (%)

	Time		
Countries	1999-2001	2003	2004
China	32.12	36.3	36.6
India	9.72	9.42	9.22
United States of America	5.64	4.90	5.01
Brazil	3.55	3.27	3.16
Turkey	2.92	2.78	2.61
Italy	2.81	2.22	2.48
Spain	2.31	2.26	2.12
Iran, Islamic Republic of	2.01	1.98	1.93
Mexico	1.91	1.83	1.79
Egypt	1.77	1.73	1.74
Indonesia	1.28	1.52	1.62
France	1.66	1.36	1.43
Russian Federation	1.35	1.42	1.41
Philippines	1.29	1.27	1.29
Total Share	70.33	72.3	72.4

Source: Food and Agriculture Organization (FAO) database

China is the largest producer country in fruit and vegetable production with a share of 37%. Fruit and vegetable production of China equals to the total production of other top fruit and vegetable producers in the world as of 2004. Fruit and vegetable production of China has increased from 1999 to 2004. Moreover, India and USA follows China with shares of 9% and 5% respectively. China, India and USA share approximately 48% of the total fruit and vegetable production in the world. However; the shares of India and USA have been declining in the period 1999-2004. On the other hand, Turkey is the fifth largest fruit and vegetable production. The

share of Turkey is respectively few (%2.6) in contrast to the top three producers of fruit and vegetable.

FAO statistics show that especially when the top agricultural producers considered, some agricultural products are significant than others according to their values. The top meat, cereal and fruit & vegetable producers like China, USA, India, Brazil, Russia, France and other countries stated in the Table 1, 2 and 3 are at top because they produce hen eggs, cattle meat, cow milk, chicken meat, pig meat, maize, wheat, rice, soybeans, sugar cane, potatoes and tomatoes. These twelve products are significant for the top producer countries of agricultural products. According to the rankings of 2005 which are the most recent values according to Food and Agriculture Organization (FAO), ranking of countries are stated at Table 4 and 5 below.

Table 4: Top 20 countries in the production of Hen eggs, Maize, Cattle meat, Cow milk, Chicken meat and Pig meat in 2005 in the world ($1000)

	Hen eggs		Maize		Cattle Meat		Cow milk		Chicken Meat		Pig Meat	
Rank	Country	Production	Country	Production	Country	Production	Country	Production	Country	Production	Country	Production
1	China	20,838,720	USA	32,562,540	USA	23,040,640	USA	21,315,090	USA	21,315,090	USA	9,179,673
2	USA	4,627,585	China	15,396,500	Brazil	16,088,270	India	10,238,690	Brazil	10,238,690	Germany	4,329,079
3	India	2,163,754	Brazil	4,050,686	Argentina	6,255,277	Russia	8,137,764	Mexico	8,137,764	Spain	3,382,251
4	Japan	2,140,310	Mexico	2,382,100	Australia	4,446,802	Germany	7,339,944	India	7,339,944	Brazil	3,149,716
5	Russia	1,783,447	Argentina	2,265,900	Russia	3,961,424	France	6,723,495	United Kingdom	6,723,495	Canada	2,359,272
6	Mexico	1,655,355	India	1,684,900	France	3,594,670	China	6,435,748	Spain	6,435,748	France	2,287,576
7	Brazil	1,354,517	France	1,536,861	Mexico	3,371,296	Brazil	6,201,721	Indonesia	6,201,721	Viet Nam	2,125,332
8	France	907,353	Indonesia	1,395,993	Canada	3,288,565	New Zealand	3,889,372	Japan	3,889,372	Poland	1,939,225
9	Indonesia	760,613	South Africa	1,393,935	India	3,087,958	UK	3,876,608	France	3,876,608	Denmark	1,892,643
10	Turkey	720,672	Italy	1,234,276	Germany	2,543,984	Ukraine	3,586,068	Russia	3,586,068	Netherlands	1,718,720
11	Germany	692,888	Romania	1,157,933	Italy	1,892,476	Poland	3,297,656	Canada	3,297,656	Russia	1,619,396
12	Ukraine	638,446	Hungary	1,045,800	Colombia	1,657,146	Netherlands	2,800,827	Thailand	2,800,827	Italy	1,488,596
13	Spain	629,503	Canada	975,150	United Kingdom	1,460,206	Italy	2,792,370	Turkey	2,792,370	Japan	1,266,011
14	Italy	607,796	Ukraine	825,020	New Zealand	1,441,723	Australia	2,699,291	Poland	2,699,291	Philippines	1,113,973
15	Iran	529,651	Egypt	790,160	South Africa	1,310,230	Mexico	2,625,826	South Africa	2,625,826	Korea	1,063,215
16	Netherlands	516,627	Serbia	732,060	Ireland	1,220,285	Turkey	2,526,430	Malaysia	2,526,430	Mexico	1,056,782
17	Korea	494,920	Philippines	604,240	Spain	1,183,056	Pakistan	2,415,267	Iran	2,415,267	Belgium	973,157
18	UK	479,204	Nigeria	555,320	Ukraine	1,151,215	Japan	2,195,335	Argentina	2,195,335	China, Taiwan	921,620
19	Poland	451,506	Thailand	485,716	Uruguay	1,047,266	Canada	2,154,114	Australia	2,154,114	Thailand	695,100
20	Nigeria	413,301	Spain	459,071	Japan	1,016,429	Argentina	2,154,114	Germany	2,154,114	United Kingdom	687,589

Source: Food and Agriculture Organization (FAO) database

Table 5: Top 20 countries in the production of Tomatoes, Potatoes, Rice, Soybeans Sugar cane and Wheat, in 2005 in the world ($1000)

	Tomatoes		Potatoes		Rice		Soybeans		Sugar Cane		Wheat	
Rank	Country	Production	Country	Production	Country	Production	Country	Production	Country	Production	Country	Production
1	China	7,463,295	China	10,588,650	China	39,193,840	USA	18,045,660	Brazil	8,725,914	China	15,027,110
2	USA	3,024,648	Russia	5,279,820	India	27,478,290	Brazil	10,936,990	India	4,825,286	India	11,230,560
3	Turkey	2,298,221	India	3,626,250	Indonesia	11,499,260	Argentina	8,345,187	China	1,819,452	USA	8,907,323
4	Italy	1,851,584	Ukraine	2,825,574	Bangladesh	8,531,902	China	3,682,341	Thailand	1,029,610	Russia	7,425,896
5	India	1,800,668	USA	2,772,055	Viet Nam	7,740,996	India	1,438,074	Pakistan	981,260	France	5,759,093
6	Egypt	1,800,668	Germany	1,618,395	Thailand	5,751,270	Paraguay	765,448	Mexico	937,277	Canada	3,984,806
7	Spain	1,059,924	Poland	1,596,912	Myanmar	5,218,745	Canada	653,408	Colombia	827,669	Australia	3,753,970
8	Iran	995,106	Belarus	1,187,234	Philippines	3,152,548	Bolivia	363,876	Australia	794,369	Germany	3,677,696
9	Brazil	782,705	Netherlands	991,560	Brazil	2,799,143	Indonesia	173,688	Philippines	643,870	Pakistan	3,367,826
10	Mexico	508,956	France	920,632	Japan	2,340,767	Italy	128,092	USA	535,948	Turkey	3,275,580
11	Russia	469,121	United Kingdom	913,815	USA	2,132,696	Russia	127,901	Indonesia	529,635	Ukraine	2,916,826
12	Greece	402,781	Canada	703,493	Pakistan	1,565,836	Nigeria	101,319	South Africa	451,230	Argentina	2,495,680
13	Chile	291,424	Iran	609,210	Korea, Rep. of	1,367,098	Uruguay	82,145	Argentina	400,861	UK	2,331,901
14	Morocco	284,607	Turkey	604,858	Egypt	1,320,662	Korea, Dem Peo. Rep	78,440	Guatemala	373,860	Iran	2,261,710
15	Ukraine	284,316	Romania	578,024	Cambodia	894,642	Serbia	72,339	Egypt	339,278	Kazakhstan	1,726,698
16	Uzbekistan	284,316	Bangladesh	566,855	Nepal	873,341	Ukraine	67,546	Viet Nam	311,550	Poland	1,334,604
17	Portugal	278,393	Peru	464,160	Nigeria	754,481	South Africa	60,371	Cuba	259,625	Egypt	1,269,827
18	Tunisia	217,976	Brazil	428,041	Iran	745,535	Romania	55,344	Venezuela	182,776	Italy	1,174,550
19	Syria	217,976	Japan	420,645	Sri Lanka	665,869	Viet Nam	53,383	Peru	147,467	Romania	1,096,071
20	Nigeria	210,631	Belgium	384,955	Madagascar	645,420	Thailand	53,383	Iran	135,005	Uzbekistan	896,105

Source: Food and Agriculture Organization (FAO) database

China, as explained in the top producers of meat, cereal and fruit & vegetable production rankings, is the largest producer of five of these twelve significant products. These five products are hen eggs, wheat, rice, potatoes and tomatoes and especially in the production of hen eggs shown in Table 4, China is five times larger than the nearest producer, USA. Agricultural production of China is high as a result of the available lands that can be used for agriculture and high labor force driven by her population which exceeds 1 billion. Secondly, USA leads the other countries in the production of cattle meat, cow milk, chicken meat, pig meat, maize and soybeans. As same reason with China, agricultural production of the products stated above is higher than other countries in USA. Top agricultural producers of the world generally have higher available lands in order to grow agricultural products whereas Russia which has the biggest area as a country in the world cannot take place in top three in Table 4 and 5 except for cow milk and potatoes because of the cold weather. Furthermore, Brazil and India are the other top producers of products like hen eggs, cattle meat, cow milk, chicken meat, maize, rice, soy beans, sugar cane and wheat. Both Brazil and India have warm weather which is appropriate for agricultural production and additionally, they do not have any threats of drought.

Turkey is in top ten like stated above in Table 4 and 5 in the production of three products. These products are tomatoes, wheat and hen eggs. The value of production is 720.6 million dollars for hen eggs, 3275.6 million dollars for wheat and 2298 million dollars for tomatoes in 2005. Turkey does not have water problems especially in the west and north side of the country. Vegetable production is available in Turkey like tomatoes and in the dry areas of Turkey; there is mostly higher cereal production. In the production of wheat, Turkey is in the tenth ranking.

The countries which are larger than Turkey in the production of wheat are generally the countries which have big land resources like Russia, Canada and Australia.

The agricultural production is significant for Turkey because agricultural production of Turkey compensates the agricultural consumption of Turkey. Whether the industrialization became the main focus after establishment of Turkey in order to catch the developed countries in the economic manner, agriculture is still very important for the country.

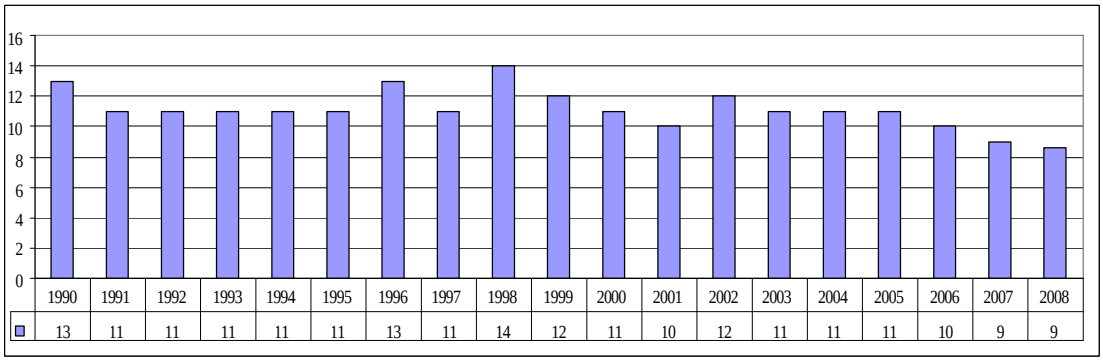


Figure 2: Share of Turkey's agricultural output in GDP (%)

Source: World Bank database

There is a declining trend in the agricultural production of Turkey from 1990 to 2007. The tendency shows that Turkey is classified as an upper-middle income country. The reason of this trend is basically subsidies provided by Turkish government to the industrial sector. In order to increase the competitive power of industrial sector in the world and for increasing the export of industrial products for inflow of foreign currencies, these subsidy mechanisms have established by government.

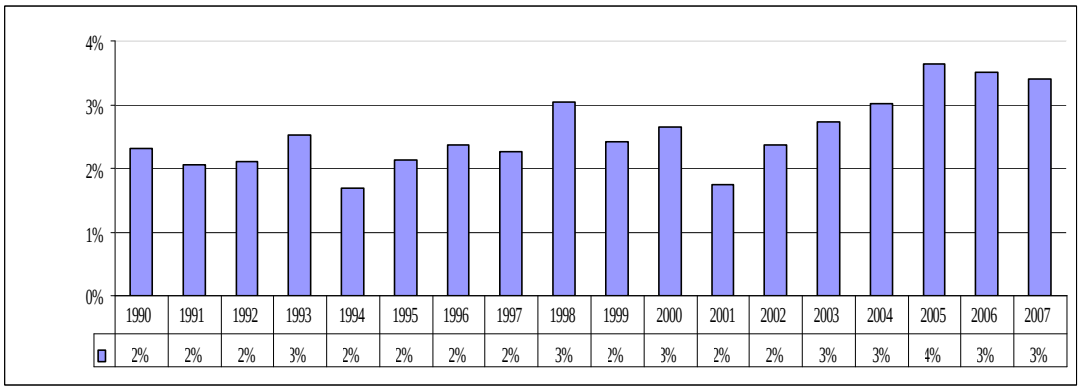


Figure 3: Share of Turkey's agricultural output in the agricultural output of world (%)

Source: World Bank database

Actually, there is both declining and increasing trends in the share of agricultural output of Turkey in the world. Smaller share is in the year of 2001 which is a consequence of the crisis Turkey faced and devaluation of lira. According to World Bank database, the calculation has been made by dollar and the value of the agricultural production has decreased in 1999, 2000 and 2001. Furthermore, the reason of the decrease in 1994 is same with 1999. Generally, Turkey has been performing almost 3% to 4% of the world's agricultural production. Turkey has not have bigger lands in contrast to the leading countries in agricultural production like USA, China or Brazil but the shares show that Turkey has a good performance in producing agricultural products. And it is also clear that Turkey has significance on the agricultural production in the world.

From 1990 to 2007, the value of agricultural output in the world and in Turkey has given below which is a detailed summary of Figure 3.

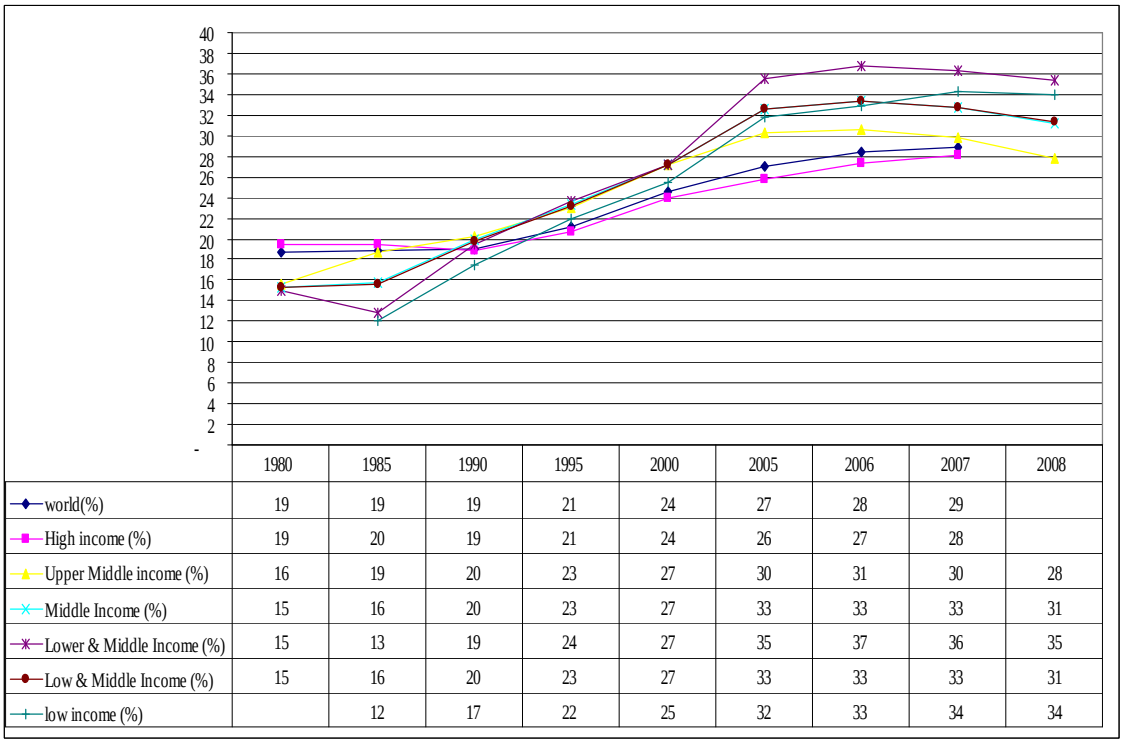
Table 6: Agricultural output in Turkey and in the world from 1990 to 2007 ($)

Year	Agricultural Output in the World	Agricultural Output in Turkey	Share of Turkey
1990	1,184,347,351,577	27,247,503,988	2%
1991	1,163,519,905,742	23,823,884,746	2%
1992	1,181,761,852,010	24,768,971,451	2%
1993	1,143,364,355,912	28,857,108,530	3%
1994	1,236,397,848,640	20,810,560,932	2%
1995	1,304,488,578,958	27,644,538,674	2%
1996	1,337,327,612,853	31,570,745,662	2%
1997	1,260,231,451,577	28,378,171,745	2%
1998	1,206,686,324,406	36,538,097,336	3%
1999	1,188,455,804,698	28,725,038,537	2%
2000	1,145,978,942,979	30,227,409,417	3%
2001	1,119,740,577,549	19,502,412,326	2%
2002	1,147,729,486,749	27,249,126,357	2%
2003	1,278,154,768,898	34,697,939,630	3%
2004	1,422,818,885,045	42,916,538,176	3%
2005	1,432,174,968,685	52,252,895,331	4%
2006	1,444,717,094,990	50,472,059,862	3%
2007	1,654,901,510,160	56,209,772,807	3%

Source: World Bank database

Table 6 shows the volume of agricultural production in the world and in Turkey. Besides the years of 1994 and 2001, there is an increasing trend on agricultural production. Turkey has faced the lowest shares in the agricultural production of world in 1994 and 2001 as a consequence of the economic crisis which leads devaluation of money and continuously devaluation of agricultural products in the world market. Furthermore, the sharp decline in the agricultural production of world for the year 2002 is a consequence of the unavailable weather conditions which influences the biggest agricultural producers like USA and China.

After the globalization, technological developments like internet and commonly usage of these developments, regional agreements made by countries and trade agreements have positive effects on the achievement of international trade in the world. International trade has become one of the most important tools for countries that countries reach win-win situation. International trade is in favor of both sides of trade. Exporters find reasonable prices to sell the products and importers on the other hand find cheaper prices to buy.



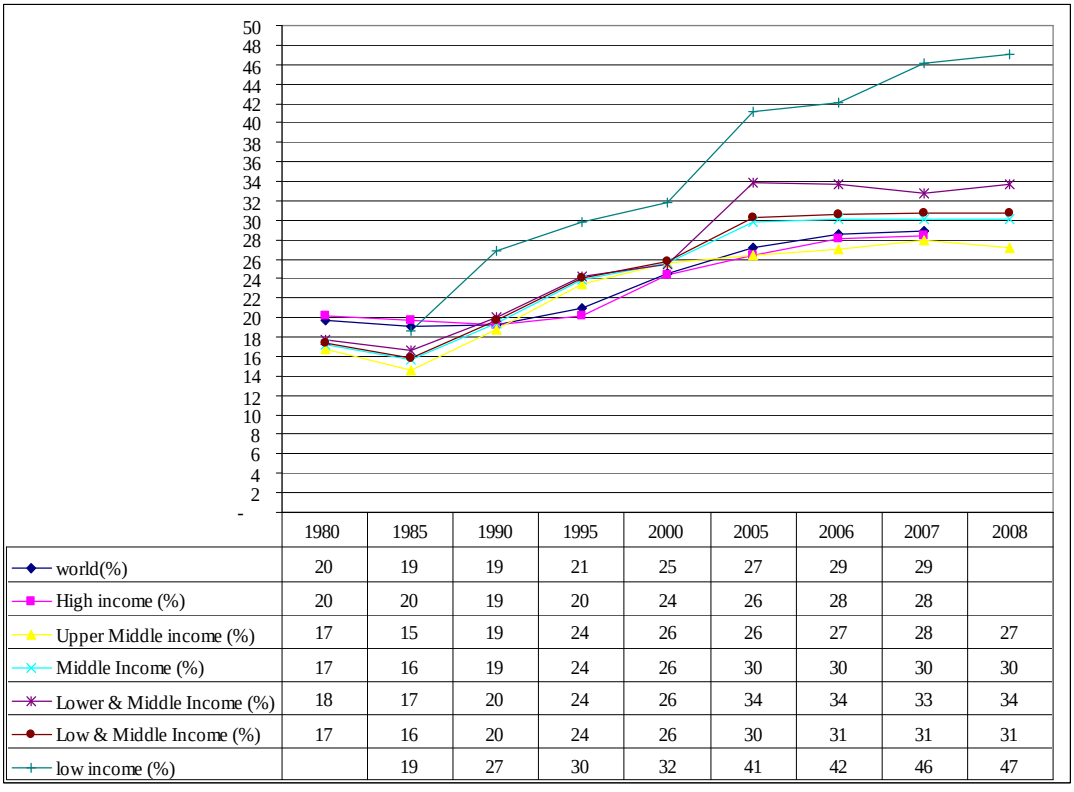
	1980	1985	1990	1995	2000	2005	2006	2007	2008
world(%)	19	19	19	21	24	27	28	29	
High income (%)	19	20	19	21	24	26	27	28	
Upper Middle income (%)	16	19	20	23	27	30	31	30	28
Middle Income (%)	15	16	20	23	27	33	33	33	31
Lower & Middle Income (%)	15	13	19	24	27	35	37	36	35
Low & Middle Income (%)	15	16	20	23	27	33	33	33	31
low income (%)		12	17	22	25	32	33	34	34

Figure 4: Ratio of international trade (exports) in GDP according to aggregate classification of countries (%)

Source: World Bank database

Figure 4 illustrates the growing tendency of exports in GDP all over the world. From high income countries to low income countries, share of the exports in GDP has increased year by year. The rates in the table stated below the figure 4 shows the

change. The values of 1980s were closer to twenty percent whereas, the values become around thirty percent after 25 years. Improvements of vehicles, developments in technology, invention of internet, achievement in the economies of world, regional agreements, political unions like EU and many additional improvements in the international relations support the raise in the share of export in GDP. Furthermore, share of high income countries is the closest value to the trend in the world. In addition, the biggest influence in the share of world has to come from the high income countries. Between high and middle-low income countries, there is approximately a difference of 5%. It shows that, share of international exports in GDP is higher in developing countries in contrast to the developed countries.



	1980	1985	1990	1995	2000	2005	2006	2007	2008
world(%)	20	19	19	21	25	27	29	29	
High income (%)	20	20	19	20	24	26	28	28	
Upper Middle income (%)	17	15	19	24	26	26	27	28	27
Middle Income (%)	17	16	19	24	26	30	30	30	30
Lower & Middle Income (%)	18	17	20	24	26	34	34	33	34
Low & Middle Income (%)	17	16	20	24	26	30	31	31	31
low income (%)		19	27	30	32	41	42	46	47

Figure 5: Ratio of international trade (imports) in GDP according to aggregate classification of countries (%)

Source: World Bank database

Trade provides a mutual benefit for both sides. In order to satisfy the needs of citizens, each country tries to find new ways to reach the product that it cannot produce or it cannot produce the product cheaper then another country. From this point of view, Figure 5 gives the information about the raising desire to reach the same product which is cheaper. Furthermore, shares of international imports in GDP in high income and upper-middle income countries are the closest values to the trend in the world. In addition, the biggest influence in the share of world has to come from the high and upper-middle income countries. Between high and middle-low income countries, there is approximately a difference of 5%. It shows that, share of international exports in GDP is higher in developing countries in contrast to the developed countries.

Ranking of the countries in international trade for the year of 2007

In order to observe the biggest traders of the world, database of World Trade Organization is used and for the year 2007, the top list of leading exporters, leading importers and total trade volume of the leading countries is stated below in the tables 7,8 and 9.

Table 7: Leading “importers & exporters (trade volume)” in international trade of world, 2008 (billion dollars)

	Commercial Services		Merchandise Trade		Total Trade	
Ranking	Traders	Trade Volume	Traders	Trade Volume	Traders	Trade Volume
1	United States	889	United States	3,457	United States	4,346
2	Germany	525	Germany	2,666	Germany	3,190
3	United Kingdom	479	China	2,561	China	2,865
4	Japan	314	Japan	1,545	Japan	1,858
5	China	304	France	1,311	France	1,611
6	France	300	Netherlands	1,206	United Kingdom	1,570
7	Italy	254	Italy	1,093	Netherlands	1,399
8	Spain	247	United Kingdom	1,091	Italy	1,347
9	Ireland	205	Belgium	945	Belgium	1,113
10	Netherlands	192	Canada	875	Canada	1,026
11	India	186	Korea, Republic of	857	Korea, Republic of	1,023
12	Belgium	168	Russian Federation	763	Spain	917
13	Korea, Republic of	166	Hong Kong, China	763	Hong Kong, China	901
14	Singapore	162	Spain	670	Russian Federation	889
15	Canada	151	Singapore	658	Singapore	820
16	Hong Kong, China	138	Mexico	615	Mexico	658
17	Denmark	134	Taipei, Chinese	496	India	657
18	Sweden	126	India	471	Taipei, Chinese	563
19	Russian Federation	125	Saudi Arabia	429	Saudi Arabia	463
20	Switzerland	112	United Arab Emirates	397	United Arab Emirates	440
	Turkey	35	Turkey	334	Turkey	368

Source: World Trade Organization database

Table 7 which is stated below is the combination of leading exporters and importers. Table 7 is about the leading economies or countries according to amounts of trade volume occurred. USA is in the first stage. After USA, an EU member, Germany comes. China is in the third place as an Asian economy and Japan on the other hand is in fourth place in the ranking.

Turkey has a trade volume of 35 billion dollars for commercial services and 334 billion dollars for merchandise trade. Turkey is very closer to top 20 ranking made according to total trade volume in the world.

Table 8: Leading “exporters” in international trade of world, 2008 (billion dollars and percentage)

	Merchandise Trade			Commercial Service Trade			Total Trade	
Ranking	Exporters	Value	Share	Exporters	Value	Share	Exporters	Value
1	Germany	1461.9	9.1	United States	521.4	13.8	United States	1,809
2	China	1428.3	8.9	United Kingdom	283.0	7.5	Germany	1,703
3	United States	1287.4	8.0	Germany	241.6	6.4	China	1,575
4	Japan	782.0	4.9	France	160.5	4.2	Japan	928
5	Netherlands	633.0	3.9	China	146.4	3.9	France	766
6	France	605.4	3.8	Japan	146.4	3.9	United Kingdom	742
7	Italy	538.0	3.3	Spain	142.6	3.8	Netherlands	735
8	Belgium	475.6	3.0	Italy	121.9	3.2	Italy	660
9	Russian Federation	471.6	2.9	India	102.6	2.7	Belgium	562
10	United Kingdom	458.6	2.9	Netherlands	101.6	2.7	Russian Federation	522
11	Canada	456.5	2.8	Ireland	99.2	2.6	Canada	521
12	Korea, Republic of	422.0	2.6	Hong Kong, China	92.3	2.4	Korea, Republic of	496
13	Hong Kong, China	370.2	2.3	Belgium	86.1	2.3	Hong Kong, China	463
14	Singapore	338.2	2.1	Singapore	82.9	2.2	Singapore	421
15	Saudi Arabia	313.4	2.0	Switzerland	75.2	2.0	Spain	411
16	Mexico	291.7	1.8	Korea, Republic of	74.1	2.0	Saudi Arabia	313
17	Spain	268.3	1.7	Denmark	72.0	1.9	Mexico	310
18	Taipei, Chinese	255.6	1.6	Sweden	71.6	1.9	Taipei, Chinese	289
19	United Arab Emirates	231.6	1.4	Luxembourg	68.9	1.8	India	280
20	Switzerland	200.3	1.2	Canada	64.8	1.7	Switzerland	276
32	Turkey	132.0	0.8	Turkey	34.5	0.9	Turkey	167

Source: World Trade Organization (WTO) database

Through reaching the values and shares of total export values stated in Table 8, two different types of trade is examined and then after summing the export values of merchandise trade with export values of commercial service trade, total export amounts and related ranking is calculated. Besides the top 20 countries in the ranking, there is an additional data about Turkey. Merchandise trade of Turkey is about 132 billion dollars. It is in the thirty second ranking according to WTO database for the merchandise trade exports. In contrast to merchandise trade, the export values about commercial service trade are not much higher. But, in the ranking table, the situation of Turkey is better. Totally, the export amount of Turkey is 167 billion dollars as of 2008. Leader in the merchandise trade export is Germany and after Germany, the top list is shared by China, USA and Japan respectively. On

the other hand, commercial service exports ranking is different. USA is leader in exports related to service sector and then UK, Germany and France comes respectively. In total, USA is in top and then, Germany, China and Japan shares the biggest pies of the export side of total international trade.

Table 9: Leading "importers" in international trade of world, 2008 (billion dollars and percentage)

	Merchandise Trade			Commercial Service Trade			Total Trade	
Ranking	Importers	Value	Share	Importers	Value	Share	Importers	Value
1	United States	2169.5	13.2	United States	367.9	10.5	United States	2,537
2	Germany	1203.8	7.3	Germany	283.0	8.1	Germany	1,487
3	China	1132.5	6.9	United Kingdom	196.2	5.6	China	1,290
4	Japan	762.6	4.6	Japan	167.4	4.8	Japan	930
5	France	705.6	4.3	China	158.0	4.5	France	845
6	United Kingdom	632.0	3.8	France	139.4	4.0	United Kingdom	828
7	Netherlands	573.2	3.5	Italy	131.7	3.8	Italy	687
8	Italy	554.9	3.4	Ireland	106.2	3.0	Netherlands	664
9	Belgium	469.5	2.9	Spain	104.3	3.0	Belgium	551
10	Korea, Republic of	435.3	2.7	Korea, Republic of	91.8	2.6	Korea, Republic of	527
11	Canada	418.3	2.5	Netherlands	90.8	2.6	Spain	506
12	Sp ain	401.4	2.4	Canada	86.6	2.5	Canada	505
13	Hong Kong, China	393.0	2.4	India	83.6	2.4	Hong Kong, China	439
14	Mexico	323.2	2.0	Belgium	81.9	2.3	Singapore	399
15	Singapore	319.8	1.9	Singapore	78.9	2.3	India	377
16	India	293.4	1.8	Russian Federation	74.6	2.1	Russian Federation	366
17	Russian Federation	291.9	1.8	Denmark	62.3	1.8	Mexico	348
18	Taipei, Chinese	240.4	1.5	Sweden	54.3	1.6	Taipei, Chinese	274
19	Poland	204.3	1.2	Thailand	46.3	1.3	Australia	246
20	Turkey	202.0	1.2	Hong Kong, China	45.8	1.3	Poland	234
							Turkey	202

Source: World Trade Organization database

As mentioned above for Table 8, Table 9 above is related to the import values of countries which share the biggest portion in the world. In the import side of merchandise trade, USA is in the first ranking and Germany, China and Japan are the follower countries. Top 2 for import values of commercial services is not different but United Kingdom and Japan are at the third and fourth ranking. As a result of being at top for merchandise and commercial service imports, total imports' ranking list has occurred like in the last columns of Table 9. Turkey has a place in top 20 for

the merchandise imports that it has done in the year of 2008. Turkey has made imports which cost 202 billion dollars about merchandise products and also it has made less than 16.5 billion dollar commercial service imports from abroad.

Trade partners of the leading countries in international trade of the world

USA is the leader according to the trade volume that it has done in 2008 in the world. Amount of the trade volume of USA is 4,346 billion dollars. Approximately, about 3,457 billion dollar trade volume is related to the merchandise trade. Significant trade partners in merchandise trade of USA are Canada, EU, Mexico, China and Japan according to WTO database. Exports of USA to those countries amounted to 818.8 billion dollars and additionally, imports from those countries to USA amounted to 1435.8 billion dollars. In total, trade volume is about 2254.6 billion dollars. It is about the 65 percent of total merchandise trade volume of USA.

EU has 27 members. The members of EU are Germany, Italy, France, Hungary, Czech Republic, Romania, Greece, Bulgaria, Slovakia, Denmark, Austria, Belgium, Cyprus, Estonia, Finland, Ireland, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovenia, Spain, Sweden and UK. The second, fifth, sixth, seventh, eighth and ninth countries in the ranking table above are the members of EU. EU countries have trade agreements which support the trade and decrease or eliminate the borders. So, trade partner section has examined by taking the EU into consideration. So, trade partners of EU are mainly EU herself, USA, Switzerland, Russian Federation, China, Japan and Turkey. There is a merchandise trade volume between Turkey and EU which is amounted about 147.3 billion dollars in 2008 according to WTO database.

One of the biggest economies of Asia with her high growing rates, China, like mentioned above, has really big trade relations with USA, EU and many other countries. As a result of the cheap labor force, China has a competitive power through producing cheaper products in contrast to other countries.

Japan, which states in the fourth ranking has trade relations mainly with United States, China, European Union, Republic of Korea, Taipei Chinese, Saudi Arabia and Australia. Japan has a merchandise trade volume of 1545 billion dollars. The total trade volume is 1858 billion dollars. Merchandise trade is dominant in the international trade of Japan and 289.4 billion dollars of the merchandise trade volume is related to China. Additionally, 215.1 billion dollars of trade volume is the trade made between USA and Japan. EU, after China and USA has the third greatest share in the trade of Japan by 180.6 billion dollars according to WTO database. In contrast to those countries, the other countries have smaller amounts of trade but they are still at the top places of ranking list.

Main trade partnerships show that the biggest trade volumes have become between the biggest economies in the world. USA uses the cheap products of China in order supply the demand of her citizens, China on the other hand has to compensate the demand of her people which exceeds 1 billion and EU which is one of the biggest and rising powers in the world trade within the member countries and the biggest developed and developing countries like China, USA and Turkey.

Table 10: Growth in the volume of World Merchandise Exports and Production, 2000-2008 (Annual Percentage Change)

Years	2000-08	2005	2006	2007	2008
World merchandise exports	5.0	6.5	8.5	6.0	1.5
Agricultural products	4.0	6.0	6.0	5.0	2.5
Fuels and mining products	3.0	3.5	4.0	3.5	0.5
Manufactures	6.0	7.5	10.5	7.5	2.0
World merchandise production	2.5	3.0	4.0	1.5	-0.5
Agriculture	2.5	2.0	1.5	2.5	3.0
Mining	1.5	1.5	1.0	0.0	1.0
Manufacturing	2.5	4.0	5.5	1.5	-1.5
World GDP	3.0	3.0	3.5	3.5	1.5

Source: World Trade Organization database

World output was continuing to grow additionally with international trade till 2007. At the year of 2008, the merchandise production has declined but merchandise trade has continued to grow. Moreover, growth has occurred for all the sectors related to merchandise production except manufacturing. From the year 2000 to 2008, agricultural output grew about 2.5% and agricultural exports had followed this growing by 4% growth rate. Agricultural trade is growing higher than trade of fuels and mining products for the year 2008.

Before international trade section, leading exporters and importers in the world for both commercial service and merchandise trade has stated and according to the results, leading countries' food export and import values have shown in the Table 11 and 12 below.

Table 11: Food exports in the world from 1985 to 2008 (billion $)

Country Name/Years	World	USA	Netherlands	France	Germany	Brazil	Canada	Belgium	Argentina	Italy	China	UK	Indonesia	Thailand	Malaysia	Australia	Turkey	Total	Share of total export supplied to world export
1985	218	30	13	17	10	9	8	6	6	6	3	7	2	3	3	6	2	130	60%
1986	248	29	17	20	13	8	8	7	5	7	4	8	2	4	2	6	2	142	57%
1987	278	30	20	24	15	8	9	9	4	8	6	10	2	4	3	6	3	160	58%
1988	302	40	21	28	17	10	11	9	5	8	7	10	3	-	3	7	3	183	61%
1989	315	43	22	29	18	9	10	10	5	9	7	11	3	7	3	9	3	198	63%
1990	345	44	26	34	20	9	11	11	7	11	8	13	3	7	3	9	3	219	63%
1991	353	44	27	33	21	8	12	12	7	12	9	15	3	8	4	9	4	227	64%
1992	380	49	30	37	23	9	13	13	7	13	10	15	3	8	4	9	3	248	65%
1993	371	50	30	35	21	10	12	14	7	12	10	14	4	8	4	10	3	244	66%
1994	415	53	34	37	23	13	13	15	8	13	12	15	5	10	6	12	4	273	66%
1995	480	62	40	43	27	13	15	-	10	15	12	18	5	11	7	12	4	296	62%
1996	491	67	40	43	27	14	17	-	12	17	12	18	6	11	7	15	5	311	63%
1997	480	63	33	41	25	17	18	-	13	15	13	19	6	11	7	15	5	301	63%
1998	451	57	36	41	27	15	17	-	13	16	12	18	6	10	7	12	5	292	65%
1999	445	55	37	40	25	14	17	18	12	16	12	17	6	10	7	14	4	303	68%
2000	437	58	30	36	23	13	18	17	12	15	14	15	6	10	5	13	4	287	66%
2001	441	58	29	34	26	16	19	17	12	15	14	14	5	10	5	13	4	294	67%
2002	474	57	34	37	28	17	19	18	12	17	16	15	7	10	7	14	4	313	66%
2003	561	63	42	46	32	21	20	22	15	20	19	18	7	11	9	14	5	365	65%
2004	652	65	48	50	38	27	25	26	17	23	21	20	9	12	10	19	6	414	63%
2005	708	67	51	50	44	31	26	27	19	24	25	20	10	13	10	18	8	441	62%
2006	793	75	56	52	48	35	29	29	21	26	28	21	12	15	11	19	8	485	61%
2007	967	96	69	60	57	42	34	35	28	31	33	24	17	18	16	19	9	589	61%
2008	1,210	124	82	70	70	55	41	41	37	36	36	26	25	24	23	23	11	724	60%

Source: World Bank database

Table 11 stated above shows the amount of agricultural exports in the world. Agriculture is a sector that included in the merchandise trade side of international trade. It is one of the biggest sectors in the merchandise trade. The countries have been chosen according to the trade rankings.

Besides the leading countries in the world, agricultural exports of Turkey have given in Table 11 above. It has an increasing trend from 1985 to 2008. In addition, the total column represents the total agricultural exports of the countries given in the table. Moreover, share of total export supplied to world export column represents the share of these countries in the world's total agricultural export. 16 countries stated in table have covered 60% of total agricultural exports in the world. The only agricultural exports of Turkey in 2008 are equal to 11 billion dollars. It is nearly one percent of the world's total food export in 2008. In a limited arable land, Turkey has a competitive advantage in agricultural exports because it has a significant place in the production and trade of food.

Table 12: Food imports in the world from 1985 to 2008 (billion $)

Country Name/Years	World	USA	Germany	Japan	UK	Netherlands	France	China	Italy	Belgium	Russia	Canada	Mexico	Hong Kong	Denmark	Poland	Turkey	Total	Share of total import supplied to world import
1985	195	25	21	18	13	10	12	2	13	7	-	5	2	3	2	-	1	132	68%
1986	224	27	26	22	16	11	15	2	15	8	-	5	2	4	3	-	1	156	70%
1987	251	28	30	25	18	14	18	3	18	9	-	6	2	4	3	1	1	179	71%
1988	284	27	31	32	20	16	19	4	19	10	-	6	4	6	3	2	1	201	71%
1989	295	28	31	34	20	14	20	5	20	10	-	7	6	6	3	1	1	206	70%
1990	320	30	36	35	23	16	23	5	22	12	-	8	6	7	4	1	2	229	72%
1991	332	30	39	37	23	17	24	4	24	13	-	8	6	8	4	2	1	240	72%
1992	356	32	42	40	25	19	25	4	24	14	-	8	6	9	5	2	1	255	72%
1993	343	32	34	42	21	18	24	3	20	13	-	9	6	8	4	2	2	239	70%
1994	393	35	39	50	24	23	28	5	22	15	-	9	7	10	5	2	1	274	70%
1995	448	37	48	54	27	26	31	9	24	-	-	10	5	11	6	3	2	292	65%
1996	476	41	45	54	29	26	31	8	25	-	12	10	7	11	6	4	3	311	65%
1997	466	45	41	50	29	21	29	7	23	-	14	11	7	12	6	4	3	300	64%
1998	464	46	42	45	30	22	30	7	23	-	13	11	8	10	6	4	2	299	65%
1999	463	49	39	47	29	23	29	7	23	16	7	12	8	9	6	3	2	308	67%
2000	458	51	33	49	27	19	27	9	21	15	9	12	9	9	5	3	2	300	65%
2001	466	52	36	46	28	18	27	10	21	15	11	13	10	9	5	3	2	306	66%
2002	496	55	39	45	30	21	29	10	23	17	13	14	11	9	6	3	2	326	66%
2003	577	61	44	47	36	27	35	16	28	21	15	15	12	8	7	4	3	379	66%
2004	659	67	49	53	42	30	39	23	32	23	16	16	13	9	8	5	3	428	65%
2005	711	73	55	54	44	32	39	23	33	24	20	18	14	9	9	6	3	457	64%
2006	773	80	60	52	47	35	40	25	36	26	24	21	16	9	10	7	4	493	64%
2007	929	88	69	55	55	45	48	36	42	32	28	24	19	11	11	10	5	580	62%
2008	1,100	95	82	66	60	57	57	54	47	38	35	27	23	14	14	13	9	690	63%

Source: World Bank database

Table 12 includes countries which are the leaders of agricultural imports in the world. USA, Germany, Japan, UK, Netherlands, France and China are the leading importers of agricultural products in the world. At the end of 2008, the agricultural imports made in the world are approximately US$1.1bn. The countries have been chosen according to the trade rankings in the tables examined in the beginning of this chapter. Besides the leading countries in the world, agricultural output of Turkey is given in Table 12 above. Generally, it has an increasing trend from 1985 to 2008. In addition, the total column represents the total agricultural imports of the countries given in the table. Moreover, share of total import supplied to world import named column represents the share of these countries in the world's total agricultural import.

Table 13: Total Merchandise Exports in the world and top ten countries including Turkey from 1995 to 2008 (billion $)

Country/Year	World	Germany	China	USA	Japan	Netherlands	France	Italy	Belgium	Russian Federation	UK	Turkey
1995	5,172	523	149	585	443	203	301	234	178	81	238	22
1996	5,411	525	151	625	411	209	306	252	177	89	259	23
1997	5,600	513	183	689	421	208	302	240	175	88	280	26
1998	5,510	544	184	682	388	214	321	246	182	75	274	27
1999	5,714	544	195	696	418	219	326	236	179	76	272	27
2000	6,458	552	249	782	479	233	328	241	188	106	285	28
2001	6,193	572	266	729	403	231	323	244	190	102	273	31
2002	6,494	616	326	693	417	244	332	254	216	107	280	36
2003	7,588	752	438	725	472	296	392	299	256	136	306	47
2004	9,224	910	593	819	566	357	452	354	307	183	347	63
2005	10,495	971	762	904	595	406	463	373	334	244	384	73
2006	12,126	1,109	969	1,037	647	464	496	417	367	304	448	86
2007	14,001	1,322	1,219	1,162	714	552	552	492	432	354	439	107
2008	16,130	1,465	1,428	1,301	782	634	609	540	477	472	458	132

Source: World Bank database

Table 14: Total Merchandise Imports in the world and top ten countries including Turkey from 1995 to 2008 (billion $)

Country/Year	World	USA	Germany	China	Japan	France	UK	Netherlands	Italy	Belgium	Korea, Rep.	Turkey
1995	5,229	771	464	132	336	289	267	185	206	165	135	36
1996	5,499	822	459	139	349	295	287	191	208	168	150	44
1997	5,689	899	446	142	339	285	308	191	210	162	145	49
1998	5,635	944	471	140	280	308	321	196	218	169	93	46
1999	5,852	1,059	474	166	310	316	325	206	221	165	120	41
2000	6,664	1,259	497	225	380	339	348	218	239	178	160	55
2001	6,415	1,179	486	244	349	329	344	209	236	179	141	41
2002	6,666	1,200	490	295	337	329	364	219	247	198	152	52
2003	7,775	1,303	605	413	383	399	399	265	298	235	179	69
2004	9,477	1,526	716	561	455	471	471	320	355	286	224	98
2005	10,769	1,733	777	660	516	504	514	364	385	319	261	117
2006	12,336	1,918	907	791	579	542	601	417	443	352	309	140
2007	14,179	2,020	1,056	956	622	620	623	493	505	414	357	170
2008	16,301	2,166	1,206	1,133	762	708	632	574	556	470	435	202

Source: World Bank database

For both the imports and exports related to merchandise trade, there is positive growth in recent years. Besides the agricultural output, merchandise trade includes the fuels & mining products and manufactures in it. Growth for the total merchandise trade can be observed from the tables above but, in order to observe the trend of specific sectors, Table 10 shows the growth in different categories of merchandise trade. In fact, all the countries have achieved their trade relations from 1995 to 2008. Total merchandise export of Turkey is 132 billion dollars and total merchandise import is 202 billion dollars at 2008.

In the parts of this chapter which explain the leading traders of the world, data given in the tables about leading importers and exporters clearly shows that merchandise trade is approximately 65-70 % of total trade in the world. In order to clarify the weight of agricultural trade in different countries, the table 15 has prepared with the help of World Bank database again. The total amount of

merchandise trade in the world has been discussed with the agricultural exports and imports. Then, the rate of agricultural international trade in total international trade has been calculated. Table 15 below includes the shares of the biggest merchandise exporter countries' agricultural exports in merchandise trade including Turkey.

Table 15: Ratio of Agricultural exports in total merchandise exports from 1999 to 2008 in the major merchandise exporter countries and Turkey (%)

Country/Year	World	Belgium	China	France	Germany	Italy	Japan	Netherlands	Russian Federation	UK	USA	Turkey
1999	8%	10%	6%	12%	5%	7%	1%	17%	1%	6%	8%	15%
2000	7%	9%	5%	11%	4%	6%	0%	13%	1%	5%	7%	13%
2001	7%	9%	5%	11%	5%	6%	1%	13%	1%	5%	8%	13%
2002	7%	9%	5%	11%	5%	7%	1%	14%	2%	5%	8%	10%
2003	7%	9%	4%	12%	4%	7%	1%	14%	2%	6%	9%	10%
2004	7%	8%	4%	11%	4%	6%	0%	13%	1%	6%	8%	9%
2005	7%	8%	3%	11%	5%	7%	0%	13%	2%	5%	7%	10%
2006	7%	8%	3%	10%	4%	6%	0%	12%	2%	5%	7%	9%
2007	7%	8%	3%	11%	4%	6%	1%	13%	2%	5%	8%	8%
2008	8%	9%	3%	12%	5%	7%	1%	13%	2%	6%	10%	8%

Source: World Bank database

In the beginning of the chapter and in the section of agricultural output, there was an interpretation that weight of agricultural output in GDP of high income countries is less in contrast to low income countries. Additionally, it is decreasing at the same period from 1999 to 2008. So, the reason behind the fewer rates in the table above is directly related to production. Table 15 mainly includes the countries which are middle income at least. Weight of agricultural export in middle income countries' and high income countries' GDP is less in contrast to low income countries. This less rates of agricultural exports in total merchandise trade is the cause of less agricultural production or less value of agricultural products.

Merchandise trade includes mining, manufacturing and agricultural products. Agricultural products are nearly as important as the other two basic cornerstones of

merchandise sector. However, the rate of agricultural exports in the merchandise sector declines in some countries like China, Netherlands and Turkey. Thus, there is also same trend in some countries from 1999 to 2008 like UK, Belgium, France, Germany, Italy and Japan. In addition, share of food export in total merchandise trade has increased for some countries like Russia and USA that can be observed from the Table 15.

Table 16: Ratio of Agricultural imports in total merchandise imports from 1999 to 2008 in the major merchandise importer countries and Turkey (%)

Country/Year	World	Belgium	China	France	Germany	Italy	Japan	Korea, Rep.	Netherlands	UK	USA	Turkey
1999	8%	10%	4%	9%	8%	10%	15%	6%	11%	9%	5%	5%
2000	7%	9%	4%	8%	7%	9%	13%	5%	9%	8%	4%	4%
2001	7%	9%	4%	8%	7%	9%	13%	6%	9%	8%	4%	4%
2002	7%	9%	4%	9%	8%	9%	13%	6%	10%	8%	5%	4%
2003	7%	9%	4%	9%	7%	9%	12%	6%	10%	9%	5%	4%
2004	7%	8%	4%	8%	7%	9%	12%	5%	9%	9%	4%	3%
2005	7%	8%	4%	8%	7%	9%	10%	4%	9%	9%	4%	3%
2006	6%	7%	3%	7%	7%	8%	9%	4%	8%	8%	4%	3%
2007	7%	8%	4%	8%	7%	8%	9%	4%	9%	9%	4%	3%
2008	7%	8%	5%	8%	7%	8%	9%		10%	9%	4%	4%

Source: World Bank database

The rate of agricultural imports in merchandise trade is shown in the table above. Besides China, all the countries from abroad have a decreasing tendency in the rate of agricultural imports in the merchandise trade. Thus, the share of food imports of Turkey has a decreasing tendency from 1999 till 2007 whereas in the year of 2008, share of food imports has grown in total merchandise trade.

The place of food in international trade is significant. Especially at mid-2008, food prices in the world have risen. As a result of this situation, some countries introduced measures to restrict food exports. For example, India and China banned exports of rice, Argentina, Russia and Kazakhstan restricted exports of wheat (WTO,

2009). Turkey, has a majority especially fort he production and trade of some agricultural products. Global food crises observed in 2008 and approaching threat of climate change increase the significance in relation of international trade and agriculture.

After mentioning about the importance and weight of agricultural trade in merchandise trade, in the next part of the chapter, international trade and the agricultural sector of Turkey will be mentioned.

International Trade and Agriculture in Turkey

The last section of this chapter will be specifically related to the Turkey. Between the period 1980 and 2008, and especially the recent terms will be analyzed according to the concepts of international trade basically and the share of agriculture in the international trade of Turkey.

International trade of Turkey has grown up since 1980 to 2008 for both the import and export side. As a result of the situation and as mentioned in the beginning of the chapter, trade volume has increased year by year. The table 17 below shows the change in the import and export values of Turkey in details.

Table 17: Foreign Trade of Turkey in 1980-2008 (billion $ and %)

					Balance of	Volume of	Proportion of
	Exports		Imports		Foreign Trade	Foreign Trade	Imports covered
	Value	Change	Value	Change	Value	Value	by Exports
Years	(billion $)	%	(billion $)	%	(billion $)	(billion $)	%
1980	2.91	28.7	7.91	56.0	-5.00	10.82	36.8
1981	4.70	61.6	8.93	12.9	-4.23	13.64	52.6
1982	5.75	22.2	8.84	-1.0	-3.10	14.59	65.0
1983	5.73	-0.3	9.24	4.4	-3.51	14.96	62.0
1984	7.13	24.5	10.76	16.5	-3.62	17.89	66.3
1985	7.96	11.6	11.34	5.5	-3.39	19.30	70.2
1986	7.46	-6.3	11.10	-2.1	-3.65	18.56	67.1
1987	10.19	36.7	14.16	27.5	-3.97	24.35	72.0
1988	11.66	14.4	14.34	1.3	-2.67	26.00	81.4
1989	11.62	-0.3	15.79	10.2	-4.17	27.42	73.6
1990	12.96	11.5	22.30	41.2	-9.34	35.26	58.1
1991	13.59	4.9	21.05	-5.6	-7.45	34.64	64.6
1992	14.71	8.2	22.87	8.7	-8.16	37.59	64.3
1993	15.35	4.3	29.43	28.7	-14.08	44.77	52.1
1994	18.11	18.0	23.27	-20.9	-5.16	41.38	77.8
1995	21.64	19.5	35.71	53.5	-14.07	57.35	60.6
1996	23.22	7.3	43.63	22.2	-20.40	66.85	53.2
1997	26.26	13.1	48.56	11.3	-22.30	74.82	54.1
1998	26.97	2.7	45.92	-5.4	-18.95	72.90	58.7
1999	26.59	-1.4	40.67	-11.4	-14.08	67.26	65.4
2000	27.77	4.5	54.50	34.0	-26.73	82.28	51.0
2001	31.33	12.8	41.40	-24.0	-10.06	72.73	75.7
2002	36.06	15.1	51.55	24.5	-15.49	87.61	69.9
2003	47.25	31.0	69.34	34.5	-22.09	116.59	68.1
2004	63.17	33.7	97.54	40.7	-34.37	160.71	64.8
2005	73.48	16.3	116.77	19.7	-43.30	190.25	62.9
2006	85.53	16.4	139.58	19.5	-54.04	225.11	61.3
2007	107.27	25.4	170.06	21.8	-62.79	277.33	63.1
2008	131.97	23.0	201.96	18.8	-69.99	333.93	65.3

Source: Turkish Statistical Institute database

That is clear from the Table 17 that whether there are decreases in some years like 1983, 1986, 1989 and 1999 for exports and 1982, 1986, 1991, 1994 and 2001 for imports, general trend is a raise from 1980 to 2008 for imports and exports. Table 17 shows the trade volume too for Turkey in the period of 1980-2008. Especially after the economic crisis faced by Turkey in 2001, the growth rates of imports and exports never became negative.

Turkey is an export oriented company and the desire of Turkey always becomes high levels of exports in order to get the inflow of foreign currency and decrease the current account balance.

Table 18: Major trader partners of Turkey in 2007 and 2008 (million $)

	2007	2008	Change (%)**		2007	2008	Change (%)**
TOTAL EXPORTS	107,272	132,003	23.1	TOTAL IMPORTS	170,063	201,823	18.7
Germany	11,993	12,959	8.1	Russia	23,508	31,318	33.2
UK	8,627	8,169	-5.3	Germany	17,540	18,682	6.5
UAE	3,241	7,981	146.3	China	13,234	15,643	18.2
Italy	7,480	7,817	4.5	USA	8,166	11,971	46.6
France	5,974	6,622	10.8	Italy	9,968	11,008	10.4
Russia	4,727	6,482	37.1	France	7,850	9,022	14.9
USA	4,171	4,290	2.9	Iran	6,615	8,200	23.9
Spain	4,580	4,051	-11.5	Ukraine	4,519	6,107	35.1
Romania	3,644	3,980	9.3	UK	5,477	5,324	-2.8
Iraq	2,845	3,912	37.5	South Korea	4,370	4,090	-6.4
Netherlands	3,019	3,143	4.1	Japan	3,703	4,022	8.6
Switzerland	935	2,857	205.5	Spain	4,343	4,547	4.7
Greece	2,263	2,430	7.4	Algeria	2,108	3,262	54.7
Saudi Arabia	1,487	2,197	47.8	Netherlands	2,655	3,048	14.8
Ukraine	1,481	2,184	47.5	Belgium	2,869	3,148	9.7

Note: ** 2008/2007 and country ranking is based on 2008 data.

Source: Turkish Statistical Institute database

Table 18 shows the countries that Turkey mostly exports to and import from. For the export side, top 5 are Germany, United Kingdom, United Arab Emirates, Italy and France. On the import side, top 5 are Russia, Germany, China, USA and Italy. From 2007 to 2008, all the exports and imports to the specifically given countries have increased except for three countries. For the export side, there is a decline in the trade of Turkey between UK and Spain, whereas for the import side, the decline has occurred only with South Korea.

Table 19: Exports and Imports of Turkey by International Standard Industrial Classification for the years 2007 and 2008 (million $)

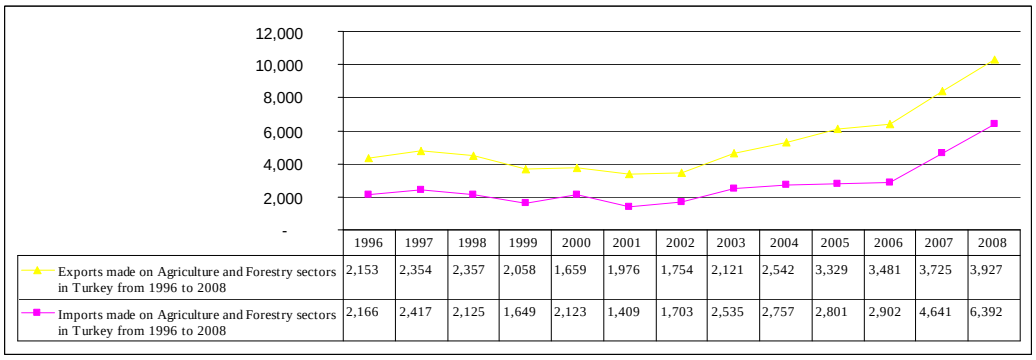
IMPORTS	2007	2008	Share(%) **	EXPORTS	2007	2008	Share(%)**
Grand Total	170,063	201,823	100	Grand Total	107,272	132,003	100
Agriculture & Forestry	4,641	6,392	3.2	Agriculture & Forestry	3,725	3,928	3
Fishery	31	41	0	Fishery	158	240	0.2
Mining & Quarrying	25,314	35,632	17.7	Mining & Quarrying	1,661	2,155	1.6
Manufacturing	133,938	150,130	74.4	Manufacturing	101,082	125,173	94.8
Other	6,139	9,628	4.8	Other	646	507	0.4

Note: **2008 yearly data

Source: Turkish Statistical Institute database

According to International Standard Industrial Classification (ISIC), shares of the sectors in the international trade of Turkey are given in the Table 19. Manufacturing industry is dominant for both export and import side of the international trade in Turkey. After mining and quarrying, agriculture and forestry comes in the shares. The share of mining and quarrying is 17.7% for exports of Turkey whereas this share is less in the imports of Turkey which is about 1.6%.

The trend of the import and export in agriculture and forestry is examined after the period 1996 to 2008. According to figure stated below, the values of exports and imports made on agriculture and forestry sectors can be observed.



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Exports made on Agriculture and Forestry sectors in Turkey from 1996 to 2008	2,153	2,354	2,357	2,058	1,659	1,976	1,754	2,121	2,542	3,329	3,481	3,725	3,927
Imports made on Agriculture and Forestry sectors in Turkey from 1996 to 2008	2,166	2,417	2,125	1,649	2,123	1,409	1,703	2,535	2,757	2,801	2,902	4,641	6,392

Figure 6: Imports and exports made on Agriculture and Forestry sectors in Turkey from 1996 to 2008 (million $)

Source: Turkish Statistical Institute database

In contrast to the other industries in Turkey, the share of the agriculture and forestry sector is less in international trade. According to the list of Turkish Statistical Institute about major import and export products, there are only two agricultural or forestry products: paper-paperboard and cereals in the major import products and one product: fruit in the major export products.

The information given in Chapter 3 states that, Turkey has a competitive advantage on trading and production of agricultural products in the world. Turkey has to solve any problem resulted from climate change in order not to lose its competitive power. In addition, with its current account deficit problems, any matter that can give rise a decline in exports of Turkey, can lead to many other major problems too.

In the following chapter, literature about the global warming, agriculture, international trade and export supply for agricultural exports has been reviewed.

CHAPTER 4

LITERATURE REVIEW

In this chapter, the literature about the impacts of global warming on international trade and agriculture has been reviewed. After examining the impacts of global warming, the export supply functions and models have been investigated. Firstly, the literature which is related to the concept of agriculture has been discussed. Secondly, impact of global warming on international trade has taken into consideration. Thirdly, in order to have an opinion to structure our model, export supply functions has taken into consideration. Through the review, empirical studies made around the world for the different countries and regions have been examined and also the impacts of global warming on the agriculture of Turkey are presented in some articles.

The Effects of Climate Change on Agriculture

Volume and efficiency of agricultural production is directly influenced by external factors like the weather conditions. Improvement of technology can make the conditions possible for specific agricultural products where the conditions are inappropriate but on the other hand climate is still the major factor for the survival of agricultural production. As a result of this situation, agriculture's commitment to the climate is bigger than other sectors.

The relationship between agriculture and climate change can be discussed in three different categories according to the Dellal and McCarl (2007). First category is about the sides of agriculture that is influenced by climate change. Efficiency of agricultural products and the cost of production are influenced by the temperature, precipitation, the amount of carbon dioxide in atmosphere, extreme natural events

like droughts. Those impacts can change the harvest time of agricultural products and efficiency of feeding grounds. In addition, according to the less or more precipitation occurrence, droughts or floods can be observed and these extreme events cause loss on agricultural production. According to these changes stated above, cost of production alters. Moreover, land appropriateness is another significant case that is influenced by climate change. Besides the temperature and precipitation, damp of land, capacity of land for stocking the damp and land efficiency are also very important. Another side of the agriculture which is also influenced by climate change is animal products' efficiency and cost of production. Rise in the temperature can affect the balance of producing and consuming the temperature in the bodies of animals and through this unbalance; death rate, consuming of animal feed, increase in weight of animals, milk production and pregnancy can change (Dellal and McCarl, 2007). And like in the food production, these changes also have impacts on cost of production. Water scarcity and supply of water which is for the irrigation can be changed as a result of the decrease in the volume of the water level and increase in the evaporation. On the other hand, supply of water which is used in irrigation can decrease because of the rising demand from other industries as a result of the high temperatures.

Second category of the relationship between agriculture and climate change is the reverse of first category, the impacts of agriculture on climate change. Besides the fact that climate change affects agriculture, also agricultural productions like livestock and rice production, fertilizer and land usage can affect climate change. Ruminant animals, rice which is grown in the water, dissolution of fertilizers and stomach fermentations cause release of greenhouse gases (Dellal and McCarl, 2007). According to the report of International Panel on Climate Change (2007), 26% of the

greenhouse gas in the world is derived from energy consumption, 19% is from industry facilities, 17% is from the change in the usage of land, 14% is from agriculture and 13% from the transportation.

Dellal and McCarl (2007) claimed that agriculture also has positive influences for the climate. The third category is about the side of the agriculture which decreases the climate change. Climate change is mainly accelerated by the increase in greenhouse gas. Some plants stocks carbon in their green parts during photosynthesis. By increasing the amount of green plants, release of greenhouse gases (GHG) can be decreased. Another contribution of agriculture in order to decrease the climate change is bio fuels. In contrast to fossil fuels, usage of bio fuels decreases the GHG.

As the top emitter of GHG, USA have policies in order to deal with the rising danger of climate change. Agricultural activities account for 6% - 8% of all GHG emissions in the United States. In the report of Johnson (2008), mitigation strategies have been mentioned in order to control the climate change in an acceptable level. In order to satisfy the control over climate change, Johnson (2008) claims that there has to be federal programs, state programs and incentives. The mitigation strategies mentioned in the report for US prepared by Johnson (2008) includes land retirement, conversion, restoration of grasslands, soil conservation and management, efficient fertilization and chemical application, crop rotations, cover cropping, manure management, feed management, vegetative and riparian buffers, windbreaks for crops and livestock, bio energy and bio fuels substitution and renewable energy use, energy efficiency and energy conservation on farms.

Not specifically for the agriculture case but, in order to handle the climate change problem, there will always be a trade-off between developing and developed countries. Parker and Blodgett (2008) claimed that if diverse countries like United States and China are ever to reach agreement about decreasing GHG emissions, a flexible strategy that allows each country to play her strengths may be appropriate for the future of agreement. The time frame in the article stated in order to figure out the climate change issue and for proving that greenhouse gas emissions has differential impacts on individual nations, as a result of individual resource endowments (e.g., coal versus natural gas and hydropower) and stage of economic development(Parker and Blodgett, 2008). In the article, historical data from 1950 to 2000 has been analyzed. There are comparisons between developing and industrialized countries including top 20 nations in order to show the highness of emission coming from the top 20 nations. Moreover, Parker and Blodgett (2008) focus on the alternative perspectives like per capita emissions and GHG intensity of economy. According to Parker and Blodgett (2008), if one were considering how to control greenhouse gas emissions, one way of trying to bridge the different interests of the developed and the developing countries would be to focus on per capita emissions as a way of giving each nation an equitable share of energy use. For the United States compared to the developing world, this metric could imply constraints depending on the compliance time frame and future technological advancements. Likewise, this approach could permit most less-developed countries to increase their emissions to accommodate expanding economies.

Telli, Voyvoda and Yeldan (2007) have discussed the economic evaluation of sector based emission reduction policies for climate change. After mentioning about the analytical evaluation of the environmental indicators, an analytical model has

been used in the article. A computable general equilibrium model for Turkey to study the economic impacts of the intended policy scenarios of compliance with the Kyoto Protocol has been used and reporting of general equilibrium effects of various possible environmental abatement policies in Turkey over the period 2006–2020 has been stated. The model is in the Walrasian tradition with 10 production sectors and a government operating within an open macro economy environment. It accommodates flexible production functions, imperfect substitution in trade and open unemployment (Telli, Voyvoda and Yeldan, 2007). Focus of the model was on CO_2 emissions and distinguishes various basic sources of gaseous pollution. Results suggest that the responsibilities of imposing emission control targets and the implied declining costs could be quite high, and that there is a need to finance the expanded abatement investments from scarce domestic resources. Policies for environmental abatement via carbon dioxide level reduction or increased energy taxes further undergo very adverse employment effects. This suggests that a first-best policy would necessarily call for a simultaneous reduction on the existing tax burden on producers elsewhere together with introduction of environmental taxes (Telli, Voyvoda and Yeldan, 2007).

Effect of climate change on global food production has examined by Parry, Rosenzweig, Iglesias, Livermore and Fischer (2004). In this research, Special Report on Emissions Scenarios (SRES) is stated. In the research, methods for impacts and adaptation at the crop level have been discussed. These methods are investigated through yield transfer functions, estimation of world food trade responses, adaptation and limitations. According to the different SRES, there are specific points that have been reached. Which method is more suitable for which Scenario can be interpreted. In addition to the climate's impacts on food production, the article also points out the

risk of hunger which is also one of the significant cases of the world. Through explaining the world food trade responses, Basic Link System (BLS) developed by Food and Agriculture Program of the International Institute for applied systems Analysis has been used. The basic linked system (BLS) is used to evaluate consequent changes in global cereal production, cereal prices and the number of people at risk from hunger. It consists of 35 national and/or regional models: 18 national models, two models for regions with close economic co-operation, 14 aggregate models of country groupings, and a small component that accounts for statistical discrepancies and imbalances during the historical period. (Parry, Rosenzweig, Iglesias, Livermore and Fischer, 2004).

In order to clarify what can be done for reducing climate change impacts on agriculture, Tubiello and Fischer (2007) have tried to answer the questions: What are the implications for agriculture of mitigating greenhouse gas emissions, by when and by how much are impacts reduced and where does it matter most? The period of 2000-2080 and projections have been used. Two models have been used by Tubiello and Fischer (2007) which are agro-ecological model and global food trade model. In the research, two distinct sets of climate simulations were analyzed: 1) A non-mitigated scenario, with atmospheric CO_2 concentrations over 800 parts per million (ppm) by 2100; and 2) A mitigation scenario, with CO_2 concentrations stabilized at 550 ppm by 2100. Impacts of climate change on crop yield were evaluated for the period 1990–2080, and then used as input for economic analyses. Key trends were computed over the 21st century for food demand, production and trade, focusing on potential monetary and human impacts. The results from this study suggested that mitigation could positively impact agriculture. With mitigation, global costs of climate change were reduced by 75–100%; and the number of additional people at

risk of malnutrition was reduced by 80–95%. Significant geographic and temporal differences were found. Regional effects often diverged from global net results, with some regions worse off under mitigation compared to the unmitigated case (Tubiello and Fischer, 2007).

All over the world especially through examining the literature about global warming and climate change, it is hard not to face the thought through curbing climate change by decreasing GHG emission. And also, many academicians and researchers believe that this can be done only by international consensus. For controlling the climate change, adaptation and mitigation strategies are pointed out by non-governmental organizations (NGO) all over the world. World Bank Development Research Group's Sustainable Rural and Urban Development Team have studied on the influence of climate change in the African Cropland. Seo, Mendelsohn, Kurukulasuriya, Dinar and Hassan (2008) researched how African farmers adapt to the climate change. The results show that farmers carefully consider the climate and other conditions of their farm when making their choices through taking action. Reason behind this research was to help farmers and policy makers in order to identify efficient adaptation strategies for climate change for increasing future benefit in new climate conditions. Research has started by analyzing the choice of crops and irrigation as a function of climate and other control variables using a sample of over 9000 farmers from 11 countries in Africa who grow crops. Then, FAO classification of African cropland into 16 Agro-ecological zones (AEZ) has used to examine AEZ specific adaptation strategies. These zone specific adaptation strategies have been examined in order to observe how adaptations would be applied across Africa. After the analysis, Seo, Mendelsohn, Kurukulasuriya, Dinar and Hassan (2008) developed a simple theoretical model of crop and irrigation

choice. In this research, logit model has been stated to explain irrigation choice and another multinomial logit model has been stated to examine crop choice. The following part of the research consisted of description the data used which is based on Global Environment Facility (GEF)/World Bank project in Africa and the FAO classification of Agro-Ecological Zones. In the rest of the article, presentation of empirical results and simulation results of the impacts of climate change on these decisions based on climate models has been stated. Finally, Seo, Mendelsohn, Kurukulasuriya, Dinar and Hassan (2008) concluded their research studies with a summary of key results and a discussion of relevant policy insights. Moreover, same team from World Bank has done another research which examines the distribution of climate change impacts across the 16 agro-ecological zones in Africa using data from the Food and Agriculture Organization combined with economic survey data from a Global Environment Facility/World Bank project. In the research performed by Seo, Mendelsohn, Kurukulasuriya, Dinar and Hassan (2008), net revenue per hectare of cropland is regressed on a set of climate, soil, and socio-economic variables using different econometric specifications ”with” and ”without” country fixed effects. Country fixed effects slightly decrease predicted future climate related damage to agriculture. With a clement climate scenario, African farmers gain from climate change; with a more severe scenario, they lose income. Some locations are more affected than others according to research. The analysis of agro-ecological zones implies that the effects of climate change will vary across Africa. This research is different from the research mentioned at the beginning of the paragraph. It quantifies the impacts of climate change for each 16 Agro-ecological Zones. In addition, there is an analysis of net revenue which includes both crop and livestock sectors. Theory

used in the research is basic Ricardian Analysis. According to Ricardian analysis used by Seo, Mendelsohn, Kurukulasuriya, Dinar and Hassan (2008):

Adaptations are implicit and endogenous. The Ricardian technique assumes that each farmer wishes to maximize net income subject to the exogenous conditions of the farm which include climate. Assuming the farmer chooses a mix of agricultural activities that provide the highest net income and chooses each input to maximize net incomes from such activities, the resulting net revenue will be a function of just the exogenous variables like output prices, climate variables, water for irrigation, soil characteristics, prices for the annual inputs, prices for each type of labor, rental price of capital, and annual cost of each type of irrigation system. In this application, net revenue includes income from both crops and livestock (p. 3).

Impact of global warming on agriculture can be catastrophic according to Romar (2009). He claims that the global warming is the main reason behind the events in Darfur which is accepted as ethnicity all over the world, and also in the case of Katrina and decline in the maple sugar industry of US. According to Faris (2007), the fighting in Darfur is usually described as racially motivated, Arabs against black rebels and civilians. But the actual problem was the fight between settled farmers and nomadic herders related to failing lands. The aggression of the warlord Musa Hilal can be traced to how climate change shattered a way of life. Reason behind the failing of lands was the drought. Amicably living people found their selves in a fight. One side is trying to protect the land that they have left and the other side is trying to survive. On the other hand, for the case about the hurricane Katrina, Romar (2009) states that as a result of the increasing glacial melt which happens through rising in temperature, ocean volume becomes bigger in contrast to before. Higher ocean volume will increase a hurricane’s destruction brought about by

higher tidal surges, even if wind and rain do not intensify. Furthermore, Romar (2009) also points out that maple sugar industry of US has influenced negatively by global warming. In the article of him called Snapshots of the Future: Darfur, Katrina, and Maple Sugar (Climate Change, the Less Well-Off and Business Ethics), he mentions about Dr. Perkins who works in Maple Research Center at the University of Vermont. Dr. Perkins has figured according to his research that maple sugaring season moving earlier and earlier and also getting shorter. And the strongest reason of this situation is climate change.

The Effects of Climate Change on International and Agricultural Trade

Besides the environmental impacts of global warming, the main issue that is discussed in this thesis is impact of global warming on economy and on sub divisions of economy like agriculture as a sector and international trade or agricultural international trade. In addition to the contribution of agricultural sector to the supply of food, which is the basic need of humanity, it is also a kind of economic activity. By the way, climate change can influence the volume of production in a positive or negative way. For instance, decrease in the volume of a product makes the prices of this specific product higher in contrast to the past. For a country where this kind of case happens, consumers should pay more in order to buy the same product. As a result of this situation, consumers try to find cheaper products and import of the country about this product increases. On the other hand, exports of this country for this specific product declines.

International trade and global warming has been discussed by Ishikawa and Kiyono (2000) through considering the non-cooperative strategic environmental regulations. Ishikawa and Kiyono (2000) claimed that the trade and industrial

structure of a country critically hinges on the government's policy tools. By using a three country model theory, which considers world consisting of three countries and every country has different specifications. Model has been discussed in a free emission equilibrium case first and secondly, in emission quota equilibrium. In addition, emission taxes are included to the study in order to define which one is more suitable for the welfare of countries, quotas or taxes.

Claudia Kemfert, who studies on economics, has researched the global economic implications of alternative climate policy strategies. In the research performed by Kemfert (2002), examination of world economic implications of climate change policy strategies, and particularly evaluation through the impacts of an implementation of clean development mechanisms (CDM), joint implementation (JI) and emissions trading with a world integrated assessment model has studied. In addition, focus of this research was on the welfare spill over and competitiveness effects resulting from diverse climate policy strategies. This study particularizes and confronts multi-gas policy strategies and finds out the impacts of sink inclusion. Furthermore, Kemfert (2002) examined the economic impacts on all world regions of the USA's non-cooperative, free rider position resulting from her recent isolated climate policy strategy decision in this research. In this research, a model called WIAGEM (World Integrated Assessment General Equilibrium Model) has been used which is an integrated economy–energy–climate model incorporating economic, energy and climatic modules in an integrated assessment approach. The model contains three of the most important anthropogenic greenhouse gases: carbon dioxide (CO_2), covering over 80% of total forced radiation by anthropogenic greenhouse gases, methane (CH_4) and nitrous oxide (N_2O). Primarily due to human activities, the concentration of these gases in the earth's atmosphere has been increasing since the

industrial revolution (Kemfert, 2002). By the help of WIAGEM, relationship between man-made emissions and atmospheric concentrations and their resulting impact on temperature and sea level has covered in the research of Kemfert (2002). According to Kemfert (2002), CDM and JI show evidence of improvement in the economic development in host countries and increase the share of new applied technologies. The decomposition of welfare effects demonstrates that the competitiveness effect (including the spillover effects from trade) have the greatest importance because of the intense trade relations between countries. Climatic effects will have a significant impact within the next 50 years, will cause considerable welfare losses to world regions and will intensify if nations highly responsible for pollution like the USA do not reduce their emissions.

In 2004, Claudia Kemfert has prepared another research on climate coalition issues. This research studies whether incentives designed for non-cooperating nations like the USA to join a climate coalition based upon issue linkage. Issue linkage is considered through increased R&D expenditures triggering improved technological innovations that advance energy efficiencies. Model calculations demonstrate that incentives exist for non cooperating countries like the USA to join a climate control coalition if nations cooperate on technological innovations. Restrictions on trade such as sanction mechanisms against non-cooperating countries are not necessarily an incentive to join a coalition. Technological spillover effects lead to improved economic situations and increased energy efficiencies in non-cooperating countries. Final findings of the research show that full cooperation in order to decrease the GHG emissions for dealing with global warming and technological improvements are in favor of all nations in the coalition.

Not specifically for global warming but about the impact of natural disasters on international trade; Gassebner, Keck and The (2006) have prepared an economic research. In this research, they investigated the impact of major disasters on international trade flows using a gravity model. Data that they used consists of more than 170 countries for the years 1962-2004 yielding approximately 300,000 observations. Results that they found is: the driving forces determining the impact of such events are the democracy level and the area of the affected country. The less democratic and the smaller a country the more are her trade flows reduced in case it is struck by a disaster. In addition, in the research, Gassebner, Keck and The (2006) distinguish the effect of a disaster on an importing and an exporting country. Global warming cannot be accepted as a disaster thus, it causes many abnormal natural events like floods and droughts. Probably, it is a highly macro outlook for the whole natural abnormalities but for the examination of the impacts of global warming on international trade, this paper can help to establish a view for trying to find possible influences of climate change.

World Trade Organization (WTO) has a committee on agricultural special session. The negotiations on agriculture contains non-trade concerns, food security, special and differential treatment, market access, domestic support, export competition, state trading enterprises, peace clause and cross linkages sections. Not all the sections stated above are directly related to the case of global warming but the part about food security has some advices in order to handle the negative impacts of global warming on agricultural international trade. According to WTO (2000), these advices are:

- ensuring stable and predictable export earnings to build up critical foreign exchange reserves for the purchase of food on reasonable terms and conditions and in a timely manner;

- ensuring physical access to food through accessing different and adequate supply sources; securing effective reliable transportation and storage facilities;

- encourage domestic agricultural production bearing in mind various constraints of a topographic or agro-climatic nature. The exclusion of certain products from reduction commitments would also contribute to maintaining food production;

- allow for the establishment by donor countries of an international reserve of food;

- promoting access to relevant agricultural technology including new seeds and plant varieties.

Brian R. Copeland and M. Scott Taylor (2001) claimed in their article called "Free Trade and Global Warming" that in an open trading world, but not in a closed economy setting: (1) unilateral emission reductions by the rich North can create self interested emission reductions by the unconstrained poor South; (2) simple rules for allocating emission reductions across countries may well be efficient even if international trade in emission permits is not allowed; and (3) when international emission permit trade does occur it may make both participants in the trade worse off and increase global emissions. Through the research, general equilibrium trade model has used and according to studies done, Copeland and Taylor (2001) has

reached that international trade can radically alter according to different conditions of environment.

Fischer, Shahl, Tubiello and Velhuizen (2005) have performed a research on the impacts of climate change on agro-ecosystems over this century from 1990 up to 2080 and at a global level with significant regional detail. In this research, an integrated ecological-economic modeling framework has been used which encompasses climate scenarios, agro-ecological zoning information, socio-economic drivers and food trade dynamics. Additionally, global simulations are performed using the Food and Agriculture Organization/International Institute for Applied Systems Analysis (FAO/IIASA) agro-ecological zone model, in conjunction with IIASAs global food system model, using climate variables from five different general circulation models, under four different socio-economic scenarios from the intergovernmental panel on climate change. First, impacts of different scenarios of climate change on bio-physical soil and crop growth determinants of yield are evaluated; second, the extent of potential agricultural land and related potential crop production is computed. The detailed bio-physical results are then fed into an economic analysis, to assess how climate impacts may interact with alternative development pathways, and key trends expected over the period between 1990 and 2080 for food demand and production, and trade, as well as key composite indices such as risk of hunger and malnutrition, are computed. This modeling approach connects the relevant bio-physical and socio-economic variables within a unified and coherent framework to produce a global assessment of food production and security under climate change. The results from the study suggest that critical impact asymmetries due to both climate and socio-economic structures may deepen current production and consumption gaps between developed and developing world; it is

suggested that adaptation of agricultural techniques will be central to limit potential damages under climate change.

The Effects of Climate Change on International Trade and Agriculture: Turkey case

Global warming is a term which became recently popular in the world especially after the year of 2000. There are almost thirty thesis published in the tez2.yok.gov.tr which is the site of Turkey's institution about the graduate and undergraduate education. This mechanism has a duty of regulation the system. According to results gathered, there are two MA theses which examine the economic impacts of global warming in Turkey. Other theses mainly include the researches done to the environmental effects of global warming. One of the theses about global warming and climate change has stated below. This thesis includes an overall outlook to the Turkey's thoughts to the changing conditions of environment. Moreover, there is also an article performed by Turkish researchers Telli, Voyvoda and Yeldan (2007) about various possible environmental abatement policies in Turkey stated in the first section of chapter 4.

Turkey is aware of the danger coming with global warming and there are many subsidies and enforcements in order to control the climate related problems and be ready for possible environmental changes. Turkey supports the renewable energy resources and clean energy mechanisms (Yamanoglu, 2006). In addition, there are financial incentives for the investments and government supported credits to the investors of renewable energy sources. Moreover, there are tax incentives such as tax exemption, customs tax exemption which also encourages the investors.

According to the research taken from the Ministry of Agriculture and Rural Affairs, Turkey has a strategy and plan for the period 2008-2012 in order to overcome the scarcity of water used in agriculture. Water scarcity is one of the consequences of global warming resulted by increase in temperature. There are seven basic parts of Turkey divided according to climate conditions and geography. Mediterranean and Central Anatolia parts of Turkey are possibly have the highest risk coming from the global warming. Water scarcity is a kind of natural disaster and it can be faced anytime. For hedging the risk of water scarcity, there occurs a need to establish a strategy for unexpected changes in the level of water (Ministry of Agriculture and Rural Affairs, 2008).

The studies about the strategy which is related to the incoming environmental problems have performed in coordination of Ministry of Agriculture and Rural Affairs, State Planning Organization, Ministry of Environment and Forestry, Ministry of Energy and Resources and Ministry for Internal Affairs (Ministry of Agriculture and Rural Affairs, 2008). In this 4 year plan, the topics such as: risk of water scarcity in Turkey and world, forecasts about the scarcity of water used in agricultural sector, aim and strategy and actions that has to be taken through challenging against scarcity of water have discussed.

Not only the case of droughts but also the floods have to be taken into consideration in order to state more appropriate strategies. Expectations through global warming are increasing in the temperatures, rise in evaporation, decrease in snows and unbalances through raining amounts and frequency which can influence the amount of usable water resources and agricultural production (Ministry of Agriculture and Rural Affairs, 2008). When these expectations thought, the logic behind considering droughts and floods together becomes clear.

The Export Supply Models

After researching the international trade and agriculture including the relation of them to global warming, helpful ideas have been gained. Thus, the empirical study that will be conducted will be related to the case: impact of global warming on agricultural export of Turkey. So, the export supply model, in other words, the determinants of export supply function have been reviewed in order to reach the most suitable study that will become the guide to this research.

Şahinbeyoğlu and Ulaşan (1999) who are the researchers at central bank of the Republic of Turkey have made a study in order to estimate export supply and demand functions of Turkey. Model of the study basically uses the real exchange rate and real domestic income.

Kargbo (2006) has researched the influence of exchange rate volatility in the trade levels. He focuses on the case of South Africa. In the research, import in addition to export has been examined. Kargbo used a function in order to state a model by using price index of agricultural products, weighted average of real incomes of industrialized countries, weighted average of export prices of South Africa's trading partners, openness of South African economy, democratic conditions (government change frequency), capital output ratio (the capacity of production) and some other binary variables.

In the research paper of Gbetnkom and Khan (2002) called determinants of exports: the case of Cameroon, they state the export supply of banana, coffee and cocoa which are the major agricultural products of this company. According to their model, the determinants are ratio of the producer price to the domestic price index, ratio of export price to producer price, agricultural export credit, average annual

rainfall in millimeters, classified road network and dummy variables related to deregulation of domestic and export marketing, abandonment of producer price fixing and quotas. The determinants are related to the export of coffee according to paper and it is the widest function including more determinants in contrast to banana and cocoa. But the main indicators are same only the sector specific dummy variables change.

Peridy and Abedini (2008) have researched the trade in the car industry. Specific consideration of trade and its determinants has been used for car industry in this article. Model of the article written by Peridy and Abedini (2008) is gravity model. International theories like Hecksher Ohlin and monopolistic competition models support the gravity model. According to article of Peridy and Abedini (2008), the dependent variable, exports of vehicles and motor cars for transporting persons have been examined by the independent variables such as GDP (Purchasing Power Parity) of the exporter and importer countries. Additionally, in this model, there are also other independent variables in order to point the cost of the trade. For instance, geographical distance and import tariff applied to car imports. On the other hand, dummy variables of this model is common language spoken by at least %10 of the population each country pair and 0 otherwise. Degree of confidence to economic agents has stated as the other dummy variable in this model. Moreover, there are also industry specific independent variables too. In this model, car production capacity, technological activity index and innovation capability index which have been accepted as proxies in this gravity model.

Another research performed by Gingrich and Garber (2010) focuses mainly on agricultural trade. In the article, researchers state that agricultural trade is a function that includes the variables such as real exchange rate, ratio of agricultural to

non-agricultural products, share of agricultural output in total output and additional binary variables such as liberalization of trade policies. This research directly focuses on the effect of liberalization on agricultural trade.

Summary and Concluding Remarks

In this chapter, the literature about the impact of global warming on international trade and agriculture has been reviewed. Firstly, the literature about of related to agriculture has been investigated. In this section, different researches have been examined. Secondly, studies on the impacts of global warming on international trade have been mentioned. Afterwards, case of Turkey about the global warming and its effects has been analyzed and finally, export supply functions have been reviewed from literature and the most applicable model has been investigated for the case of this thesis.

Based on the literature review, there were no specific studies which examines agricultural, international trade and global together. Most of the studies are about the impacts of global warming on agriculture, mainly the agricultural production. In the literature, especially the international regulative organizations and decisions are popular in the researches briefly summarized above. Carbon trading, international cooperation of countries to the regulative mechanism done for environmental protection, strategies stated for challenging global warming by countries and different regions all over the world are the other hottest topics in literature.

Generally, the thought of the researchers and also the results reached according to the studies in the literature, if countries or unions cannot take protective actions against global warming, agricultural production will decrease and in some parts of the world like Africa, food scarcity will be felt more frequent. Furthermore,

international trade is in favor of the countries. Countries or people make trade if they find something cheaper or when this trade will be in favor of them. Global warming is a threat which tries to change the balances of international trade. This international trade which is directly related to agriculture has done in order supply the need of demand for food and hunger. So, the unbalances are also a kind of threat to the human health too. Therefore, Romar (2009) in his article gives an example that the reason behind the massacre lived in Darfur is not ethnicity but global warming driven problems.

Besides, as it is figured out in chapter two, the place of Turkey is considerable about the agricultural production in the world and also, agriculture is one of the most important sectors of Turkey. Additionally, researching the alteration through the competitive power of Turkey in the case of international agricultural trade patterns as a result of global warming will be the main aim of test that will be performed in the next chapter.

CHAPTER 5

METHODOLOGY AND DATA

The major 15 food export markets of Turkey are Iraq, Germany, Russian Federation, Italy, Netherlands, United Kingdom, France, USA, Iran, Romania, Greece, Ukraine, Bulgaria, Saudi Arabia and Belgium for the year 2008 according to the data retrieved from Exporters' Assembly of Turkey. Table 20 presents the major 15 countries in the food export of Turkey with the export volumes.

Table 20: Major 15 food markets of Turkey in the year of 2008 ($)

Ranking	Country	Total Agricultural Exports in 2008 ($)
1	Iraq	1,369,529,525
2	Germany	1,224,642,342
3	Russian Federation	964,815,252
4	Italy	626,540,332
5	Netherlands	483,138,125
6	UK	458,368,713
7	France	437,502,124
8	USA	394,449,308
9	Iran	351,834,825
10	Romania	345,221,705
11	Greece	325,969,994
12	Ukraine	317,039,390
13	Bulgaria	303,650,772
14	Saudi Arabia	287,814,520
15	Belgium	279,208,446

Source: Exporters' Assembly of Turkey

After determining the major food markets of Turkey, European countries extracted because of the proximity, high share of European Union in total trade volume of the world stated in Chapter 3 and high purchasing power in contrast to the other countries in the Table 20. Ten of these countries are in Europe. These countries are Germany, Italy, Netherlands, United Kingdom, France, Romania, Greece, Ukraine, Bulgaria and Belgium. After reaching the major European food export markets of Turkey, the most competitive countries in these markets have been examined. Major

food exporters to these ten European countries are determined from the United Nations Database. The sample set in the study is the major exporters to these ten European food markets. Table 21 lists these sixteen countries.

Table 21: Major Rivals of Turkey in European Food Export Markets

Ranking	Country	Export Amount in 2008 ($)
1	Netherlands	33,820,979,179
2	Germany	29,033,000,919
3	France	27,446,440,169
4	Spain	19,105,854,965
5	Belgium	18,363,530,777
6	Italy	14,242,545,021
7	Brazil	11,932,673,978
8	Ireland	7,998,118,028
9	Denmark	7,497,567,116
10	Poland	7,138,917,639
11	Argentina	6,161,365,191
12	United Kingdom	5,788,057,297
13	USA	5,742,681,434
14	Austria	4,145,870,548
15	China	4,050,009,723
16	Turkey	2,852,159,698
	World	277,360,772,816

Source: United Nations Database

Major rivals of Turkey in European food export market are Netherlands, Germany, France, Spain, Belgium, Italy, Brazil, Ireland, Denmark, Poland, Argentina, United Kingdom, USA, Austria and China. Turkey ranks the sixteenth.

Panel data in the study cover these 16 countries for the period of 1990-2008. The data is retrieved from the World Bank and United Nations. Agricultural exports of a country depend on many internal and external factors such as exchange rate, price, level of output, tariffs and etc. In this study, the basic model of Weeks is utilized for Turkey and her major rivals (Gingrich and Garber, 2010). Basic model of Weeks is:

$$AGTRADE_t = \alpha_0 + \alpha_1 \ln(RER_t) + \alpha_2 \ln(RPAM_t) + \alpha_3 \ln(SHGDP_t)_t + \alpha_4 AGTRADE_{t-1} + \alpha_5 RPOL_t + \alpha_6 CONF_t + \varepsilon_t \quad (1)$$

The model stated above is adjusted to estimate the effect of climate change on agricultural trade capability of Turkey and as well as the rivals' of Turkey in European food market besides the traditional and non-traditional determinants in the literature.

The adjusted model can be defined as,

$$AGT_t = \beta_0 + \beta_1 \ln(RER_t) + \beta_2 \ln(RPAM_t) + \beta_3 \ln(SHGDP_t)_t + \beta_4 \ln(ARL)_t + \beta_5 \ln(FDI)_t + \beta_6 \ln(POP)_t + \beta_7 \ln(AGM)_t + \beta_7 \ln(AGM)_t + \beta_8 \ln(PED)_t + \beta_9 \ln(CO2)_t + \beta_{10} \ln(CO2I)_t + \varepsilon_t \quad (2)$$

The dependent and independent variables are defined as follows:

AGT_t : net agricultural exports relative to total agricultural output in year t

RER_t : the real exchange rate, measured in local currency unit per US$ in year t

$RPAM_t$: the ratio of agricultural to non-agricultural prices in year t

$SHGDP_t$: the share of agricultural output in total output in year t

ARL_t : the arable land available in year t

FDI_t : the foreign direct investments (net inflows) in year t

POP_t : population in year t

AGM_t : Agricultural machinery (tractors per 100 sq. km of arable land) in year t

PED_t : Particulate emissions damage in year t (willingness to pay to avoid mortality attributable to particulate emissions) (US$)

$CO2_t$: Carbon dioxide emission in year t (kt)

$CO2I_t$: CO2 intensity in year t (kg per kg of oil equivalent energy use)

Dependent variable is the net agricultural trade balance calculated by exports-imports, divided by agricultural output (AGT).

One of the traditional determinants for agricultural trade is real exchange rate (RER). Real exchange rate is calculated by official exchange rate divided by GDP deflator. If real exchange rate appreciates, agricultural exports become less competitive at international markets. In other words, if domestic currency depreciates, imports from this country will be favorable in contrast to other countries where the same commodity is more expensive. Therefore, the expected sign for real exchange rate is negative.

Second traditional independent variable is ratio of agricultural prices to non-agricultural prices (RPAM). Calculation of this variable has been made dividing nominal output of each sector to real output. A rise in prices of agricultural products may stimulate more agricultural production and agricultural exports. The sign of this independent variable is expected to be positive.

Third independent variable is the share of agricultural output in total output (SHGDP). Share of agricultural production in total GDP may have a positive impact on net agricultural trade.

In order to see the impact of agricultural production capability, arable land (ARL), net inflows of foreign direct investment (FDI), population (POP) and agricultural machinery (AGM) are included as agricultural production capability factors in the model.

Arable land (ARL) is measured in hectares and the size of the arable land is directly related to the agricultural production capacity of a country. If arable land increases, agricultural production and agricultural export increases. Based on this assumption, the sign of arable land variable is expected to be positive. However, size

of arable land is expected to diminish due to climate change. Climate change can alter the size and quality of arable land due to change in precipitation levels and natural disasters such as droughts or floods. Supply of water which is major input for irrigation can also be affected negatively because of global warming. On the other hand, climate change may increase the availability of arable lands and water resources in some parts of the world where the regions mainly consist of swamps. Therefore, the sign of this variable may become ambiguous.

Net inflows of foreign direct investment (FDI) are also taken into account as an independent variable. FDI inflows usually address service sector and industry sector, especially in the manufacturing industry. Consequently, FDI influences agricultural trade in a negative manner.

Population (POP) is a variable which shows the level of potential demand domestically. If a country has high population, there will be more domestic consumption of agricultural products and less agricultural products available to be exported. Hence a negative sign is expected for population variable.

Agricultural machinery (AGM) is included in the adjusted model and it is defined as tractors per 100 sq. km of arable land. The influence of this independent variable on agricultural trade balance is expected as positive since technological improvements have a positive effect on production. However, there may be a negative influence of this variable. Use of gasoline leads air pollution and air pollution (caused by mainly carbon dioxide and carbon monoxide emission gases) has a negative impact on the availability of land and water. So, in conclusion, the effect of this independent variable may be both negative and positive. This variable is ambiguous.

The effect of climate change on agricultural trade can be captured by emission indicators such as particulate emission damage (PED), carbon dioxide emission (CO2) and carbon dioxide intensity (CO2I) in the adjusted model. Emission is a common tool to define the pollution ratio of the air which is used all over the world. World Bank's indicator for emission is defined as particulate emission damage (PED) and is stated in dollars. It describes the willingness to pay to avoid mortality attributable to particulate emissions in a country. In order to observe the impact of emission in value on the agricultural trade balance, this specific indicator of World Bank has included to the model. Expected relation between emission damage and agricultural trade is negative. However, particulate emission damage may show that countries do not care the emission that they release to the environment through their usage of energy sources such as oil and coal in order to increase their industrial production. As a result of this situation, if the industrial developments are in favor of agricultural production, it may have a positive influence too for the agricultural trade capability of countries. Therefore, the expected sign of the variable becomes ambiguous.

Last two independent variables of the model are directly related to the impact of greenhouse gas emissions. The variables are selected as carbon dioxide emission (CO2) and carbon dioxide intensity (CO2I). World Bank describes CO2 in kilo tones (kt) and CO2 intensity as kg per kg of oil equivalent energy use. As it is mentioned above, emission gases generally unfavorable for agricultural production and competitive power of the countries in food market. There are two side effects of greenhouse gases (GHG): (1) 14% of greenhouse gas in the world is derived from agriculture, so that agricultural output may accelerate GHG; (2) efficiency of agricultural products and the cost of production are influenced by the temperature,

precipitation, the amount of carbon dioxide in atmosphere, so that the negative impact of climate change can affect harvest time and efficiency of agricultural products. Therefore, the expected sign of these two independent variables are ambiguous.

The effect of climate change on agricultural trade capability of Turkey and her major rivals in the European food markets is analyzed by Panel Data Models. Two versions of the panel data models are considered in this study: Ordinary Least Square (OLS) and Fixed Effects Model (FEM). Two versions of the model are estimated for two groups: (1) the period of 1990-2008 is analyzed for all the countries in the sample, (2) the period 1990-2008 is tested by dividing countries into two groups as emerging markets and developed markets. Since the economic development levels and structure of the economies are different in the sample, it is better to disaggregate the sample.

Ozkan-Gunay (2004) describes panel data procedures as the simultaneous investigation of a system of equations that consider both country specific characteristics and change over the time. Fixed Effect Model (FEM) assumes that the effects of the numerous omitted individual time varying variables are individually unimportant but are collectively significant where ε_t is a classical disturbance with $E(\varepsilon_{it}) = 0$ and $Var(\varepsilon_{it}) = \sigma_E^2$ $Y_{it} = \alpha_i + \beta/X_{it} + \varepsilon_{it}$

The individual effects can be absorbed into the intercept term of a regression model as a means to explicitly allow for individual or time heterogeneity in the temporal cross-sectional data. Thus α is a separate constant term for each unit that varies both cross-sectional across countries and over time. The problem of multicollinearity is avoided by imposing the following restriction.

$\sum_i \alpha_i = \sum_i \gamma_t = 0$

NLOGIT has been used in computing the regression analyses.

CHAPTER 6

EMPRICAL FINDINGS

The effect of climate change on agricultural trade capability of Turkey and her major rivals in the European food market is analyzed for the period of 1990-2008 by employing panel data models. Two sets are tested as 'Set I' for the pooled data and 'Set II' for the emerging and developed countries. For each set, two types of panel data models are run with different explanatory variables to determine the best identification for agricultural trade capability.

The results of OLS model are presented in Table 22 for the period of 1990-2008. Nine versions of the OLS model are run to determine the best specification in the study. One independent variable is eliminated one by one in each version. The explanatory power of the OLS model with all variables version 1 is around 0.64, indicating that the independent variables are 64% capable of explaining the changes in agricultural trade capability. However the R^2 in the rest of the versions do not improve. Therefore, the first version of the model in OLS can be accepted as the base model. The striking feature of the base model is that all the coefficients (except RER) are statistically significant.

The calculated F values in most of the versions of OLS estimations are higher than the one percent critical value from F Table (2.17). For the base model, F value is 41.3. Therefore, the hypothesis that the independent variables do not have any explanatory power is rejected at the one percent level.

Table 22: Panel Data Estimates of Climate Change Effects on Agricultural Trade Capability of Turkey and her major rivals in European Food Market (1990-2008): Ordinary Least Square Model

Version No	1	2	3	4	5	6	7	8	9
Constant	12.403***	9.146***	6.800***	7.769***	2.077***	1.800**	2.670***	0.140**	0.257***
	(10.763)	(7.632)	(7.63)	(9.081)	(3.554)	(2.696)	(7.669)	(2.078)	(6.001)
RER	0.02	0.009	0.029**	0.028**	0.023*	0.032*	0.039**	0.044**	0.033**
	(1.7)	(0.736)	(2.501)	(2.368)	(1.716)	(2.059)	(2.703)	(2.739)	(2.126)
RPAM	-0.35**	-0.12	-0.10	0.099	0.034	0.23	0.16	-0.04	0.022
	(-2.326)	(-0.728)	(-0.644)	(0.649)	(0.202)	(1.183)	(0.871)	(-0.2)	(0.112)
SHGDP	0.69***	0.37***	0.29***	0.26***	0.45***	0.31***	0.26***	0.11**	
	(9.929)	(5.928)	(5.379)	(4.811)	(8.012)	(4.989)	(5.137)	(2.223)	
ARL	-0.14***	-0.101**	-0.057	-0.06	0.13***	-0.18***	-0.17***		
	(-3.493)	(-2.257)	(-1.325)	(-1.353)	(3.113)	(-6.639)	(-7.388)		
FDI	0.062**	0.101***	0.12***	0.11***	0.16*	0.042			
	(2.273)	(3.389)	(4.199)	(3.760)	(5.191)	(1.304)			
POP	-1.05***	-0.65***	-0.48***	-0.40***	-0.47***				
	(-11.523)	(-7.763)	(-8.924)	(-8.346)	(-8.992)				
AGM	-0.46***	-0.43***	-0.37***	-0.37***					
	(-10.147)	(-8.646)	(-8.418)	(-8.361)					
PED	0.075**	0.034	0.096***						
	(2.467)	(1.020)	(3.260)						
CO2	0.69***	0.27***							
	(7.226)	(3.074)							
CO2I	-1.25***								
	(-7.733)								
R^2	0.64	0.54	0.53	0.52	0.39	0.20	0.20	0.03	0.16
Adjusted R^2	0.62	0.53	0.52	0.50	0.38	0.18	0.19	0.22	0.01
F [.,.]	[10,236]	[9,237]	[8,254]	[7,256]	[6,258]	[5,259]	[4,266]	[3,281]	[2,282]
F values	41.3	31.44	36.33	39.18	27.44	12.81	16.42	3.18	2.26

Dependent variable is the net agricultural exports relative to total agricultural output.
Figure in parentheses are t statistics
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

The coefficients measure magnitude of the effect coming from independent variables on agricultural trade capability. The impact of real exchange rate (RER) on agricultural trade is statistically insignificant and positive in all nine versions of OLS model. However, the magnitude of RER is relatively low.

The coefficient of ratio of agricultural to non-agricultural prices (RPAM) is negative and statistically significant at the 5% level only in the base model. Based on the OLS model results, it can be concluded that competitiveness in agricultural goods

deteriorates as the domestic relative price of agricultural to non-agricultural products rise.

The share of agricultural output in total output (SHGDP) has the expected sign (positive) and statistically significant at 1% level in all versions of the OLS model, except the 8th version. It can be interpreted as 1% increase in share of agricultural output in total output can lead to a 0.7% increase in agricultural trade.

The coefficient of arable land (ARL) has a negative sign, opposite to the primarily expected sign, and statistically significant at 1% level. The possible explanation for the negative relation between agricultural trade and size of the arable land is that the agricultural productivity of the countries in the sample is comparatively high with respect to their size of arable lands.

Foreign direct investment (FDI) has a positive effect on the agricultural trade in all versions of OLS model and is significant, contrary to the expectation. This can be interpreted as FDI inflows could improve the technological possibilities that will accelerate the agricultural production. However, its impact is relatively low.

The coefficient of population (POP) is negative and significant at 1% significance level in all versions. Negative sign in the OLS model indicates that domestic consumption in the sample countries dominates and lowers amount available for export in agricultural sector.

The variable of agricultural machinery (AGM) is defined as tractors per 100 sq. km of arable land and taken into account as indicator for technological infrastructure in agricultural sector. However, the coefficient has a negative sign and significant at 1% level. The expected sign of this variable is positive.

In order to capture the impact of climate change on agricultural trade capability, three different emission indicators are considered. Particulate emission damage (PED) is included to see the impact of avoiding negative effects of climate change. Since PED can be described as the willingness to pay to avoid mortality attributable to particulate emissions in each country, the positive relation between PED and agricultural trade implicitly states that the countries with high GHG emissions have higher agricultural trade levels. On the other hand, it also indicates that some countries are ignorant to pay the monetary cost to compensate particulate emissions. The second variable for emission is carbon dioxide emission (CO2) and it has a positive sign, indicating that countries with higher level of agricultural trade have higher emission levels. The coefficient of CO2 is statistically significant at 1% level. Since the reason behind carbon dioxide emission is related to agricultural production (17% of GHG emission is derived from agricultural production), higher CO2 emission leads higher agricultural production and finally, higher agricultural trade balance. The last climate change variable is the emission intensity (CO2I) and measured as kg per kg of oil equivalent energy use. The sign of the coefficient is negative. This variable has been described and calculated by World Bank and basically shows the level of the pollution derived from different energy sources like coal. Carbon dioxide intensity is respectively higher in the countries where coal or any different energy source usage is higher respectively. For instance, the highest carbon dioxide intensity in 2008 belongs to China and China has one of the major influences to agricultural trade capability negatively with respect to carbon dioxide intensity.

The Hausman test is used to test the performance of OLS and FEM. The Hausman statistics favors FEM. FEM assumes that the intercept changes across

countries and this term captures the country specific characteristics, such as differences in economic development levels, technological infrastructure, standard and regulations in the agricultural sector. Parallel to the OLS estimation approach, nine versions of FEM are estimated for the pooled data, Set I. The results of FEM estimations are presented in Table 23.

Table 23: Panel Data Estimates of Climate Change Effects on Agricultural Trade Capability of Turkey and her major rivals in European Food Market (1990-2008): Fixed Effects Model

Version No	1	2	3	4	5	6	7	8	9
RER	0.015	0.004	0.001	0.004	0.003	0.012	0.013	0.015*	0.015*
	(1.569)	(0.393)	(0.150)	(0.437)	(0.321)	(1.393)	(1.602)	(1.815)	(1.935)
RPAM	-0.13	-0.11	-0.12	-0.02	-0.07	-0.06	-0.04	-0.05	-0.06
	(-0.992)	(-0.804)	(-0.919)	(-0.123)	(-0.606)	(-0.558)	(-0.391)	(-0.474)	(-0.750)
SHGDP	0.28**	0.12	0.065	0.08	0.1	0.04	-0.009	-0.007	
	(2.671)	(1.138)	(0.647)	(0.811)	(1.028)	(0.442)	(-0.127)	(-0.107)	
ARL	0.43	0.11	-0.14	0.20	0.46	0.57*	0.59*		
	(0.938)	(0.227)	(-0.365)	(0.544)	(1.459)	(1.814)	(1.921)		
FDI	-0.02	-0.001	0.001	0.0006	0.004	0.01			
	(-0.955)	(-0.070)	(0.052)	(0.034)	(0.208)	(0.553)			
POP	0.54	1.97**	1.43**	1.03**	0.92*				
	(0.706)	(2.658)	(2.761)	(2.111)	(1.986)				
AGM	-0.12	-0.10	-0.32**	-0.16					
	(-0.661)	(-0.563)	(-2.228)	(-1.224)					
PED	0.11**	0.087*	0.12**						
	(2.269)	(1.786)	(2.723)						
CO2	0.44	-0.3							
	(1.620)	(-1.247)							
CO2I	-2.25***								
	(-5.071)								
R^2	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.87	0.87
Adjusted R^2	0.88	0.87	0.87	0.87	0.87	0.87	0.87	0.86	0.86
F [.,.]	[25,221]	[24,222]	[23,239]	[22,241]	[21,243]	[20,244]	[19,251]	[18,266]	[17,267]
F values	74.68	69.04	77.45	79.52	84.06	87.01	97.92	99.54	105.78

Dependent variable is the net agricultural exports relative to total agricultural output

Figure in parentheses are t statistics

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

R^2 and adjusted R^2, 0.89 and 0.88 respectively, improves significantly when country specific effects are taken into account in FEM. In addition, F values are very high compared to F table value. Therefore, the null hypothesis of independent variables have no explanatory power is rejected at the 1% significance level.

OLS and FEM estimations are consistent in terms of real exchange rate (RER), ratio of agricultural prices to industrial prices (RPAM), ratio of agricultural output to GDP (SHGDP), agricultural machinery (AGM), particulate emission damage (PED), carbon dioxide emission (CO2) and carbon dioxide intensity (CO2I). On the other hand, the coefficients of arable land (ARL), net inflows of foreign direct investment (FDI) and population (POP) have opposite signs in FEM. The impact of real exchange rate has a positive sign but insignificant. FEM estimations also reveal negative effect of RPAM on agricultural trade capability, but they are insignificant even at 10% level in FEM. The impact of the ratio of agricultural output to total output (SHGDP) on agricultural trade capability is positive and significant at 5% significance level. A 1% increase in the ratio (SHGDP) leads to 0.3% increase agricultural trade. The striking difference is that arable land in FEM estimations indicate a positive effect on agricultural trade, however it is insignificant. The effect of FDI on agricultural trade capability exhibits inconsistent results in terms of sign but the magnitude of this negative impact is small and insignificant. Similarly, population (POP) has an opposite sign in FEM. The coefficient of this variable is positive but statistically insignificant in the base model. Yet, it is significant in other versions of FEM. The impact of AGM is still negative and insignificant.

In contrary, emission variables have the same signs. There is a positive relation between particulate emission damage (PED) and agricultural trade and it is still significant. In addition, the positive impact is observed for carbon dioxide emission (CO2), however it is insignificant. The negative impact still exists with respect to carbon dioxide intensity (CO2I) and agricultural trade. The magnitude of CO2I is striking in FEM. A 1% increase in CO2I causes a 2.3% decline in

agricultural trade capability. It can be interpreted as agricultural trade capability declines when the emission intensity level of the country increases.

Since the FEM results capture country specific characteristics better and explain the impact of different variables on agricultural trade capability better for the given sample, it is worth to disaggregate the sample set as developed countries and emerging markets. The sensitivity analyses for different country groups are also considered for the same period. Table 24 presents the empirical results which categorize the countries as emerging and developed countries. Emerging countries are Turkey, Brazil, China, Argentina and Poland whereas developed countries are the rest eleven countries: Netherlands, Germany, France, Spain, Belgium, Italy, Ireland, Denmark, United Kingdom, USA and Austria. After categorization of countries, FEM and OLS models are applied as three different versions.

The results of OLS model are presented in Table 24 for the period of 1990-2008 for emerging and developed countries. Three versions of the OLS model are utilized to determine the best specification after disaggregation of the countries in the study. Two independent variables are eliminated one by one in second and third versions of model.

In the first versions of models all the variables have been included. In the second version of the models, one of the independent variables, agricultural machinery (AGM) has been excluded since the expected sign of this variable mostly resulted in the opposite in SET 1. Moreover, in the third version, real exchange rate (RER) is not included to the model. As mentioned in the polled data, expected sign of the real exchange rate is negative. However, in all of the versions of OLS model,

results showed that this variable effects dependent variable in a positive trend and also significant in seven of the versions.

Table 24: Disaggregated Data Estimates of Climate Change Effects on Agricultural Trade Capability of Emerging and Developed Countries in European Food Market (1990-2008): Ordinary Least Square

Version No	1		2		3	
Country sets	EC	DC	EC	DC	EC	DC
Constant	2.75	14.85***	-5.95***	9.48***	1.54	15.39***
	-0.93	-10.359	(-4.22)	-7.294	-0.581	-11.097
RER	0.01	0.02	0.01	-0.02		
	-1.661	-0.85	-1.409	(-0.692)		
RPAM	0.12	-0.67***	0.01	-0.57***	0.06	-0.67***
	-1.087	(-3.713)	-0.118	(-2.876)	-0.625	(-3.076)
SHGDP	0.13	0.85***	0.20*	0.78***	0.08	0.84***
	-1.296	-9.773	-1.811	-8.211	-0.807	-9.806
ARL	0.54*	-0.14**	1.34***	0.14***	0.66**	-0.14**
	-1.932	(-2.323)	-8.761	-2.952	-2.643	(-2.313)
FDI	0.04*	0.04	0.06**	0.10***	0.06***	0.04
	-1.72	-1.395	-2.172	-2.89	-3.305	-1.299
POP	-0.55***	-1.44***	-0.90***	-1.63***	-0.55***	-1.51***
	(-3.655)	(-10.190)	(-7.860)	(-10.591)	(-3.754)	(-12.617)
AGM	-0.23***	-0.46***			-0.23***	-0.46***
	(-3.289)	(-6.502)			(-3.623)	(-6.722)
PED	-0.14***	0.06	-0.16***	0.09**	-0.17***	0.05
	(-3.030)	-1.621	(-3.319)	-2.098	(-4.605)	-1.391
CO2	0.1	1.08***	0.1	1.01***	0.04	1.14***
	-0.767	-7.623	-0.689	-6.437	-0.344	-8.776
CO2I	-0.1	-1.16***	0.11	-1.10***	0.18	-1.18***
	(-0.269)	(-5.661)	-0.304	(-4.872)	-0.595	(-5.936)
R^2	0.9	0.68	0.88	0.61	0.9	0.68
Adjusted R^2	0.88	0.66	0.86	0.59	0.89	0.66
F [.,.]	[10,64]	[10,178]	[9,65]	[9,179]	[9,73]	[9,181]
F values	55.75	38.24	52.77	30.71	76.4	42.37

Dependent variable is the net agricultural exports relative to total agricultural output

Figure in parentheses are t statistics *** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

The explanatory power of the OLS model with all variables version 1 is around 0.90 for emerging countries and 0.68 for developed countries, indicating that the independent variables are capable of explaining the changes in agricultural trade capability for both emerging and developed countries after disaggregation. Additionally, R^2 values in the rest of the versions also improve. Minimum R^2 value for emerging countries is 0.88 for OLS model and is 0.61 for developed countries.

Furthermore, in the first version of the OLS model where all ten independent variables are included, five of the coefficients are statistically significant except real exchange rate (RER), ratio of agricultural prices to industrial prices (RPAM), share of agricultural output in GDP (SHGDP), carbon dioxide emission (CO2) and carbon dioxide emission intensity (CO2I) for emerging countries. The first version of OLS model which is run for developed countries, only three independent variables are statistically insignificant which are RER, FDI and PED.

The calculated F values in all of the versions of OLS estimations are higher than the one percent critical value from F Table (2.17) for both emerging and developed countries. For all the versions of OLS model estimations, F value is minimum 52.77 for emerging countries and 30.71 for developed countries. Therefore, the hypothesis that the independent variables do not have any explanatory power is rejected at the one percent level.

The impact of real exchange rate (RER) on agricultural trade capability is statistically insignificant and positive in version 1 for both emerging and developed countries. However, the magnitude of RER is relatively low. On the other hand, same conditions are valid for version 2 where agricultural machinery has been excluded from the model for emerging countries and the opposite situation is eligible for developed countries that RER affects dependent variable negatively but coefficient is statistically insignificant and magnitude is relatively low. In the third version of OLS model, RER has been excluded.

The coefficient of ratio of agricultural to non-agricultural prices (RPAM) is positive and statistically insignificant for emerging markets however, ratio of agricultural to non-agricultural prices (RPAM) is negative and statistically significant

for developed countries at the 1% level for all three versions of OLS model. Based on the OLS model results, it can be concluded that since the population of emerging countries are relatively high (population of the emerging countries in the sample is equal to 1.7 billion however population of developed countries are 660 million), prices of agricultural products are insignificant since domestic consumption levels are higher.

The share of agricultural output in total output (SHGDP) has the expected sign (positive) and statistically significant at 1% level in all three versions of the OLS model for developed countries. It can be interpreted as 1% increase in share of agricultural output in total output can lead to a 0.8% increase in net agricultural trade for emerging countries. Same explanation is applicable stated in above for the insignificance of SHGDP in emerging markets that higher population levels lead in somehow higher production but also higher domestic consumption.

The coefficient of arable land (ARL) has both negative and positive signs. Signs of the coefficient differ in version 2 for developed countries. Expected sign of the arable land is mainly positive. In emerging countries, the expectation satisfied for all three versions however, as mentioned above in SET 1, possible explanation for the negative relation between agricultural trade and size of the arable land is that the agricultural productivity of the developed countries in the sample is comparatively high with respect to their size of arable lands. On the other hand, the possible explanation of the positive sign of arable land (ARL) observed in version 2 is: in order to observe the effect of agricultural production to agricultural trade capability of developed countries, besides the arable land (ARL) variable, agricultural machinery has also to be included since the technological opportunities are higher in developed countries in contrast to emerging markets. Arable land (ARL) is

statistically significant at 1% level in version 2, at 5% level in version 3 and at 10% level in version 1 for emerging countries according to OLS model estimations. Furthermore, arable land (ARL) is statistically significant at 1% level in version 2 and 5% level in both version 1 and 3.

Foreign direct investment (FDI) has a positive effect opposite to the expectation on the agricultural trade in all versions of OLS model and is significant for emerging countries. Explanation of this opposition to the expectation may be the FDI inflows could have been improve the technological possibilities that will accelerate the agricultural production. However, its impact is relatively low. On the other hand, same signs are valid in all versions of OLS model for developed countries but FDI is significant only in version 2 for developed countries. Possible explanation of this situation may be after excluding agricultural machinery (AGM), influence of technological improvements or investments could have been observed in one variable for developed countries where FDI inflows and technological improvements are relatively high compared to emerging markets.

The coefficient of population (POP) is negative and significant at 1% significance level in all versions for both emerging and developed countries in SET 2 as observed in SET 1. Negative sign in the OLS model indicates that domestic consumption in the sample countries dominates and lowers amount available for export in agricultural sector.

The variable of agricultural machinery (AGM) has a negative sign and significant at 1% level for version 1 and 3. However, the expected sign of this variable is positive. Since the sign has not changed after disaggregation of countries, agricultural machinery has been excluded in version 2. In the OLS model,

explanatory power of the variables has not changed significantly. However, in version two, sign of carbon dioxide intensity has changed for emerging country group. Therefore, carbon dioxide intensity (CO2I) is insignificant for emerging countries for finding out the effect of climate change on agricultural trade capability of emerging countries. Additionally, excluding the AGM has resulted alterations in the signs of arable land and real exchange rate for developed countries. Since the magnitude of the coefficient of real exchange rate is respectively low and statistically insignificant for developed countries, overall influence of dependent variable is rare. Possible reason of the change in the sign of arable land (ARL) has explained above for developed countries.

As mentioned above in the empirical findings of SET 1, three different emission indicators are considered in SET 2 too which are particulate emission damage (PED), carbon dioxide emission (CO2) and carbon dioxide emission intensity (CO2I). Expected sign of particulate emission damage (PED) is ambiguous. Results of OLS model SET 2 shows that PED has a negative and significant coefficient for emerging countries for all versions. On the other hand, coefficient is positive and insignificant for developed countries. It can be interpreted as 1% increase in particulate emission damage can lead to a 0.14%-0.18% decrease in net agricultural trade capability of emerging countries. The reason behind this consequence is particulate emission damage of emerging markets are growing for emerging countries especially for China, Turkey and Poland after 2000s. On the other hand, this particulate emission damage is decreasing for developed countries. This conclusion shows that the effect of particulate emission damage on agricultural trade capability is negative in emerging markets since there is not enough policy in order to handle the threat of global warming however decreasing levels of particulate

emission damage in developed countries has a positive impact on agricultural trade capability. OLS model of SET 2 clarified the results reached in SET 1 that behind the positive sign of particulate emission damage observed in SET 1 OLS model, there was the effect of developed countries. The second variable for emission is carbon dioxide emission (CO2) and it has a positive sign for 3 versions of OLS model and for both emerging and developed countries, indicating that countries with higher level of agricultural trade have higher emission levels. The coefficient of CO2 is statistically significant at 1% level for developed countries. Since the reason behind carbon dioxide emission is related to agricultural production (17%of GHG emission is derived from agricultural production), higher CO2 emission leads higher agricultural production and finally, higher agricultural trade balance. The countries stated in the model are also the leaders in the food export market of Europe. However, the magnitudes of coefficients for CO2 in emerging countries are insignificant and respectively low. The reason of the difference is the low level of agricultural production level in emerging countries in contrast to developed countries and also in the model there are 5 emerging countries whereas eleven developed countries including USA.

Third and last variable is the emission intensity (CO2I). The sign of the coefficient is negative for developed countries in all versions of OLS model and significant at 1% level. On the other hand, CO2I is negative but insignificant for emerging countries where all the variables included in the model, version 1. Additionally, sign of the CO2I changes in version 2 and 3. Coefficients are still insignificant. Possible explanation of these results could be real exchange rates and agricultural machinery in developed countries has no significant influence on the relation between carbon dioxide intensity and agricultural trade capability unlike in

the emerging countries. After disaggregation of the countries, it can be easily observed from the Table 24 that, CO2 and CO2I has same trends for emerging and developed countries except the version 2 and 3 for emerging markets.

Fixed Effect Model is employed after OLS model. Three versions are stated in FEM and the excluded variables are same for each version. The results of the FE model can be observed in Table 25 in the right side.

Table 25: Disaggregated Data Estimates of Climate Change Effects on Agricultural Trade Capability of Emerging and Developed Countries in European Food Market (1990-2008): Fixed Effects Model

Version No	1		2		3	
Country sets	EC	DC	EC	DC	EC	DC
Constant						
RER	-0.01	0.01	-0.01	0.005		
	(-1.156)	-0.263	(-1.141)	-0.224		
RPAM	0.22**	-0.26	0.19**	-0.26	0.17*	-0.23
	-2.091	(-1.337)	-2.084	(-1.348)	-1.771	(-1.220)
SHGDP	-0.12	0.11	-0.08	0.11	-0.08	0.11
	(-0.954)	-0.522	(-0.803)	-0.5	(-0.708)	-0.524
ARL	0.84**	0.53	0.91**	0.64	0.65*	0.51
	-2.351	-0.777	-2.769	-1.238	-1.894	-0.752
FDI	0.04	-0.04	0.04**	-0.04	0.02	-0.03
	-1.673	(-1.544)	-2.064	(-1.535)	-1.232	(-1.380)
POP	0.39	-0.74	0.44	-0.74	0.32	-0.63
	-0.7	(-0.723)	-0.793	(-0.724)	-0.641	(-0.667)
AGM	-0.07	-0.06			-0.09	-0.07
	(-0.522)	(-0.250)			(-0.739)	(-0.290)
PED	-0.26***	0.20***	-0.26***	0.20***	-0.24	0.2***
	(-4.524)	-2.936	(-4.531)	-2.937	(-4.300)	-2.939
CO2	-0.03	0.73*	-0.08	0.70*	0.04	0.72*
	(-0.162)	-1.812	(-0.466)	-1.832	-0.199	-1.809
CO2I	-0.45	-2.67***	-0.41	-2.68***	-0.49	-2.65***
	(-1.034)	(-4.521)	(-0.968)	(-4.542)	(-1.275)	(-4.530)
R^2	0.94	0.9	0.94	0.9	0.95	0.9
Adjusted R^2	0.93	0.89	0.93	0.89	0.94	0.89
F [.,.]	[14,60]	[21,167]	[13,61]	[20,168]	[13,69]	[20,170]
F values	70.75	71.52	77.09	75.52	94.6	76.34

Dependent variable is the net agricultural exports relative to total agricultural output

Figure in parentheses are t statistics

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

In the FEM results, minimum R^2 and adjusted R^2 values are 0.90 and 0.89 respectively. R^2 and adjusted R^2 values improve significantly when country specific effects are taken into account in FEM for developed countries. In addition, F values are very high for both emerging and developed countries compared to OLS model. Therefore, the null hypothesis of independent variables have no explanatory power is rejected at the 1% significance level.

OLS and FEM estimations in SET 2 are consistent in terms of ratio of agricultural prices to industrial prices (RPAM), arable land (ARL), net inflows of foreign direct investment (FDI), agricultural machinery (AGM), particulate emission damage (PED) and in somehow carbon dioxide intensity (CO2I) for emerging countries. On the other hand, the coefficients of real exchange rate (RER), share of agricultural output in GDP (SHGDP), population (POP) and carbon dioxide emission (CO2) are opposite of OLS model estimations for emerging countries. All the variables stated in all versions of FEM model and have opposite signs with OLS model thus these variables are statistically insignificant for emerging markets.

For the estimations resulted in FE model SET 2 for developed countries, signs of RPAM, SHGDP, POP, AGM, PED, CO2 and CO2I are consistent with the estimations of OLS model. On the other hand, signs of RER, ARL and FDI are different when country specific features are taken into consideration.

Real exchange rate is inconsistent in the estimations of FEM. It is negative for emerging countries and positive for developed countries but both of the results are statistically insignificant.

The coefficient of ratio of agricultural to non-agricultural prices (RPAM) is positive and statistically significant at the 5% and 10% level for emerging markets

however, ratio of agricultural to non-agricultural prices (RPAM) is negative and statistically insignificant for developed countries for all three versions of OLS model. Expected sign of RPAM is positive that when agricultural prices increase, willingness to export agricultural products rise respectively for emerging countries.

Sign of the share of agricultural output in GDP is negative for emerging markets in all versions of FEM. The dependent variable, net agricultural trade balance (AGT) is calculated agricultural exports-agricultural imports divided by agricultural output. When the conditions of each economy are taken into consideration, increase in agricultural output may lead a decrease in the AGT if the food trade balance remains same for the countries. For instance, the SHGDP levels of China, Turkey, Argentina, Brazil and Poland are 11.31%, 8.65%, 9.84%, 6.70% and 4.51% respectively. All the SHGDP ratios of these emerging countries are above the ratios of developed countries.

The coefficient of arable land (ARL) in FEM for all three versions is positive as expected for emerging and developed countries. In emerging countries, the expectations for all three versions are statistically significant at 5%, 5% and 10% level respectively whereas in developed countries, all three versions are not statistically insignificant. Possible explanation of this consequence is more effective usage of arable land by developed countries with the help of technologically achieved structure of their agricultural sector.

Foreign direct investment (FDI) has a positive effect opposite to the expectation on the agricultural trade in all versions of FEM for emerging countries and statistically significant when agricultural machinery has been excluded from the model at 5% significance level. Explanation of this opposition to the expectation may

be the FDI inflows could have been improve the technological possibilities that will accelerate the agricultural production for emerging markets. However, its impact is relatively low. On the other hand, signs of the coefficients are negative when conditions of countries specified in FEM for developed countries. explanation for this situation could be the inflows of foreign direct investments to developed countries may be related to the industry or service sector and this situation can result a decline in the competitive power of agricultural sector.

The coefficient of population (POP) is negative and insignificant for developing countries where most of the population is employed at the service and industry sector. However, coefficient of population is positive but still insignificant for emerging countries where most of the population works in agricultural sector. Population leads domestic consumption level for developed countries. On the other hand, it is a kind of input for agricultural production in emerging markets.

The variable of agricultural machinery (AGM) has a negative sign and insignificant for version 1 and 3. However, the expected sign of this variable is positive. Since the sign has not changed after examining each country's characteristics, agricultural machinery has been excluded in version 2 and according to results; explanatory power of the variables has not changed significantly. The only alteration in statistical significance happened for the FDI of emerging countries. All the magnitudes of the coefficients are relatively low for all three versions of FEM.

As mentioned above in the explanations of OLS model SET 2, expected sign of particulate emission damage (PED) is ambiguous. Results FEM SET 2 shows that PED has a negative and significant coefficient for version 1 and 2 in emerging countries except version 3. On the other hand, coefficient is positive and significant

for developed countries. All the levels of significance are 1%. Explanations made in OLS model are applicable for FEM model estimations too.

Carbon dioxide emission (CO2) which is the second variable included in order to consider the impact of climate change on agricultural trade capability, responses to FEM in the same way for developed countries but significance level has decreased from 1% level to 10% level. Carbon dioxide emission still accelerates the agricultural trade capability when the country characteristics are pointed out by FEM model for all three versions. However, carbon dioxide emissions of emerging countries are low in contrast to developed countries and in version 1 and 2, sign of the CO2 is negative and magnitude is relatively low. Possible explanation may be the CO2 emission in China, Turkey, Brazil, Argentina and Poland is unfavorable for agricultural trade capability since the usage of economic tools cannot be directed to improve the agricultural production and export in contrast to developed countries.

Last variable is the emission intensity (CO2I). The sign of the coefficient is negative for developed countries in all versions of FE model and significant at 1% level. On the other hand, CO2I is negative but insignificant for emerging countries. According to FEM, results show that kg per kg of oil equivalent energy use is higher in emerging countries thus; this index is not low in developed countries. Particulate emission damage is negatively related to agricultural trade capability of both emerging and developed countries.

In this chapter, results of OLS and FE models are interpreted and discussed in two main sets. In SET 1, all the countries examined in different versions by applying different scenarios in OLS and FE models. Moreover, emerging and developed countries categorized in SET 2 and examined through in three versions by applying

again OLS and FE models. For the conclusion of this empirical study and major implications, please refer to the next chapter.

CHAPTER 7

CONCLUSION AND POLICY IMPLICATIONS

As the average temperature of the Earth continues to increase as a result of increasing greenhouse gas emissions sent to the atmosphere, many regions will experience different climatic changes and environmental impacts. The impact of climate change on the agricultural sector is projected for various climate change scenarios. Consequently, the global warming and global food security issues will continue to be in the center of policy debates as climatic trends continue for the rest of the century.

There are conflicting hypotheses regarding the relation between climate change and agricultural production, and agricultural trade in the literature. Agriculture is one of the most affected sectors by the climate change. Unfavorable weather conditions may cause water scarcity, unstable rainfalls and increase in temperatures, resulting in lower efficiency in animal and agricultural production and agricultural trade capability of the countries. The purpose of this thesis is to determine the effect of climate change on agricultural trade capability of Turkey and her major rivals in the European food market. The main hypothesis is that variables of climate change have a negative effect on agricultural trade capability of Turkey and her rivals for the period of 1990-2008. Panel data models, Ordinary Least Square and Fixed Effects models are employed to analyze main determinants of agricultural trade for 16 countries for the period of 1990-2008. The empirical evidence supports that climate change affects the agricultural trade capability of Turkey and the major comparative emerging and developing countries.

Empirical studies about the effects of global warming on the environment and economy has been examined by many researchers all over the world. There are also studies for the economics of global warming. However, studies for Turkey are rare and also mainly related to the environmental sciences. The main contributions of this study to literature are as follows; this study is one of the first studies that use a macroeconomic approach to test the impact of climate change on agricultural trade capability of Turkey. Second, three main topics have been considered together in this study: agriculture, international trade and climate change. Third, agricultural trade has been examined by adding also technological developments and net inflows of foreign direct investment. Fourth, Turkey and sixteen major rivals of Turkey in European food market have been examined for the period 1980-2008. The choice of the countries to the sample has been made according to the recent information. Panel data and country specific characteristics have been analyzed for all the countries and also, this analysis have been made to emerging and developed countries specifically stated in the sample. Finally, ten different variables which represent the inputs of international trade, climate change and agricultural production have been used together in this model.

Three of the independent variables have been used in order to measure the effect of global warming to agricultural trade capability specifically. Moreover, agricultural production perspective has not excluded through considering agricultural trade capability of countries. Arable land variable has been used in order to observe the effect of agricultural production capacity. Additionally, technological improvements (agricultural machinery) and investments (net inflows of foreign direct investment) have been used for the first time in a research which covers agricultural trade and climate change concepts together. Besides arable land, other domestic

determinants such as population have been added to the model in order to consider the impact of domestic consumption.

The study is based on country-level data of Turkey and her major fifteen rivals in the European food market: Netherlands, Germany, France, Spain, Belgium, Italy, Brazil, Ireland, Denmark, Poland, Argentina, United Kingdom, USA, Austria and China for the period from 1990 to 2008. The agricultural trade capability (net agricultural trade balance) of the countries has been analyzed through using ten independent variables.

The effect of climate change on agricultural trade capability of Turkey and her major fifteen rivals in European food market is analyzed by testing two econometric models: Ordinary Least Square (OLS) and Fixed Effects Model (FEM). Two sets of these models are run separately. In set 1, effects have been analyzed for all the countries in the period 1980-2008 and in set 2; countries have divided into two categories: emerging and developed countries. NLOGIT has been used in computing the regression analyses.

Empirical results for both periods reveal that FEM outperform OLS for the given sample set. FEM detects country specific changes by assigning a constant term for each country. This term captures the country specific characteristics, such as differences in economic and political environment, standard and regulations for agricultural sector. The impact of climate change on agricultural trade capability is overestimated when the country specific effects are not taken into account.

The empirical evidence reached from set 2 in the FE model support that particulate emission damage and carbon dioxide emission decrease the agricultural trade capability in emerging countries. Turkey, China, Brazil, Argentina and Poland as emerging countries have to deal with the global warming in order not to lose

competitive power in European food market or these countries have to canalize their industrial development which causes rise in carbon dioxide emission to agricultural sector. Industrial developments should support the agricultural production too besides industry sector. Empirical evidence supports the opposite situation for developed countries. Particulate emission damage and carbon dioxide emission have a positive influence of agricultural trade capability. This consequence leads that, developed countries do not allow to lose their competitive power in European food market resulted from negative effects of particulate emission damage and carbon dioxide emission by canalizing the industrial and technological developments to agricultural sector. The last variable included to measure the impact of climate change on agricultural trade capability of countries in the sample is carbon dioxide intensity. Carbon dioxide intensity supports the hypotheses that agricultural trade capability of emerging and developed countries have influenced negatively from climate change. Carbon dioxide intensity is defined as kg per kg of oil equivalent energy use by World Bank. As can be understood from the definition, intensity includes the energy sources like coal and since the effectiveness is less in contrast to oil and the level of emission released to the environment is very high, this indicator becomes unfavorable for agricultural trade capability of both emerging and developed countries. Thus, there is also another consequence of these findings. Turkey as a growing economical power has problems about its current account deficit. Exports are unfavorable for current account deficit. Any reason that may decrease the export level of Turkey, leads an increase in current account deficit. So, there is also macroeconomic outcomes of the threat resulted from climate change.

In the future studies, more recent data can be used in order to observe the alteration in influence of climate change on agricultural trade capability of countries.

For instance, some of the emerging countries stated in the sample may become developed and after this change in development level of countries, influence of climate change can be analyzed again. Additionally, according to availability of data, indicators that represent the weather conditions specifically such as average temperatures of countries in years or average rainfalls per meter to a country may be included to this model. The study can be extended by adding other emerging and developed countries to the sample and also regional studies can be performed like impact of global warming on agricultural trade capability of Africa or North America. Furthermore, if the time series available, time series may be compared by making two or more data sets to focus on the time related impacts. On the other hand, for Turkey, this study can be specialized by using a specific region. First of all, most competitive product of Turkey in the food markets of world can be chosen. Then, through taking into consideration of the area that this food produced, research can be specified. Additionally, primary data could be used by a questionnaire prepared for the major producers of this specific product in that region. If there is a station of Turkish State Meteorology Service in that region, any weather indicators could be obtained which could be useful to determine the impact of climate change on the specific food's trade capability in this region.

Finally, after this study, policy implications for Turkey in the upcoming years should be:

- Investment on renewable energy sources
- Channeling of the industrial and technological developments to agricultural sector.
- Strong control mechanism for speculative actions of food prices in order not to lose the competitive power in European food markets

- The action plans stated in the first national report on climate change prepared by Ministry of Climate and Environment has to be applied in order to decrease the effects of climate change
- Preparation for the threat of hunger that will become one of the biggest problems of the humanity in the future.
- Readiness of the plans for the scenarios of International Panel on Climate Change
- Policies that will increase the control over trade deficit and afterwards, over current account deficit have to prepared in case of losing competitive power in agricultural production and trade in the future.

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