Master thesis

"The hidden influences on the prices of commodities''

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Preface *Amsterdam, Netherlands*

This is the final result of my Msc. Thesis which I have written at the Wageningen University. I this research I took an in depth look in the market of commodities. This market is becoming more and more important due to the fact that more people are depending of this market. Not only for their products but also for their finance as there is a growth in the investments done in these markets.

The food prices have experienced important fluctuations the last decade. Especially the last months this topic is daily discussed in newspapers and the journals. Especially the period between 2006 and 2011 has been very interesting. This brought us on the discussion that there might be factors affecting the prices which are becoming more important, however are not taken in consideration. In a speech by Henk Bleker, minister for Agriculture and Foreign Trade at the seminar on food prices on 25 March 2011, he stated that discussions on what caused the food prices to rise are not so important but that we should start increasing the food production by new ways of producing and innovation. After this research I can state that he is right when saying that raising the production of food by looking to new and innovative ways of producing. Nevertheless it is very important of being aware what causes the prices to rise. Increasing production would be a solution if there was a mismatch between supply and demand. The fact that the prices are influenced by many different factors shows that it is important of being aware of the factors which can influence prices.

I found that factors are becoming more important due to the increased globalization. Factors are affecting each other. This is becoming particularly clear with the political unrest which started in the beginning of 2011. This has such an important impact on the prices of different commodities.

Now that I finalized this project I would like to thank in the first place my supervisor Dr. E.F.M. Wubben for his time, feedback, interest in the subject and thinking on improvements. Secondly I would like to thank my co-supervisor Dr. W. Schoenmakers as well for his time and interesting feedback. Next to both supervisor which who I had personal contact I would like to thank the experts in the field of the commodity market which provided me their interesting and important opinions and arguments on the influence of the different factors affecting the commodity prices. This are;
Prof. Francis Declerck, José Sette, Edwin Burgers and David Fousert.
By providing their opinions I could triangulate my findings and arguments. This has been important for my thesis.

Samuel Gans
June 2011

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Executive summary

This project is containing information on a very important and actual problem. The new and more important character of factors, which can influence the commodity prices and which can lead to price bubbles. This had lead to the following research question; *Are the common used predicting models still accurate enough, or are new factors playing an increasingly important role in the price setting of commodities which lead to a necessity to change the standard models?* The growing food prices are main reason why this topic is discussed extensively in the press lately. In this project a specific look is taken to four commodities (wheat, oil, gold and coffee) and with special attention to the United States. Reason for choosing four commodities and especially for these four, is due to the fact that with these four commodities most of the groups of commodities are captured (see chapter 2 for explanation) which will help to find out if factors are important in all groups of commodities or just in a specific group or commodity.

Discussion of these four markets showed in the first place that there has been an important change in the way how commodities are being traded. Less trade is conducted as physical trade, this trade moved to trade on exchanges and the OTC market. This made the market more open for new participants on the commodity market. These participants are not only acting on these markets to trade products they produced or which they need for consumption. These new reasons of acting on the commodity markets, has as effect that the trading is preceding in another way. This change shows that there is a need for a fresh look to the factors which are possibly affecting the prices of commodities.

Looking to the methods and models used for price prediction it is clear that for every situation there are different methods and even different models. It depends on the data availability but also on the time scale for which you want to make a prediction. It is important to be aware that different factors can become important. Next to these points it is important to be aware of the effect of a certain factor and if this factor is important to take in consideration in a forecasting model or that it is just important to be aware of the fact that those factors exist and can influence to a certain extent the prices.

Most important conclusion which I found during this project is that factors are affecting each other, something what has to be taken in account. When you are working in the field of commodities it is important to broaden your scope and take in consideration factors which you might not see as important directly.

That there are still many questions unanswered on the field of commodities and commodity trading is clear. The fact that the world is increasingly globalized is making this market more reactive and tangible for incentives from other markets. This will become more and more important the coming decades as some commodities will become scarcer. The power of the government and the panic reactions can become more important the coming year and are affecting each other (the domino effect).

Chapter 1 Introduction

This chapter presents the introduction of an MSc-thesis on the influences on the price of commodities. In this first chapter the project will be explained, the introduction is divided in two parts, the conceptual research design and the technical research design. The goal of the conceptual research design is to understand what objectives are tried to be achieved during the research process (Verschuren & Doorewaard, 2006). This part comprises of a problem analysis which will lead to a problem statement and an objective. The research framework will be used to clarify the set up of the research, and will lead to the research questions. In section two we find the technical research design which is defined as; to try to identify how these objectives are going to be realized (Verschuren & Doorewaard, 2006). This section comprises the research materials and the strategy which will be followed in order to be able to answer the research questions.

1. Conceptual research design

1.1 Problem analysis

Many of the products which are used as raw material are following a long trajectory before ending in the hands of consumers. Most of these products are commodities. These commodities are traded on the commodity market. In the search to all necessary information on commodities the following sub-paragraphs provide information about commodities, the market in which these commodities are traded, and the participants active on these markets.

1.1.2 Commodities

A commodity is a collective name for different types of products, traded on the commodity market. In the process of understanding the commodity market, first the term commodity is defined. According to the business dictionary (www.businessdictionary.com sept. 2010), commodities are defined as “reasonably homogenous goods or materials, bought and sold freely as an article of commerce. Commodities include agricultural products, fuels, metals, etc., and are traded in bulk on a commodity exchange or on spot market”. In the following chapter commodities will be discussed in detail. For the introduction we have enough information.

1.1.3 Commodity market

Commodities are traded on commodity markets. The commodity market started in the 19th century with agricultural products (Jacks 2005). The main reason for starting commodity markets was to render trade more smooth and predictable. It started with contracts about quantities of commodities, which would be traded. This market is separated in different parts.
Commodity trading is conducted on OTC markets (over-the-counter market) and exchanges, and consists of spot trading, physical forwards and derivatives. (Maslakovic 2008).
The definitions used for spot trading, physical forwards and derivatives are:

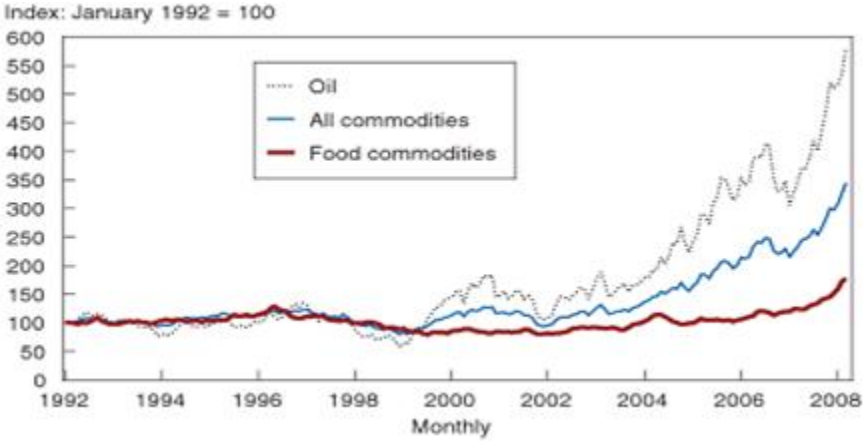
- Spot trading
- The physical market

- Derivatives

Commodity markets have seen an upturn in the volume of trading in recent years, far beyond physical commodity export growth. Again this will be discussed extensively in chapter 2 part 2.1.2.

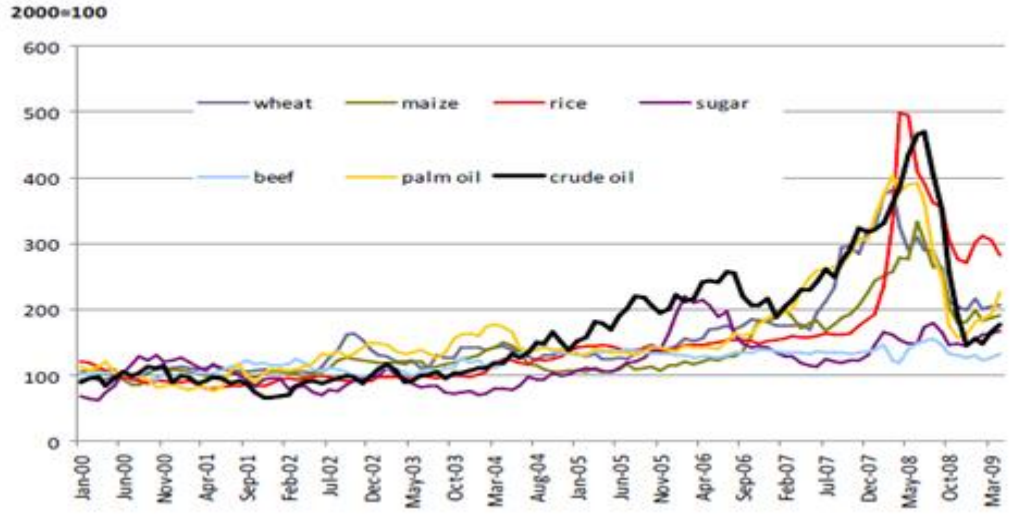
In recent years, there has been a sharp price spike on the commodity markets. Prices of many commodities such as oil, nickel, tin, corn and wheat have reached record highs in early 2008 (Maslakovic 2008, p7). The prices of commodities were on the rise for different reasons. This can be an increasing demand for certain commodities e.g. palm oil, which is used in many products. Another reason can be a decreasing supply e.g. the production of wheat and sugar due to extreme weather (Financieele Dagblad, 2010). In figure 1 the development of the prices of commodities are shown in a graph. There is a distinction made between oil, food commodities, and all commodities. The graph shows a clearly an upward trend. The steep price rise which is visualized in this graph is also called a price bubble.
The graph in figure 1 demonstrates a rising trend in the prices of commodities. This graph displays the price indices of oil, food commodities, and all commodities, for the period between 1992 and 2008. It is clear that the three groups show an increase during the period since 2000 up to 2008. The increasing demand for oil is mainly caused by the increase of transportation (IEA 2010) this is reflected in the increase in prices. Figure 2 is also providing information on price indices of commodities but more specified on individual commodities. The turnaround from growth to decline in the second half of 2008, which has been discussed above, is clearly confirmed by the graph.

Figure 1: Prices of commodities rose



Source: International Monetary Fund: International Financial Statistics

Figure 2: index of world commodity prices, January 2000 – April 2009



Source: Defra, based on UN indices

Commodity exporting countries have benefited from the rising price trend, via rapidly growing export revenues (http://stat.wto.org sept. 2010). Also investments in the commodities sector have accelerated. Commodities can be used to diversify a portfolio of financial assets as they react differently to changing economic conditions compared to equity and bonds, “returns on commodity futures are negatively correlated with those on equity” (Galvani 2010, p2). In the past commodities played a small role in institutional and private investors´ portfolios. In recent years however there have been increased investments in commodities. “According to the most widely-quoted industry source (Barclays) index fund investments increased from $90 billion at the beginning of 2006 to a peak of just under $200 billion at the end of 2007” (Sanders and Irwin 2010, p1) Factors that have contributed to these increased investments include: the significant rise in prices of commodities; their function as hedge against inflation; economic uncertainty in global markets; underinvestment in commodities production in the past two decades; rising demand particularly in emerging markets such as China and India; and diversification benefits. Investors can gain a share in commodities through: direct investments in physical commodities; direct investments in commodity-related companies (such as those in the area of exploration and production of commodities) and investment in commodity futures through exchange traded standardized contracts (Maslakovic 2008).

1.2 Problem statement

After having discussed shortly the commodities and their markets, in this part the problem will be discussed which is the reason this research will be done. Related to the growth of the commodity markets, also the number of stakeholders has increased. Stakeholders, who have an interest in these markets, can be the producers of the commodities, the commodity market participants, the customers, the regulators, and the governments (see table 5 in chapter 2). For these stakeholders it is important to have the right information and forecasts about prices, because the forecasts are used to guide decisions (Diebold & Mariano 1995). Another reason for having the accurate information and forecasts is the fact that price fluctuations cause insecurity, something which most stakeholders will try to avoid (Mankiw 2007).

Different organizations are predicting the prices of commodities. OECD (Organization for Economic Cooperation and Development) and FAPRI (Food and Agricultural Policy Research Institute) are two organizations which are predicting prices of commodities. Those organizations use different methods to forecast the prices of different products. However, most of the time the predictions are close to the real prices. Nevertheless, in the case of wheat OECD and FAPRI, and their methods, failed in predicting adequately the price rises of wheat in 2007 (Holst 2010).

There are many factors influencing the prices of commodities. The forecasts from FAPRI and OECD are made with the use of different models, based on extrapolation, as in autoregressive models, supplemented with factors which have an impact on the prices. The price influencing factors discussed by Holst (2010) are; the amount of production and consumption (supply and demand), the inventory, the price development of other commodities, macroeconomic trends, and technological progress. The more is known about factors which influence the prices of commodities the better and more accurate the predictions of prices can be made. Most of these influential fundamental factors have been topics of interest for publications, and are captured in models.

A problem can be that influencing factors are changing, or new factors are occurring. If these new or changed factors are not taken in account in the predicting models this will automatically lead to discrepancy between the predictions and the real prices. Robles, et al. (2009, p2) simply claim that "Changes in supply and demand fundamentals cannot fully explain the recent drastic increase in food prices" Alternatively, as stated by Holst (2010, p8) "It might be quite impossible to predict when exactly speculators will participate in the future markets and which consequences their activities will have on the market prices. Therefore only more or less predictable determinants can be taken in account." The message of Holst (2010) is that it is quite impossible to predict precisely the influence of speculators.

Reason for the resumption of the discussion about influencing factors, is the fact that there have been large increases in the prices of commodities and especially the food prices in 2007-2008. These quick and unexpected increases in prices are also known as price bubbles.
In order to define price bubbles we have to define the fundamental values, that is "the price which leads to a long term balance between production and consumption" (Steiglitz and O'Callaghan 1997, p2). After having defined the fundamental factors the Price bubbles are defined by as "a large or sustained discrepancy between the market price and this fundamental value" (Steiglitz and O'Callaghan 1997, p2). The large increase of the prices is not only devoted to influencing factors like the supply and demand and other known influencing factors. For this reason the participants are mentioned as possible influencer of the prices. A literature study will provide us other factors which are becoming increasingly important or which will play a major role in the longer term on the price setting of commodities.

Resuming this all; it is clear that prices of commodities are being influenced by several factors, especially the change in demand and supply. Most of these factors which influence the prices of commodities are known and have been taken into account when predicting prices and making forecasts. The fact that large forecasting organizations like FAPRI and OECD didn't predict the prices rises of wheat in 2007 shows that there is/are (an)other influencing factor(s) which is/are not yet taken into consideration. The possible influencing factors which are not known or not yet taken into

account in the predicting models, can lead to less accurate predictions. This is the main problem which will lead this research.

1.3 Research objective

Section 1.1.4 above introduced the problem of our research, thereby building towards the research objective, to be detailed in this section. A research objective need to be formulated in a adequate way according to (verschuren & doorewaard, 2000). By this they mean that the research objectives need to be useful, feasible, clear, and information rich. Following the research objective we will detail the research framework in section 1.4. Most of the known influencing factors are predictable and the impact is calculable. However are these factors used in the models still accurate and still everything including? For example the influence of the participants on the commodity prices is not clear. As stated in 1.2 different publications have raised this topic and used different methods to come to a conclusion. Especially the influence of the participants on the price bubbles is being discussed because the extreme increase of prices.

The phenomenon of price bubbles is an important subject, and is discussed extensively in the article of Sanders et al. (2009). This debate became more important in 2007-2008 due to an unprecedented rise and fall of commodity prices (Maslakovic 2008). This is becoming clear when seeing the number of publications listed in section 1.2.
After finding some evidence linking speculation and price behavior, Robles, et al. (2009, p7) arrive at the following conclusion: “The excess price surges caused by speculation and possible hoarding could have severe effects on confidence in global grain markets, thereby hampering the market’s performance in responding to fundamental changes in supply, demand and costs of production.”
An FAO news headline from 2009 reads, “Financial speculation in basic food commodities played a key role in the 2007-2008 food price crises which pushed millions of people deeper into hunger” (http://www.wfp.org oct. 2010).
These statements show the importance of knowing what has led to this price bubble. As stated earlier, most of the influencing factors are well known. So why were the two large price bubbles (1974 and 2007-2008) not predicted in advance? Are the predicting models still complete and holding all the necessary components? “New” influencing factors are not always accepted directly due to discussions on their effects. Main reason for the lack of clarity in the most actual discussion “the role of the commercials and non-commercials” is what Sanders et al. (2009) argue in his article, that those who argue that it is true that there is a speculative bubble in commodity future prices often use non-standard techniques or data. This is one of the arguments which are used by those who are against the idea of the existence of price bubbles and the influence of the commercials and non-commercials.

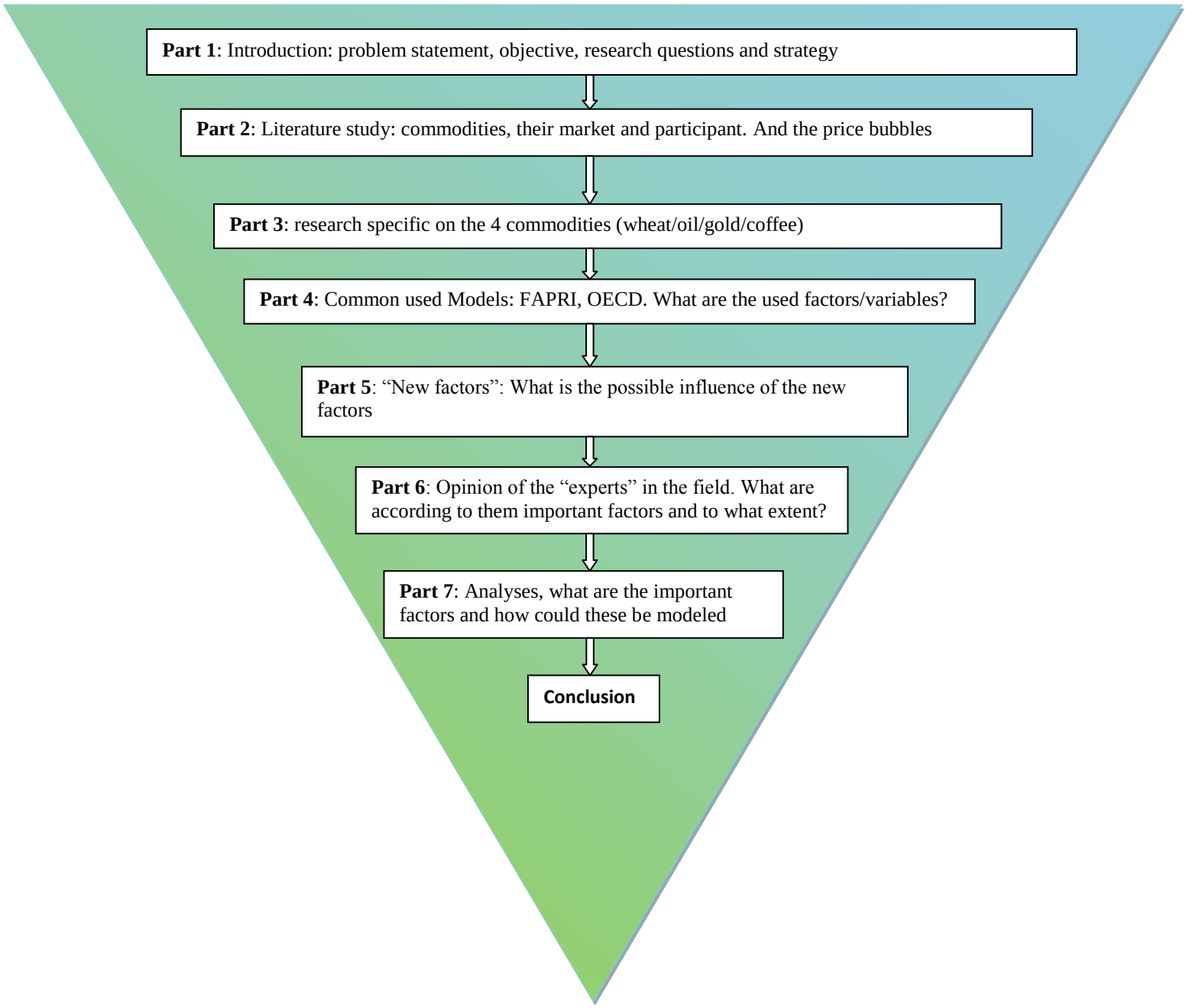
The objective of this research is, taking a closer look to the existing price predicting models used by the larger predicting organizations (for example FAPRI, OECD) and look which exogenous factors are captured in the model, and look if other factors should be considered. Factors which are not yet used or not yet known and which are influencing the prices.
This objective has as goal to supplement the price predicting models with “new” influencing factors, if necessary. This can show that the presently used predicting models are not accurate enough

anymore and in order to be able to predict and avoid price bubbles and make better predictions and forecasts of prices of commodities on the commodity market.

1.4 Research framework

The research framework is a clear systematic overview of what and how this research will be structured. Figure 3 shows a clear schematic overview of the research. The related sub questions will be discussed with the different parts. This must finally result in the conclusion by which the research question will be answered.

Figure 3: schematic overview of the structure of this research



Source: graph based on own information

The total research will be based on seven different parts, which are illustrated in figure 3. The different parts will be discussed to clarify the main goal of these parts and the way the parts will be conducted.

Part 1 The first part is the introduction of this research. In this part the reason for doing this research is explained; the problem statement. Sequel to the problem statement is the objective, which is formulated. The central question is based on the objective in order to achieve the right results. In this first part different sub questions will be formulated, which will support the central question.

Part 2 consists of a literature study. The first sub question is going to be discussed and answered in this part. This sub question will be introduced in section 1.5. The purpose of this literature study is to provide the necessary information about commodities, the commodity markets and the participants on these markets. Also the discussion on price bubbles and price fluctuations will be explained in detail. What are the different theories on these price bubbles? These price bubbles are the main cause of this research so important to discuss profoundly before continuing. What will be the effects of commodity prices rising and the price bubbles? In this part information will be provided which is necessary for answering sub question 1.

Part 3 In this chapter we will start to make the segmentation between four different types of commodities. These commodities are wheat, oil, gold, and coffee. Those commodities are selected for the reason they are all important commodities traded in large quantities (IFSL Research commodity trading, 2008). The IFSL has formulated five groups of commodities in which the commodities are divided in different industries: Grains, Meats, Industrial metals, precious metals, food & fiber and energy. The fact that the four chosen commodities are all different types and coming from different industries makes it possible to see if there are similarities on the influence of factors on the prices of different types of commodities.
In this chapter these four commodities will be introduced and their market will be extensively discussed. The data for the past 10 years will be considered to find the fluctuations seen in the demand and supply but also in the prices. After this research enough information is provided to understand the area of the commodity market and the situation on this market and of the four commodities. This third part is providing the last information necessary for answering the first sub question.

Part 4 This part will supply information on how prices are set, and how they are predicted. The market working theories will be discussed which is important for the setting of prices. Important is the fact that prices are determined for a large extent by the demand and supply. The fluctuations are merely noise.
For the four commodities the most common predicting model are discussed. How these models are set up and what the factors (variables) are which are taken in account as price influencing and as basis for the prediction of the prices. The influencing factors on the prices of commodities which are already known are discussed thoroughly. In this part the second sub question will be answered.

Part 5 the fifth part is the part in which new influencing factors are discussed which are not taken in account in the commonly used predicting models (discussed in part 3). This part will be structured similar to the previous parts. Taking in account the four commodities as a basis, and discussing

possible new influencing factors for each of the commodities. For each commodity “new” influencing factors will be discussed and explained. This is done with the help of a literature study, to explain what this factor consist of, and how it can affect the prices. For each of the new factors a small research will be done to find how accurate their influence on the price of a certain commodity can be predicted.
For example the effect of the commercials and non-commercials will be discussed partly by literature and partly in a meta-analysis. This meta-analysis is used to compare publications about the influence of the participant’s active on the commodity market, on the prices of commodities, and especially the influence on the emergence of price bubbles. The answer of sub question 3 will be based on information of this fifth part but as well on information from part 3.

Part 6 this part consist of interviews. In the precedent parts we have been looking to four commodities in the United States. The common used predicting models are discussed as well as possible new influencing factors which may be playing a role in the prediction of prices. To find out to which factor are important and affecting the prices, three groups of specialists are asked to give her/his opinion on the importance of the factor in predicting the prices. The opinion of the “experts” in the field will help us to triangulate the arguments. Part 6 will provide information for answering the fourth sub questions.

Part 7 In this seventh part an analysis will be made of all the information provided in the previous chapters. What are the important factors provided in literature and to what extent are these factors seen back in the period 2000-2010 in which the data are being controlled. Are the factors found similar to those provided by the experts. Finally when a clear overview is made of the factors which seems to be important when prices are predicted. In this analysis also the different methods and models will be taken again in consideration to see how the different factors could be added to the forecasting models. The last sub question will be answered at the end of this part. And also in the last part the conclusion.

Conclusion this will consist of a conclusion on the whole research. In this part the results from the different parts will be combined, to answer the main question of the research, this research question will be introduced in the following section.

1.5 Research issue

According to Verschuren & Doorewaard (2000) research questions have to meet two criteria. First research questions need to be formulated in an efficient ways (i.e. they need to contribute to the research objectives). Second, research questions need to have a clear direction (i.e. they need to make understandable what needs to be researched). To achieve the objective of this research the following research question is defined, which will lead to the conclusion.

Research Question:
Are the common used predicting models still accurate enough, or are new factors playing an increasingly important role in the price setting of commodities which lead to a necessity to change the standard models?

The goal of this central question is to see if the common used price predicting models, e.g. those used by OECD and FAPRI, are still accurate enough or that, due to new possible influencing factors the model is not up to date anymore. This is done by looking to four specific commodities, first the used price predicting models are discussed and especially the factors which are taken in account for the prediction of the prices.
After knowing which models are commonly used and which and how factors are used in the model, the research in order to answer the central question will focus on other influencing factors which are not used in the models or which are not known. These factors will be extensively discussed. In order to see which factors are of importance in the price setting of the commodities, we will demand "the experts" on this field what their opinion is on; the importance of the different influencing factors (commonly known and used and not known or used). This will result in new models, which we will test on the commodities to see if the models with new or extra factors are more accurate than the ones used presently. Hopefully models which are adapted with new/other influencing factors give more accurate price predictions.

The following sub questions are determined to support the central question. These sub questions belong to part two, three, four, five and six described in the research framework in section 1.4. The first three sub questions are based on for a large extends on a literature study in which the necessary information is gathered in order to continuo with the two last sub questions.

1 What are the characteristics of the commodity markets?
This question will be answered in the literature study in part 2. Main goal is to discuss and explain the commodity market, with as goal to know what this market consists of, the way of working of this market and to define which participants are active on the commodity market. After the more general part we will look more specifically to the four commodities. These will be extensively discussed. This is important because the following parts are using those four commodities as a basis. In this chapter the price bubbles will be discussed which are seen on the commodity market. The publications on price bubbles will be discussed, and especially the different views on this issue. The price bubble of 1974 will be compared with the price bubble of 2007-2008 trying to find similarities between both price bubbles. This will show the importance of knowing the influencing factors.

2 What do the commonly used price predicting models consist of?

This chapter will continue with the structure in which the differentiation between the four commodities is used. In this chapter the main goal is to discuss the most common used price predicting models. Important in this chapter is the question what these models consist of; which factors (variables) and techniques are used to predict the prices. Each of these factors will be explained to understand to what extent they are influencing the prices? We will discuss why the different factors are taken into account in the model, and if there have been changes in the history of these models. In this chapter the differences between the long term and short term for influencing factors will also be discussed.

3 What are new or not yet used price influencing factors, which are increasingly important?

In this chapter we will focus on factors which can affect price but which until now are not taken in account in the predicting models.

The factors will be explained based on the existing literature. Existing models of these factors will be used, which could be added to the existing predicting models. For the four commodities different influencing factors will be used and discussed. Influences of commercials and non-commercials are one which is affecting the four commodities and will be used for the four commodities. Other possible influencing factors which can affect commodity prices will be found within the existing literature.

For each of these factors there will be a research done, based on literature and other research methods like a meta-analysis, to find to what extent these factors are possibly influencing the prices. This chapter will be important for the final conclusion because new factors are being discussed.

After the three first sub questions a conclusion will be made on all information found. We will provide an overview of the four commodities; which model is used to calculate the prices presently and what are these models consisting of. For each commodity we will provide new influencing factors which are possibly affecting the prices. The different factors which will be analyzed in chapter three are part of the methodology of this research.

4 What are the most important factors influencing the prices according to "the professionals?

In this chapter the opinion of three groups of "professionals" will be discussed. An interview will be done with a producer of a commodity, importer of the commodity and trader of the commodity. They are asked what in their opinion important factors are which affect the prices of a commodity. This interview will be divided in three parts.

- First part; the existing and used models are discussed and the used influencing factors are given a weight and are ranked.
- Second; the new possible influencing factors, discussed in chapter 3 are given a weight
- Third; the interviewed has the possibility to add factors which affect the prices in their point of view.

5 Is one of the new factors important to take in consideration in the forecasting models and for which reason and time scale?

With the information from the interviews and influencing factors, we can an advice on which factors are becoming more important for the predicting models. This conclusion will be based on the information found in literature, data and the opinion of the experts.

In the seventh part, as described in section 1.4, the information from the five sub questions will be combined to come up to a conclusion. By looking to the results which are finally achieved in chapter five, we can answer the central research question.

In this research there are some concepts which will be used and which are important. To clarify those concepts the following key-concepts definitions are used in the research.

- **Commodity market**: Open and organized marketplace where ownership titles to standardized quantities or volumes of certain commodities (at a specified price and to be delivered on a specified date) are traded by its members. (http://www.businessdictionary.com oct. 2010)

- **Commodities**: A commodity is an article of trade or commerce, especially agricultural or mining products. Commodities are often used as input for the production of other products or services. The quality of a given commodity is essentially uniform across producers. The price of a commodity is to a large extent set by the supply and demand of the commodity.

- **Commodity traders**: The term participants will be used as overarching term for all the participating groups on the commodity market in this research. Nevertheless, based on information from the Commodity Futures Trading Commission (CFTC) the four groups of traders are defined as follow. Dealer/intermediary, Asset manager/institutional, leveraged funds and other reportable (http://www.cftc.gov 2010,).

- **Speculators**: Future market participant who attempts to gain from anticipated change in prices of commodities or financial instruments. Speculators aim primarily at quick profit from a short-term acquisition of assets (http://www.businessdictionary.com).

- **Hedge**: an investment made in order to reduce risk of adverse price movements in a security, by taking an offsetting position in a related security, such as an option or a short sale. (http://www.businessdictionary.com)

- **Meta-analysis**: Meta-analysis can be understood as a form of survey research in which research reports, rather than people are surveyed. (Lipsey and Wilson 2001, p1)

- **Price bubble**: In order to define price bubbles we have to define the fundamental values, this is “the price which leads to a long term balance between production and consumption” (Steiglitz and O’Callaghan 1997, p2). After having defined the fundamental factors the Price bubbles are defined by as “a large or sustained discrepancy between the market price and this fundamental value” (Steiglitz and O’Callaghan 1997, p2).

Summarizing the first part of this research proposal “the conceptual research design” we can see that the issue of the price bubbles and price fluctuations is important. A Price bubble is something which is known already for a longer time (price bubble 1974). There have been publications which focused on this subject. However different conclusions are being made on what is causing these price bubbles on the commodity market. This is the problem with these price bubbles; it is not clear what the exact cause is. Fact is that these price bubbles can cause major damage and critical situation in the world, especially the increasing food prices. The question is; if the existing models are still including everything necessary to predict the prices as accurate as possible. The main objective is to correct the price predicting models with “new” influencing factors if necessary. In section 1.4 a schematic overview is given on the set up of this research. The first six parts are all aiming to find enough information and evidence to answer the central research question in the seventh part, the conclusion.

2 Technical Research Design

The technical research design is build up by a description of the research material, the research strategy and the research planning.

2.1 Research strategy

This research will be composed of seven parts. The basis will be formed by a literature study. In the second part all the necessary information about commodities will be discussed. This literature study must provide the essential information, to understand the commodities and their market. In the next chapter and the third part of this research the four commodities will be discussed profoundly. The four commodities, which will be investigated, are wheat, oil, coffee and gold. This third part consists as well of a literature study. As can be seen in the research framework (paragraph 1.4), sub questions one and two will be answered in these two parts. Those questions are necessary to be discussed before continuing with the following parts, which are consisting of the methodological part. To understand the problem of price bubbles and the influencing factors which affect the prices, it is important to have enough knowledge from this commodity market.

The following parts of this research will use different research methods with as goal to gather enough data and information to answer the main question.

The fourth part is focusing on the different methods which are known to predict prices and the different models which are mostly used. A closer look will be taken to the models which are commonly used for the prediction of the four commodities. A discussion on these models will help to understand the models and especially the exogenous factors which are taken in consideration. In the fifth part the focus will lay on new or not yet used price affecting factors. In this part we will search for new factors and discuss them extensively. These factors are found in the large amount of literature on these commodities. For each of the four commodities new affecting factors are discussed. This will be based on a literature study to explain what the effects could be. Also other research methods are used in order to find if a factor is possibly affecting the prices and why. The factors will be combined with information from previous chapters on the production and

import/export data. The discussion on the influences of commercials and non-commercials on the commodity market is important and will have an important place in this part. This will be handled with the use of a meta-analysis. The different publications on the influence of participants on the prices of commodities will be compared. Motivation for using this method is the fact that there still is discussion about the possible influence of participants on the commodity prices and on the price bubbles. There are different views on this question. The fact that the publications done until now did not use standard techniques and data is the main cause for this discussion. By comparing some of the publications done, the results can be compared, with the aim of finding similarities in the results. Important for the meta-analysis is that the eligibility criteria for the meta-analysis is taken in consideration. These are criteria which have to be known from the different publications in order to compare them. This meta-analysis will provide an overview of the different opinions and arguments, and is used to find evidence between the different publications and their conclusions, and especially between the different data and techniques which are used.

The sixth part, in which sub question four is going to be discussed, will be based on interviews. This chapter is aiming to find evidence for the findings done in previous parts and be able to triangulate the arguments. The interviews with “experts” on the market of the commodities are done to see what their opinion is on the factors which could influence the prices. They are asked to give a certain weight to the different factors which will be used to see which factors are more important and which should be taken in account in the predicting models. The experts who will be asked on their opinion are experts in different fields of the commodity market.

In the seventh part all the information is used to analyse the markets of the four commodities. Main goal is to compare the factors found in literature with the data from the second and third part to find if there are factors missing in the predicting models, and if the factors proposed already had a certain effect. Also the information from the experts in the field will be used to look which factors are important; this will be used to triangulate the data. In this part it will become clear which factors are interesting to think of and in what for time scale their influence can be important. A short discussion will follow on what type of method or model would fit to calculate the effects of the factors.

Finally the results of the literature study, the new influencing factors and new predicting models will be discussed in the last part “the conclusion”. Are the presently used models still accurate enough, or has there been changes in the market which lead to an accuracy in the models? Are there new factors which play a role on the market of the commodities, which will affect the prices? This chapter will answer the main research question which is discussed in part 1.5 of the research proposal.

Chapter 2 The Commodities

In this second chapter the first part of sub question one will be discussed and answered. The question was; what are the characteristics of the commodity markets? The commodities in general, the commodity market and the participants will be discussed in order to understand how this market is functioning. After having explaining the commodities and their market, the existence of price bubbles will be subject of discussion on the commodity market.

In the research a differentiation between four commodities will be used. The four commodities where justified in chapter 1 in of this research, those commodities are; wheat, gold, oil, and coffee. The discussion on the four commodities separately will be done in chapter 3. In this chapter we will focus on the commodities in general and their market with participants. However more arguments to explain the choice of those four commodities will be provided in part 2.1.1

2.1 Commodities

A commodity is a collective name for different types of products, traded on the commodity market. In the process of understanding the commodity market, first the term commodity is defined. According to the business dictionary (http://www.businessdictionary.com Oct. 2010), commodities are defined as "reasonably homogenous goods or materials, bought and sold freely as an article of commerce. Commodities include agricultural products, fuels, metals, etc., and are traded in bulk on a commodity exchange or on spot market". Other dictionaries give similar definitions: "an article of trade or commerce that can be transported, especially an agricultural or mining product" (www.investorwords.com). In the article of Mowshowitz (1992, p.5) commodities are discussed: "When looking at these definitions some features seem to be important, product must be transportable, tradable and agricultural or mining products. The term commodity is often used by business people to refer to relatively high volume products, as distinguished from specialized or one-of-a-kind articles". Two important features make a product into a product of trade; being able to, (1) appropriate the product and (2) value the product. Because of these features, not all products can be seen as a commodity. Well known commodities (which consist of the features) are Wheat, nickel, gold, iron, soybeans, oil, cacao, silver, cotton and corn.

As a conclusion, the definition for a commodity which will be used in this research is a combination of different definitions*: A commodity is an article of trade or commerce, especially agricultural or mining products. Commodities are typically used as input for the production of other products or services. The quality of a given commodity is essentially uniform across deals. The price of a commodity is to a large extent set by the supply and demand of the commodity.*

2.1.1 The different types of commodities

From the introduction to this project it became clear that commodities can be separated in six different groups. The six main groups are (1) grains, (2) meats, (3) industrial metals, (4) precious metals, (5) Food& Fiber and (6) energy (Maslakovic 2008), in table 1 these different groups are listed with some of the main commodities which are counted in these groups. This distinction is made in order to categorize the different types of commodities. The number of different types of

commodities have increased over the years (Bodie & Rosansky 1980), this are more exotic products, gas. However next to these also currencies are traded on the commodity market, just as power derivatives and environmental emission trading. In section 2.1.2 the quantities which are traded per commodity will be discussed to demonstrate the growth trends which are seen in most of the commodities.

Table 1: Different types of commodities and specious (Maslokovic)

Grains	Meats	Industrial metals	Precious metals	Food & Fiber	Energy
Corn	Cattle	Aluminium	Gold	Cocoa	Crude oil
Soybeans	Hogs	Copper	Platinum	Coffee	Heating oil
Wheat		Lead	Silver	Cotton	Natural gas
Oats		Nickel		Lumber	Unleaded gas
Soy meal		Palladium		Orange Juice	
Soybean oil		Zinc		Rubber	
Rice				Sugar	

Source: Maslakovic 2008

Table 2: Different types of commodities and the specious (WTO)

Agricultural products	Fuels and mining products	Manufactures
	Fuels	Iron and steel
	Total	Chemicals
		Office and telecom equipment
		Automotive products
		Textiles
		Clothing

Source: data subtracted from the website of the WTO (2010) (Dec. 2010)

Most of the larger organizations which are focusing on trading in the world like the World Trade Organization (WTO) or the Food and Agriculture Organization of the United Nations (FAO) make use of a less detailed classification between the types of commodities they use a subdivision consisting of (1) agriculture products, (2) fuels and mining products, and (3) manufactures (WTO 2010). In table 2 the classification of the WTO is shown. What can be seen is that under the three groups they placed different types of commodities. Fuels and mining is divided in total and in fuels, manufactures is divided in; iron and steel, chemicals, office and telecom equipment, automotive products, textiles and clothing. Because their focus is less detailed the different groups are not divided in different products. For this reason the group of agricultural products is not subdivided further in detail.

When comparing both tables and subdivisions it becomes clear that the subdivision of maslokovic is one which is more focused on details compared to the one used by WTO. Reason for this less detailed subdivision of the WTO can be their interest in the different commodities which are reflected in the subdivision. If their interest is on a certain subject it is not necessary to detail all the commodity types which are of less interest for you. The agricultural products are not detailed just like the fuels and mining in the WTO subdivision. However Maslokovic is going much more in to depth on those two types of commodities.

Using subdivisions like the two presented in table 1 and 2 for the commodities makes it well-organized and makes it possible to oversee the trends in commodity trading in a particular type of

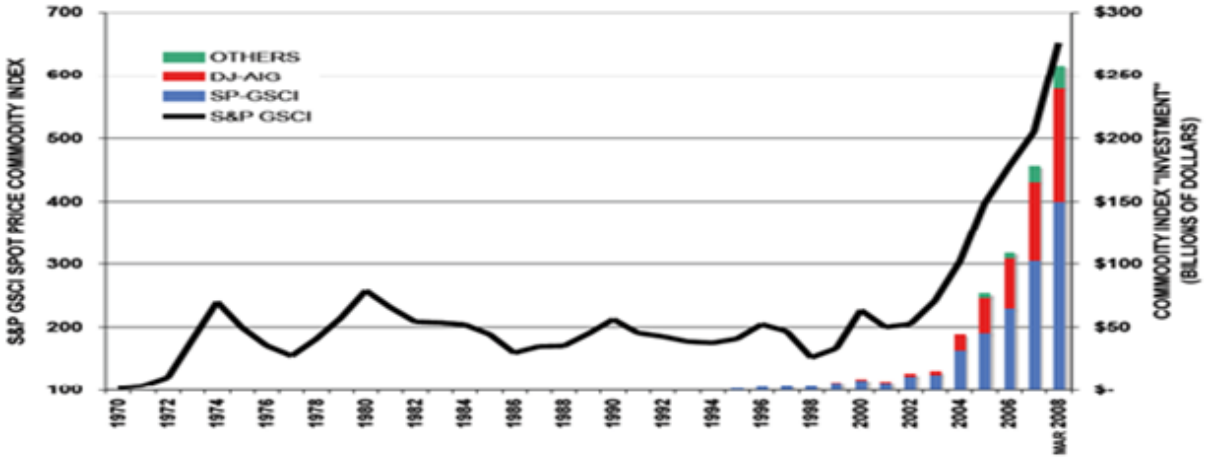
commodities by generalizing to a few groups. This will help to make conclusions on the effect of an occurrence to a certain group of commodities. In this research we use four commodities which have been explained in previous parts. Next to the reason of product availability and the importance of the four commodities for human being it can be seen that we include commodities from almost all the different groups presented in table 1 and table 2. Wheat and Coffee is subtracted from the groups Grains and Food & Fiber in the Maslakovic 2008 subdivision and from the group Agricultural products in the WTO subdivision. Oil can be found back under energy in the Maslakovic 2008 division and under Fuels and mining products in the WTO table. In table 1 of Maslakovic 2008 gold is found in the group of Precious metals, and in the WTO table in the group of manufactures**.** Using these four commodities is providing information on a broad range of the different commodities and the different groups of commodities.

Next to the reason of taking in account most of the different groups used in the subdivision of Maslakovic 2008 and the WTO there is another important reason why wheat, gold, oil and coffee have been chosen in this project. Wheat is one of the most important commodities when looking to the diet of people all over the world. The prices of food are increasing lately and this growing trend begins to become problematic for many people. Oil is an important commodity as it is used as a raw material in a large scale of products, which means that increasing oil prices will affect the prices of the products in which oil is used. Oil is not only affecting prices because it is a raw material, it is leading to higher transportation costs. Gold is interesting as it is a commodity which becomes more interesting when a country has an increased level of financial insecurity. A weak Dollar will have as effect that people are investing in gold instead of keeping the dollars. Finally coffee, this commodity is less interesting as the quantities are less important; however it is the main product of export and affecting the GDP of many developing countries. Reason for choosing four different commodities is to see if there are possible relations detectable between the four commodities, knowing how and if commodities affect each other can be very important for forecasting prices.

2.1.2 **Trend of the commodity prices**

As stated above, the number of commodities and their prices has been increasing over the years. To see this clearly figure 5 is giving a clear overview. In this graph the commodity index investment with S&P GSCI (Goldman Sachs Commodity Index) spot price commodity index during the period between 1970 up to 2008 are compared. It is clear that the prices of the commodities have been following an increasing trend in this period. Especially in the period 2002 up to the peak in 2008 all the major commodities price indices experienced an enormous increase, which resulted in an increase of the commodity market (number of contracts and the total volume) as well. Table 3 is showing the data for the last seven years, it is interesting to see that both food and mineral prices have continued their sharp increase. The prices of many commodities collapsed after their peaks in 2008. This increase was also seen in the prices of oil. The price of oil was mainly driven up by a decrease in the supply. The trends will be discussed more in detail later on in chapter 3 when the four commodities are discussed.

Figure 5 commodity index investments compared to S&P GSCI spot price commodity index



Source: Goldman Sachs, Bloomberg, CFTC commitments of traders CIT supplement

Table 3: Indices of selected primary commodity prices, 2003-2009 (2000 = 100)

Commodity	2003	2004	2005	2006	2007	2008	2009
All commodities	105.1	126.1	140.8	183.6	207.2	256.6	
Crude petroleum	102.4	133.8	189.1	227.8	252.1	343.8	170
Food and tropical beverages	103.1	116.7	127.0	149.6	162.5	228.1	
Wheat	126.8	114.9	109.2	128.5	225.9	288.0	180
Maize	118.9	124.9	109.9	136.8	189.0	253.2	170
Rice	97.9	120.6	141.2	149.0	163.1	343.6	220
Sugar	86.7	87.6	120.9	180.6	123.3	156.5	145
Coffee	80.6	92.3	131.8	144.8	166.3	192.3	160
Cocoa	197.7	174.5	173.3	179.4	219.9	287.1	240
Palm oil	142.9	151.9	136.1	154.2	251.5	305.8	160
Agricultural raw materials	112.4	123.5	132.3	152.2	169.4	202.2	
Cotton	107.1	103.6	91.5	97.0	106.8	120.8	95
Tropical logs	114.3	136.3	136.7	130.2	155.7	216.8	190
Rubber	162.0	194.9	224.4	315.2	342.3	391.3	175
Minerals, ores and metals	97.6	137.3	173.2	277.7	313.2	332.4	
Aluminium	92.4	110.8	122.5	165.9	170.3	166.1	90
Copper	96.6	152.8	198.4	361.2	392.6	383.6	180
Gold	130.3	146.6	159.4	216.6	249.7	312.4	300

Source: UNCTAD 2008: Estimates for 2008 and forecasts for 2009 based on UNCTAD database.

2.1.3 The commodities markets

Commodities are traded on commodity markets. The commodity market started in the 19th century with agricultural products (Jacks 2005). The main reason for starting commodity markets was to render trade more smooth and predictable. It started with contracts about quantities of commodities, which would be traded. This market is separated in different parts.

Commodity trading is conducted on OTC markets (over-the-counter market) and exchanges, and consists of spot trading, physical forwards and derivatives (Maslakovic 2008).

The definitions used for spot trading, physical forwards and derivatives are:

- Spot trading is “cash sale for immediate delivery” (http://www.businessdictionary.com Oct. 2010).

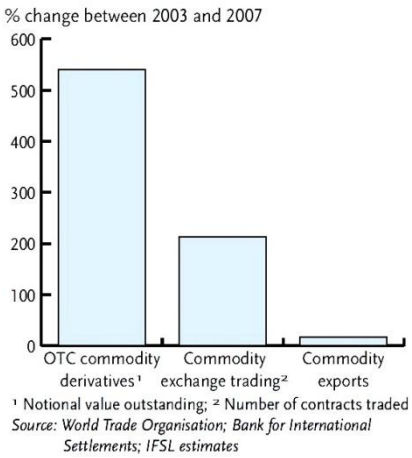
In addition, a spot commodity is; “commodity bought or sold in a spot market, with the expectations that will be actually delivered on the contracted date” (www.investorwords.com Oct.2010).

- The physical market is another word for spot market and is “a market in which commodities such as grain, gold and crude oil are bought and sold for cash and delivered immediately” (www.investorwords.com). A physical commodity is “the actual commodity that is delivered to the contract buyer at the completion of a commodity contract in the spot market or futures market” (www.investorwords.com Oct.2010). Physical forwards consist of direct trade in which products are physically traded on an in advance specified date.
- Derivatives are “financial instruments whose characteristics and values depends upon the characteristics and value of an underlier, typically a commodity, bond, equity or currency. Examples of derivatives include futures and options” (www.investorwords.com Oct.2010).

The differences between long and short positions in forward markets and derivatives are as follows:

- The long position holder is the buyer of the contract and the short position holder is the seller of the contract.
- The long position will take the delivery of the asset and pay the seller of the asset the contract value, while the seller is obligated to deliver the asset versus the cash value of the contract at the origination date of this transaction.
- When it comes to default, both parties are at risk because typically no cash is exchanged at the beginning of the transaction. However, some transactions do require that one or both sides put up some form of collateral to protect them from the defaulted party. (www.investipedia.com)

Figure 6: Commodities trading

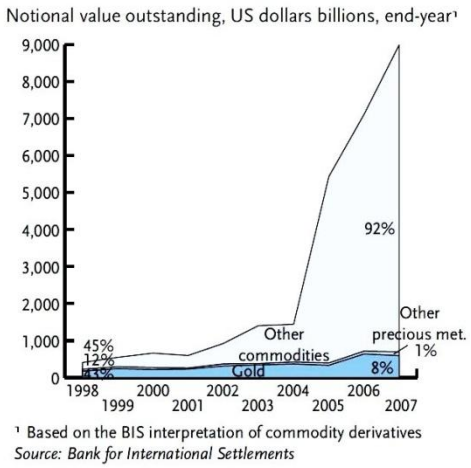


Commodity markets have seen an upturn in the volume of trading in recent years, far beyond physical commodity export growth. The following numbers and graph will give an impression of the growth of these two markets (OTC market and exchanges). In the five years up to 2007, the value of global physical exports of commodities increased by 17% while the notional value outstanding of commodity OTC derivatives increased more than 500% and commodity derivative trading on exchanges more than 200% (Figure 6).

The notional value outstanding of banks’ OTC commodities’ derivatives contracts (based on the BIS interpretation of commodity derivatives) increased 27% in 2007 to $9.0 trillion (figure 7). Commodities’ share of the overall notional value outstanding of OTC derivatives grew from 0.5% to 1.5% during the past decade. OTC trading accounts for the majority of trading in gold and silver (Maslakovic, 2008). In the second half of 2008 the growth turnt into a decline which last up to the first half of 2009. In december of 2009 the OTC market is recovering very modestly with an increase again of 2%.

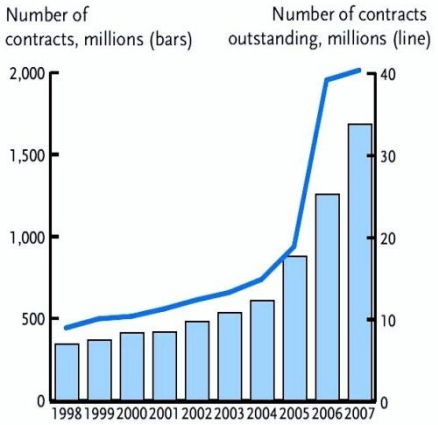
Global physical and derivative trading of commodities on exchanges increased more than a third in 2007 to reach 1,684 million contracts, as shown in figure 8 (Maslakovic, 2008).

Figure 7: OTC Derivatives trading of com 1



¹ Based on the BIS interpretation of commodity derivatives
Source: Bank for International Settlements

Figure 8: Exchange-traded commodity trading



Source: Bank for International Settlements

Table 4 provides an overview of the two different markets, and the different types of trading.

Table 4: different commodity markets

	OTC Trading	**Exchange trading**
Physical trading	Accounts for most OTC trading. Participants include farmers, refiners, and wholesalers. Trading is done on the spot and forward market and is delivery based.	Physical trading of commodities accounts for a small proportion of the total trading of commodities on exchanges. It is typically used to balance out an excess of demand or supply on the physical market.
Derivatives trading	Precious metals and more recently energy contracts are often traded through OTC derivatives markets	Derivatives trading accounts for most of trading on exchanges. Traders include hedgers, speculators and arbitragers.

(Source: Maslakovic 2008, 2)

Table 4 specifies four acknowledged parts of the commodities markets.

First physical trading of OTC transactions takes place directly between principals and therefore has a high degree of flexibility in their transactions. These principals are essentially wholesale markets in which individually-tailored contracts are traded. A very large proportion of OTC commodities' trading is taking place between producers, refiners ("a person, device, or substance that removes impurities, sediment, or other unwanted matter from something" (freedictionairy.com)) and wholesalers of commodities on the spot market. Trading is delivery based and typically done through brokers and other intermediaries. For most commodities that are physically traded there is no central meeting place where the commodities are physically traded, and where it does exists it typically handles only a small part of the trade (Maslakovic 2008; Dodd 2002). Commodities which are most common on this market are metals, energy, grains, soy, livestock, food and fibre and increasingly exotic commodities.

Second, OTC derivatives' trading has gained in importance in recent years. In some products such as gold and silver and more recently energy products, derivatives' trading on the OTC markets has

expanded much faster than trading on exchanges. Until around the turn of the century, the vast majority of OTC derivatives trading are in interest rate contracts and foreign exchange contracts (Dodd 2002). After 2000 “the large increase in trading over the last years was due to a rise in trading in non-precious metals, and in oil and natural gas as energy prices rose” (Maslakovic 2008, p3). This market consists mostly of gold, silver, and energy products.

Third, exchange trading on the physical market, is providing a central regulated market in which large numbers of buyers and sellers can come together to deal in a competitive, transparent and open environment. “Commodity exchanges have gradually developed from physical markets where deals were made out of warehouses to futures markets which allow for both hedging to protect again losses in a declining market and speculations for gains in a rising market” (Maslakovic 2008, p4). Commodities which are traded on the exchanges are mostly soft commodities. Soft commodities are defined as commodities that are grown, rather than mined, e.g. coffee, cocoa, sugar and fruit (www.investopedia.com).

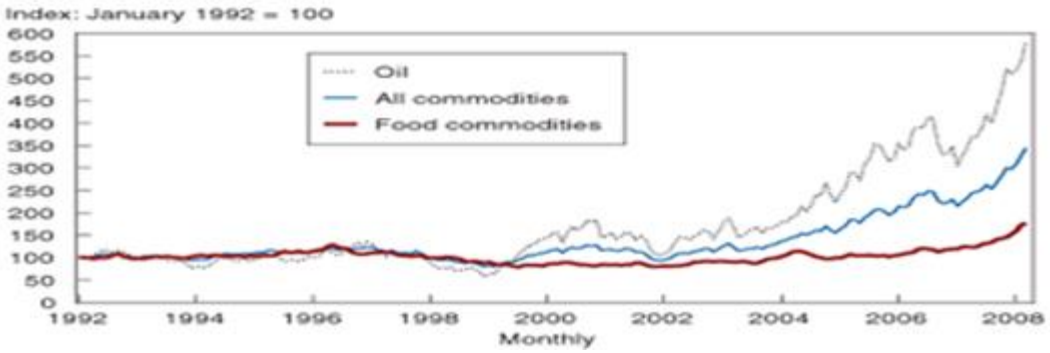
Fourth, the derivatives markets for futures were developed initially to help agricultural producers and consumers manage their price risks. “Derivatives exchanges are more standardized in terms of contract sizes, maturity dates and margin requirements than OCT markets and tend to dominate trading of “soft commodities”. The vast majority of trading on commodity exchanges is in derivatives” (Maslakovic 2008, p3). On this market we see also more trading of energy and non-precious metals.

In recent years, there has been a sharp price spike on the commodity markets in general, which continued up to 2008. Prices of many commodities such as oil, nickel, tin, corn and wheat have reached record highs in early 2008 (Maslakovic 2008, p7). The prices of commodities were on the rise for different reasons. This can be an increasing demand for certain commodities e.g. palm oil, which is used in many products. Another reason can be a decreasing supply e.g. the production of wheat and sugar due to extreme weather (Financieele Dagblad, 2010). In figure 9 the development of the prices of commodities are shown in a graph. There is a distinction made between oil, food commodities, and all commodities. The graph shows a clearly an upward trend. The steep price rise which is visualized in this graph is also called a price bubble. However, there is a clear difference in the increasing line of the three groups of commodities. The oil price is increasing much more severe than the price of food, which shows the smallest increase over the years. This is strange because prices of oil are affecting to a large extent the prices of food, which will be extensively discussed in chapter 3. What could be the reason for this much smaller increase of the food prices in relation to the increase of the oil prices in the same periods? As we discussed in part 2.1.1 that less detailed subdivisions could help us to generalize the trends for a certain group can also be dangerous and giving a wrong view on the actual situation. Keeping this in mind we will have a look at figure 10 which demonstrate (more detailed) a rising trend in the prices of commodities. This graph displays the price indices of oil, food commodities, and all commodities, for the period between 1992 and 2008. It is clear that the three groups show an increase during the period since 2000 up to 2008. The increasing demand for oil is mainly caused by the increase of transportation (IEA 2010) this is reflected in the increase in prices. This more detailed figure shows clearly that only beef and sugar have known a less important increase during this period. The other commodities have a similar growing trend as the oil prices. The effect of generalizing all food commodities is made clear with this graph. It shows the danger which can occur when not being careful with the data. The commodities

which showed not this spectacular growth are pulling the growth number of the whole group of food commodities down.

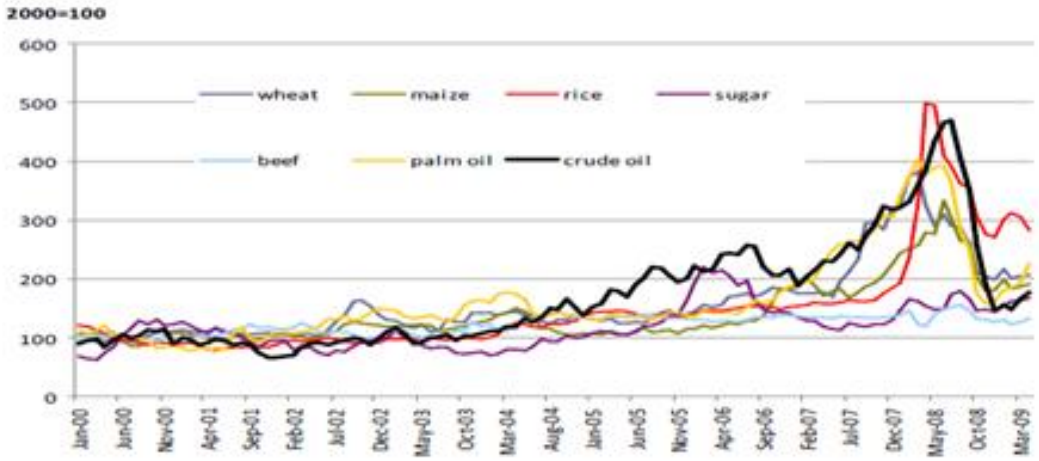
Figure 10 is also providing information on price indices of commodities but more specified on individual commodities. The turnaround from growth to decline in the second half of 2008, which has been discussed above, is clearly confirmed by the graph.

Figure 9: growth trends of different groups of commodities



Source: International Monetary Fund: International Financial Statistics

Figure 10: index of some commodity prices, January 2000 – April 2009



Source: Based on UN indices

Commodity exporting countries have benefited from the rising price trend, via rapidly growing export revenues (http://stat.wto.org Nov. 2010). Also investments in the commodities sector have accelerated. Commodities can be used to diversify a portfolio of financial assets as they react differently to changing economic conditions compared to equity and bonds, “returns on commodity futures are negatively correlated with those on equity” (Galvani 2010, p2). In the past commodities played a small role in institutional and private investors´ portfolios. In recent years however there have been increased investments in commodities. “According to the most widely-quoted industry source (Barclays) index fund investments increased from $90 billion at the beginning of 2006 to a peak of just under $200 billion at the end of 2007” (Sanders and Irwin 2010, p1) Factors that have contributed to these increased investments include: the significant rise in prices of commodities; their function as hedge against inflation; economic uncertainty in global markets; underinvestment in commodities production in the past two decades; rising demand particularly in emerging markets

such as China and India; and diversification benefits. Investors can gain a share in commodities through: direct investments in physical commodities; direct investments in commodity-related companies (such as those in the area of exploration and production of commodities) and investment in commodity futures through exchange traded standardized contracts (Maslakovic 2008). This means that the participants on the commodity markets have changed, the purpose of those acting on these markets is not the same as before these increases in investments on this market. This chapter will be continued with a discussion on the participators on the commodity market.

2.1.4 The participants on the commodity markets

On the question which participants are active on the commodity market, literature provides divergent information about categories of participants. Table 5 lists the participants mentioned in literature.

Table 5: the different participants on the commodity market

Source	Participants				
IFSL Research 2008 Maslakovic	Producers, refiners and wholesalers of commodities on the spot market	Traders include hedgers, speculators and arbitragers.	Institutional and private investors´ portfolios.		
Sanders et al. 2009	Large traders Commercial (hedgers)	Large traders Non commercials (speculators)			
Galvani and Plourde 2010	Investors that have an interest in hedging against energy commodities' price fluctuations by means of buy-and-hold portfolios.				
Sanders et al. 2009	Index investors are purely involved in a financial transaction using the futures markets, and they do not engaged in the purchase or hoarding of the cash commodity.				
CFTC http://www.cftc.gov 2010	Dealer/Intermediary	Asset Manager/ Institutional	Leveraged Funds	Other Reportables	
FAO http:www.fao.org 2010	Hedgers	Speculators	Investors	Locals	Index providers
Chang et al. 1997	Uses the same description of the participants as CFTC				
Okuno et Al. 1980	Large traders which influence the prices	Small traders which are price takers			

Source: various sources

Because most of the literature is using definitions and descriptions of the Commodity Futures Trading Commission (CFTC) for their classification, the CFTC-descriptions of the commodity market participants will be used in this research. That is, a distinction is made between dealers/intermediary, asset manager/institutional, leveraged funds and other reportables. Another reason for using this subheading of the CFTC is the fact that a traders classification may change over time. The description from CFTC is the most recent one (July 22, 2010). The term participants will be used in this research as the overarching term encapsulating all the participants active at the commodity markets. Based on

information from the Commodity Futures Trading Commission (CFTC) the participants can be separated into four groups, which are defined as follows:

-Dealer/intermediary: “These participants are described as the “sell side” of the market. Though they may not predominately sell futures, they do design and sell various financial assets to clients. They tend to have matched books or offset their risk across markets and clients. Futures contracts are part of the pricing and balancing of risk associated with the products they sell and their activities. These include large banks (U.S. and non-U.S.) and dealers in securities, swaps and other derivatives” (http://www.cftc.gov 2010, p2).

The other side of the market, the “buyer side” may be divided in the following three groups:

-Asset manager/institutional: “These are institutional investors, including pension funds, endowments, insurance companies, mutual funds and those portfolio/investment managers whose clients are predominantly institutional” (http://www.cftc.gov 2010 p2). This can be seen as the investors, the participants which are focusing on investments.

-Leveraged funds: “These are typically hedge funds and various types of money managers, including registered commodity trading advisors (CTAs); registered commodity pool operators (CPOs) or unregistered funds identified by CFTC. The strategies may involve taking outright positions or arbitrage within and across markets. The traders may be engaged in managing and conducting proprietary futures trading and trading on behalf of speculative clients” (http://www.cftc.gov 2010, p2). These participants are acting on the commodity market with the as goal, speculating. They will be called “speculators” in this research, but a less negative term is “arbitrager”.

-Other reportables: Reportable traders that are not placed into one of the first two categories from the “buyer side” are placed into the **“**other reportables” category. The traders in this category are mostly using markets to hedge business risk, whether that risk is related to foreign exchange, equities or interest rates. This category includes corporate treasuries, central banks, smaller banks, mortgage originators, credit unions and any other reportable traders not assigned to the other two categories (http://www.cftc.gov 2010, p2). This group can be seen as the participants who are focusing on hedging

So far we saw that the commodity market consists of two different markets on which participants are active, the OTC markets and the exchanges. Those participants are divided in four groups using the subheading used by the CFTC. As discussed in 2.1.4 the commodity market is growing rapidly, at least, till 2008, this growth has been followed by a sharp decrease and a new period of growth afterward. The numbers of commodities which are traded is increasing (Bodie & Rosansky 1980), but also the number of participants which are active on the commodity market, which is seen in the increasing number of investors on the commodity market (Domanski & Heath 2007). Reason that the participants acting on the commodity market are subdivided in different groups is because of their different reason of acting on the commodity market. These different reasons can basically be described as hedging, speculating and investing. However in most discussion on the possible influencers on the price bubbles, the distinction between commercial and non commercials are used. Sanders et al. (2009) determines the commercials as hedgers and the non-commercials as the speculators.

2.2 Price Bubble

As section 2.1 indicated an enormous increase of commodity prices from 2002 up to 2008 which was followed by a collapse of the prices. This part will discuss the concept of price bubbles. Price bubbles are one of the items which are extensively discussed in publications on commodities. A definition for price bubbles which is often used is; "a speculative bubble exists when the price of something does not equal its market fundamentals for some period of time for reasons other than random shocks. (Fundamental is usually argued to be a long-run equilibrium consistent with a general equilibrium)" (Rosser 2000, p. 107).

According to Siegel (2003) a speculative bubble is usually caused by exaggerated expectations of future growth, price appreciation, or other events that could cause an increase in asset values. This will lead to a situation in which trading volumes are becoming higher, and as more investors rally around the heightened expectation, buyers outnumber sellers. This will push prices beyond what an objective analysis of intrinsic value would suggest. The bubble is not completed until prices fall back down to normalized levels; this usually involves a period of steep decline in price during which most investors panic and sell out of their investments. Finally stable price levels are realized.

Interesting of these price bubbles is the fact that there are some essential questions which have not been answered in a convincing way; how can we identify a price bubble? And if we are able to identify price bubbles and measure it, how can we react?

Reason that it is important to know how these price bubbles are working, is the fact that it can cause much insecurity and disruption in an economy. The main problem caused by price bubbles is the fact that it can lead to an increase of food prices and lead to more poverty and hunger. Next to these main problems there is a problem when they burst. Than the bubble can impose losses on investors holding the bubble assets and potentially on the financial institutions that have extended credit to them. When this occurs in an asset in which many investors are participating this can lead to a financial stress which can affect the economy.

There have been many publications which discussed the causes of a price bubble. Especially the influence of commercials and non-commercials have been subject of interest for many publications. Some of the most recent authors which publicized on this subject are; Irwin and Sanders (2010), Irwin, Sanders and Merrin (2008), Irwin (2008), Gilbert (2010), Robles, Torero and von Braun (2009), Zawojoska (2010), Masters (2008), Wahl (2008), Krugman (2008), and Stoll and Whaley (2009). In chapter 5 we will discuss what the role of commercials and non-commercials is on price bubbles. Different publications present different views on the question if their influence is possibly leading to price fluctuations and price bubbles in a worse case.

As explained the cause of the price bubbles are not clear presently. This means that making good forecasts is difficult. These forecasts are used by different people. Organizations, governments, investors etc. are using the forecasts for making their plans.

2.3 **Conclusion**

Concluding the first part of this chapter, and answering the first part of sub question one; the commodity, the commodity market and the participants acting on this market have been discussed. This general information is necessary for the rest of this research. To get a clear overview the following important points have been discussed until now. Commodities are products which are articles of trade or commerce. Commodities are typically used as input for the production of other products or services. The quality of a given commodity is essentially uniform across deals. The price of a commodity is to a large extent set by the supply and demand of the commodity. Commodities are subdivided in groups to create a clear overview. Commodity trading is conducted on OTC markets and exchanges, and can consist of spot trading, physical forwards and derivatives. These markets have grown over the last years, in the five years up to 2007, the value of global physical exports of commodities increased by 17% while the notional value outstanding of commodity OTC derivatives increased more than 500% and commodity derivative trading on exchanges more than 200%. In the second half of 2008 the markets collapsed and start recovering at the end of 2009. During the last years an growth of the prices of most of the commodities have been seen. Especially oil and most of the food commodities have experienced this growth. Nevertheless the second half of 2008 was the beginning of a sharp downturn of the prices. This can be seen as a so called price bubble. The answer on the question, what can be the cause of this last price bubble is not yet answered with an unambiguous answer. Nevertheless all the publications which have been done on this subject, in chapter 5 this discussion will be continued. Next to the growth of the prices, there has been a growth of the numbers of commodities traded and of the participant's active on the commodity markets. These participants are not only acting on behalf of need of the commodities but also on order to hedge and speculate.

- Commodities are products which are articles of trade or commerce
- Commodities trading is conducted on OTC markets and exchanges
- Trade on the OTC market and exchanges increased last 10 years.
- Number of participants increased
- Participants are acting with different purposes on the market than 10 years ago, hedging and speculation has become an important reason of acting on the commodity market.
- The prices of commodities have seen large growth up to 2008 and at the end of 2008 a sharp downturn. This is called a price bubble.
- The actual reason for these price bubbles is not clear yet. However it is leading to a higher degree of insecurity as the forecasts have difficulties in predicting the prices during a price bubble.

From all this information we conclude that commodities are affecting many people and many people are involved with it. The forecasts are important for an increasing amount of people, organizations and governments because their decisions are based on forecasts. As the price bubbles are difficult to predict and the prices during these periods as well it is interesting to continue looking to possible causes of price changes. The possibility that forecasting models are not complete anymore makes it interesting to find more information on this subject.

The following chapter will focus on the four commodities which are used in the rest of the chapters. To get a clear view of those four commodities, these will be used in following chapters when looking to possible new influencing factors. These commodities have been selected for different reasons;

- Data availability.
- Their importance for many people in different ways.
- Their effect on other commodities.
- With these four commodities almost all the different groups of commodities are captured in this research.

Chapter 3 The four commodities

This chapter is following up chapter 2. In the previous chapter we discussed the question what commodities are and what types of commodities are known. The markets on which commodities are traded and the participant's active on these markets have been described. As explained earlier in this research the basis for the following chapters are the four commodities which are being chosen to discuss. This chapter will contain the discussion of the four commodities. For the four commodities a similar structure is used to enlighten the commodity, starting with an introduction with general information (what it is, where and how it is produced and in which quantities). In this research the focus will be on the United States. The reason for taking the United States as the main country of interest is due to data availability. Next to the argument of data availability we also have the fact that the United States is an important producer, consumer, or exporter of the four commodities. In this general part it will be clarified if it is a commodity which is exported or which has to be imported because the commodity is not produced in the United States. This general part is followed by first a part paying attention to the situation worldwide, which will be continued by a more specific discussion on the situation in the United States, in which not only the data will be subject of interest but also the market of the commodity and the participants on this market. Question will be answered as, on what type of market is the commodity traded and who are the participants trading on this market?

3.1 Wheat

3.1.1 General information

"It is believed that wheat developed from a type of wild grass native to the arid lands of Asia Minor. Cultivation of wheat is thought to have originated in the Euphrates Valley as early as 10,000 B.C., making it one of the world's oldest cereal crops" (www.indiancommodity.com Dec. 2010).

"All wheat grows best on loamy soils that are medium in texture, fairly high in organic matter and fertile. Wheat is not well adapted to acidic soils; most favorable pH range is from 7.0-8.5. Wheat cannot germinate in dry soil. Any condition that reduces root growth of weak seedlings. Moisture stress reduces tillers per plant and thus reduces yield. This means that wheat does not produce well in warm, humid areas. It requires moderately cool conditions for germination followed by cooler period for tiller formation grain matures best under warm, dry condition that are also ideal for harvesting the crop" (http://hubpages.com/hub/wheat-production Dec. 2010).

The farming process starts before the seed even goes into the ground. This is where the first decisions need to be made. Most wheat farms use nitrogen fertilizer. This is a major input cost of farming and can account for up to 45% of variable wheat farming costs. Spring wheat tends to accumulate more weed growth and requires more fertilizer. Wheat is a very flexible crop when compared to the other grains. For that reason, it's grown in a wide variety of conditions. Fertilizer costs are extremely depending on the soil nutrition and weather of the farmland that hosts the crop. The prices are calculated and based on the costs which have been made during the production. This means that increased costs will affect the prices of the wheat (Miller 2007).

The seeds are planted in the fall for winter wheat and in the spring for spring wheat. The seed input costs vary on which strand of wheat you plant and whether or not genetically modified seeds are used. On average, seed costs account for about 20% of variable costs. Once spring hits, both winter and spring wheat grow rather rapidly. During this process wheat requires a fair amount of water, especially as harvest nears. Very few farms report using irrigation, with the overwhelming majority who do so found in the Pacific growing regions. Irrigation does increase yields, but it is an expensive process. Once the wheat is ready for harvest, it is collected with a combine and the grain is removed from the stock with threshing equipment. Machinery (repairs included) and fuel costs make up approximately 15% of the total variable costs associated with farming wheat (Miller 2007).

Fertilizer, seed, fuel and machinery account for approximately 80% of the costs of farming wheat. These costs differ, sometimes dramatically, on a year to year basis. The higher the price of wheat is, the more the value of increasing yields becomes. This has as effect that when the yield is increasing farmers will be willing to spent more to increase the production. This will result in a higher demand for and higher prices of input costs. (McElroy et al. 1994; Miller 2007)

3.1.2 **Situation worldwide**

Wheat is the dominant grain of world commerce. It is easily transported and stored and it is used to produce a large variety of food. Wheat is an important part of the daily diet of many millions of people. Approximately two-thirds of the wheat produced in the world is used for human food and about one-sixth is used for livestock feed. Industrial uses, seed requirements, and post-harvest losses account for the remaining withdrawals from the world wheat granaries (www.indiancommodity.com Dec. 2010).

Since 1990 the total quantity of wheat grown in the world is approximately 21.757.118 million bushels per year (this is 21.757.118 * 0.027216 ≈ 590 million metric tons). Most of this grain is consumed in the region that grows it, but roughly 4.089.076 million bushels (110 million metric tons) are traded internationally (USDA 2010). In table 6 the exact numbers are shown for the wheat production. In this table the quantity produced and the quantities traded are shown. These numbers are for the total wheat production worldwide and for the United States specific. The largest producing countries are; China, India, United States, and Russia.

With 150.5 million metric tons of wheat produced in 2009, China alone will account for 17% of the world's wheat production. The rest of the global leaders in wheat production and their percent of global market share in respective order are (percent of global production): India (11%), U.S. (10%), and Russia (9%). Altogether they produce 47% of the world's wheat. The European Union as a group is also a large producer of wheat with 113 MMT, or 17% of global production France is a major producer of wheat in Europe (http://futurewheat.com Dec. 2010).

When considering the data on export of wheat we see that China is not one of the largest players. Reason for this fact is the enormous population living in China and the policy of China to be self sustaining, this means that the wheat is mostly produced for the own population. The five major exporting regions include the USA as the largest exporter, and the European Union (EU), Canada, Australia as the second, third, and fourth largest exporters depending on the year considered. Large importers include Japan, Indonesia, North Africa, Philippines, Mexico and Korea.

In general wheat demand tends to be inelastic across importers, but individual traders face greater demand elasticity in a particular market because of the competition that they face from other traders in that market.

Table 6: World and US, wheat production, exports

Year	world producion	US production	US share %	World exports	US exports	US share %
1990	21.634.733	2.729.778	12.62%	3.815.577	1.069.452	28.03%
1991	19.970.574	1.980.139	9.92%	4.039.897	1.282.305	31.74%
1992	20.673.261	2.466.798	11.93%	4.043.241	1.353.580	33.48%
1993	20.520.260	2.396.440	11.68%	3.810.947	1.227.761	32.22%
1994	19.218.100	2.320.981	12.08%	3.608.784	1.188.277	32.93%
1995	19.750.332	2.182.708	11.05%	3.644.792	1.241.143	34.05%
1996	21.365.365	2.277.388	10.66%	3.928.013	1.001.522	25.50%
1997	22.420.351	2.481.466	11.07%	3.836.521	1.040.391	27.12%
1998	21.694.368	2.547.321	11.74%	3.722.028	1.045.743	28.10%
1999	21.561.283	2.295.560	10.65%	4.169.235	1.086.499	26.06%
2000	21.425.258	2.228.160	10.40%	3.730.479	1.062.041	28.47%
2001	21.438.706	1.947.453	9.08%	3.891.710	962.311	24.73%
2002	20.887.991	1.605.878	7.69%	3.882.818	850.211	21.90%
2003	20.386.109	2.344.415	11.50%	3.995.254	1.158.324	28.99%
2004	23.027.026	2.156.790	9.37%	4.108.902	1.065.911	25.94%
2005	22.752.587	2.103.325	9.24%	4.298.463	1.002.781	23.33%
2006	21.903.109	1.808.416	8.26%	4.108.865	908.476	22.11%
2007	22.457.205	2.051.088	9.13%	4.309.376	1.262.612	29.30%
2008	25.105.765	2.499.164	9.95%	5.278.601	1.015.415	19.24%
2009	25.084.894	2.218.061	8.84%	4.972.343	881.017	17.72%
2010	23.622.201	2.208.391	9.35%	4.674.755	1.250.000	26.74%
Avarage	21.757.118	2.230.939		4.089.076	1.093.132	

Source: numbers are based on data of the USDA. Numbers are in million bushels. (Wheat = bushels x 0.027216= tons)

3.1.3 **Situation US**

The United States is in the top five of large producer of wheat, however as we saw in table 6, for export it is a key player. In the United States there are five different types of wheat grown for food consumption. The differentiation is made between winter and summer wheat according to the time of the year the seed is planted. The five types of wheat known in the United States according Mash (2005) are;

- HRW hard red winter wheat
- HRS hard red summer wheat
- SRW soft red winter wheat
- SWW soft white winter wheat
- DUR durum

These different types of wheat are used for the different times the seed is planted but also the location where the wheat is planted. Most HRW is grown in the central and southern Great Plains, HRS in the northern Great Plains, SRW east of the Mississippi River, SWW in the Pacific Northwest and DUR durum in North Dakota and Montana. Historically, wheat for food in the USA has been used predominately as input into flour production. The hard wheat classes have higher protein content desirable for baking. The higher protein content in HRS and HRW wheat is suited for the production of bread and rolls. Durum is used in the production of semolina flour and a variety of pasta products. The soft wheat classes have lower protein content. Soft red winter wheat is used in flat breads, cakes, crackers and pastries. Soft white wheat is processed into crackers, cookies, pastries, muffins and flour for cakes. HRW has the widest range of protein content and is often mixed with HRS and SRW (Mash 2005).

There are different qualifications used for the different types of wheat. These qualifications are focusing on the different types and their quality. The prices are based on these qualifications. Different institutions are dealing with these qualifications, the best known is the FAO, but also an organization as The U.S. Wheat Associates has all necessary information on the qualifications of the different types of wheat, the demand and supply, and the prices.

Some statistics on US wheat market;

- Wheat is the principal cereal grain grown in the United States, ranking fourth in volume of crop production worldwide and first in export of the crop.
- 36 percent of the in the United States produced wheat is consumed by consumers in the US, 50 percent of the produced wheat is exported to the rest of the world. Ten percent is used for the livestock and the remaining four percent is saved for the seed.
- 60-63 million of acres of wheat is harvested each year

These numbers and facts are based on the Western Organization of resource council from 2002

In table 7 the quantities produced and used of wheat in the United States are shown. From this table it can be seen that the planted acreage are decreasing for most of the different types of wheat but that the quantities produced are increasing. This is due to fertilizers which are used and also the use of GMO (Genetic Modified Organism) techniques. The use of GMO's has lead to types of wheat which consist of all the preferred characteristics which lead to an increasing yield.

Table 7: Wheat: planted acreage, harvested acreage, production, and yield

year	planted acreage (1000 acres)	Harvested acreage (1000 acres)	production (1000 bushels)	Yield (bushel per acre)
1991/92	1.671	395	9.734	24.6
1992/93	1.542	391	11.440	29.4
1993/94	1.493	381	10.340	27.1
1994/95	1.613	407	11.341	27.9
1995/96	1.602	385	10.064	26.1
1996/97	1.457	345	8.936	25.9
1997/98	1.400	316	8.132	25.7
1998/99	1.566	418	12.161	29.1
1999/00	1.329	383	11.038	28.8

2000/01	1.328	296	8.386	28.3
2001/02	1.328	250	6.896	27.6
2002/03	1.355	263	6.488	24.7
2003/04	1.348	319	8.634	27.1
2004/05	1.380	300	8.255	27.5
2005/06	1.433	279	7.537	27.0
2006/07	1.396	274	7.193	26.3
2007/08	1.334	252	6.311	25.0
2008/09	1.260	269	7.979	29.7
2009/10	1.241	252	6.993	28.0
2010/11	1.211	265	7.431	28.0

Source: numbers are based on data of the USDA. Numbers are in million bushels.

When looking to table 7 the production of wheat in the United States is stable since 1990 in relation to the total production in the rest of the world. The production in the United States is around 10% of the total world production.

3.1.4 **The market where wheat is traded**

Wheat is traded on the commodity market in the United States. Around 50 percent of the produced wheat in the United States is exported to the rest of the world. Even if the United States aren't the largest producers of wheat, worldwide their export number is many times elevated than the numbers of the other exporting countries. The United States are responsible for approximately 30 percent of the total world export (which can be seen in table 6), Canada which is second in this list has a share of the total wheat export of around 16 percent. Egypt is at the moment the largest importer of wheat. In this part also the different cost posts have been subject of interest. This can be important for this project, when we will start looking to the possible influencing factors on the prices of wheat. Important will be how the prices are set and how the product is produced to see what possible points are which can affect prices.

Investing in wheat futures allows traders to participate in the agricultural markets without holding a physical market position. Investing in wheat futures also provides growers with a risk management tool to protect the price of their expected purchase or sale of physical grain. As already discussed in the previous part on wheat, it is produced in different countries all over the world and also imported by countries all over the world. This makes wheat a truly global market and allows traders to enter into a global environment to create a broad trading strategy using wheat alone or in combination with other grains.

In the United States the different types of wheat which are produced are also produced in different parts of the country, due to preferable climatic situations. Hard red winter wheat is grown in the Plains from Texas to South Dakota. Hard red winter wheat futures are traded at the Kansas City Board of Trade (KCBT). Soft red winter wheat is grown primarily in the eastern Corn Belt from Missouri to Michigan. Soft red winter wheat futures and options are traded at the Chicago Board of Trade (CBOT). Hard red spring wheat is grown primarily in the Dakotas and Minnesota, with North Dakota the largest producing state. Hard red spring wheat futures are traded at the Minneapolis Grain Exchange (MGEX). All three of these classes of wheat futures are now traded electronically on the CME Groups Globex trading platform.

The main wheat futures contract at all three exchanges where wheat is traded is for 5000 bushels of the specified wheat although CME Groups Chicago Board of Trade also trades a mini wheat futures contract of 1000 bushels. Wheat contracts are traded on July, September, December, March, and May calendar months.

Like most crops, wheat tends to follow a seasonal price pattern based on the weather. If the winter wheat crop has broken dormancy in good shape and spring rains are sufficient, wheat prices may decline seasonally going into the harvest period as the market assumes an injection of new, larger wheat supplies. After harvesting reveals the size of the crop, wheat prices tend to move up seasonally from June/July through the end of the year. This seasonal price pattern is also the basis for a typical wheat/corn spread that is, buy wheat in June/July when prices presumably are at their lowest level of the season and sell corn, which often rallies to a seasonal high in mid-summer based on weather fears. (www.usda.mannlib.cornell.edu Nov. 2010)

As a crop grown in many areas of the world, wheat has a fairly stable price history and more trend-based moves compared to other commodity sectors. However, traders and investors in the wheat market must understand how intermarket influences affect the market on a continuous basis. U.S. wheat has to compete with crops such as corn, milo/sorghum, oats, soybeans and sunflowers, depending on the area of the country, so production incentives in the U.S. can influence wheat production. As a result, wheat prices tend to trade in concert with prices for other crops, sometimes as a leader but more often as a follower. So traders need to be aware of intermarket pricing of several different commodities. (www.tradertech.com Nov.2010)

3.1.5 **Participants on the wheat market**

Traders in the KCBT wheat pit typically represent interests that handle and process wheat - producers, exporters, millers and bakers - and whose inventories are subject to price change. They use futures contracts to minimize the risk of price change, a procedure called "hedging."

Speculators also are represented in the KCBT wheat pit. They perform the crucial role in any futures market of assuming risk from hedgers. These investors neither own nor plan to own commodities, but hope to profit from price changes in the futures contracts they buy and sell.

The futures price is simply what a buyer is willing to pay and a seller is willing to accept for a product. Traders shout bids and offers until they agree on the price. This method of trading, called "open outcry," is different from stock trading because transactions can occur only in the open forum of the trading pits. The KCBT itself does not set prices. The exchange is merely the place where buyers and sellers of hard red winter wheat meet to conduct business. Bids and offers are based on the traders' assessments of supply and demand factors as well as technical indications of price relationships. Wheat futures can be used for a variety of price protection and investment strategies. These are based on information of www.tradertech.com (Nov. 2010) and include:

- Ensuring a selling price for wheat that has not been harvested or for wheat inventories.
- Locking in a purchase price for wheat that will be needed in the future.
- Profiting from a discrepancy in the usual price relationships between hard red winter wheat and another commodity, between two delivery months of the hard red winter wheat futures contract, or between hard red and another type of wheat.

- Participating in economic trends such as an improvement in commodity prices versus stock prices.
- Protecting uncovered KCBT wheat options positions.
- The purpose of a hedge is to ensure price protection against adverse market moves. While a hedge limits the potential for loss, it also limits the potential for further profit.
- A hedge involves taking a futures position opposite, but equal in size to, a cash position. The price movement of one position tends to offset the other because futures and cash prices tend to move in the same direction. This means that a loss in value of the cash position will be offset by a gain in the futures position.
- Hedging merely reduces the risk of price fluctuations that can affect the value of a commodity.

3.1.6 **Conclusion**

Concluding this discussion on the wheat market, we see in the world situation first of all that wheat is an important commodity because it is part of the daily diet of millions of people and used as feed for livestock. It is produced in large quantities in different countries. 590 million metric tons is the total quantity which is approximately produced every year since 1990. China is by the largest producer of wheat with a share of 17 percent of world total wheat production. Nevertheless China is using most of the produced wheat for use own consumption in China. This is the reason why we saw in the discussion specifically on the United States the United States is responsible for 10 percent of the world wheat production, nevertheless is the largest exporter of wheat with a share of around 30 percent of the world export. Interesting is the fact that 50 percent of the wheat which is produced in the United States is exported; this makes it again interesting to look to the United States because a large part of the production will be traded. In a country as China much of the wheat which is produced is consumed directly which makes it difficult to find clear and reliable data. Important point is the fact that the market of wheat has been stable in the last decade, the production and the export numbers did not change much. What is seen in the data of the United States is the fact that the yield per acre has increased. Reason is the use of better technology which makes it possible to use seed which possess of preferred characteristics. In the United States there is a distinction between four different types of wheat which are grown in different areas (due to climatic conditions) and which has different purposes.

Also discussed in this part is the fact that wheat can be affected by other commodities. This will also be an important point for the rest of the research. There are publications which discuss the effects of the use of biofuels on the prices of commodities. This will be point of interest in chapter 5. The wheat in the Unites States is traded on different markets. This is depending on the type of wheat which is traded. As we have seen, four different types of wheat are produced in the United States.

3.2 Gold

3.2.1 General information

Gold is a precious metal which is also classed as a commodity and a monetary asset. It has acted as a multifaceted metal down through the centuries, possessing similar characteristics to money in that it acts as a store of wealth, medium of exchange and a unit of value (Solt and Swanson 1981). Gold has also played an important role as a precious metal with significant portfolio diversification properties (Ciner 2001). This is seen in a for example during a moment of crisis, people invest in gold due to the low fluctuations which are seen in the gold prices.

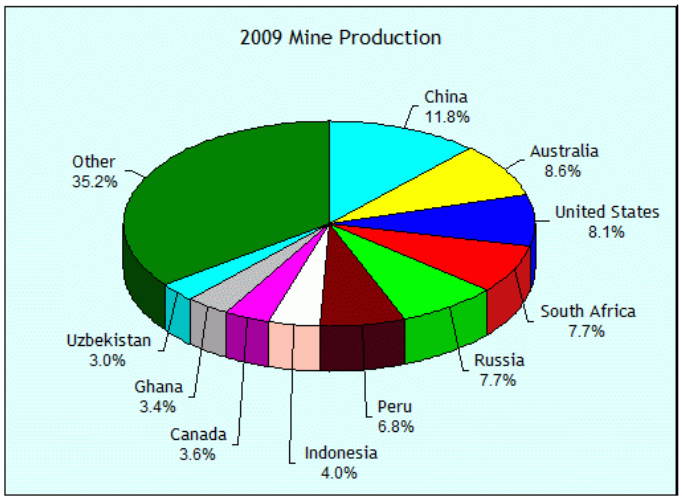
Gold is used in industrial components, jewelry, as an investment asset and reserve asset. Gold is a unique asset due to the fact that much of the gold ever mined still exists today. Approximately 2500 tons of gold is mined per annum. Aboveground stocks account for 135,000 tones. Governments and investors account for approximately 60,000 tones, jewelry accounts for 63,000 tones and 15,000 tones is held in other forms such as electronics, industry, and medicines. The part which is used by investors and government is partly in hands of central banks and international financial institutions, which maintain 32,000 tons of gold in their reserve. Gold is held in central banks reserves for a number of reasons: diversification, economic security gold maintains its purchasing power, physical security gold is a liquid asset, confidence cushion in a crisis, maintains value, income gold leasing, insurance against market crises. (http://news.goldseek.com Nov. 2010)

3.2.2 Situation worldwide

Gold is won by mining. This happens especially under the ground. Figure 11 shows that the most important producer of gold at the moment is China; The Chinese gold production rose from 285 to 313,98 tons of gold from 2008 to 2009. With this amount China is the largest producing country for the third following year. The gold production increased with 62 percent in China since 2001, while the world production decreased in this period with 9.6 percent. The production of China started to play an important role in the total world supply since 1995.

China is followed by Australia on the second place with an annual production of 227 tons. The third place is hold by the United States with a production of 216 tons in 2009. Interesting is the enormous decrease South Africa have seen since the 1970'ies in which they were responsible for 67.7 percent of the world production of gold. Most of the countries have experienced a decline in the annual production of gold. Reasons for this decreasing trend are the following points; first, the mines face more difficulties in finding the gold. The gold which was easy reachable has been used and now they will have to dig deeper into the ground to find and reach the gold. This means that it will be more expensive and that the mining process becomes more dangerous. Second is the fact that developing countries have become greener. This means that there is more awareness for the environment. Mining organizations are facing pressure from the environmental activism of organizations as Greenpeace. Third point is that in some countries which are political very unstable the mining companies face corruption from the government. The countries in which this is not an issue and in which dangerous working conditions for the miners are not an issue can continue producing gold, for example China.

Figure 11: Mine production for 2009



1. China: 313.98 mt
2. Australia: 227.00 mt
3. United States: 216.00 mt
4. South Africa: 204.92 mt
5. Russia: 205.00 mt
6. Peru: 180mt (estimate)
7. Indonesia: 90.00 mt
8. Canada: 95.00 mt (estimate)
9. Ghana 90.20 mt
10. Uzbekistan 80mt (estimate)

Other: 854mt
TOTAL: 2572mt

Source: (http://www.goldsheetlinks.com)

3.2.3 **Situation US**

When looking specifically to the United States, since 1970 until the 1995 an increasing trend was seen, with a peak around 1995, the total share of the United States in relation to the world production was 14.1 percent. From this period until now there have been a declining trend and the share of the United States in relation to the total world production declined to 8.1 percent in 2009. This decline is not only a decline of the share of the total world production in percentages, also the real production numbers declined, which means that less gold have been mined during these years. Reason for this declining numbers is the same as the main causes mentioned in the part of world situation. Also in the Unites States more difficulties to reach the gold is making it more difficult and dangerous to mine. The work situation of the miners is taken in account which means that fewer risks will be taken than in e.g. China.

In the United States, Nevada is the top gold producing state, followed by Alaska and California. According to the National Mining Association, mined gold supply is decreased by the growing global gold demand. Global gold demand exceeds global gold supply by approximately 60 percent annually, creating an ongoing structural shortage situation (http://www.goldsheetlinks.com Dec. 2010).

3.2.4 **The market where gold is traded**

Since the beginning of time, gold has had a special place in history. It has been used to build religious idols, settle political differences, honor monarchs, and demonstrates affection, serves as currency and, more recently, has been used for commercial processes. Until 1971, gold backed the U.S. dollar and is still held by central banks around the world for use in times of emergency. During the gold standard the price of an ounce of gold had been fixed at $35 per ounce. The gold standard was a period in which gold was used as a standard; the gold standard is defined as a commitment by participating countries to fix their prices of their domestic currencies in terms of a specified amount of gold (www.economics.about.com Dec. 2010). Following the removal of the gold standard for currencies, gold prices skyrocketed 2,200% in U.S. dollar terms over the next nine years, peaking briefly above $800 in 1980. It then spent the next 19 years dropping as low as $260 in 1999 before starting its next long-term rally. “But thanks to an easing of currency restrictions following the last

recession, the Fed (Federal Reserve, the central bank of the United States) is facing increasing challenges. The effective Fed funds rate was above 6% in early January 2001 but by early 2004, the rate had fallen more than 80% to 1% and the Fed did not start increasing the rate again until June 2004, more than a year after the rally had begun. The Fed has taken a much more accommodative stance on rates, which continued through 2007, and a weak dollar and rocketing commodity prices during this year are the evidence of this: Gold again surpassed $800 in 2007". (Blackman 2008, p.1)

The current gold market price is a clear reflection of the value of gold for risk protection of other financial assets. Gold prices are affected by supply and demand, as with any other type of commodity, but the demand for gold increases in a difficult market as investors hurry to buy up as much gold as they can use it as a hedge against a financial disruption.

Table 8: Gold price 1950 to 2009

2009	$972.35	1989	$401.00	1969	$41.00
2008	$871.96	1988	$410.15	1968	$43.50
2007	$695.39	1987	$486.50	1967	$35.50
2006	$603.46	1986	$390.90	1966	$35.40
2005	$444.74	1985	$327.00	1965	$35.50
2004	$409.72	1984	$309.00	1964	$35.35
2003	$363.38	1983	$380.00	1963	$35.25
2002	$309.73	1982	$447.00	1962	$35.35
2001	$271.04	1981	$400.00	1961	$35.50
2000	$279.11	1980	$594.90	1960	$36.50
1999	$290.25	1979	$459.00	1959	$45.25
1998	$288.70	1978	$208.10	1958	$35.25
1997	$287.05	1977	$161.10	1957	$35.25
1996	$369.00	1976	$133.77	1956	$35.20
1995	$387.00	1975	$139.29	1955	$35.15
1994	$383.25	1974	$183.77	1954	$35.25
1993	$391.75	1973	$106.48	1953	$35.50
1992	$333.00	1972	$63.84	1952	$38.70
1991	$353.15	1971	$44.60	1951	$40.00
1990	$386.20	1970	$38.90	1950	$40.25

Source: based on www.goldinfo.net

In table 8 the gold prices since 1950 is shown. The gold standard held the price of gold stable around 35 dollars an ounce. After removal of the gold standard it is clear how the prices are growing extremely. The prices are fluctuating after 1970; nevertheless they kept a very high value. This makes gold interesting.

Gold has always maintained its value, irrespective of the condition of the economy, due to its resilience and scarcity. Gold is one of the few metals that do not degrade in time which makes it highly valuable. Due to its stability people tend to move their assets into gold bullion to protect against paper currency devaluation (www.thegoldeconomy.com Dec. 2010). When we take again a look to table 8 and take in account the economic downturns and/or crisis's, the following becomes clear. According to www.nowyounow.wordpress.com the economy in the United States had several

periods of economic downturn. Economic downturn or recession is defined as "A prolonged economic retraction, they are conventionally defined by two or more consecutive quarters of negative GDP growth. Recessions are marked by declines in productivity and investment and high unemployment" (Farlex Financial Dictionary, www.financial-dictionary.thefreedictionary.com Dec. 2010). The periods of such a economic downturn have been seen in; 1953, 1957, 1960, 1969, 1973, 1980, 1981, 1991, 2001, 2007. In table 8 only the economic downturn periods after 1970 are interesting, when the gold standard was removed. When comparing the periods of economic downturn with the prices no spectacular changes are seen. Most of the periods didn't affect the prices. With this information we can conclude that gold is indeed an interesting commodity to invest in, in periods of economic insecurity.

The number of contracts in the gold futures market grew to record numbers in the last years. This growth was not seen since gold began trading in the New York Comex in 1975, and stayed there for all of the past year as many funds and other speculators stayed in the market longer than they have during ordinary rallies.

Confidence in the future stability is a principal factor determining the value of the Dollar and with it, the gold price. With uncertain relations with previously strong allies whose trade and cooperation is needed to maintain the stability of the Dollar, the strength of the Dollar cannot be relied on, particularly since it is in a downtrend which began 4 years ago. The future is unpredictable and uncertain. (www.technicalindicators.com Dec. 2010)

A precious metal futures contract is a legally binding agreement for delivery of gold in the future at an agreed upon price, this is comparable with other futures contracts. The contracts are standardized by a futures exchange as to quantity, quality, time and place of delivery. Only the price is variable.

There are a few different gold contracts traded on U.S. exchanges: one at COMEX and two on eCBOT. There is a 100 troy ounce contract that is traded at both exchanges and a mini contract (33.2 troy ounces) traded only at the eCBOT. The most active months traded (according to volume and open interest) are February, April, June, August, October and December.

3.2.5 **Participants on the gold market**

The primary function of any futures market is to provide a centralized marketplace for those who have an interest in buying or selling physical commodities at some time in the future. The metal futures market helps hedgers reduce the risk associated with adverse price movements in the cash market. Examples of hedgers include bank vaults, mines, manufacturers and jewelers.

Hedgers take a position in the market that is the opposite of their physical position. Due to the price correlation between futures and the spot market, a gain in one market can offset the losses in the other. Hedgers use these contracts as a way to manage their price risk on an expected purchase or sale of the physical metal (King 2010, www.investopedia.com Dec.2010).

Financial leverage is the ability to trade and manage a high market value product with a fraction of the total value. Trading futures contracts is done with performance margin. It requires considerably less capital than the physical market. The leverage provides speculators a higher risk/higher return investment.
In the futures markets, it is just as easy to initiate a short position as a long position, giving

participants a great amount of flexibility. This flexibility provides hedgers with an ability to protect their physical positions and for speculators to take positions based on market expectations.

Unlike hedgers, speculators have no interest in taking delivery, but instead try to profit by assuming market risk. Speculators include individual investors, hedge funds or commodity trading advisors. Speculators come in all shapes and sizes and can be in the market for different periods of time. Those who are in and out of the market frequently in a session are called scalpers. A day trader holds a position for longer than a scalper, but usually not overnight. A position trader holds for multiple sessions. All speculators need to be aware that if a market moves in the opposite direction, their position can results in losses (King 2010, www.investopedia.com Dec.2010)

The futures market exists for the benefit of miners to take advantage of high prices when they occur in the futures market. A miner can lock in a good profit in the futures market when prices are right. If a mining company passes up the opportunity to lock up a good profit, he will then be speculating instead. Sometimes he will be right and other times he will be wrong. Those miners who decide to speculate rather than hedge at a profit put their companies at risk if the price goes the wrong way. Solid, long lasting companies are usually not based on speculation (www.technicalindicators.com Dec.2010).

3.2.6 **Conclusion**

Concluding this discussion on gold, we saw in the general part that a strong point of gold is the fact that it keeps its value. It is a commodity which is not degrading, this makes it very valuable. The production of gold or the mining is becoming more difficult, which makes it more expensive and more dangerous to achieve the gold. This and the pressure of environmental protection organizations have as effect that in most countries the production of gold is declining. The production in China has been growing over the years and has taken the leading position in this market for three years now. Almost 12 percent of the mining production is taking place in China. When looking to the worldwide mining situation a clear declining trend is seen in the total gold production. This means that the difference between demand and supply continuo growing, as the demand is not falling. This is seen back in the prices of gold. After the removal of the gold standard which was in place up to 1971, the price skyrocketed. We can state that gold is a very important commodity for investors and hedgers. Due to it stability it is offering a high degree of security also during periods of financial stress. Hedgers and investors are using this to create stability in their portfolio. What is seen is that in periods of economic downturn more people are investing in gold.

3.3 Oil

3.3.1 General information

Oil is a fossil fuel. It is formed more than 300 million years ago. Some scientists say that tiny diatoms are the source of oil. Diatoms are sea creatures the size of a pin head. They do one thing just like plants; they can convert sunlight directly into stored energy. The process is as follow, when the diatoms died they fell to the sea floor. Here they were buried under sediment and other rock during the years. The rock squeezed the diatoms and the energy in their bodies could not escape. The carbon eventually turned into oil under great pressure and heat. As the earth changed and moved and folded pockets where oil and natural gas can be found were formed. Oil has been used for more than 5,000-6,000 years. In the beginning it was not used much and not for the purpose it is used nowadays (www.energyquest.ca.gov Dec.2010).

Most petroleum oil came from distilling coal into a liquid or by skimming it off of lakes. Then on "August 27, 1859, Edwin L. Drake, struck liquid oil at his well near Titusville, Pennsylvania. He found oil underground, and more important a way that could pump it to the surface" (www.energyquest.ca.gov Dec. 2010). This method of drilling for oil is still being used today all over the world in areas where oil can be found below the surface. Oil and natural gas are found under ground between folds of rock and in areas of rock that are porous and contain the oils within the rock itself. To find oil and natural gas, companies drill through the earth to the deposits deep below the surface. The oil and natural gas are then pumped from below the ground by oil rigs. They then usually travel through pipelines or by ship. The crude oil is used in different ways. The petroleum or crude oil must be changed or refined into other products before it can be used. Below a list is provided of some of the products made from oil. Many of the products used in our civilization is made from oil, made by machinery and systems dependent on oil, and transported by oil as either gas or diesel fuel.

Ammonia, Anesthetics, Aspirin, Auto Parts, Ballpoint pens, Bandages, Car Battery Cases, Carpets, Cosmetics, Credit Cards, Eye Glasses, Food Preservatives, Food Packaging, Perfume, Petroleum Jelly, Shoes, Toothpaste, Trash Bags (www.3k88.com/products.htm Dec. 2010). This list is a small part of all the products which consist of oil, but already shows the importance of oil. It is affecting our life in all possible ways. This makes it a very interesting commodity and a commodity for which prices are affected by small changes.

3.3.2 Situation worldwide

In table 9 the total demand and supply for 2008 up to 2011 is shown. If you look to the Total demand of the world it is clear that in these years the demand did not change very much and was around 88 million barrels a day. The total supply is also stable in this period and is approximately 85 million barrels a day. This shows that there is a shortage of oil. This is affecting the prices, and leads to a situation in which prices are always under pressure and can be kept high.

Table 9: World oil Supply and Demand (in million barrels per day)

	2007	2008	2009	2010	Share in percentage of total (2010)
OECD Demand					
North America	25.5	24.2	23.3	23.8	27.26
Europe	15.5	15.4	14.5	14.4	16.49
Pacific	8.4	8	7.7	7.7	8.82
Total OECD	49.3	47.6	45.4	45.9	52.58
Non-OECD demand					
FSU	4.1	4.2	4	4.2	4.81
Europe	0.8	0.8	0.7	0.7	0.80
China	7.6	7.7	8.4	9.2	10.54
Other Asia	9.5	9.6	10	10.3	11.80
Latin America	5.7	6	6	6.3	7.22
Middle East	6.6	7	7.2	7.5	8.59
Africa	3.1	3.2	3.2	3.2	3.67
Total Non-OECD	37.3	38.5	39.5	41.4	47.42
Total Demand	86.7	86.1	85	87.3	**100.00**
OECD Supply					
North America	13.9	13.3	13.6	14	
Europe	5	4.8	4.5	4.2	
Pacific	0.6	0.6	0.6	0.6	
Total OECD	19.5	18.7	18.8	18.8	
Non-OECD supply					
FSU	12.8	12.8	13.3	13.6	
Europe	0.2	0.1	0.1	0.1	
China	3.7	3.8	3.9	4.1	
Other Asia	3.6	3.6	3.6	3.6	
Latin America	3.6	3.7	3.9	4.1	
Middle East	1.7	1.7	1.7	1.7	
Africa	2.6	2.7	2.6	2.6	
Total Non-OECD	28.2	28.4	29.1	29.8	
Total Non-OPEC	50.9	50.8	51.7	52.6	
Total OPEC	34.5	35.6	33.4	34.2	
Total Supply	85.5	86.4	85.1	86.8	

Source: http://omrpublic.iea.org/omrarchive/12nov10tab.pdf (Dec.2010)

The oil producing countries can be classified in OPEC countries and Non-OPEC countries and in OECD and non-OECD countries. First OPEC stands for Organization of the Petroleum Exporting Countries. "This organization have been is a permanent, intergovernmental Organization, created at the Baghdad Conference on September 10–14, 1960, by Iran, Iraq, Kuwait, Saudi Arabia and

Venezuela"(www.opec.org Dec.2010). The five Founding Members were joined by nine other Members during the following years: Qatar (1961); Indonesia (1962) – suspended its membership from January 2009; Socialist Peoples Libyan Arab Jamahiriya (1962); United Arab Emirates (1967); Algeria (1969); Nigeria (1971); Ecuador (1973) – suspended its membership from December 1992-October 2007; Angola (2007) and Gabon (1975–1994). OPEC had its headquarters in Geneva, Switzerland, in the first five years of its existence. This was moved to Vienna, Austria, on September 1, 1965 (www.opec.org Dec.2010).

OPEC's objective is to "co-ordinate and unify petroleum policies among Member Countries, in order to secure fair and stable prices for petroleum producers; an efficient, economic and regular supply of petroleum to consuming nations; and a fair return on capital to those investing in the industry" (www.opec.org Dec. 2010).

Countries which are not member of the OPEC are seen as Non-OPEC. These are countries which are as well producing oil but which are not member of the OPEC organization. Reason for countries not to join OPEC is the fact that OPEC is making general agreements on the total production of oil and so the supply. By doing this they are able to influence the prices in order to keep the prices stable. Some countries as Russia are not interested in these types of agreements in which their production is controlled. "The U.S. Energy Department's Energy Information Agency (EIA) said seven of the world's fifteen largest oil producers are outside of OPEC. As of 2006, those countries were Russia, the United States, China, Mexico, Canada, Norway, and Brazil. Britain had been on the EIA's list as of 2004, but production has continued to decline significantly in the North Sea, said EIA energy analyst Matthew Cline" (www.iea.org Dec.2010). Overall in 2007, "Non-OPEC nations produced roughly 48 million bpd, comprising nearly 60 percent of total production for the year" (http://www.cfr.org Dec.2010).

Next to the OPEC and non-OPEC countries which are especially focusing on oil, there is a second distinction between oil producing and demanding countries. The Organization for Economic Cooperation and Development (OECD) is an organization which provides a forum in which governments can work together to share experiences and seek solutions to common problems. "We work with governments to understand what drives economic, social and environmental change" (www.oecd.org Jan. 2011). This organization is not focusing only on the oil production but on the working together on economic problems in general. The OECD consists of a list of countries which are member of this organization. Important fact is that all the countries which are member of the OECD are political and economically stable countries. Interesting is to see that the OECD countries which are "political and economically stable countries" cannot fulfill their demand for oil with their own supply, leading to the situation in which they will have to import oil from countries which are not member of the OECD organization. Often this import is coming from countries which are less "stable". This shortage of own supply has as effect that the OECD countries are becoming more dependent of these less "stable countries". This discussion will be continued in chapter 4 when we will look at different forecasting models.

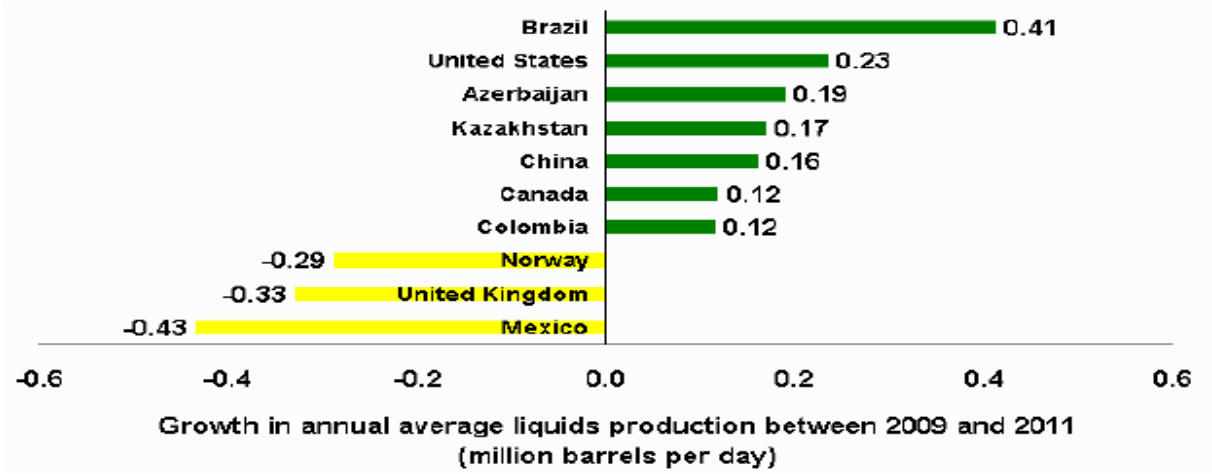
Many non-OPEC producers are faced with wells that are quickly depleting. Some major producers, such as the United States, Mexico, and Norway, have experienced a decline in production in recent years. However, overall numbers for non-OPEC producers are bolstered by the significant increases in production from Brazil, Canada, Russia, and a few other former Soviet states (http://www.cfr.org

Dec.2010). The numbers of growth or decline for 2010 are shown in figure 12 in which it becomes clear that Brazil is becoming more important for the oil production.

Effect of these depleting wells is that due to high oil prices an incentive exists to expand expensive unconventional oil projects. “The sharp decline in oil prices in 2008 may make investment in unconventional projects unattractive in the short term. Some experts, including officials at the IEA, worry that wildly fluctuating oil prices and the inability for some firms to get financing because of the credit crisis will deter investment in any type of new oil production, leading to a supply crunch”(www.iea.org Dec.2010).

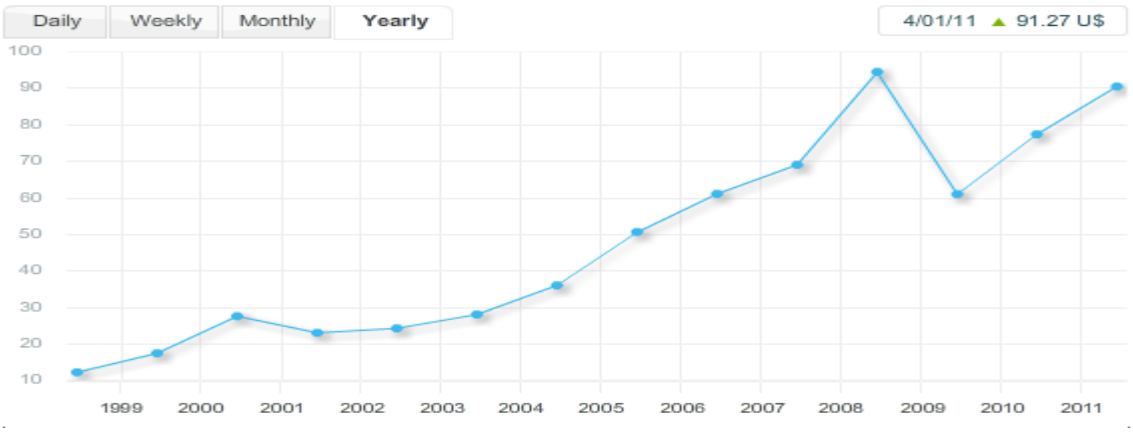
In figure 13 the world price of oil since 1999 is shown. The sharp increasing trend is clearly visible. This was the effect of an increasing demand and more difficulties of achieving the oil. The unconventional oil projects like drilling in deep sea areas in the Mexican golf are more expensive. The downturn in 2008 was an effect of the economic crisis which started in 2007. The prices are increasing again due to the economy which is recovering from the crisis. However due to some economist like Fatih Birol of the IEA these increasing price can lead to a disruption of the trade balance and affect the economic recovery (www.nu.nl Dec.2010). This remark is done to put pressure on the OPEC countries to increase their production to decrease the oil prices. This price increases will lead to the awareness of importing countries that they have to become less dependent of oil.

Figure 12: Non-OPEC supply growth



Source: shorter energy outlook 2010 http://www.eia.doe.gov/emeu/steo/pub/special/pdf/2010_sp_01.pdf

Figure 13: world oil price 1999 to 2011



Source: www.opec.org

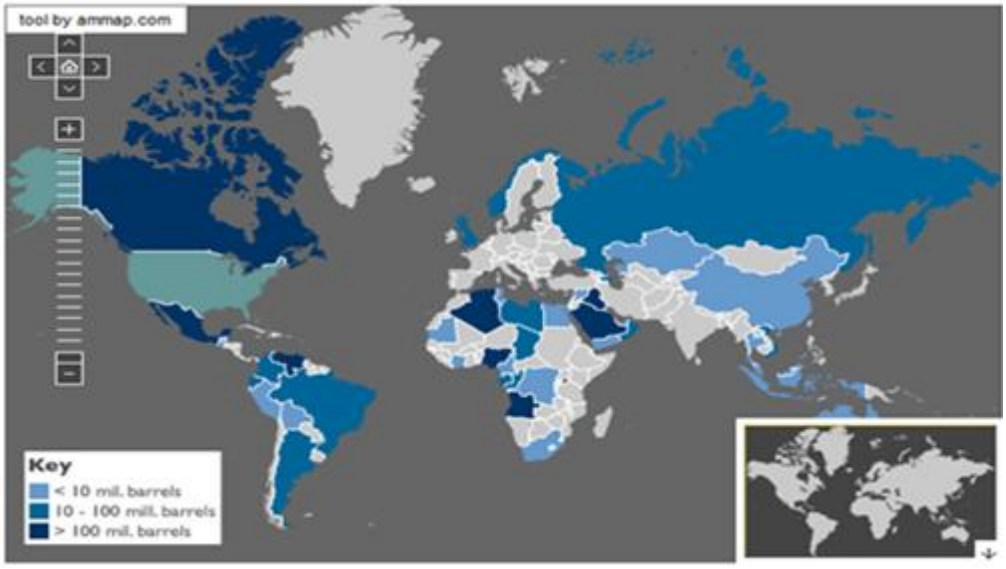
3.3.3 **US Situation**

Oil is found in 18 of the 58 counties in California. Next to oil from California also oil is coming from Alaska, and an increasing amount comes from other countries (www.energyquest.ca.gov Dec.2010). In Florida most of the oil found in the Gulf of Mexico is coming in the United States.

However the fact that the Unites States is a large producer of oil as is seen in table 9 with a production of approximately 14 billion barrels per day, we should take in consideration that in table 9 we look at the supply of North America. This consists next to the United States also of Mexico and Canada. The real production of the United States is around the 7 million barrels per day. The United States consumes more oil than any other country in the world: 18.7 million barrels of oil per day, according to the U.S. Energy Information Administration's (EIA) short-term energy outlook. To satisfy that demand, the United States imports 9 to 12 million barrels of oil per day. This is also seen in table 9 (and later in table 16) in whom it is clear that the total supply per day in the United States is lower than the total demand per day. This indicates that there is import needed in order to satisfy the customers need.

U.S. oil consumption remains high even as the price of oil skyrockets, and the United States is forced to funnel money directly into unstable and hostile regimes to fund its habit. Now, with oil and gas prices reaching record highs, the threat from the dependence on foreign oil to feed our carbon economy is more real than ever. The United States imports approximately 62 percent of its oil. Canada supplies approximately 20 percent of these imports, and Mexico contributes 10 percent. But over 30 percent come from regimes that are less friendly or stable, including Saudi Arabia, Venezuela, Nigeria, Angola, Iraq, and Algeria (respectively the 2nd, 4th, 5th, 6th, 7th, and 8th largest oil importers to the United States).

Figure 14: America's top annual suppliers of crude oil



Source: Energy Information Administration

The top seven countries which are producing and exporting oil to the United States are listed below in table 10, they account for more than $140 million worth of oil every year. These numbers are for 2009. The numbers are changing fairly between the years. When looking to the month of august in 2010, the numbers changed not much but some countries exported more than others. These numbers and facts are based on (http://www.globalpost.com Jan. 2011).

Table 10: top seven export partners US, divided in member OPEC/Non-OPEC and the economic and political stability

country	quantity (barrels per day)	OPEC/non-OPEC	economic and political stability 2010
Canada	1.938.000	Non-OPEC	*low risk*
Mexico	1.096.000	Non-OPEC	*medium low risk* (civil commotion, supply chain vulnerability, terrorism)
Saudi Arabia	989.000	OPEC	*medium risk* (terrorism, legal regulatory, political interference)
Venezuela	965.000	OPEC	*high risk* (economic, exchange transfer, civil commotion, sovereign non payments, legal and regulatory, political interference)
Nigeria	771.000	OPEC	*high risk* (economic, exchange transfer, civil commotion, war, terrorism, sovereign non payments, legal and regulatory, political interference)
Angola	449.000	OPEC	*medium high risk* (economic, sovereign non payments, legal and regulatory, political

			interference)
Iraq	448.000	OPEC	*high risk* (economic, civil commotion, war, terrorism, sovereign non payments, legal and regulatory, political interference)

Source: table is based on information of http://www.scdigest.com, www.opec.org, www.globalpost.com

To clarify the important countries which are exporting to the United States table 10 is providing information on the different countries based on their importance as export partner, OPEC or Non-OPEC and their economic and political stability. What this table is making clear is that the two stable countries or with the lowest risks are the two Non-OPEC countries. The other countries have to different factors which are presently leading to an increased risk level of these countries. For the United States this is not an ideal situation because they are more or less depended on countries which are not stable. The risks have been calculated for the year 2010 by www.scdigest.com which has analyzed the situation in the different countries in the world based on 9 factors which can influence the level of risk. These factors are; economic, sovereign non payments, legal and regulatory, political interference, exchange transfer, civil commotion, supply chain vulnerability, war and terrorism. At the other side we know that for most exporting countries in this list the United States is a key player, for example the United States is number one export partner of Iraq (www.globalpost.com Jan. 2011). This means that they are also to a certain extend depended of the United States.

3.3.4 The market where oil is traded

Futures contracts are financial instruments and carry with them legally binding obligations. Buyer and seller have the obligation to take or make delivery of an underlying instrument at a specified settlement date in the future. Oil futures are part of the derivatives family of financial products as their value 'derives' from the underlying instrument. These contracts are standardized in terms of quality, quantity and settlement dates. There are futures markets for a number of instruments ranging across currencies, bonds, equities, interest rates and commodities.

In the case of crude oil, the main futures exchanges are the New York Mercantile Exchange (NYMEX) and the Intercontinental Exchange (ICE) where West Texas Intermediate (WTI) and North Sea Brent crude oil are traded respectively.

These exchanges trade what is referred to as 'light- sweet' crude oil and a single contract, or 'lot', calls for the purchase or sale of 1,000 barrels of oil. Traders can buy and sell oil for delivery several months or years ahead. The bulk of activity in commodity futures markets is typically concentrated on oil for delivery in the next three months. However, in the past five years, activity has increased substantially for deliveries much further into the future as more investors put money into commodity indices. In the last couple of years, investor interest has grown in commodities, which are now regarded as an alternative asset class to equities or bonds. (http://www.futuresmag.com)

Each futures exchange has a clearing house which ensures that trades are settled in accordance with market rules and that guarantees the performance of the contracts traded. The NYMEX operates its own clearing house. A clearing house is defined as “An agency associated with an exchange, which

settles trades and regulates delivery" (www.investorsword.com Jan.2011). In the UK, the London Clearing House (LCH.Clearnet) is a recognized house that clears business for many different exchanges. The ICE exchange as well is recognized as a clearing house by the UK regulator, the Financial Services Authority (FSA). In the US, the equivalent government regulator is the Commodity Futures Trading Commission (CFTC). When a buyer and a seller agree to trade on futures exchanges, their transaction is recorded and the clearing house then steps in between them, in effect breaking the 'bond' between the buyer and the seller to become counterparty to both sides. The clearing house, among other roles, is responsible for the management of the risk on transactions on the exchange - it establishes margin levels, default rules and ensures the settling of individual positions. When market participants buy futures, they do not pay the full amount of value of the contracts they purchase. Rather, they pay an initial margin that acts like an insurance deposit (the amount is determined by the clearing house). This initial margin represents a percentage of the value of the transaction. At the end of each trading day, individual positions are evaluated relative to the closing price of the market published by the exchange - participants are then said to be 'marked to market'. If their position is profitable, that profit will accrue into their account. In contrast, if the position is not profitable, the loss will be deducted from the initial deposit and the participant will be given a 'margin call' (called the variation or maintenance margin) to make up the difference. On the settlement date or the expiry of futures contract, the buyer and seller have the obligation to make or take delivery of the instrument. For oil, settlement can be carried out in two ways: through the actual delivery of oil into a predefined location or through a cash settlement (http://www.telegraph.co.uk Jan. 2011).

3.3.5 **The participants on the oil market**

Participants on futures exchanges include companies, those that have an interest in the instrument for their daily business (a refinery, a utility or an airline company). These companies typically seek to off-load the risk of volatility in the price of oil and are thus referred to as 'hedgers'. On the other side, there are the so-called 'speculators', typically banks and other financial institutions with a view on the direction oil prices will take. They assume the risk and provide liquidity to the market. Futures contracts are traded on regulated futures exchanges. Trading can take place through electronic dealing systems, open outcry around a pit or a combination of both. To trade on an exchange, you need to be a member of that exchange. Exchange members can trade on their own account or they can execute orders for hedgers or speculators. In the latter case, exchange members are acting as brokers and will collect a fee for their service. (http://www.telegraph.co.uk Jan. 2011)

3.3.6 **Conclusion**

Resuming this section on the oil market, we can state that the oil is one of the most important commodities. It is affecting many people as it is used in an enormous amount of products. Not only is it used as a raw material for the production of these products also the transportation of these products is depending on oil. We saw a distinction between OPEC and Non-OPEC countries and OECD and Non-OECD countries. Both are organizations in which have different countries which are member. What we have seen is that the OECD is an organization which has a broader range of interest (not only oil) and which has members (countries) which can be seen as political and economically stable. However from table 9 it became clear that their supply is not large enough to provide the large demand of the OECD countries, and especially the large demand of the United

States. The United States is leading in consumption of oil with a demand of almost 19 million barrels per day. When looking to the countries which are exporting oil to the United States we can conclude that the Non-OPEC countries are more stable political and economic. However the United States are becoming depending of these less stable countries as they are by far the largest consumers of oil. Their own production is by far not enough to fulfill the demand. This makes the Unites States depending on less stable countries. Due to the fact that oil is such an important commodity for so many products and people increases in prices can have large effects on the economy and also in the recovery of the economy after the financial crisis of 2008.

Because of the importance of oil many participants are active on the market to use it to hedge their portfolio or to speculate on this market.

3.4 Coffee

3.3.1 General information

The global spread of coffee growing and drinking began in the Horn of Africa, where, according to legend, coffee trees originated in the Ethiopian province of Kaffa. It is recorded that the fruit of the plant, known as coffee cherries, was eaten by slaves taken from present day Sudan into Yemen and Arabia through the great port of its day, Mocha. Coffee was certainly being cultivated in Yemen by the 15th century and probably much earlier. In spite of political turmoil, social upheaval and economic vicissitude, the 20th century saw an essentially continuous rise in demand for coffee. “U.S. consumption continued to grow reaching a peak in 1946, when annual per capita consumption was 19.8 pounds, twice the figure in 1900” (http://www.ico.org Dec. 2010). Especially during periods of high global prices, this steadily increasing demand lead to an expansion in production throughout the coffee-growing regions of the world. With the process of decolonization that began in the years following the Second World War, many newly independent nations in Africa, notably Uganda, Kenya, Rwanda and Burundi, found themselves in varying degrees dependent on coffee export revenue.

The coffee plant is a tropical shrub that grows about 30 feet high and contains a number of small red fruits that look something like berries. Each berry contains two seeds, which are called “beans.” The coffee berries are picked and then washed. They are then left in the sun to dry for a few weeks, and are turned over now and then to make sure they dry evenly. Once the berries are dry, the beans are squeezed out. These beans are green, but then they are roasted, and turn brown. It takes about five pounds of berries to produce a pound of coffee beans. The roasted beans are ground into a powder, packaged, and sent to the supermarket. Coffee has become a popular drink because coffee beans contain a mild drug called caffeine. In spite of modern technology, no one has yet invented a machine to pick coffee berries, and they must still be picked by hand. (http://www.bigsiteofamazingfacts.com)

The quality of coffee also affects the premium or discount paid for a coffee. There are five classes of coffee these are based on (http://www.coffeeresearch.org Dec. 2010):

- Class 1. Specialty Coffee – 0-5 defects.
- Class 2. Premium Grade – 6-8 defects.
- Class 3. Exchange Grade – 9-23 defects. This is the grade traded on the NYCE. Class 1 and 2 demand premiums to this price, whereas Class 4 and 5 coffees demand discounts.

- Class 4. Below Standard Grade – 24-86 defects.
- Class 5. Off Grade – More than 86 defects.

Next to these different classes based on quality there is a distinction made between the different types of coffee based on their production area. The various types of coffee are distinguished by the variety and origin (highland or lowland), the flavor and the aroma. Arabica is a well-flavored, aromatic coffee with less caffeine than Robusta, which has a somewhat unrefined, earthier taste. This information is subtracted from (http://www.hollandbymail.com Feb. 2011).

Highland and lowland coffee
Highland coffees have a particularly fine aroma and are cultivated on plantations at an altitude of 600 to 1,800 meters above sea level. Lowland coffees have a different flavor and originate from plantations at lower altitude. In general the higher the altitude, the more superior the quality of coffee produced. However, this is not always the case, since plantations at lower altitude can also produce very good quality coffee.

Arabica coffee
Arabica is the oldest species of bean and is the most widely cultivated, accounting for 74 percent of the beans grown in the world. Arabica beans grow at altitudes between 600 and 1,800 meters above sea level and take six to nine months to mature. The Arabica beans command a higher price on the coffee market because growing coffees at higher altitudes is more expensive and labour-intensive. High-grown coffees are also at risk of frost damage, so farmers tend to build plant replacement costs into their prices. Production costs are higher since most Arabicas, especially those grown at the highest altitudes, are hand-picked and processed in the more expensive wet method.

Robusta coffee
The Robusta plant was discovered in the 1870s, growing wild in the Congo. About 26 percent of the world coffee trade consists of Robusta beans. Robusta today is mainly cultivated in West Africa and Southeast Asia. Robusta trees are very hearty plants that grow at lower altitudes (sea level to 600 meters) and are more cold- and moisture-tolerant and disease-resistant than the delicate Arabicas. Robustas mature in about half the time of Arabicas and yield almost twice as many berries. Robustas are also used for commercial, canned and instant coffees. Because they are cheaper to produce, Robustas are sometimes combined with Arabicas to make a low-cost blend with some of the flavor characteristics of the more expensive Arabica beans

This information is necessary as will be seen in chapter 4 and 5 when forecasting models will be presented and possible price affecting variables will be discussed.

3.4.2 **Situation worldwide**

The importance of coffee to the world economy cannot be overstated. It is one of the most valuable primary products in world trade, in many years second in value only to oil as a source of foreign exchange to producing countries. Its cultivation, processing, trading, transportation and marketing provide employment for hundreds of millions of people worldwide. Coffee is crucial to the

economies and politics of many developing countries; for many of the world's Least Developed Countries, exports of coffee account for more than 50 percent of their foreign exchange earnings. (http://www.ico.org Dec. 2010)

In table 11 the total production of the exporting countries is stated. Interesting is the fact that most of the producing countries are countries which are seen as developing countries according to the numbers and lists of the WTO (World Trade Organization). When we take a closer look to the total production of the world it is the 121.616.000 bags is the average yearly production for the period 2005 to 2010. The total quantity produced is varying approximately between 115.000.000 and 130.000.000 bags during this period, and shows small changes between the years. This is the reason why it was possible to take a average of the 5 years. For the individual countries there was also small fluctuations seen between these years, especially the larger producing countries. These numbers used for coffee is in bags, a bag stands for 60kg each. Brazil has been the largest producer of coffee in the world for the last 5 years, followed by Vietnam and Colombia. When we look back even further in time it becomes clear that new countries entered the top of the list. The production of Vietnam was not significant 20 years ago but has grown enormously and is second largest producer worldwide nowadays.

Table 11: Total production of exporting countries (000 bags)

Country	production avarage 2005- 2010 (000 bags)	% of world production
World	121.616	
Brazil	40.698	33,46
Colombia	10.955	9,01
Costa Rica	1.586	1,30
Côte d'Ivoire	2.315	1,90
El Salvador	1.421	1,17
Ethiopia	4.479	3,68
Guatemala	3.802	3,13
Honduras	3.497	2,88
India	4.642	3,82
Indonesia	9.360	7,70
Mexico	4.285	3,52
Nicaragua	1.604	1,32
Peru	3.510	2,89
Uganda	2.862	2,35
Venezuela	1.275	1,05
Vietnam	17.230	14,17
Others	8.095	
Total		100,92

Source: based on information of the International Coffee Organization (own calculations)

The growing trend in the production of coffee for the past 20 years had a large influence on the prices. In table 12 the average prices of coffee are shown for the years 1998 up to 2010.

Table 12: Average coffee prices

Year	price
1998	108,95
1999	85,71
2000	64,24
2001	45,59
2002	47,74
2003	51,9
2004	62,15
2005	89,36
2006	95,75
2007	107,68
2008	124,25
2009	115,67
2010	147,24

Source: www.ico.org

The main reason that prices have fallen since 1998 is the massive oversupply of coffee on world markets in relation to demand. Production has increased by 15 per cent since 1990 as a result of the planting of new coffee trees, technological innovation, and the arrival of newcomers on the market. As stated Vietnam was an insignificant exporter of coffee. Today, it is the world's second largest exporter. Other factors have contributed to the steady expansion of coffee supplies. The pressure of debt has forced countries to expand exports in order to generate hard currency. Meanwhile, the World Bank and other agencies have actively promoted export production, through project lending and wider macro-economic reforms. For example, World Bank loans were instrumental in helping Vietnam start producing and exporting coffee. In Colombia and Bolivia, farmers were encouraged by UN-sponsored programmes to switch from cocoa to coffee. And in Angola, the International Coffee Organization (ICO) recently provided funds for the revival of the country's coffee production, which had been shut down by war. World demand for coffee has increased at a far slower pace than supply. In the past ten years production has increased at twice the rate of consumption. The result: massive oversupply, leading to rising stocks and sinking prices. The awareness of this problem resulted in decreasing production (also by increasing demand for fair trade production will be discussed at end of this chapter) which leaded to less supply and increasing prices again. However from 2007 up to 2010 a clear price growth is seen. We will continue on this lately growing price on the next page.

According to (http://www.ico.org) the total export of all the producing countries increased, the total production for the year 1990 was around 93.000.000 bags, and in 2010 it increased up to approximately 121.000.000 bags. During this period the production increased, in 1999 the production reached the 130.000.000 bags. This growth has as effect, the overproduction discussed in the previous part.

In table 13 the export numbers for 2010 are shown. Important to be aware of is the fact that the numbers in table 13 are based on almost all the months of 2010 but the last months are used of 2009 to complete the year and make it possible to use. This number will be compared with the average calculated in table 11. When looking to the total average world production for 2005 to 2010 we saw that 121.616.000 bags were produced, looking to the total export for 2010 we see that approximately 75 percent of the produced coffee is exported. When looking to specific to the different producing countries it becomes clear that most of the countries produce for export. This substantiates the price declines which have been discussed above and seen in table 12. In the following table 13 the total export is shown, a large part of the production is used for export because many countries are depending on the export of coffee as they do not have the climatic conditions to produce coffee. Again Brazil, Colombia and Venezuela are leading in the export of coffee. These countries have an important share in percentage of the total world export.

Table 13: export numbers, percentage of own production exported and percentage of the export in relation to the world export.

Country	export 2010 (60kg bags)	% export of their average production	% of export of the world
TOTAL	93.566.809	76,93%	
Brazil	31.482.926	77,35%	33,65%
Colombia	7.293.331	66,57%	7,80%
Costa Rica	1.185.046	74,72%	1,27%
Côte d'Ivoire	2.037.990	88,04%	2,18%
Ecuador	1.152.403	119,19%	1,23%
El Salvador	957.935	67,40%	1,02%
Ethiopia	3.032.117	67,69%	3,24%
Guatemala	3.429.921	90,20%	3,67%
Honduras	3.159.821	90,36%	3,38%
India	4.100.732	88,33%	4,38%
Indonesia	5.894.331	62,97%	6,30%
Mexico	2.525.932	58,94%	2,70%
Nicaragua	1.673.198	104,31%	1,79%
Papua New Guinea	977.331	96,52%	1,05%
Peru	3.425.593	97,60%	3,66%
Uganda	2.660.691	92,97%	2,84%
Vietnam	14.650.234	85,02%	15,66%
Other exporting countries	3.927.277		4,20%
Total			100

Source: based on information of the International Coffee Organization (own calculations)

Table 14: change coffee prices in relation to change import and export

	2007	2008	2009	2010
Price of coffee	107,68	124,25	115,67	147,24
Total production	119276000	128377000	119894000	121616000
Total export	96640487	97662441	95466356	93566809
Total import	99594815	101347788	98497468	75311706
Total re-export	28347401	31468464	30669692	24424045
Inventory	21098427	21372534	22609628	

Source: based on information of the International Coffee Organization (own calculations)

Table 14 is interesting for the analysis of the change of export and import and the effect on the price changes for the last four years. What can be seen in this table is first of all the sharp increase of the prices in 2010. This is remarkable when looking to the rest of the data. When assuming that the price is set to a large extends by the demand and supply we would expect a declining price in 2010. The export is higher than the import. This is different than the discussion on falling prices discussed in the

previous part. Next to this, the inventory is hold by the most important importing countries. This inventory would help to stabilize the prices. Again this makes it interesting to see that prices continue increasing (except in 2009 in which the prices have decreased as the price bubble of 2007-2008 burst). These findings show why it is interesting to see to "new" influencing factors on the prices of coffee. This will be done in chapter 5. As José Sette Director of the ICO answered on my question why there are changes between the import and export:

"Timing: coffee exported at the end of one year may only be registered as being imported in the next year (or even following years, for example in case of coffee that is sent to free ports and only officially imported at a much later date);

· Undeclared exports;

· Undeclared imports;

· Double (or triple even quadruple) counting. For instance, a batch of green coffee may be exported to Europe and held as speculative stock. At a later date, re-exported to the USA where it is processed. Then re-exported in bulk form to Singapore, where it is packed. The batch is now again re-exported in smaller lots to various countries in the Asian region. As you can see from this example, the same batch can be re-exported at least three times".

3.4.3 **US situation**

When taking a specific look to the United States it becomes clear that all their coffee is imported. Table 15 shows that the United States are the largest importer of coffee worldwide with roughly 23.000.000 bags which are imported on a yearly base, for 2010 this number will be 17.072.532. This number has been stable over the last five years, but has been growing fast the years before as discussed in the introduction of coffee. The number two on the list is Germany with approximately 17.000.000 bags imported yearly and for 2010 will import 15.288.713 bags. Interesting in table 15 is the second row which shows the numbers of re-export from the different countries. This consists of coffee which is traded again from countries which imported it. This can be because large organizations as nestle is importing it to one country and re-exports it after it is processed. For the European Union this consists also of re-export between countries of the European Union.

The total consumption of coffee for 2009 in the United States was 21.435.967 bags of coffee. This means first that all coffee is imported, however that the United States some years also import coffee from non coffee producing countries and some year export coffee which they imported to non coffee producing countries.

Table 15: Coffee import for 2010 and the quantities of coffee re-export in 2010 all in 60 kg bags.

country	import 2010	re-export 2010
TOTAL	75311706	24424045
European Union	50819463	21053520
Austria	1022993	352400
Belgium	4740042	4071042
Bulgaria	405680	99838
Cyprus	59158	0
Czech Republic	734378	345916
Denmark	701866	159415

Estonia	221519	156052
Finland	903589	128460
France	5138782	803460
Germany	15288713	8446562
Greece	781751	39379
Hungary	515554	211290
Ireland	133000	5994
Italy	6300567	1806299
Latvia	100092	33282
Lithuania	278563	131433
Luxembourg	268361	87587
Malta	9721	28
Netherlands	1849113	964701
Poland	1238105	458727
Portugal	686835	135782
Romania	651344	32229
Slovakia	435186	174846
Slovenia	155412	8796
Spain	3720596	1237036
Sweden	1308442	376711
United Kingdom	3170099	786259
Japan	5091711	103481
Norway	557720	6322
Switzerland	1770280	911181
USA	17072532	2349539

Source: based on information of the International Coffee Organization

3.4.4 **The market where coffee is traded**

There are two markets for coffee: the cash market and the futures market. The cash market is the market today. It is the price you would pay for coffee today if you could receive it today. The futures market is used to help determine the price for future deliveries. It is used to purchase a contract today to guarantee a future shipment of coffee. More importantly, however, the futures market for commodities like coffee is used to help protect against the wild variations that occur due to coffee market speculation. (http://www.coffeeresearch.org Dec.2010)

There are two different types of coffee, Arabic coffee and Robusta coffee. Brazil and Colombia produce mostly Arabica coffee and together account for more than 40 percent of world coffee production. Vietnam produces Robusta coffee, generally considered to be a lower quality type of coffee than Arabica. These two different types are traded on the following exchanges. This information is subtracted from the website traderstech.com.

Arabica coffee futures and options are traded in New York on the Intercontinental Exchange (ICE, formerly the New York Board of Trade). Some facts on the trade of coffee;

- The size of the Coffee futures contract is 37,500 pounds.
- Coffee commodity trading is now done electronically.
- Coffee futures prices are quoted in cents per pound, and the minimum price fluctuation is 5/100 cent/pound, equivalent to $18.75 per contract.
- The coffee futures contract months are March, May, July, September and December.
- The contract prices physical delivery of exchange-grade green beans from one of 19 countries of origin in a licensed warehouse to one of several ports in the United States and Europe.

Robusta coffee futures are traded in London on Euronext.liffe.

- The size of this coffee futures contract is 10 metric tons.
- Coffee futures prices are quoted in U.S. dollars per metric ton with the minimum price movement $1 per ton or $10 for the contract.
- Contract delivery months are January, March, May, July, September and November with 10 delivery months available for trading.

Other international exchanges that trade coffee futures include the Singapore Commodity Exchange (Robusta), the Commodities & Futures Exchange (BM&F) in Brazil (Arabica) and the Tokyo Grain Exchange (Arabica and Robusta).

3.4.5 **The participants on the coffee market**

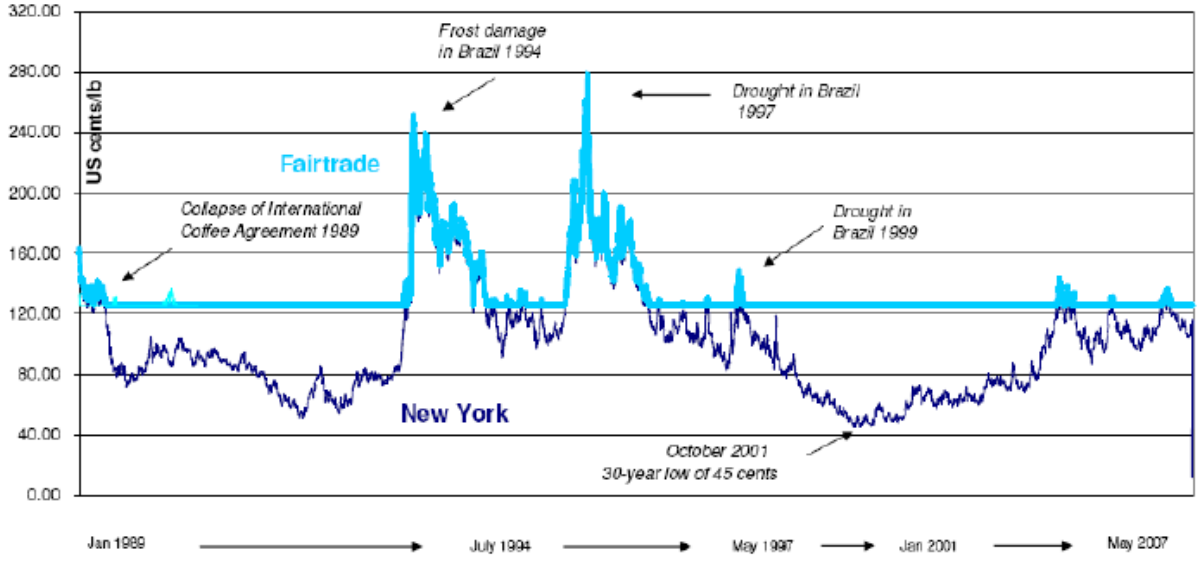
The United States is the world's largest importer of coffee as seen in the previous text and tables. Kraft, Nestlé, Procter & Gamble and Sara Lee are the major roaster companies and account for purchases of about 50 percent of all the annual production of coffee. Demand for coffee is price inelastic: When coffee prices rise, people do not reduce their coffee consumption proportionally; when coffee prices fall, consumer demand for coffee does not proportionally increase to any great extent. Seasonally, U.S. coffee consumption tends to rise in the winter, which may lend support to coffee futures prices.

A trend in most of the developed countries from the last years is the increasing awareness for sustainability. This has led to a situation in which companies are paying much attention to the situation in which the coffee is grown and produced. Fair trade is playing an important role in the coffee market. Fair trade is defined as, "a trading partnership, based on dialogue, transparency, and respect that seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions to, and securing the rights of, disadvantaged producers and workers especially in the South" (FINE, 1998). FINE is a workgroup which has been created by the following organizations; fair trade Labeling Organization (FLO), International Fair Trade Association (now World Fair Trade Organization, WFTO), the Network of European Worldshops (NEWS) and the European Fair Trade Association (EFTA). Fair trade coffee was presented under the Max Havelaar brand in 1988. Around 78 percent of all Fair trade certified coffee is produced in Latin America, with Mexico, Peru, Guatemala, Colombia and Nicaragua being the largest suppliers. 80 percent of all fair-trade certified coffee is sold in the EU, while the United States, the United Kingdom, France, Canada

and Germany together account for three quarters of worldwide sales of fair-trade certified coffee. (E. Pay, 2009)

"Sales of Fair trade certified coffee in Europe have increased considerably over the course of the past few years. Many European countries have registered double-digit growth rates in Fair trade coffee sales over the period 2001–2006, and fair-trade coffee remains the fastest growing market segment in the European coffee market. Despite its rapid growth in recent years, Fair trade coffee still accounts for less than 1 percent of the total European coffee market, with market shares varying considerably between countries" (E. Pay, 2009).
This growing trend in the production of fair trade coffee is due to the increasing interest of large organizations as Procter & Gamble, McDonalds, and Starbucks in fair trade products and coffee. These organizations are aware of the demand of an increasing number of customers for fair trade coffee. With their large campaigns and range they have an important influence on the increases of the fair trade coffee. However the fact that large organizations start selling fair trade coffee has as effect that smaller organizations focusing on fair trade are being competed out of the market. Another negative downturn of fair trade is the fact that the producers of coffee have a minimal price they get for their produced coffee. This means that the market working of free trade is not working idealistic anymore. Prices are kept higher during some periods. Figure 15 is making this problem clear; the price of fair trade coffee is not crossing a certain minimum line, where the price of the New York coffee is falling even lower. For the farmers this is positive however for the trade not. The effect of this will become more important as the quantity of fair trade coffee will become more important.

Figure 15: The Arabic coffee market 1989-2007: comparison of fair trade and New York prices



Source: www.fairtrade.org

The last decade next to fair trade coffee there have been a larger movement trying to increase the sustainability of coffee. According to a 2010 report of "The State of Sustainability Initiatives Review" on sustainability and transparency (an initiative of Aid environment, the International Institute for Environment and Development (IIED), the International Institute for Sustainable Development (IISD) and the United Nations Conference on Trade and Development (UNCTAD)), over the past five years,

sustainable coffee (this is not particular fair trade coffee) sales have grown by 433 per cent and, at 457,756 metric tons, accounted for 8 per cent of global exports in 2009.
- Global supply of sustainable coffee, however, is still significantly higher than demand, with supply reaching 1,243,257 metric tons, or 17 per cent of global production.
- A total of 75 per cent of all sustainable coffee comes from Latin America, as compared to approximately 59 per cent for conventional global production.
- Reported premiums for sustainable coffees for 2009 ranged from US$0.025 to US$0.405 per pound, with most premiums falling in the US$.05 to US$.10 per pound range

These numbers means that investing in sustainability is important but should match the demand. This would otherwise lead to prices which can drop to low.

3.4.6 **Conclusion**

Concluding the discussion on coffee it became clear that coffee is an important commodity. Most of the producing countries are countries which are seen as developing countries by the WTO. The export of coffee is an important share of their GDP. This means that many people in these countries are depended of the production of coffee. Interesting was the fact that the demand which was growing during the last decades have been overtaken by the total supply, to such an extent that oversupply has led to declining prices in the 90ties. However the prices have started growing again since 2004 and especially in 2010. A logical reason would be a large demand and declining supply which would lead to a scarcity on the coffee market and higher prices. However as we have seen there is no oversupply and the most important importing countries hold inventories to be able to stabilize the fluctuations between demand and supply. However prices have increased. This would mean that other factors than supply and demand are affecting prices. This will be discussed in depth in chapter 5. The United States do not have the possibility to produce coffee themselves. Al their coffee is imported, with their enormous consumption of coffee the United States are leading on the import list.
A new trend which is becoming more important is fair trade coffee. This phenomenon is leading to a not idealistically working market system due to the minimum prices which are accorded to the farmers. This can become more important as the total share of fair trade coffee becomes more important. This will happen due to large organizations which see free trade as an excellent way of fulfilling the demand of customers for sustainable products.

3.4 **Comparisons of the four commodities**

Now that the four commodities have been discussed extensively it is interesting to compare these four with each other. We have explained why those four commodities are chosen in the previous parts and chapters. In the discussion of the four commodities it became clear that they are all important commodities and have a certain influence.

In chapter 2 it is discussed that the commodities can be separated in different groups; (1) agriculture products, (2) fuels and mining products, and (3) manufactures (WTO 2010) according the WTO. Following the description of Maslakovic 2008 the different groups are; (1) grains, (2) meats, (3) industrial metals, (4) precious metals, (5) Food& Fiber and (6) energy.
The choice of the four commodities was made in order to capture most of the groups.

In this chapter it became clear that these four commodities are affecting many people. Their impact can be important. To recapture them; wheat is the diet of many people all over the world, especially in the poorer areas wheat is a large part of the daily diet. Food price increases will affect these poor people in a severe way. Next to the diet of many people, wheat is important feed for livestock. A growing wheat price will be seen back finally in the cost of the livestock's.
Gold is a commodity which will not lose value over the years. This means that it creates stability and security. What have been seen in the part about gold was that many investors start investing in gold when the insecurity increases on the financial market.
Oil is used first of all as raw material for a countless number of products. Second it is used for the machines producing all kind of products, and the transportation of them. This implies that growing oil prices have an effect on many other products and commodities. This shows the importance of understanding why oil prices are fluctuating.
Coffee is as we will see in table 16 the smallest commodity in quantity produced and traded, nevertheless it is important as it is produced in mostly developing countries for which coffee is an important part of the GDP. Price fluctuations can have a severe effect on the GDP of these countries and for the people producing the coffee.

Table 16 provides an overview of the four commodities and is showing the following characteristics;

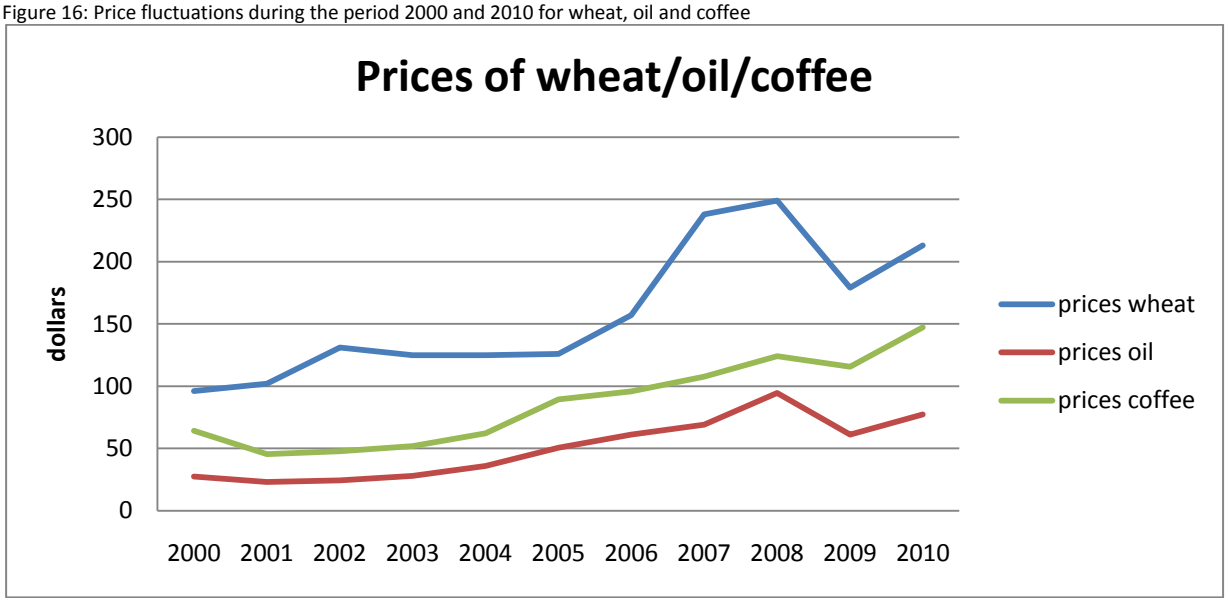
- Total demand worldwide
- Total demand in the United States
- Total supply worldwide
- Total supply in the United States
- Prices

The time range is 10 years from 2000 up to 2010. This time range is chosen in the first place due to data availability, in the second place, with this time range trends become visible caused by for example new technologies or climate changes. This information is interesting to take in consideration, especially as will be seen in the following chapters.

Looking in general to table 16 it is clear that in the first place the prices of the four commodities have experienced a growing trend. This has been discussed in previous parts. The price bubble discussed in chapter 2 is clearly visible in the price fluctuations of wheat, oil and coffee. However the gold price

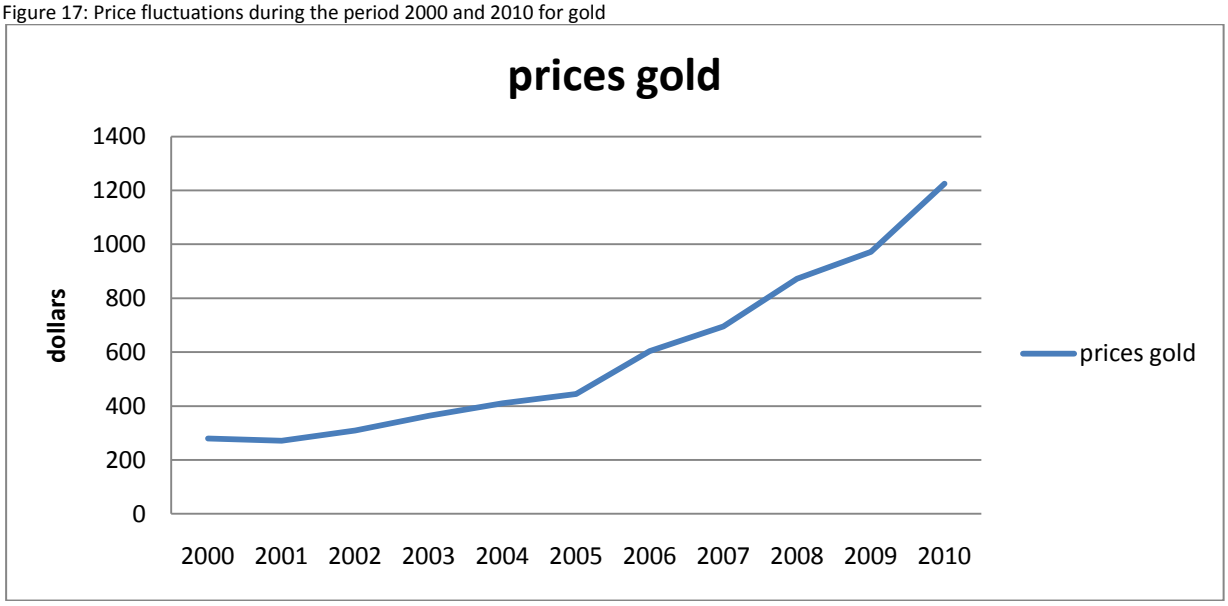
seems to be almost untouched by the price bubble of 2007/2008. Reason that the gold prices didn't declined has been discussed in chapter 3 in the part discussing the gold market. In the following chapters this will again be explained. Interesting fact when considering the prices is the growth which is seen almost directly after the decline of prices in 2008.

Figure 16: Price fluctuations during the period 2000 and 2010 for wheat, oil and coffee



Source: based on the information from table 16

Figure 17: Price fluctuations during the period 2000 and 2010 for gold



Source: based on the information from table 16

Taking the demand and supply in consideration, it is becomes clear in table 16 that in general the demand worldwide for the four commodities experienced a small growth or numbers which are more or less stable. For the US market these numbers have been stable during the past 10 years. The growth seen worldwide is (as we will discuss in coming chapters) due to e.g. the growing population number, change of diet as the income increases. Looking to the supply this pattern is similar. Worldwide a growing trend is visible in numbers and specific in the Unites States a small decline or stable numbers is experienced.

Table 16: comparison of the four commodities for demand/supply/prices for the world an specific the US (2000-2010)

year	Total demand World				Total demand US				Total supply World				Total supply US				Prices			
	Wheat	Gold	Oil	Coffee	Wheat	Gold	Oil	Coffee	Wheat	Gold	Oil	Coffee	Wheat	Gold	Oil	Coffee	Wheat	Gold	Oil	Coffee
2000	589400	3821	76,2	85214905	36300	396,4	24,1	23766839	582400	NA	76,7	113298000	60800	352,5	14,3	0	96	279,11	27,6	64,24
2001	595500	3729	77,3	85307908	33900	413,1	24	21415141	575100	NA	77,2	107857000	53300	≈325	14,36	0	102	271,04	23,12	45,59
2002	603759	3363	77,7	87155360	30448	409,3	24,1	21638914	567643	3560	76,9	122627000	43705	≈290	14,56	0	131	309,73	24,36	47,74
2003	588478	3207	79,3	89106474	32507	375	24,5	22760196	554595	3879	79,8	104787000	63814	≈280	14,61	0	125	363,38	28,1	51,9
2004	610111	3515	82,5	91989592	31823	371,8	25,4	23183954	628845	3361	83,4	116062000	58738	≈270	14,58	0	125	409,72	36,05	62,15
2005	623761	3753	84	92458435	31191	377,3	25,6	23041516	619721	3984	84,7	111277000	57280	262	14,14	0	126	444,74	50,64	89,36
2006	616109	3435	85,3	97437476	30940	338,5	25,4	23708762	596105	3451	85,5	129257000	49217	260	14,21	0	157	603,46	61,08	95,75
2007	616757	3571	86,5	99594815	28614	278,1	25,5	24219282	611185	3471	85,5	119276000	55821	238	14,27	0	238	695,39	69,08	107,68
2008	641754	3812	86,4	101347788	34293	267	24,2	24277004	683267	3513	86,4	128377000	68016	234	13,91	0	249	871,96	94,45	124,25
2009	651615	3493	85	98497468	30932	263	23,3	23575458	683109	3890	85,2	119894000	60366	216	13,63	0	179	972,35	61,06	115,67
2010	665790	3812	87,8	NA	32550	233,3	23,9	NA	642891	4108	87,3	134498000	60103	NA	14,1	0	213	1224,52	77,45	147,24

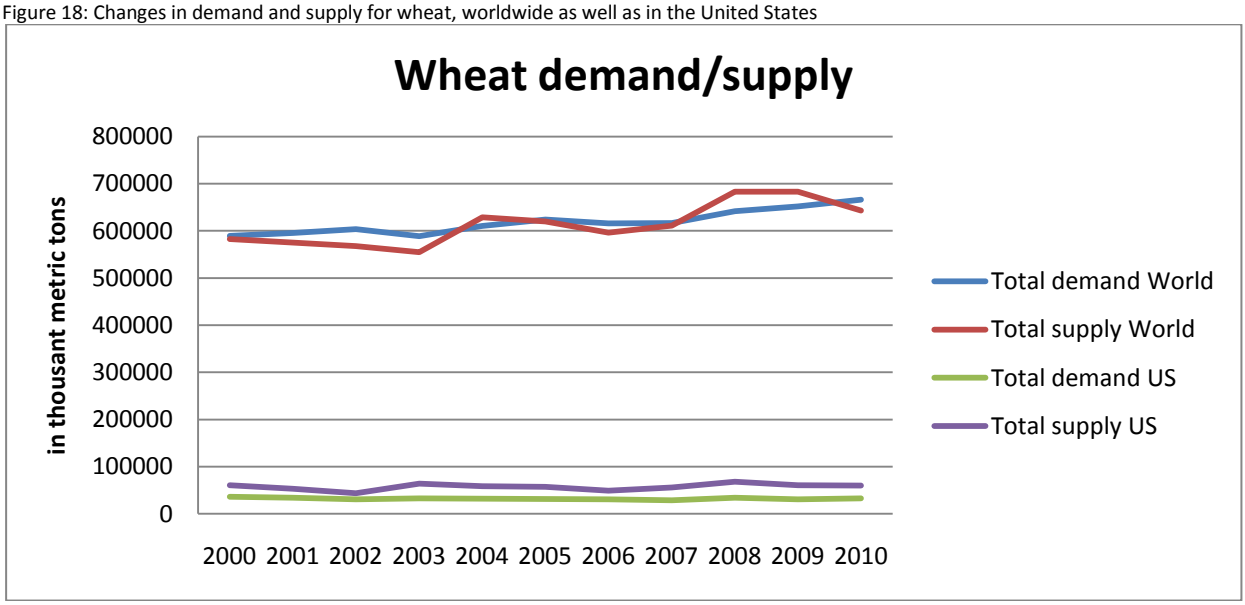
The quantities of wheat are in thousand metric tons (price per bushel).
The quantity of gold is in metric tons per year (and dollar per ounce).
The quantity of oil is in million barrels per day (price per barrel).
The quantity of coffee is in bags (60kg) (price per bag).
Source: Numbers are based on information subtracted from the following locations: http://www.gold.org/world_of_gold/market_intelligence/gold_demand/gold_demand_trends
www.ico.org www.usda.com www.opec.com www.oecd.com http://www.fas.usda.gov/grain/circular/2006/12-06/grainfull1206.pdf

With the use of the overview which is provided in table 16 it is possible to get a better view on the four commodities and how these markets are changing. After the general discussion on changes seen for the four commodities, a closer look to the individual commodities will be taken to compare the changes in demand/supply and the effect on the prices. With the use of graphs different aspects of the commodities are shown in relation to each other. Main goal is to show what is occurring on the market of the commodities. These simple analysis will be used later on in chapter 5 when factors will be discussed which can have a certain effect on the prices of the commodities. The numbers used in table 16 are yearly numbers due to a lack of data availability; monthly data would show more details of mismatches between demand and supply but are not achievable for the four commodities and for a longer period.

Wheat

The data provided in table 16 for wheat is used to create the figure 18. This graph is used to clarify the changes on the wheat market. It shows the changes for the period 2000-2010 in demand and supply worldwide as well as in the United States.

Figure 18: Changes in demand and supply for wheat, worldwide as well as in the United States



Source: based on the information from table 16

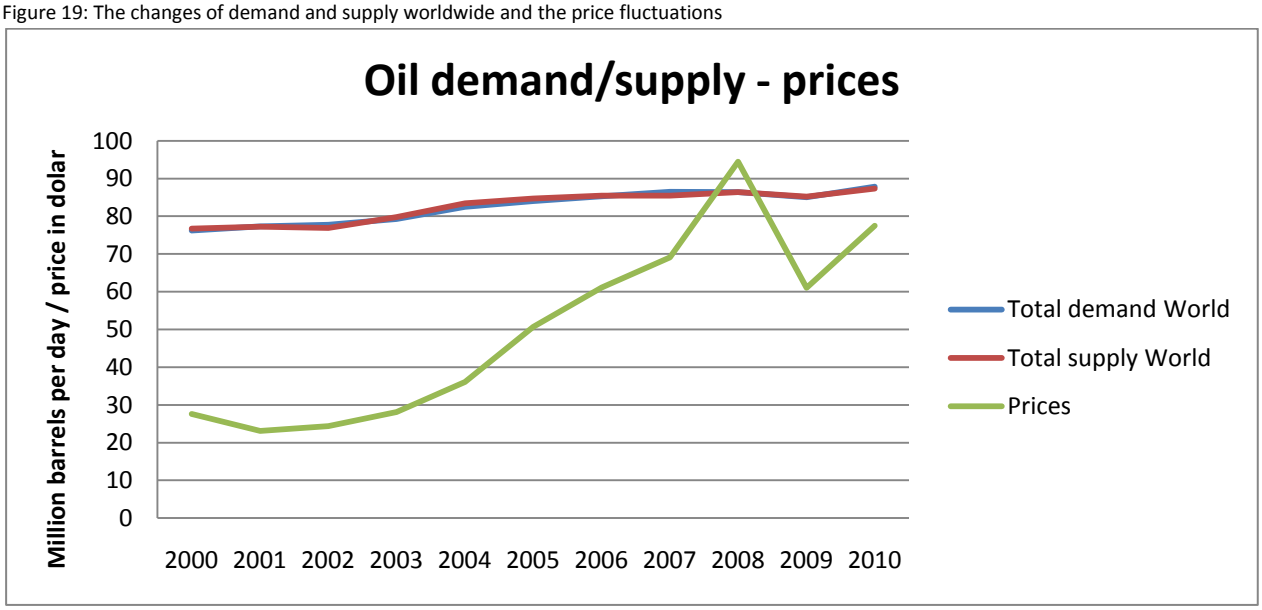
When looking to this graph it is visible that there are some small fluctuations in the demand and supply. This is leading to small mismatches. However there is inventory which is used to stabilize the situation and avoid the effects of the mismatches. When looking to figure 16 the price fluctuations for wheat are shown. These fluctuations are more extreme than the fluctuations seen in the demand and supply. However in 2005 and 2006 an undersupply is seen, as well as a steep growth of the price during this period. From 2007 up to 2008 there is a situation of oversupply. At the end of 2008 the wheat prices experienced an important decline, which is recovering at the end of 2009.

Oil

The following two tables are focusing on the oil market. In figure 19 the demand, supply and the price is shown. Remarkable is the fact that demand and supply are showing a slow growth during these 10 years. However the demand and supply are following each other and are not showing important fluctuations. Main reason for price fluctuations is a mismatch between demand and supply.

This demand and supply curve would imply that the price would stay stable; nevertheless we could note the price fluctuating during this period. To find what the cause is of the price fluctuation we need to look to other factors which can influence the prices. This will be done in chapter 5 part 5.3.

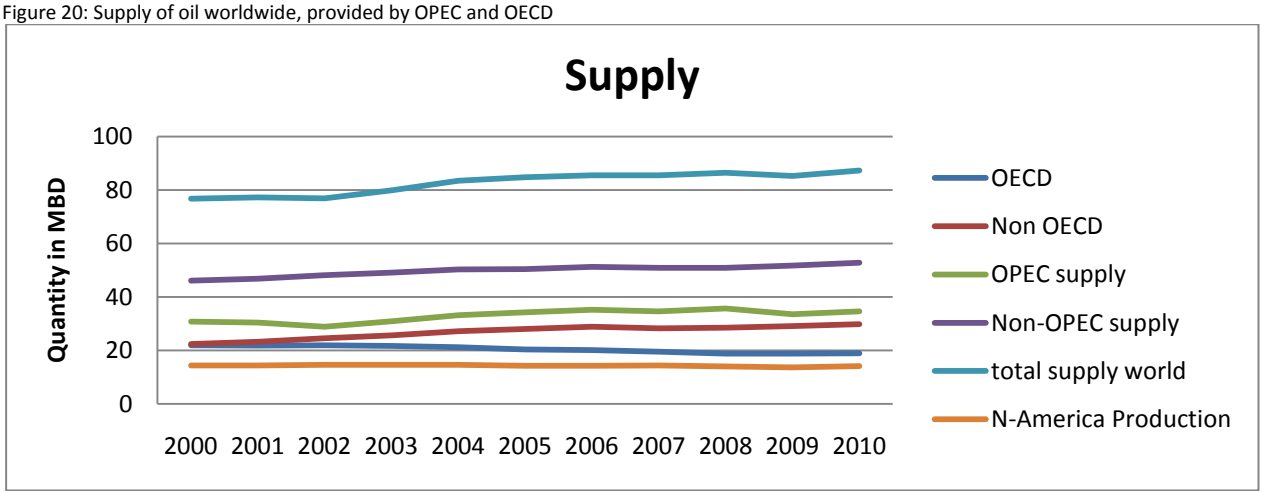
Figure 19: The changes of demand and supply worldwide and the price fluctuations



Source: based on the information from table 16

In the next figure 20 the supply is shown. In de discussion on the oil market it became clear that oil is produced in different countries and that there is a distinction made between two organizations the OPEC and the OECD. In the graph this distinction is also made to show how the different groups are standing in relation to each other. There are no spectacular changes in the curves. A slight decline is seen in the OECD supply and a small growth in the other groups.

Figure 20: Supply of oil worldwide, provided by OPEC and OECD



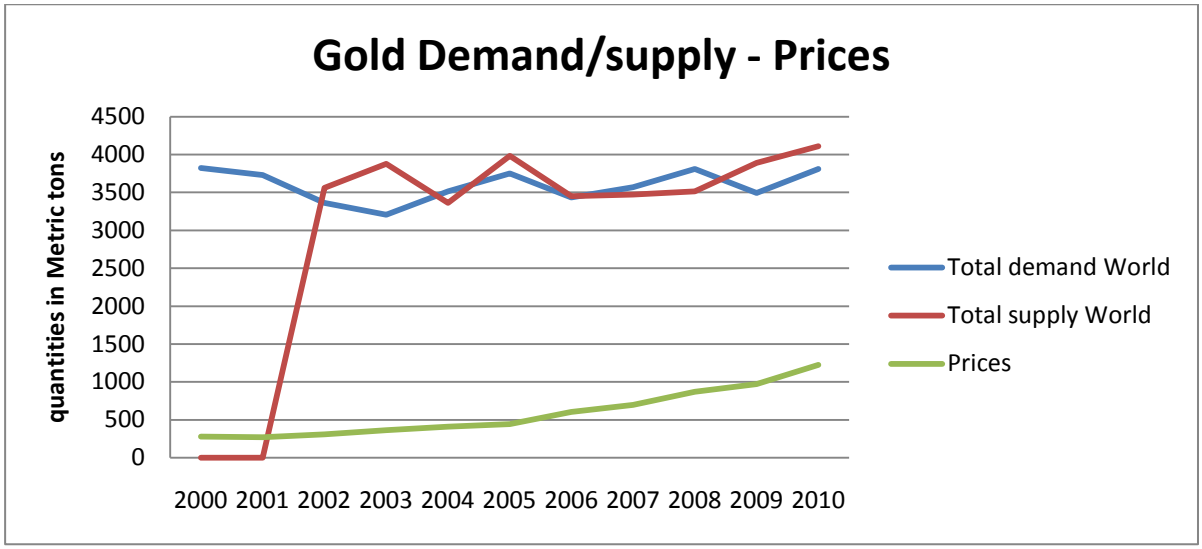
Source: based on the information from table 16

Gold

In the figure 21 the demand and supply for gold are shown. Small fluctuations are occurring during the period 2000 and 2010. These fluctuations are staying stable around the 3500 metric tons per year. The price is not showing a similar pattern and is constantly growing, from a low level of approximately 300 dollar in 2000 up to 1200 dollar at the end of 2010. This price of gold is per ounce. The reason that the supply of gold is laying around 3500 metric tons per year instead of the 2500

metric tons as discussed in previous parts of this chapter is the fact that this 3500 consist of new mined gold but also recycled gold.

Figure 21: Changes in demand and supply worldwide and the effect on the prices.



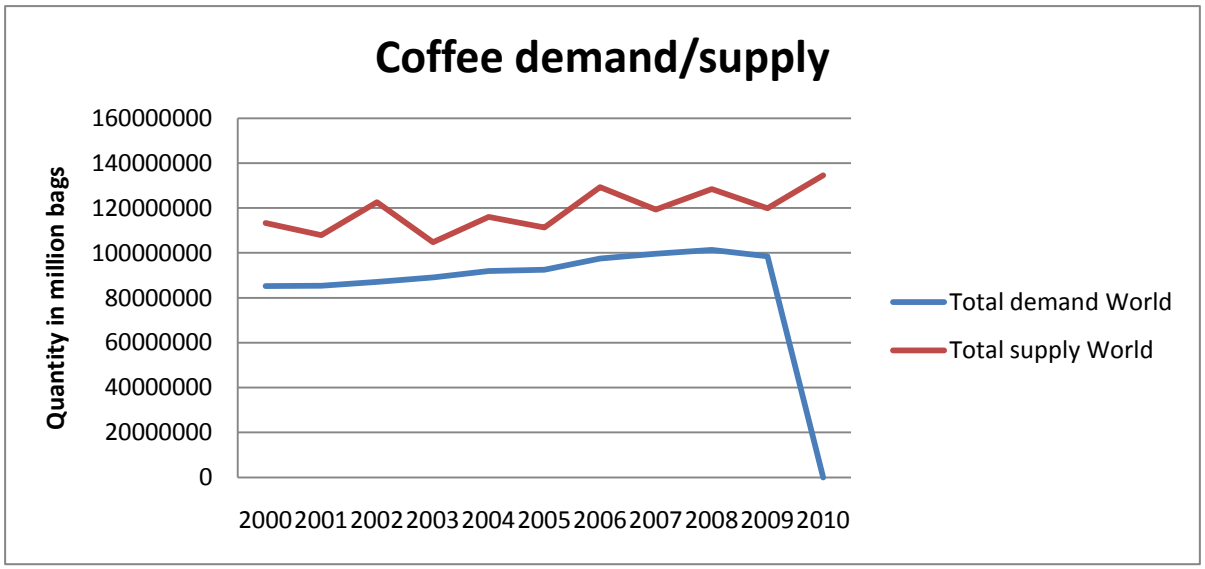
Source: based on the information from table 16

This graph shows that a mismatch between demand and supply is not the main factor leading to price change. The price fluctuation is not consistent with the fluctuations seen between the demand and supply. In chapter 5 this discussion will be continued when affecting factors on the gold prices will be discussed.

Coffee

In this last figure 22 the changes on the coffee market are shown graphically. Interesting is the fact that the demand is growing slowly but stable and is bellow the world supply at all moment. The supply is showing clear fluctuations during the years. This has been shortly discussed and will be discussed in detail in chapter 5, it is clear that the supply is very much depending on factors as for example the weather. When considering the price fluctuations shown in figure 16 a stable growth is seen for the coffee during the period 2000-2010. The price bubble is clearly visible in 2008; however the increasing prices are not what we could expect of a market in which the supply is constantly above the demand. The reasons for this effect will be discussed in a later stadium of this research.

Figure 22: Changes in demand and supply on the world market between 2000 and 2010



Source: based on the information from table 16

3.6 Conclusion

As was discussed in the previous chapters, price fluctuations can increase insecurity. This is not preferable due to the increasing number of different participants on the commodity market. For the participants having a clear view/idea of what the prices are going to do is important. In chapter 2 the different groups of commodities has been point of interest, because there are different types of commodities we have made the choice of four different commodities. In this chapter, a closer look has been taken on the four specific commodities (wheat, gold, oil, coffee).

The four commodities have been discussed in a similar way, and started with a first part with general information, in which the use of the commodity has been discussed. This background information and information on the way of producing will be useful in chapter 5, when the influencing factors are going to be discussed. It continued with information on the situation in the world; where is the commodity produced, the production quantities and the trade. This general part on the commodity and the situation in the world where followed by more specific information for the United States its market and participants.

It became clear that all four commodities are important commodities in different ways. Wheat is a commodity which is part of menu on daily basis for many people and is used as feed for large parts of the livestock. Oil is a commodity which is used as a raw material for many products. Not only as raw material but also for the transportation and the fabrication of many products. This means that oil price is affecting many other commodity prices and has a large impact on the economy. Gold is a commodity which is special due to the fact that it will maintain its value over the years. Gold is seen as a save investment product. During periods of economic decline many people start investing in gold. And finally coffee, this is a commodity which is produced in mostly developing countries. Many people in these developing countries are depending on the production of coffee, and it is often a large part of the GDP of those countries. This makes coffee for many people very important.

What became clear from the comparison of the four commodities is that the fluctuations between the demand and supply are not dramatically. However the prices have experienced an important growth during this period. We could conclude that this is not only explained by the small mismatches between supply and demand. Important to take in consideration is the fact that next to the regular demand/supply there is inventory for the four commodities. These are used to stabilize changes on the supply and demand market. Now we used yearly data, when using more detailed data for smaller time scales like monthly data or daily data it may show more mismatches between demand and supply.

The price bubble which has been discussed in chapter 2 could be seen clearly in the graphs discussing the prices of the commodities. Interesting is the fact that the gold prices seem to stay untouched by the price bubble. The reason is that during periods of economic instability or downturn, investing in gold is interesting as it is a stable commodity and so a secure investment.

In the following chapters the focus will be on the forecasting of the prices in the future.

Chapter 4 The common used forecasting models

"Prices are ever changing. They change from hour to hour, from day to day, from season to season, and year to year. Every change affects the relationships of individuals, of groups of people, and of nations. Many factors are combined to make prices what they are. Prices are both a cause and an effect. The causes may be analyzed as just as substance may be analyzed chemically, and the proportion due each cause ultimately may be determined. The science of price analysis is still new but has progressed far enough to be of help" (Warren and Pearson 1933, p.2 subtracted from Labys 2006).

In this chapter the focus will lay on the prediction of influencing factors which can affect the demand/supply the production and finally the prices of a certain commodity. These influencing factors are the variables which can be taken in account in a forecasting model. Forecasts are increasingly important, and for an increasing number of people, which is discussed in the first chapter "the introduction of this research". This chapter will begin with an explanation of forecasting and the necessity of it. Different types of forecasting methods are discussed and more interesting different types of models which are commonly used for forecasting. We will continue with the discussion on two large organizations, FAPRI and OECD, who are dealing with forecasts. In this part the models which are used are discussed. How are these models modulated, and what are they consisting off. Finally, just as have been done in the precedent chapters we look to the four commodities separately. Important is to clarify the commonly used models for each of the different commodities. And why these models are used instead of other models.

4.1 **Forecasting**

Forecasting is a tool to help predict the future. Before considering the forecasting models, the definitions for forecasting is given by the business dictionary (www.businessdictionairy.com Jan.2011), it is defined as; "a planning tool which can be used in order to cope with uncertainty in the future". According to Copra and Meindl (2010, p.71) "forecasting is the art and science of making projections about what future demand and conditions will be". Obtaining this forecast information means using sophisticated techniques to estimate future sales or market conditions. This definition of Copra and Meindl is especially focusing on the forecast an organization needs in order to optimize the supply chain of their organization.

The forecasting of prices has been done for centuries now. The twentieth century has been latest spectator to the impact and the importance of commodity price fluctuations. It is known that the commodity price records have come down to us from the ancient civilizations of India, Mesopotamia, Rome, Egypt and Greece. Earlier in the 19th century, formal research began on the relationship between agricultural demand, supply and prices in the market context. The different methods used have been changing in the last century. Methods which have been used mostly in the beginning of the forecasting of commodity prices were simple.

Predictions are very important within scientific and economic communities. As Diebold and Mariano (1995, p.134) states, 'forecast accuracy is of obvious importance to users of forecasts because forecasts are used to guide decisions'. There are different peoples, institutes, organizations or companies which are very interested in good predictions. This can be e.g. a government, a producer

of a commodity or the trader of the commodity. But also investors which are seeking to hedge or speculate on the market of a certain commodity are benefiting from a good forecast. Many decisions are made upon these forecasts. This shows that a accurate prediction is of importance.
Nowadays a world without forecast would be hard to imagine. Many decisions are built on the forecasts made. For example many organizations are using these forecasts to calculate how much they need of a certain product.
On the commodity market, forecasts play also an increasingly important role. Because many commodities are produced and traded all over the world the forecasting of supply and demand is interesting. Prices are to a large extent set by the demand and the supply of a certain product (Krugman, 2008). Due to the fact that more participants are acting on the commodity market, as has been discussed in chapter 2 part 2.1, it makes the forecast even more important. More and more participants are acting on the market to enrich themselves or to reduce risks. For these participants forecasts are essential. But also for all these organizations which are using forecasts for estimating price changes of food prices, something which is important with the enormous amount of poverty in the world. People are making decisions based on forecast so this shows the importance of a high accuracy in forecasting.

Summarizing this first part of chapter 3, we saw that forecasting is something which has been done for long time now and is becoming increasingly important due to the higher involvement of participants on the commodity market which are making decisions based on the forecasting of prices.
This means that more accurate methods and models are required to satisfy the growing demand of precise forecasts.

4.2 **Different methods and models**

Presently there are different types of forecasting methods. First of all different subject on which forecasts can be made (prices, demand or the long or short term), but also many different ways to forecast. A small discussion on some general different types of forecasting methods will give a clear overview. The different methods which are commonly used are according to Walonick (1993);

- Trend extrapolation
- Simulation methods
- Cross-impact matrix methods
- Consensus method
- Scenario
- Decision trees
- Genius forecasting

In appendix 1 the different methods are discussed extensively.

When comparing the different methods it become clear that different techniques are used to forecast. Some are based on historical data and try to find trends and similarities in data which can be used to predict future prices. Other use more mathematical models to find cycles in the data which could mean that regularity is seen in the prices in the past. These methods are often more

complex and are making use of data and assumptions. Wrong data can have an important effect on the forecast. Other methods are making use of the knowledge of experts on a certain field. Getting the opinion of different experts makes sure that different views are taken in account. However this method is very time consuming.

It is seems clear that no forecasting technique is appropriate for all situations. According to Walonick (1993, p6) "there is evidence that comparing different forecast and combining different techniques can improve the accuracy of the forecast. However there is also evidence that adding quantitative forecasts to qualitative forecasts reduces accuracy. Research has not yet revealed the conditions or methods for the optimal combinations of forecasts".

Combining different techniques can indeed have as effect that the methods can compensate the weaknesses of each other and complement each other. What will be seen is that for the forecasting of commodities often different methods are used or at least different characteristics of the different techniques. Having a model which is using different variables is increasing the accuracy, however be aware of the influence of one variable on another. The use of different models will make it more complex and means that the knowledge of different methods is required. Simplicity is often seen as a strong point for methods and models.

These descriptions of Walonick are somewhat general and not going into depth. For that reason we use the summarizing table 17 (which can be found in the appendix 2) which consist of most of the commonly used forecasting methods and a short explanation on the way of working. Reason for not discussing all the existing models is the fact that there is an enormous amount of different types of models which is known, many of these models are rarely used or just in a specific case, which makes it less interesting for this research.

Summarizing this discussion on the different methods and models which are known for forecasting; first we saw the different methods which are used to make forecasts. These methods are very different and stretch from using just your imagination, up to the use of mathematical calculation. There is not one method which is the best method. Each method has its strong and weaker points. For this reason combining different methods is increasing the forecasting ability of the methods. For each problem or situation there is an appropriate method. After the discussion on the different methods a closer look has been taken on the different models which are often used for the forecasting of commodity prices. Here a variety of models is proposed which are most commonly used for the forecasting of the different commodity prices. Especially the extrapolative models and the regression models are often used in literature for forecasting of commodity prices. Important for our project are models which are based on historical data and trends but which are completed with variables which can influence the prices.

4.3 **Common used model and the large forecasting organizations**

Before looking to the used forecasting methods for the four commodities, it is important to be aware of the differences between long, medium, and short term forecasts. Because the possibility exists that on the market of the commodities quantities and prices are often random, a large amount of

risk and uncertainty is involved in the process of market analyzes and forecasting. The nature of the price fluctuations varies and they are caused in the long, medium or small term.

- In the long run the focus is especially on trends in the commodity prices. According to (Labys 2006) the economic analyzes of long term price trends had its origins in studies of historical commodity price movements, which span several centuries. From a practical point of view the predictions of the long run price trends have been important for evaluating investments in commodity industries, particularly in mineral and energy projects in developing countries. The econometric methods of interest have been those dealing with structural breaks, booms and slumps, secular movements, and risk analyzes. Also in the long term, commodity markets are subject to shocks or change in trends, which range from natural catastrophes and political/military interventions to structural market changes.
- The medium term issues are related to the cyclical, often unstable nature of commodity price fluctuation, such as does linked to the business cycle movements. Kondratief proposed that commodity and consumer prices reveal cycles that re-occurs every 50-60 years. More recent studies have examined the interrelations between commodity prices and business cycles. Related econometric models have not only used spectral and dynamic factor analyses but also have involved structural time series models, which emphasize cyclical components. Medium trend to be more related to national economic conditions or to market forces themselves.
- Short term issues derive from overwhelming nonlinear, stochastic nature of price swings and the difficulty of forecasting them. Price can be disrupted in the short term due to different events. This can be e.g. a disaster, political or economic disruption. Especially the two last possible events have been discussed in shortly in chapter 2, and will be discussed extensively in chapter 5. These types of possible effects should be taken in account as they can have a major impact.

The different ranges of time in which fluctuations can occur are essential for our research. Later in this chapter when for the four commodities, forecasting models will be discussed, long-, medium-, or short term have to be taken in consideration. Also when in chapter 5 new possible influencing factors are introduced this will come back.

As seen previously there are different types of forecasting models. For each different purpose and commodity a different method or technique will be most appropriate. Because, as Diebold and Mariano (1995) stated, the forecast are important to make decisions. This has lead to an increasing number of people, governments and organizations etc. which are more depending on forecasts. Due to the growth of the commodity markets which have been discussed in chapter 2 part 2.1.2 more participants are active on the markets. Also the continuously globalizing of the market is leading to more participants on the market. Not only the numbers of participants is growing also the money which is involved in this market is greater than ever. Effect of the rising importance of the market is that more organizations are focusing on the forecasting of the market and the prices of different commodities. Many decisions are based on these forecasts, this means that non accurate forecasts can lead to insecurity and unrest, which is a very undesirable situation.

There are organizations which are focusing on the forecasting of prices of different commodities. These organizations are not focusing on all different commodities but mostly on a group of commodities as discussed in part 2.1.1 of chapter 2. Especially for agricultural products and oil there

are organizations which have as objective to predict the prices. These commodities are important due to the fact that they influence many people and financially are very interesting. For these predictions different models are used. Some of these large organizations are FAPRI (Food and Agricultural Policy Research Institute), OECD (Organization for Economic Co-operation and Development), and WTO (World Trade Organization). These organizations have as main goal to inform policymakers, producers, investors in order to make medium and long term decisions. These forecasts can be used for the decision making. Providing most accurate forecasts possible is logically an important issue. Long-run predictions of wheat prices are published regularly by the OECD and the FAPRI. Both institutions are intrinsically motivated to offer very accurate forecasts because "their reputation rises and falls with the exactness of their predictions" (Diebold and Mariano 1995, 134)

4.3.1 **Structure of the models**

How forecasting models are modulated is depending on the type of model which is used for the forecast. In this part the focus will be on predicting models which are most commonly used in the forecasting of the commodity prices. In order to get a clear view of these models we will discuss what the different parts of the models are. The models used are often extrapolative models which are using historical data to calculate future prices, and which encompass variable which can affect the prices. Some requirements for successful forecasting according to (www.gwu.edu Jan. 2010) are;

1. There are regularities to be captured,
2. The regularities are informative about the future,
3. The proposed method captures those regularities,
4. The proposed method excludes non-regularities.

These points show that when using a model it is important to be aware of what the necessary input is and which information and data you have.

Most models used for forecasting are based on the following three points. These points are described on (www.logisitik.com Jan. 2010).

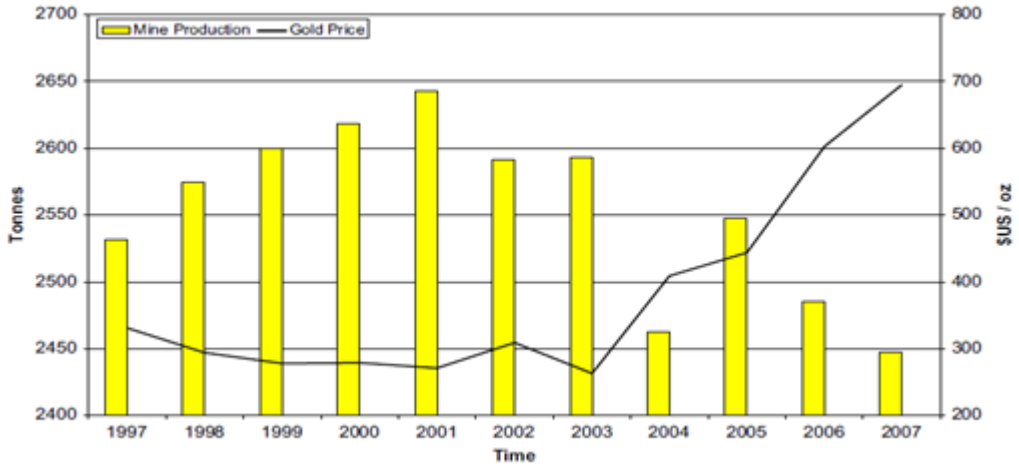
1. Deterministic terms like intercepts, trends, seasonal factors, or other factors with known values.
2. Observed stochastic variables which the model attempts to characterize and have unknown future values.
3. Past, present, and future innovations.

An important point when using models is; that you should be aware of the possibility of making mistakes. A small mistake can have a large impact on the final results of your forecast.
Some possible mistakes are inaccurate measurement, misspecification, inaccurate estimation, fluctuations in unexpected ways.

Important to keep in mind is that "the price of a commodity fundamentally is driven by supply and demand. Another key quantity is the available inventory at the date of analysis, worldwide or in a given region. This inventory has in particular a major impact on price volatility. In contrast to financial markets, volume risk is as important as price risk. It takes several forms volumetric options (financially traded or embedded in supply contracts) uncertainty on oil reserves may generate a downward jump on the stock of an oil company" (Geman 2005, p.3). This means that volume risk can affect the demand and supply of a certain commodity. As stated by Geman, supply and demand are

often most important for the price of a commodity, so volume risk can influence the prices. In figure 23 the effect of changing supply is demonstrated. As illustration the change in price of gold is shown in relation with the declining supply of gold. Less gold is mined which means a declining supply. As discussed in chapter 3 part 3.1 the demand has not changed much over in this period. It is clear that less supply leads to prices which are increasing when demand is not changing.

Figure 23: Gold price in relation to the gold production (1997-2007)



Source: Shafiee, S., Tropal, E. (2010)

4.3.2 **Variables**

As discussed in 4.3.1 the models consist of different elements. The historical data are very important and are the basis of most models; however the variables which are used in the models are affecting the predictions. These are leading to possible changes in the forecast. These affecting factors (variables) are important for the prediction of the prices on the commodity market because they are adapting prices for possible effects which are not found back in the historical data. Variables are defined as, "characteristic, number, or quantity that increases or decreases over time, or takes different values in different situations. There are two basic variables, the dependent and the independent variables" (www.businessdictionary.com Jan.2010). The dependent variable is a variable which can take different values only in response to an independent variable. Exogenous variables are defined by Pearl (2000) as "A factor in a causal model or causal system whose value is independent from the states of other variables in the system; a factor whose value is determined by factors or variables outside the causal system under study". As with endogenous variables, the status of the variable is relative to the specification of a particular model and causal relations among the independent variables. A variable can be made endogenous by incorporating additional factors and causal relations into the model (Pearl 2000).

The organizations FAPRI, OECD, WTO which were shortly discussed in part 4.3 are using models which are based on historical data and which are supplemented with variables. The main reason for this research is the question if the variables used are still accurate and if there is a possibility that

new variables are influencing the prices of the commodities. If the models used are missing variables, this will affect the accuracy of the forecast.

To clarify the forecasting models as discussed until now, a short discussion on the FAPRI model will follow. This will show how models are build up out of different element. OECD and WTO are using similar models for price forecasts, for this reason only a FAPRI model will be discussed more extensively. FAPRI is using a model for the prediction of grains which is based on, a non-spatial, multi-market model that covers several countries/regions and includes a rest-of-the world aggregate. It has links to other models in the FAPRI framework, such as the U.S. crops model, international cotton, dairy, livestock, oilseeds, rice, and sugar models. Reason for this link is the fact that these models can affect each other. The data sources included in the model are the USDA-FAS (Foreign Agricultural Service) Production, Supply, and Distribution (PS&D) data set, the International Monetary Funds' (IMF) International Financial Statistics (IFS) macroeconomic data set, USDA attaché reports, and other sources for commodity prices (http://www.fapri.iastate.edu Jan. 2010).

The grains model interacts with the dairy and livestock models that provide information on feed demand in the countries, and with oilseeds and rice models that provide information on the relative profitability and area harvested for the competing crops. Each country sub model consists of at least one commodity depending on the relative importance of the commodity and the relative importance of the country in the world markets as a supplier or a buyer. In terms of the structure of the models, the following identity is satisfied for each country/region and the world: Beginning Stock + Production + Imports = Ending Stock + Consumption + Exports (http://www.fapri.iastate.edu Jan. 2010).

Production is divided into yield and area equations, while consumption is divided into feed and non-feed demand. To satisfy the identity, two different methods are used. In most of the countries, domestic price is modeled as a function of the world price with a price transmission equation, and the identity is satisfied with one of the variables set as the residual. In other cases, prices are solved to satisfy the identity. Agricultural and trade policies in each country are included in the model to the extent that they affect the supply and demand decisions of the economic agents. Examples of these include taxes on exports and imports, tariffs, tariff rate quotas, export subsidies, intervention prices, and set-aside rates. The grains model assumes that the existing agricultural and trade policy variables will remain unchanged in the outlook period. Macroeconomic variables, such as GDP, population, and exchange rates, are exogenous variables that drive the projections of the model. The model also includes an adjustment for marketing-year differences by including a residual that is equal to world exports minus world imports, which ensures that world demand equals world supply (http://www.fapri.iastate.edu Jan.2010).

Resuming this part, the discussed methods and models in part 4.1 and 4.2 have been dissected to make clear what most models are consisting of and what is important to be aware of when working with such methods and models. What became clear is that many models are using historical data as a basis and seek for trends, seasonality's or other cycles which influence the prices. This are effects which occur in the long- or medium term. In the short term it is often variables which can affect the prices, for example a disaster, economic or political disorder. Taking in account all possible factors which are influencing the prices will lead to a higher accuracy. Nowadays there are organizations which are dealing with these forecasts and are aiming to provide governments, traders, buyers etc.

with price forecasts of commodities with the highest accuracy. In the following part a specific attention will be paid again to the four commodities and their forecasting models.

4.4 Commonly used model for the four commodities

In this part a closer look will be taken to the four commodities. Because there are different forecasting methods and models known and used, assumptions will be made in this project on the four models which will be used for the prices forecasting of the four commodities. This assumption will be based in the first place on the general information provided in the first part of this chapter (to take in consideration which information is important) and in the second place data availability. Specific literature on forecasting of the four different commodities is used. These models will be discussed into detail because they will serve as a basis for the following chapters of this research. Important questions are, why this specific method and model is used, and what the implications of this model are? Next to this, understanding the model in detail is important because as stated earlier, these models will form a basis for the following parts of this research as we will search for possible factors which have an influencing role but which are not taken in consideration.

The fact that we use existing models has been discussed in the introduction. To explain this choice; the main question is about the possible incompleteness of the existing forecasting models. Using an existing model which takes in account different parameters and exogenous variables presently could be supplemented with extra exogenous variables. In addition the weight of the different variables can be reviewed. This means that a variable which is presently influencing for a large part the forecast might be less important and could be given less weight.

4.5 Discussion on the four models used

In the previous parts, different forecasting models have been presented. Reasons for having selected these models are the simplicity of these models and because it are commonly used models in the publications. It also provided a good inside look to the models how these are functioning. A fact which has to be taken in account is that large (and important) forecasting organizations will not provide their exact models which are used for their forecasting. The models presented in this chapter are simple models which give the possibility of adding new (exogenous) variables to it.

In table 18 a clear overview is provided of the four different models which are discussed previously. When comparing the models it is clear that there is a difference in the type of models. The different factors discussed in table 18 show that differences are in the first place the difficulty of the different models; especially the model used for coffee forecasting is difficult. All four model need much data for the prediction of the prices and are all based on historical data. The model used for the wheat forecasting is also taking more actual data in account. Looking to the time range all four models are focusing on the short term, the gold model can also be used for a longer term. The longer the time range is for which you want to make a prediction the less accurate it will be. This is due to the fact that the models use historical data as a basis. The forecasting models used for wheat and for oil are both econometric model. This makes it possible to add new variables to it. Both models are based on supply and demand. The econometric model used for the wheat prediction has as basis the prices of the past 10 years. This is combined with the demand and supply of the past 10 years. This time range is taken to see if there are trends in this period. This can help to take in account effect of change of climate (to some extend) and change in the technology used. Interesting is the fact that wheat

forecasting model is the only one which takes clearly exogenous factors in account in the model. Prices of crude oil are an important factor for the prediction of wheat prices.

All four models take historical data as a basis for forecasting which are based on the demand and supply. The econometric models can easily be completed with extra variables which can have a certain effect. The ARIMA model and the VECM model can be completed with variables which are conducted by the use of a regression model; nevertheless this will be more difficult for the model used for the coffee forecasting as you should take in consideration four different types of coffee.

It is interesting to see that presently wheat has the only predicting model which considers the effect of another commodity. When we compare the models which are chosen for the four commodities all four are part of the method of trend extrapolation or of the method simulation methods. Both methods are especially focusing on the short term prediction. For longer term other methods would be suitable. Especially with new factors beginning to become important in the future a method of scenario thinking could be interesting. The time frame in which you want to have a prediction is a leading question for the method and model used.

The discussion of the four different models can be found in the appendix 3. The most important points are discussed in table 18.

Table 18: Comparison of the models of the four commodities

	Model Wheat	**Model Oil**	**Model Gold**	**Model Coffee**
Type of model	Econometric model	Econometric model	ARIMA model	VECM Model
Complexity	Simple model	medium	medium	difficult
Data availability	Much data required (production/consumption/stock for ten years)	Much data required (demand/inventory/spot price)	Much data required (based on historical data)	much data is required (prices of the four different types of coffee for a long period)
Data used	Mostly historical data (stock-to-use-ratio/acreage/production/consumption, for the past ten years)	Historical data and actual data	Historical data (white noise is based on historical data)	Historical data
Exogenous variables	Yes are used in the model (oil price)	Not used in the model	not used in the model	yes the different coffee types, as they are influencing each other, but no other exogenous factors

Long or Short term	short term	short term	short term and longer term	short term
Trends and seasonality's	Due to the time range of 10 years trends and seasonality's are captured in the model	yes are taken in account as in the oil market seasonality's are important	Due to the time range of 10 years trends and seasonality's are captured in the model	yes due to the large time range which is used
Possibility of adaption	Yes new exogenous factors can easily be added to the model	yes there is a possibility of taking in account new factors	There is a possibility of adding data from a regression analysis (effect of currency exchange for example)	Difficult

Source: based on information of the previous parts from this chapter

4.6 Conclusion

Concluding this fourth chapter; it has become clear that forecasting is an activity which is known and utilized for a long period now. In the discussion about the different types of methods it became clear that there are methods which are useable for different situation and that the combination of methods is often making your forecast stronger. When making a forecast it is important to be aware of what type of forecast you want to make and which method would fit for that case. This has to do with data availability, the existence of many exogenous factors which affect the product for which you want to make a forecast. It is important to understand that combining methods can lead to increased complexity which could result in mistakes; combining methods should be done with care. For example a combination of the knowledge of different experts, the discussion of scenarios and finally the use of a model to make the predictions or substantiate the predictions made by the experts. This can enforce your findings.

When looking to the more statistical and mathematical methods many different models are known. There is an increasing amount of models known which have their own qualities. This is to be able to use the most suitable model each situations. In the search for forecasting models for the four commodities it became clear that there are different models used which also have different objectives. Which method/model to use is depending on the available information/data, the affecting factors which play a role and the time frame for which the forecast is made.

In this chapter we continued with information on how the models are constructed. The main points which are mostly seen in the models are as follow;

1. Deterministic terms like intercepts, trends, seasonal factors, or other factors with known values.
2. Observed stochastic variables which the model attempts to characterize and have unknown future values.
3. Past, present, and future innovations.

In the discussion on the consistency of models it became clear that models often consist of a basis which is based on historical data and which are adapted for possible trends or seasonal factors. Next to these data the models are often adapted with exogenous variables which can affect prices. These exogenous variables, are factors which are not directly in relation with a certain commodity, however do have a certain influence on the prices. Taking in account exogenous variables can be important when the prices are being influenced by these factors. Denying these factors would affect the final results of the prediction. Important to keep in mind when using a certain model is the fact that when for a model assumptions have to be made, that the final results can be affected by wrong assumptions.

Now we know which models are commonly used we can observe which factors are taken in consideration. In the following chapter the focus will lay on these exogenous factors which can have a certain influence on the prices of the commodities. In literature some factors have been described, however most of these factors are not taken in account in the models. Are some of the factors perhaps becoming more important presently and should be considered in the models, or are there factors which have not being discussed until know? Interesting will be the comparison between the four commodities. Are there factors which are influencing all the commodities and to what extent. The comparison of the different commodities and influencing factors can provide interesting information.

Chapter 5 Influencing factors on the commodities

In this chapter the focus will lay on factors which may influence the prices of the four commodities. Different factors are already known and are taken in account in the forecasting models as discussed in previous chapters. The affecting variables which are taken in account in the models we use as a basis have been discussed in chapter 4 in paragraph 4.3.2. In this chapter we will search for possible exogenous factors which are not yet captured in the models or which are not thought about as being possibly an affecting factor.

This chapter will start with a general part in which variables will be discussed and in which way these are affecting the prices; how are variables chosen and for which reason? Further in this chapter the four commodities will again be discussed separately in order to find specific influencing variables which are not taken in account in the existing models for the different commodity. This will consist of factors which have been discussed in literature and new not yet discussed factors which are not yet known (or not given attention) and which might be interesting in the future. This will be based on literature. The difference between long term and short term as explained in chapter 4 will be taken in account in this part. Obvious there are many factors which can affect the prices of a certain commodity in one way or another, however the possible effect of these variables is important, which means that only important affecting factors are being discussed. Adding many variables into a model would not lead to more accurate predictions but to a more chaotic model which will become almost unusable for the price forecasting.

As we discussed in part 2.2 of chapter 2, price bubbles have been an interesting discussion lately. The possible influence of commercials and non-commercials (hedgers and speculators) has been point of interest in different publications by different authors. Because this could be an effect which is affecting all commodities traded on exchanges or on the OTC market it will be taken in account for all the four commodities (as the four commodities are being traded on the OTC market and on the exchange). This will be done in a separate part before starting the search for new variables for the four commodities individually.

5.1 **Variables**

The commodities trading models, discussed in chapter 4 are structured similarly. The basis for these models is formed by historical data which is adapted to a certain extend for errors or with noise. Some models are more complex in a sense that additional exogenous factors are added to the model to correct prices for possible changes in the market. These factors are formulated as variables in such models. In chapter 4 variables have been discussed. We saw that there are different types of variables. In this chapter the exogenous variables are especially important. These are the affecting factors which are influencing the prices but are not directly related to a commodity itself. Variables which can influence the prices can change over time. This is one of the reasons this research is pursued. The possibility exists that the currently used models are not covering all affecting factors anymore. Changes in the environment can have lead to new situations which are provoking pressure on prices.

Depending on the type of market, it is not possible to forecast prices, merely based on historical data. Trends which are seen in a long term are important but do not capture effects in the medium or short term, like cycles or seasonality. Especially commodity markets which are not stable (as

discussed in chapter 4) would have difficulties to produce accurate forecasts. These forecasting models are accomplished with the use of variables which are possibly affecting prices.

Important in the search for possible influencing factors, is first of all that we take in account the long term but also the medium and short term in which factors can influence in a certain way the price (even if it is difficult to add all in one model). Next to this time scale we will have to make a distinction between influencing factors which are already known but not used and influencing factors which are not yet taken in account at the time of writing it is not affecting the prices yet. However possibly it could become an important affecting factor in the future. Before looking to the four different commodities and what is affecting the prices we will start the important discussion on the effect of the commercials and non-commercials on the commodity prices.

5.2 Influence of commercials and non-commercials

In part 2.2 of chapter 2, price bubbles have been discussed. These severe price increases and downturns are causing unrest and instability on the markets. The last price bubble (2007/2008) was affecting most of the commodities. Important was the skyrocketing of food prices and oil prices. The increase of food prices is an interesting debate presently as it is affecting many people and leading to hunger especially in developing countries (as discussed in previous chapters). For this reason many publications (published after 2008) are focusing on the discussion of the last price bubble. The possible cause is an interesting subject. Different views are proposed in the publications. Most important discussion is the one on the effect of commercials and non-commercials. These participants who are acting on the commodity markets with as prime goal hedging or speculating (discussed in part 2.1.4 in chapter 2). This discussion is interesting for the research as this could be a possible affecting factor, one which presently is not used in forecasting models. Before looking to the different publications a short reminder on commercials and non-commercials will be provided.

The futures markets perform two essential functions. First, they facilitate the transfer of price risk and increase liquidity between agents with different risk preferences. The second major economic function of future markets is price discovery. Commercial traders, including producers and processors of agricultural commodities, utilize futures contracts to insure their future inventories against the risk of fluctuating prices. Non-commercial traders, such as speculators, operate in futures markets for possible gains from futures prices increases. Last decade a significant increase in commodity futures trading has been experienced as discussed in chapter 1 and 2. Especially a new class of non-commercial actors composed of institutional investors is active.

Johnson (1960) defines Speculation as the assumption of the risk of loss in return for the uncertain possibility of a reward. It is ordinarily understood to mean the purchase of a good for later resale rather than for use, or the temporary sale of a good with the intention of later repurchase in the hope of profiting from an intervening price change. Only if a particular position involves no risk can it be called, strictly speaking, an “investment.” Financial speculation involves the buying, holding, selling, and short-selling of stocks, bonds, commodities, or any valuable financial instrument to profit from fluctuations in its price as opposed to buying it for use or for dividend or interest income. Speculators are especially short term oriented. Speculation is one of four market activities in financial markets, along with hedging, long- or short-term investing, and arbitrage. The typical definition of a speculator is a market participant who does not produce, use or consume the commodity in its ordinary course of business, but rather enters the futures market solely to profit from changes in

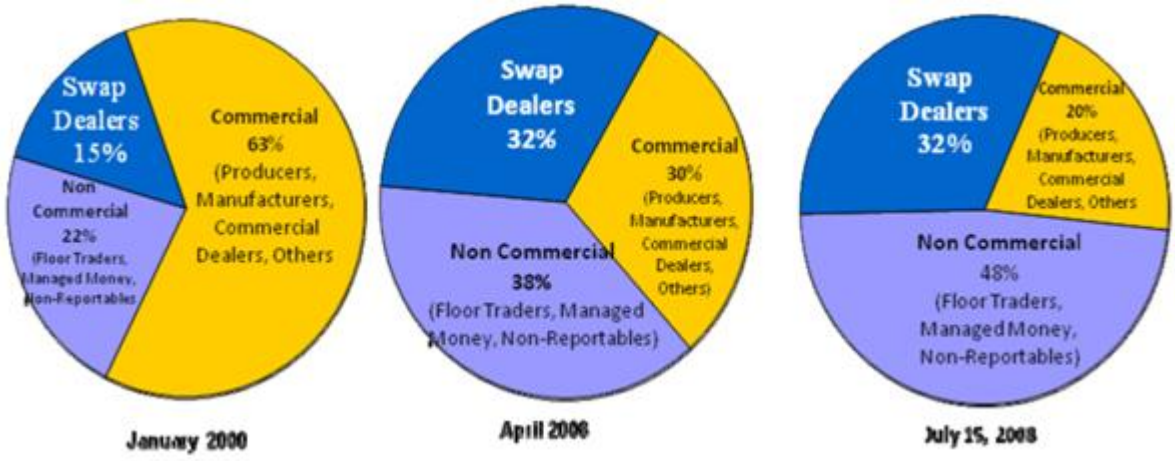
commodity prices. The speculator generally finds it advantageous to deal in futures contracts rather than either buying a quantity of the commodity at the current "spot" price and holding it in the hope of a rise in the spot price in the first place, and in the second place selling the commodity short by promising in private negotiations with a buyer to deliver at a specified later date, at a price which he expects to be above the spot price that will prevail at that date.

Johnson (1960) is using the term hedging to describe the activity of someone who is using the futures market to manage the price risks associated with the sale, purchase, or use of a commodity. Hedging has sometimes been described as an activity undertaken by the producer, merchant, or end-user of a commodity as opposed to a speculator who does not produce, use, or consume the commodity. Futures markets are useful for hedging operations. An essential feature of commodity hedging is that the trader synchronizes his activities in two markets. One is generally the" cash or spot market (the market for immediate delivery); the other is generally the futures market. A future contract, being merely a promise of the seller to deliver within a specified month and a promise of the buyer to take delivery of a standard quantity and quality of the commodity at an agreed price is readily adaptable by its homogeneous character to being traded on an exchange. Since there are numerous strategies and approaches to managing price risks, however, it often is impossible to distinguish, from an economic perspective, whether a particular transaction is, in fact, hedging or speculation. The line between minimizing risks which is what the term “hedge” include, and maximizing profits, which is what the term “speculation” include, can be extremely difficult to draw.

A third group which is seen acting on the commodity market next to the commercials (hedgers) and non-commercials (speculators) are the investors who regard commodities as assets, like equities, bonds, estates, etc. They usually take long positions through commodity index certificates or swaps, which are provided by banks and other financial institutions. “There can be no doubt that financial investors have built up large long positions on commodity markets between 2003 and mid-2008. The assets allocated to index traders and swap dealers have risen from 13 billion US-Dollars at the end of 2003 to 161 billion US-Dollars as of June 200812, 17% of the total market value of 945 billion US-Dollars” (Masters 2008, p. 2; CFTC 2008, p. 3).

To show what the importance is of the commercials and non-commercials in relation to each other, figure 25 is showing the percentage of trade which is conducted by the different groups. What become clear is that the percentage of trading which is done by non-commercials is increased strongly from 2000 to 2008. The percentage of commercials is declining in this period.

Figure 25: evolution of speculative trading



Source: CFTC data

5.2.1 **Method**

As stated earlier there are different publications with as subject; “the role of the commercials and non-commercials”, however different views are proposed in these publications. Due to the large variety in arguments given in the different publications it is not useful to start an own research on the influence of the commercials and non-commercials and come up with my own view. However it is useful to take in to account the different views and arguments. Such a method is based on a meta-analysis. These types of methods are used to compare different methods used and argumentation on a certain subject. However we will not follow the exact process of the meta-analysis. According to Cooper (1998) and Lipsey and Wilson (2001) there are different tasks when conducting a meta-analysis. The first task is the problem formulation and involves an explication of the research question(s) or objectives of the meta-analysis. The second, an explicit set of inclusion and exclusion criteria must be specified that clearly define the characteristics of studies that will be included in the meta-analysis. Third, a comprehensive search for all eligible studies, published or unpublished is conducted. This typically involves searching multiple sources. The fourth task involves the coding of eligible studies. Using a coding form similar to a survey, information about the features of the studies are captured and effect-sizes are computed. The latter represent the results or findings of the studies and are discussed in more detail below. Fifth, the effect-sizes are analyzed using statistical methods specific to meta-analysis. These may include analyses that examine the relationship between coded study features and effects sizes. And finally, the results are interpreted and written up. The focus of this chapter is on the statistical methods of meta-analysis, that is, the computation of effect-sizes and their analysis. Before introducing effect sizes, I discuss issues related to primary study design and meta-analysis.

In this project we cannot use the meta-analysis as explained by Cooper (1998) and Lipsey and Wilson (2001) due to the lack of the right information provided in the different publications. Many arguments provided in publications are arguments based on the opinion of a certain researcher. Often it is not based on facts or methods which come up with a certain result.

The way the different publications on the effect of commercials and non-commercials will be discussed in this project is as follow.

First: what is our objective and what is the information we need to find; the objective is to find enough evidence to be able to conclude if there is a certain influence on the prices of commodities. Second: it is important to describe what criteria are taken in account. In this project there are many different publications, we will only focus on the effect of the three groups discussed in part 5.2 of this chapter, the commercials, the non-commercials and the investors (in the rest of the research we will talk about commercials and non-commercials, yet the investors are taken in consideration). Third: consist of the search for the different publications and different opinions. Because there is such a large amount of information available this will be sorted in two tables to distinct the publications which are arguing for and against the existence of influence on prices of the commercials, non-commercials.
Fourth: this part will consist of finding the two most important and well explained and substantiated arguments, arguing for and against of the possible influence.
Fifth: at this point, checking of the arguments will take place, this will be done by using data to check the validity of the arguments and see to what extent they are important and influencing the prices.
Sixth: in this last stage which will be conducted we will find the analysis of the findings done in the fifth stage and the rest of the arguments which are summarized in the two tables produced in the third stage.

Because the two first stages have already been discussed shortly we will continue with the third stage in which all the different argumentations found in the different publications are summarized in table 19 and table 20.

5.2.2 Publications and opinions

After the price bubble in 2007/2008 the debate began to intensify when food prices started to rise. Most publications in which the discussion is held on the influence of commercials and non-commercials are recently publicized. Many arguments are provided from economists who are basing their arguments on the existing theories and knowledge. Not many have been using tests to substantiate their arguments. In the two tables (table 19 and 20 which can be found in the appendix 4) the arguments for and against are provided. The information is based on all the different publications. The tables are an enumeration of all the arguments based on most of the literature/publications.

5.2.3 The most important arguments

In this part, two arguments arguing for and two arguments advocate against the possible influence of commercials and non-commercials will be discussed. These arguments are subtracted from table 19 and 20. These four arguments are chosen because the argument is supported by different authors or have a similar view and because they can be controlled with the use of historical data.

Arguments advocate for the existence of influence of the commercials and non-commercials

1*: The fact that there is a growing amount of money circulating in the different commodity markets has affected the markets and made them more reactive and sensitive for fluctuations on other markets (financial market). This is also called an, increased volatility on the commodity market. (supported by; Masters 2008, Masters and White 2008, Tang and Xiong 2010, Agricultural and Food Policy Center 2008, Childs and Kiawu 2009, The Global Food Markets Group HM Government, At the*

UNCTAD 2011 conference the following experts came with a similar argument; Mr. Etsuo Kitahara Executive Director International Grains Council, Mr. Lindsay Jolly Senior Economist International Sugar Organization, Mr. José Sette Acting Executive Director International Coffee Organization, Mr. Roger Janson Trading Manager Cargill Geneva)

In order to find if this argument is truthful and makes sense the following data will be combined and compared in order to find connections. The three points which are going to be compared are;

- Number of trade which has been taken place in the period 2000 up to 2009. This time range has been chosen because of data availability. Important is to make the distinction between the OTC market and the exchanges. The information is provided by the BIS bank and World Federation of Exchanges. The information on growth will be general as no data is available in which the distinction has been made for the four commodities.
- In this part a short discussion will be hold on the financial disruptions which have been seen on the financial market during the period 2000 and 2010. This will be to see if the increased number of contracts makes the commodity more reactive for external financial effects.
- The prices of the four commodities during the period 2000- 2010 will be exposed to find out what the prices have done during this period.

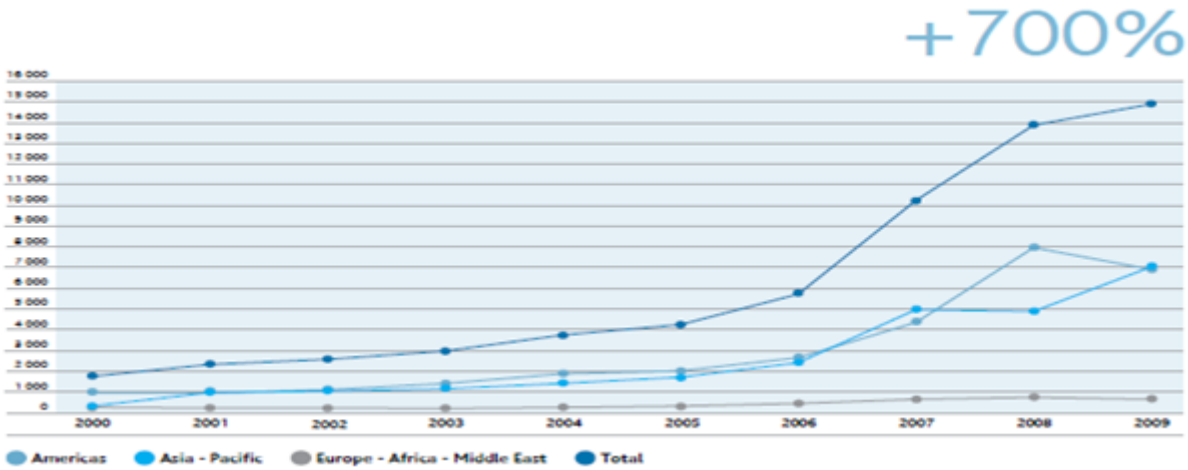
After having collected these data the three points will be analyzed in order to find if the argument is correct. We would expect that due to the increased number of trades an amount of money on the commodity market makes it more reactive to financial disruptions on other markets which will be translated in price fluctuations.

In the first place a closer look will be taken to the OTC market and the exchanges in order to see if and how large the increase of commodities traded have been. This will be done as stated earlier for the period 2000 up to 2009.

Before starting to look to the data, two citations are interesting. First citation is from Mr. Ke Tang from the Renmin University of China. During the UNCTAD conference in February 2011 he made the following point, “The change since 2000, when many financial institutions discovered commodities as a new asset class, hundreds of billions of dollars flowed into the commodities market and precipitated a fundamental process of financialization”. Given that the commodities market used to be partially segmented, financialization of commodities should improve the sharing of commodity price risk and lower the hedging cost. Portfolio rebalancing of index investors can spill over shocks from outside to commodities markets and from oil to non-energy commodities.
Second citation is subtracted from this same conference from H.E. Amb. Richard Jones**,** Deputy Executive Director, International Energy Agency stated, “Commodity index investment has increased from $55 billion in late 2004 to $354 billion in 2010”

These two citations of experts already show that there have been important increases of amount of money circulating in the commodity market. To make this growth visible the following graphs will be shown and discussed. In figure 26 the total number of trades in equity shares (in millions) is shown. This is the number of individual trades which have been taken place. A clear growth is seen over the period. This discussion is specified on the commodities traded on the exchange.

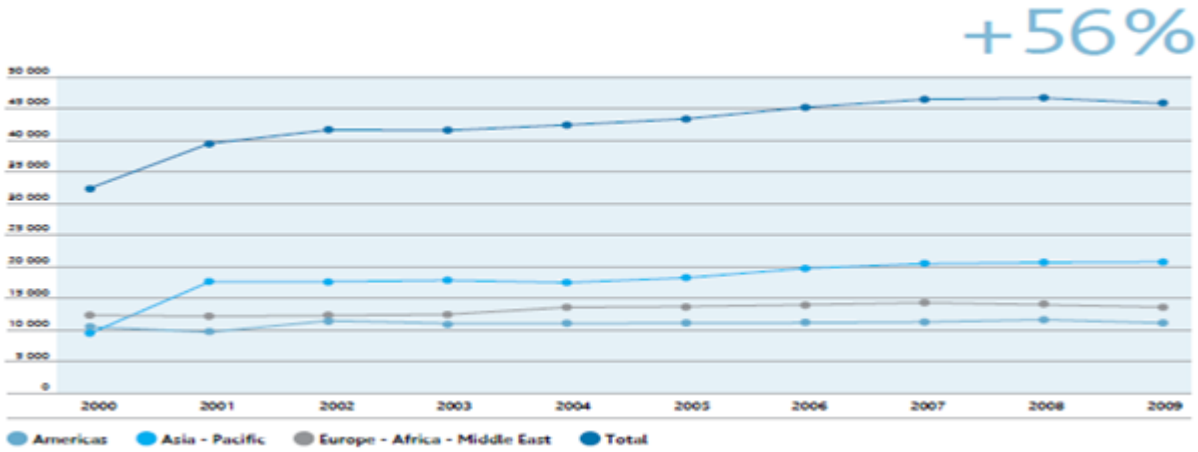
Figure 26: Total number of trades in equity shares (in millions)



Source: World Federation of Exchanges www.world-exchanges.org

Not only have the number of trades experienced a growth during the period, also the numbers of listed companies which are active on the commodity market also have experienced a growing trend. This is clearly seen in figure 27 in which it can be seen that the total growth of companies listed in the period 2000 to 2009 is 56%.

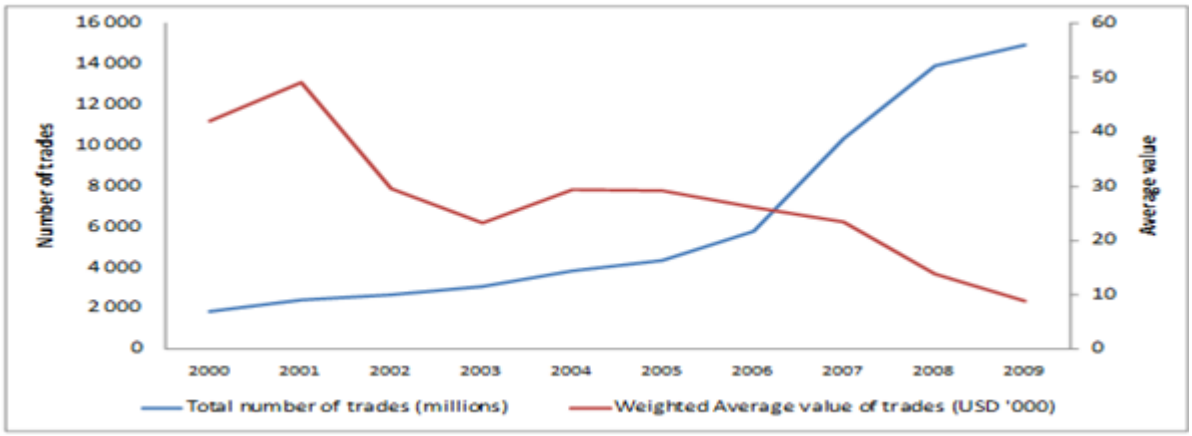
Figure 27: Total number of listed companies



Source: World Federation of Exchanges www.world-exchanges.org

These data are interesting; however with this knowledge concluding that the amount of money on the commodity market has experienced an important growth is not possible. This is why figure 28 is taken in consideration. In this graph the average size of the trades is shown. It is clear that the amount of trades has experienced an enormous growth, nevertheless the average size of the trades have been lower. In the period 2000-2009 a decline of the average size of the trades with 85% is noted. This means that there are more trades taking place but that these trades are of a smaller size.

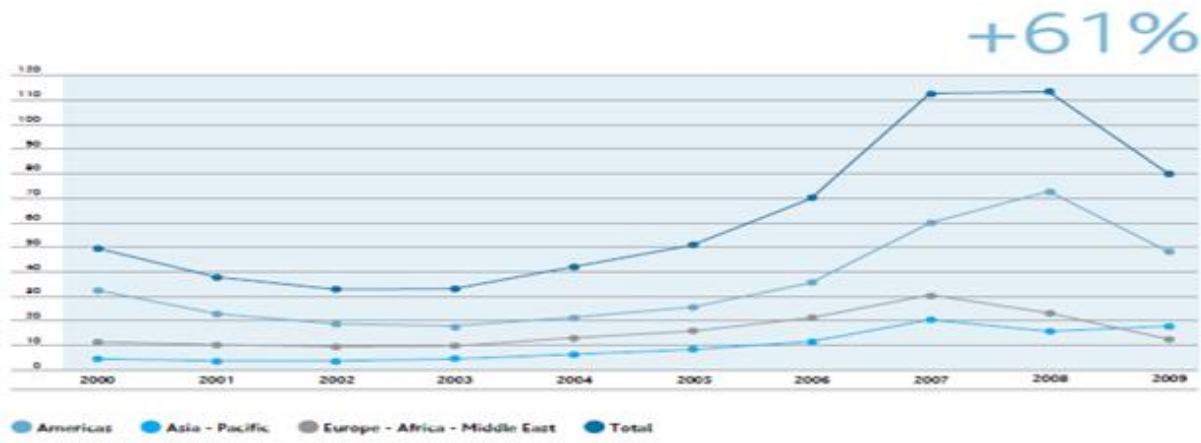
Figure 28: The explosion of the number of trades has to be compared to the average size of trades. This average has dropped 85% over the last ten years.



Source: World Federation of Exchanges www.world-exchanges.org

The last graph, number 29 is the most important one for the discussion. A growth of the numbers of trades has been seen just like the number of companies acting on the commodity market which experienced a growth. Nevertheless we saw that the average sizes of the trades declined. In this last graph the total value of share trading is denoted. An increase of 61% is experienced in the period 2000-2009. This implies that even if the average value of the shares decreased the total value have shown a growth.

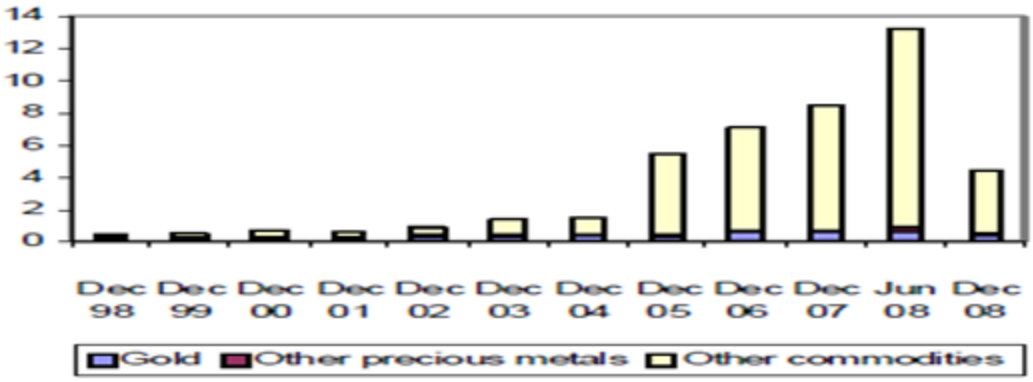
Graph 29: Total value of share trading (in USD trillions- 000 000 millions)



Source: World Federation of Exchanges www.world-exchanges.org

When looking specific to the OTC market in figure 30 it is made clear that there is also a growing trend experienced. These numbers shown in the graph are for the period 1998 to 2008. The spectacular growth up to the beginning of 2008 is clearly visible and as well as the decline in the second half of 2008. This is similar to the prices on the commodity market as has been discussed in chapter 2 and 3.

Figure 30: Notional amount of outstanding over-the-counter commodity derivatives. December 1998 –December 2008. (Trillion dollar)



Source: BIS, Quarterly review, June 2009

It might be clear that during the last 10 years a sharp growth is experienced on the commodity market just like Mr. Ke Tang and H.E. Amb. Richard Jones stated during the UNCTAD conference in February 2011. This increase of participants on the commodity market and the number of contracts traded has lead to a growing amount of money on the commodity market (even if the average size of the trades decreased). When considering the activities which could lead to distress in the financial market, the best example presently is the financial crisis which started in 2007/2008. This crisis was one hitting especially the financial world. When taking the figures in chapter 2 in account, it is clearly visible that the downturn started in the second half of 2008. This could be explained by the financial disruption worldwide in which people tend to be more risk averse and invest less in currencies etc. and also on the commodity market. The financial crisis of 2008 is a crisis which has touched almost everyone to a certain extent. The effects have been seen worldwide, and also on the commodity market. Smaller events as the political unrest in the Middle East in the beginning of 2011 and the earthquake which caused a tsunami in Japan show also that it affects the trade market. This will be interesting to follow the coming period to see to what extent it affects the markets and prices of the four commodities.

The last step was to see if this increase of volatility on the commodity also affected the prices. In table 16 the prices of the four commodities for the period 2000-2010 are shown. A clear growth is seen in this period. It seems to show a similar pattern as the growth seen on the commodity market. To find if the similarities seen by comparing the different graphs also the growth percentage of the prices are calculated. For the four commodities the following percentages growth are being calculated over the period 2000-2010.

Wheat: 121,87 percent growth
Oil: 180,62 percent growth
Gold: 338,72 percent growth
Coffee: 119,2 percent growth

When analyzing this comparison we can clearly state that the growth seen on the OTC market and the exchanges is leading to a commodity market which can be more affected by financial disruption from other markets. This is affecting prices. The financial crisis of 2008 is in the same period of the declining prices of commodities. However looking to the gold market the financial crisis has been reason to invest in gold as it is a safe investment. According to the opinion of Mr. Ke Tang and H.E. Amb. Richard Jones the fact that the numbers of trades on the commodity market has increased is leading to higher volatility on the commodity market. This makes the market more reactive to other

financial markets. Nevertheless it is not clear to what extent the increasing numbers of commercials and non commercials is influencing the prices because there are more externalities affecting prices.

***2**: The second important argument which is provided in the different publications is that the price bubble is caused by the effect of speculation on oil prices. This speculation would have affecting the oil prices, which finally has affected the prices of other commodities. (Supported by; Masters 2008, Masters and White 2008, Kilian and Murphy 2010, the Global Food Markets Group HM Government)*

In order to find if this argument is correct it is important to look first to the increase of activity on the commodity market for oil. In the previous part when the growth on the commodity market has been discussed we have seen that this growth is also seen for the oil market. As there is no specific information available for the oil market information of the BIS will be gathered.

A second step is to see how the crude oil is affecting other commodities. This has been discussed in previous chapters as discussed in chapter 3 and 4. If we can state that the interest of speculators started especially on the commodity market for oil and that oil affects other commodities this arguments is making sense.

In the discussion on the previous argument, the conclusion is made that there is a relationship between the increasing activity on the commodity market from commercials and non-commercials and the increasing volatility which makes the commodity market more reactive to fluctuations in other markets. On the question if the speculators are affecting the prices there is not one clear answer. As Christian Upper, Head of the Financial Markets from the Bank for International Settlements states; “the evolution of open interest over time does not really support the hypothesis that speculative trading has been a major factor. That said, it is very difficult to fully rule out the bubble hypothesis, partly because of limited data on inventories, demand and supply conditions”.

This would imply that the effect of speculators but in general de commercials and non-commercials is present. Nevertheless this is probably not the main cause for price bubbles and price fluctuations.

That the oil is affecting other commodities is something which have been shortly discussed in chapter 3 and 4, in which we have seen that the oil is used in many other products however is also used for the production and especially the transportation of many commodities. In chapter 4 part 4.4 when the forecasting models have been discussed it became clear that the price fluctuations of oil prices are directly followed by other commodities. This has not always been the case. However the utilization of oil has increased the last years.

Concluding this discussion on this argument it can be stated that just like the first argument discussed the argument is correct but to a certain extent. That the oil is influencing the prices of other commodities has been shown already, that there have been more commercials and non-commercials acting on the oil market has been shown and argued by Christian Upper, Head of the Financial Markets from the Bank for International Settlements. To what extent this influence is affecting the prices is still not clear.

Arguments against the influence of the commercials and non-commercials

The two arguments subtracted from table 20 which are arguing for the existence of influence of commercials and non-commercials on the prices of commodities are;

***1**: An argument which is found in table 20 and which is discussed in several ways by different authors is the first important argument which will be discussed. According to these publications the main cause of the price increases is the fail in getting the supply and demand right. (Supported by; Krugman 2008, Hamilton 2009, Einloth 2009, Irwin Sanders and Merrin 2009, Wright 2009, Smith 2009)*

This is one of the basic principles of price setting. However many publications are discussing this mismatch especially for the oil market. The fact that there was a small oil inventory has as effect that a small disruption could lead to shortage on the market, which would lead to price changes. This price changes has affected the prices of other commodities. This is due to the use of oil as raw material in many products and due to increasing transportation costs. Higher costs have as effect, higher marginal costs of production. This will be calculated in the prices.

In the table 21 more detailed data are provided on the oil market. The data shown in this table are for the past 10 years. To get a clear view what this table is showing, all the rows will be discussed and taken in account what is stated in the argument which is arguing that the change in commodity prices is due to a change in the oil price. In this argument it is stated that the change in oil prices was caused by a small inventory which lead to a situation in which a small mismatch between supply and demand would affect prices directly.

Table 21: Information on the oil production and consumption for the period 2000-2010

year	Total demand world	Total demand N-America	N-America Production	N-America import	OECD supply	Non-OECD supply	OPEC supply	Non-OPEC supply	total supply world	Total stock OECD (government + industry)	prices avarage
2000	76,2	24,1	14,3	na	21,9	22,4	30,7	46	76,7	3728,25	27,6
2001	77,3	24	14,36	10122	21,8	23,2	30,4	46,8	77,2	3873	23,12
2002	77,7	24,1	14,56	9434	21,9	24,5	28,8	48,1	76,9	3901	24,36
2003	79,3	24,5	14,61	10061	21,6	25,6	30,8	49,1	79,8	3904	28,1
2004	82,5	25,4	14,58	10897	21,2	27,1	33,1	50,3	83,4	3969	36,05
2005	84	25,6	14,14	11493	20,3	28	34,2	50,4	84,7	4084	50,64
2006	85,3	25,4	14,21	11222	20,1	28,8	35,1	51,2	85,5	4157	61,08
2007	86,5	25,5	14,27	11097	19,5	28,2	34,6	50,9	85,5	4132	69,08
2008	86,4	24,2	13,91	10713	18,7	28,4	35,6	50,8	86,4	4159	94,45
2009	85	23,3	13,63	9497	18,8	29,1	33,5	51,7	85,2	4297	61,06
2010	87,8	23,9	14,1	9610	18,9	29,8	34,5	52,8	87,3	4274	77,45

All the quantities are in millions of barrels per day. Except, the N-American import which is in thousands of barrels per day and the inventory which is in million barrels in total for a year. Prices are in dollars.

Source: OPEC, OECD, IEA

The total demand worldwide is showing a small growth during the period 2000-2010. It starts with 76 million barrels per day (mbd) and ends in 2010 with a demand of 87 mbd. This growth is not spectacular and is showing a smooth rise during these 10 years. When considering the Total demand of Nord America it can be seen that the total demand is minimally fluctuating around 24 mbd. In this table Nord America is used, important to know that this consist of the United States, Canada and Mexico. The data for just the United States are often not available or put together under the group

Nord America. As have been stated in chapter 3 part 3.3.3 the demand of the United States of oil is around 20 mbd, this implies that a large part of the demand of Nord America is from the United States. The next row shows the production of oil in Nord America, this has been stable in the past 10 years and turning around 14,2 mbd. When looking specific to the United States and their total production it is approximately 7,5 mbd. This is by far not enough to fulfill the total demand of around 20 mbd. This point has already been discussed in previous chapters. In the four following rows the supply of the OECD, Non-OECD and the OPEC and Non-OPEC is shown. These numbers are not changing much in the time range in which we are looking at the data. However the OPEC countries show a small growth and the OECD a small declining trend. The next row illustrates the import of oil to Nord America. This is not showing important changes. This is logic when we have the knowledge of the stable demand of Nord America and the stable production. Interesting is the row in which the total supply worldwide is shown, this in combination with the total demand will be a basis for the answer on the argument. A growing trend is seen in the total supply, almost similar to the total demand discussed in the first row. This would not imply that there is a mismatch between the demand and supply. To look if the small mismatch seen can be harmful due to a changing stock, the row with the stock in the OECD countries is considered. This consists of the total stock in OECD countries hold by the government and the industry. This is actually stable in our time frame and shifting between 3700 and 4200 millions of barrels during the year which are presented.

Using this information we could state that the prices would expect to stay stable as there is only a small change in the data of the past 10 years. Nevertheless when considering the average oil prices for the ten years (last row) large fluctuations are seen.

To see if this stability in the demand and supply is due to the fact that the data used are the averages for the different years, it is important to take in consideration also a smaller time scale to find out if there is an effect of seasonality which is leading to changing inventories. To see if seasonality's are present in the oil market or that mismatches occur during the years in table 22 the data for the four quarters of the years 2007 to 2010 are shown. These years are taken as this is the period in which the price bubble reached its peak and experienced its collapse. The years 2009 and 2010 are also taken in consideration to see the growing prices after the price peak.

Table 22: Specific data oil market for 2007-2010 per quarter.

2010	Demand	Supply	Mismatch		Average prices
Q4	87,8	88,2	0,4		82 – 90
Q3	88,6	87,4	-1,2		75 – 78
Q2	87	87	0		71 – 85
Q1	86,4	86,5	0,1		72 – 80
2009					
Q4	85,9	86,2	0,3		70 – 80
Q3	85,4	85,5	0,1		65 – 75
Q2	84,2	84,6	0,4		50 – 60
Q1	84,4	84,3	-0,1		40 – 50
2008					

Q4	85,3	86,2	0,9		40 – 90
Q3	85,3	86,3	1		100 – 145
Q2	85,7	86,8	1,1		140 – 110
Q1	86,9	87,1	0,2		105 – 90
2007					
Q4	87,2	86,5	-0,7		90 – 100
Q3	85,7	85,2	-0,5		77 – 80
Q2	85,1	85,2	0,1		65 – 77
Q1	86,2	85,6	-0,6		60 – 68

Source: Own table based on data of the IEA and OECD

Taking a closer look to table 22 and especially to the prices we clearly see the price patterns which have been discussed earlier in this research. Increasing prices in 2007 with a peak in the second quarter of 2008, followed by the sharp collapse of the prices in third and fourth quarter of 2008. In 2009 the prices started to recover slowly a trend which has been continued in 2010. When looking to the mismatch between the demand and supply we can state that there was a mismatch in general in 2007, this constant under supply is raising the prices. In 2008 it is clearly that there is an oversupply which has lead to decreasing prices. In the following two years (2009 – 2010) there is a small under supply however prices have started to increase again.

On the question, "can state that these mismatches have lead to the price fluctuation"? A clear answer is difficult to give. We can see that the mismatch lead to price fluctuations however is this the only cause of the fluctuations or are there other factors which play an role on the price fluctuations.

***2**: A second important argument which is discussed in the publication is one on commodities which have fewer participants active on their market, especially speculators. Nevertheless these commodities have experienced growth of the prices and the decline at the end of 2008. (Supported by; Headley and Fan 2008, Irwin, Sanders and Merrin 2009, Markets Group HM Government)*

If the price bubble was an effect of the presence of speculators and other participants we would expect to find no fluctuations in the commodities with none or less speculators active on their market.

To find if this argument is correct four commodities will be chosen which are traded in quantities which are not too small, which are traded all over the world and which are not (or to a small extent) traded on the commodity market (exchanges and OTC market).

To get a clear view of commodities which are not or less traded on exchanges or on the OTC market, four commodities are chosen which are large enough in total production and trade but which are not (or to a small extent) traded on exchanges or OTC market.

In the four tables four commodities are presented which are used for this argument. These data are data for the production in California. This is due to a lack of data. We make the assumption that these data (price fluctuations) are comparable for the rest of the world; California has an important position on the world market of these four commodities. The four commodities are traded all over the world which gives us the possibility of making this assumption. Interesting is the fluctuations in

the prices in these tables. Prices are provided for the period 2000- 2010 as this time range is used in the other parts of this project.

Table 23: California table grapes (2000-2010)

Year	Bearing	Yield Per Acre	Production	Utilized Production	Value Per Unit	Total Value
	Acres	Tons	Tons	Tons	$/Ton	$1.000
2000	89.000	8,70	774.000	774.000	**565,00**	437.448
2001	88.000	8,10	713.000	713.000	**610,00**	435.177
2002	88.000	8,44	743.000	743.000	**616,00**	457.628
2003	85.000	8,61	732.000	678.000	**601,00**	407.607
2004	83.000	9,28	770.000	770.000	**695,00**	535.009
2005	83.000	10,50	872.000	872.000	**442,00**	385.116
2006	83.000	8,64	717.000	717.000	**898,00**	643.777
2007	82.000	9,65	791.000	791.000	**787,00**	622.894
2008	83.000	11,70	973.000	973.000	**405,00**	394.521
2009	84.000	10,40	876.000	876.000	**463,00**	405.974
2010	84.000	10,70	900.000	900.000	**381,00**	343.220

Source: USDA

Table 24: California walnuts (2000-2010)

Year	Bearing	Yield Per Acre	Production	Value Per Unit	Total Value
	Acres	Tons	In-Shell Tons	$/Ton	$1,000
2000	200.000	1,20	239.000	**1.240,00**	296.360
2001	204.000	1,50	305.000	**1.120,00**	341.600
2002	210.000	1,34	282.000	**1.170,00**	329.940
2003	213.000	1,53	326.000	**1.160,00**	378.160
2004	214.000	1,52	325.000	**1.390,00**	451.750
2005	215.000	1,65	355.000	**1.570,00**	557.350
2006	216.000	1,60	346.000	**1.630,00**	563.980
2007	218.000	1,50	328.000	**2.290,00**	751.120
2008	223.000	1,96	436.000	**1.280,00**	558.080
2009	227.000	1,93	437.000	**1.710,00**	747.270
2010	227.000	2,25	510.000	**NA**	NA

Source: USDA

Table 25: California olives (2000-2010)

Year	Bearing	Yield Per Acre	Production	Value Per Unit	Total Value
	Acres	Tons	Tons	$/Ton	$1.000
2000	36.000	1,47	53.000	**656,00**	34.743
2001	36.000	3,72	134.000	**672,00**	90.096
2002	36.000	2,86	103.000	**573,00**	58.983
2003	36.000	3,28	118.000	**409,00**	48.289
2004	32.000	3,36	107.500	**564,00**	60.643
2005	32.000	4,44	142.000	**564,00**	80.097
2006	31.000	0,76	23.500	**771,00**	18.119
2007	30.000	4,42	132.500	**654,00**	86.694
2008	30.000	2,23	66.800	**697,00**	46.587

2009	31.000	1,49	46.300	**696,00**	32.209
2010	33.000	5,76	190.000	**582,00**	110.535

Source: USDA

Table 26: California kiwifruit (2000-2010)

Year	Bearing	Yield Per Acre	Production	Utilized Production	Value Per Unit	Total Value
	Acres	Tons	Tons	Tons	$/Ton	$1.000
2000	5.300	6,42	34.000	30.500	**455**	13.888
2001	4.900	5,27	25.800	23.000	**667**	15.340
2002	4.500	5,8	26.100	23.100	**783**	18.097
2003	4.500	5,64	25.400	24.000	**853**	20.472
2004	4.500	5,93	26.700	24.700	**809**	19.977
2005	4.500	8,27	37.200	36.200	**620**	22.461
2006	4.200	6,21	26.100	25.400	**911**	23.148
2007	4.200	5,83	24.500	23.700	**950**	22.517
2008	4.200	5,48	23.000	22.000	**888**	19.545
2009	4.200	6,1	25.600	24.900	**847**	21.084
2010	4.200	8,4	35.300	34.300	**NA**	NA

Source: USDA

Taking the rows with the “value per unit” in account we see the prices in dollars per ton. We would expect that if the argument is correct, that commodities which are not traded on exchanges or the OTC market have experienced the price bubble of 2007/2008 which affected almost all commodities which are traded on exchanges or OTC markets as they are influenced by the speculation or hedging from the commercials and non-commercials.

Looking to the four rows with prices it is difficult to state if this argument is correct. The first two tables (table grapes and walnuts) are clearly showing a growing trend of the prices up to 2007 and a clear downturn of the prices in 2008 and 2009. This pattern is similar to the pattern of the price bubble which we have seen in chapter 3 part 3.4 when we compared the four commodities. Looking to the two following commodities in table 25 and 26 we cannot find back this similar pattern of the price bubbles as seen in chapter 3 or in the prices of table grapes and walnuts (table 23 and 24). The fact that two of the commodities discussed here are showing the effect of the price bubble and two are not, are already showing that a clear answer on this question is difficult to give.

5.2.4 Analysis

Analyses of the findings in part 5.2.3 and the information in table 19 and 20 will show that there is not one final answer. As could be seen there are many arguments subtracted from the publications. After discussing the four arguments mostly provided in the publications it became clear that these four arguments are all four correct in the way they are proposed. However the four arguments are explained in such a way that they can be correct without proving evidence for the incorrectness of the other arguments. This is the difficulty of the discussion. Most publications are agreeing that the increased number of commercials and non-commercials has a certain influence on the prices of the commodity, however how large this influence on the prices is, is a point of discussion. Problem is that the discussion on how large the influence is stays very important.

A fact which can be stated is that the presence of these new participants on the commodity market is leading to an increased amount of money in the different commodity markets. This increased volatility has caused some changes in the commodity market. It makes them more reactive to changes in other markets. However as already stated, what the exact effect is of the increased number of participants on the commodity market is still an important question.

A possibility for further research would be to use a simulation game/program in which the way of acting of different commodities could be tested under different situations. This with as goal to find what the effect is of the commercials and non-commercials in more detail.

5.3 The four commodities

In the following parts the four commodities will again be taken in account one by one to take in thought the influencing factors which are used presently in the models and factors which are not yet taken in account in the models but which are being discussed in literature as affecting the prices. Also possible new influencing factors are being addressed. These will be argued with the use of different literature. In each discussion there will be a differentiation between the long term and the short term. This is done to get an idea of the term in which the factor could affect prices. This can be interesting for chapter 7 in which we will look which forecasting method is suitable for the different affecting factors. The question if a factor is influencing the prices in either in the short term or long term is important for the method used.

The discussion in the beginning of this chapter accounts for the four commodities. This effect of the commercials and non commercials is of importance for the four commodities which we discuss. This will not be taken in consideration specifically again for all the four commodities. To see if one of the factors mentioned is already possibly influencing the prices, at the end of the discussion of the different factors affecting one of the commodities a comparison will be made with the use of the graphs from chapter 3. These are the graphs which have been used at the end of chapter 3 in order to compare the commodities and explain how the market was changing. When a price fluctuation is seen in a certain period, we will look if factors which could possibly have affected the prices were already active.

5.3.1 Wheat

Wheat has been discussed extensively in the previous chapters. We have seen that wheat is an important crop used in many diets of people. In addition, wheat is also used as feed for livestock. In chapter 4 the forecasting models have been discussed, the model which is used, takes three variables in account on which the price forecast is based. The first one is the historical prices; this is not a variable which has an impact on the prices but is used as a basis. The second variable is the stock to use ratio, this is affected by the production of wheat and the consumption. This variable is important for the changes in prices. The third variable is the average crude oil price. This is an important exogenous factor which is affecting the wheat prices.

When looking to the literature we have seen the following variables which are affecting prices in a certain way. The variables are discussed in the following way; explanation of the variable, how it is

affecting the prices, to what extent the variable is affecting prices, in what time frame is it important for the influence on the price, and is it already taken in account in models.

To find out if a factor is already affecting the prices of the commodity, at the end of the discussion of the factors a small discussion will hold on the effect on the prices based on the analyses and tables of chapter 3.

1: ***Price of oil***

This variable is taken in account in most of the forecasting models. Reason that this variable is important in the models is because (as discussed in chapter 4) the prices of wheat are following fluctuations of oil prices. That wheat prices follow the oil prices is due to the fact that increasing oil prices are influencing the input costs of the wheat. This is seen back in the production costs however also in the transportation costs as has been discussed in chapter 3 part 3.3.1. This variable is one which is affecting prices in the short term. The increasing oil prices have an effect on the wheat price in the following way; increasing input costs, use of biofuels. These variables which will be discussed below are not only caused by the fluctuation of the price of oil, however changes in the price of oil are affecting the price to a certain degree.

As argued in chapter 4 part 4.4.1 by Brümer et al. (2008), the wheat prices are influenced by the oil prices. Looking to the fluctuations in the prices between 1970 and 2007 (figure 24) the wheat prices followed the fluctuations of oil. Brümer et al. argue that this is an effect of the increasing transportation costs. Next to Brümer et al. also (Abbott et al. 2008; Henderson 2008; Trostle 2008) argued that surging energy costs are linked with the price escalation of foods. Trostle (2008) specifically indicated that prices of all commodities (food and nonfood) have increased along with the price of oil. The variables which will follow will show that increasing oil prices are not only affecting the transportation costs but are also affecting on different ways the wheat prices.

2: ***Increasing demand for biofuels***

One of the factors which is influencing the prices of wheat but which is not influencing directly the prices is the growing demand for biofuels. This is again an effect which is of importance in the longer term. The diversion of food crops as biofuels stands out as an important new single factor which many have seen as explaining the 2006–2008 food price spikes. Rosegrant et al. (2008) argue that there is a clear 'food-vs.-fuel' trade-off. According to this view, the diversion of food crops and, more generally, agricultural land into the production of biofuel feed stocks puts upward pressure on food prices and links changes in food prices to changes in the crude oil price.

To clarify this statement of Rosegrant et al. (2008) it is important to know what biofuels are. Biofuel is defined according to (http://www.clean-energy-ideas.com Feb. 2011) "as fuel produced from renewable biomass, this fuel is considered to be much cleaner than petrol/diesel alternatives". Biofuel is considered carbon neutral, as the biomass absorbs roughly the same amount of carbon dioxide during growth, as when burnt. Some biofuels currently in use are:

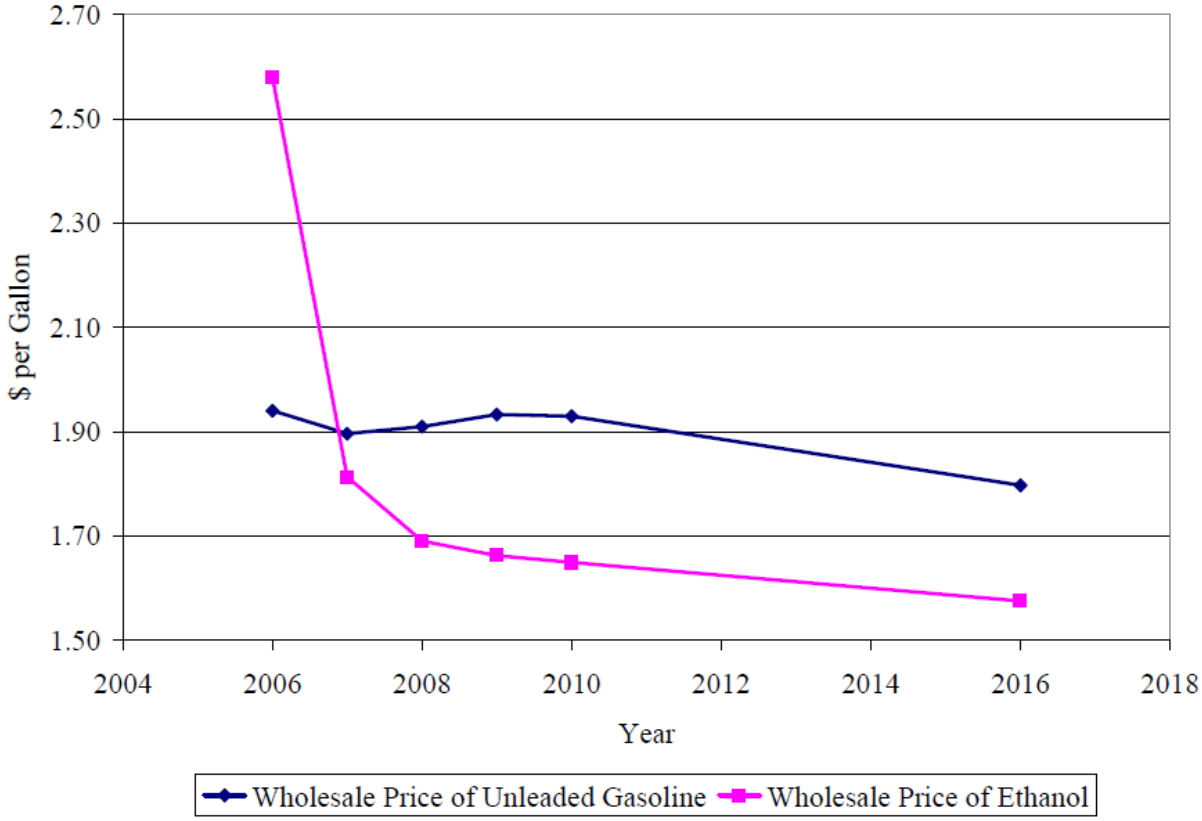
- Biobutanol
- Biodiesel
- Bioethanol

- Biogas
- Vegetable Oil

Biodiesel and (bio)ethanol are two important types of biofuels in the United States. For ethanol especially corn is used in the United States and for the production of biodiesel predominantly soybeans. The intuition behind the large response of ethanol relative to biodiesel is as follows. Crop growers in the United States choose between planting corn and soybeans. Many farmers choose corn over soybeans because an acre of corn provides more energy value than an acre of soybeans. This suggests that, under this framework, the biodiesel sector will not grow substantially without a change in the structure of subsidies under reasonable assumptions about energy values of soybeans relative to corn.

Under current federal ethanol policy of the United States and current projections of crude oil prices, U.S. ethanol production from corn is projected to climb to 14.8 billion gallons by 2011. To supply this expanded ethanol production, corn acreage is projected to increase to almost 94 million acres S. Tokgoz et al. (2007). The states that have visited the issue so far have actually worked to impose lower per-gallon taxes on ethanol than on gasoline. Therefore, S. Tokgoz et al. (2007) have assumed that the wholesale-to-retail markup on ethanol is the same in percentage terms as the markup on gasoline. The continued use of this assumption means that if ethanol sells at its energy value at retail pumps then it will also be priced at its energy value at the wholesale level. Figure 31 is showing the wholesale prices of unleaded gasoline and the wholesale price of ethanol. The wholesale prices of ethanol are already lower than that of unleaded gasoline and are even declining more. This will lead to a growing demand for ethanol.

Figure 31: prediction wholesale price unleaded gasoline and ethanol (2006-2016)

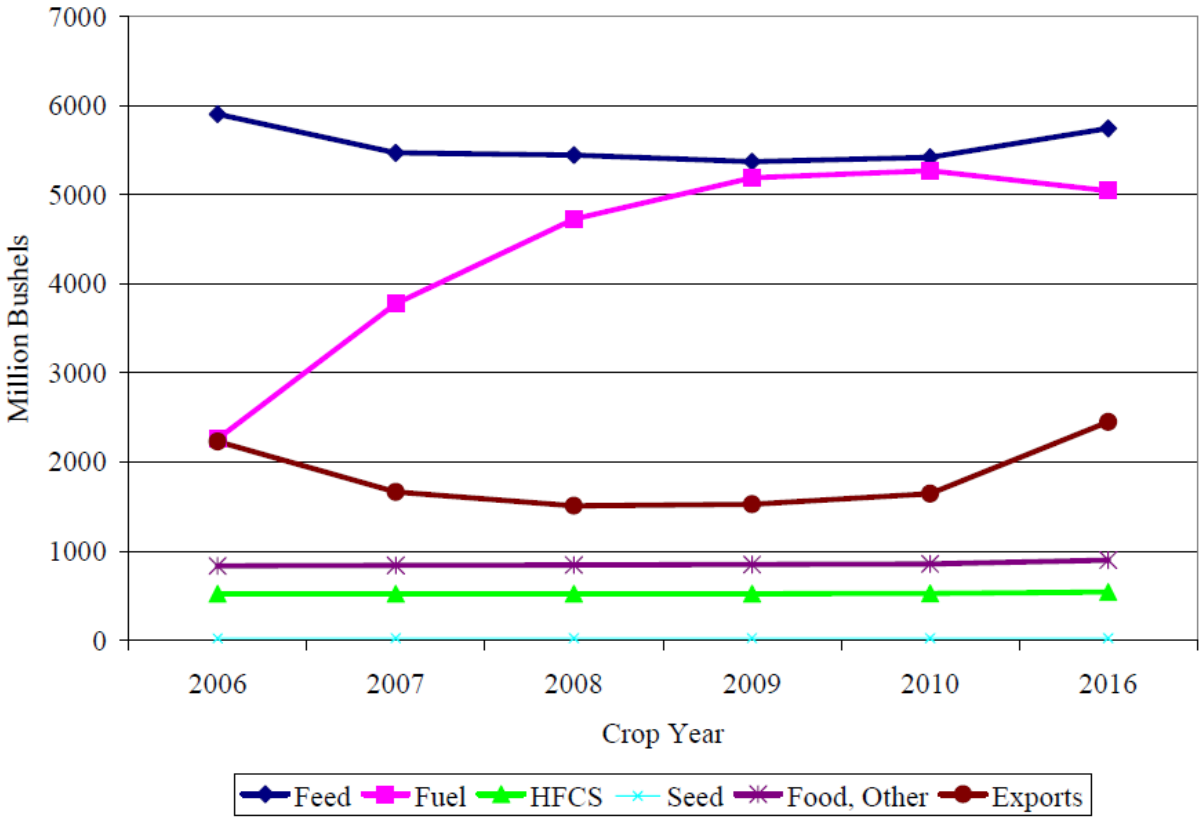


Source: Emerging Biofuels: Outlook of Effects on U.S. Grain,Oilseed, and Livestock Markets S. Tokgoz et al. (2007)

The problem with this increasing production is becoming clear on the hand of an example of the situation in the summer of 1995, U.S. corn prices went up dramatically because parts of the country were experiencing a temporary scarcity. Livestock growers could see a healthy corn crop in the fields and they could observe a futures market that predicted a low price after this crop was harvested. As a result, many livestock producers chose to ignore the short-term losses that they were experiencing and stay in business. We would not expect to see this kind of behavior in response to a permanent increase in feed prices but we do not have any historical evidence to base this on because we have not experienced a feed cost increase that livestock producers viewed as being permanent. This means that farmers will choose for a crop which is most rentable in the long term.

In figure 32 the prediction for the quantities of corn used for different uses is shown. It is clear that due to the increasing use of corn for fuels the demand for corn is increasing. This increasing demand means that more corn production will take place in the United States which will allow less space on the land for other crops. An increasing market value of ethanol has a large effect on the price of corn but also on the prices of other agricultural prices (as wheat).

Figure 32: Prediction of the demand for corn for the different utilities of corn (in the US)



Source: Emerging Biofuels: Outlook of Effects on U.S. Grain,Oilseed, and Livestock Markets S. Tokgoz et al. (2007)

Biofuel is not produced from wheat; nevertheless it is affecting the prices of wheat. This because the energy costs are increasing and the pressure on the environment created a situation in which the demand for biofuels is growing. Land is used to grow corn or soybeans which are used for the biofuels. This means a decline of the production of other crops.

This variable is again also depending on many other variables. Increasing oil prices due to less availability of crude oil will lead to a growing demand for replaceable products which are cheaper or which know less price fluctuations. The increasing pressure which is related to the awareness for the environment is also a factor which can push more people or organizations to start using biofuels.

3*:* ***Population growth and increasing income average per capita in the world***

A combination of population growth and economic growth in developing and transitional economies has lead to a situation in which the income of the world population has increased for many people. This growing number of people with a higher income is an important factor. There are different ways to measure the poverty rates; four different poverty lines are used; the original World Bank's poverty line or $1/day, $1.5/day, $2/day and $3/day lines. Using the original World Bank definition ($495 annual income) the poverty rate declined from 15.4 percent of the world population in 1970 to 5.7 percent in 2000, a decline of a factor of almost three. This is especially impressive given that, during the same period, world population increased by almost 50 percent (from 3.5 to 5.5 billion citizens). The implication is that the total number of poor citizens went from 534 to 322 million, a decline of 50 percent.

Income is affecting the diet of the people. Meat consumption in developing countries is growing enormously (Mullins 2008). As a result of the move toward a more meat based diet, demand for feed has multiplied in these rapid economic-growth countries. Especially in Asia there are many people which have seen an increasing budget. People start to change their eating habits; the cheaper grains like rise are supplemented with a growing amount of meat. The growth in China, India's consumption of agricultural commodities is likely to increase due to changing eating patterns and rising income (Gould and Villarreal 2006; Delgado and Santos 2008; Streifel 2009). Therefore, the continuous growth in the middle classes of many emerging countries including India and China will continue to shift toward a meat-based diet, thus sustaining the upward pressure on feed commodity prices. More than 80% of the increase in Chinese grain and oilseed demand stems from diet changes (Delgado and Santos 2008; Streifel 2009).

The growth of population is not finished and therefore the increasing population is something which will become more important in the coming years. According to the UN (United Nation) the growth will continue the following years. As described on (http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/P/Populations.html Feb. 2011) the growth of the population is more or less an exponential one. This would imply that with the population growth in 2010 of 1.2% the world population would be doubled in 57 years (with this growth rate); this means from 6.2 billion people in 2010 to 12.4 billion people in 2076. However the expectations of the UN are that in 2050 9.1 billion people. This population increase means that more citizens have to be fed. Current estimates by the Food and Agriculture Organization (FAO) project that there is a need to increase global food production by 70% by the year 2050 to sustain food demand.

This change is affecting prices in the longer term. The income growth takes time and also the effect of this increasing income. That people are changing their diet due to a higher income which is not an effect which is seen directly. Calculating the increase or decrease in wheat prices due to increasing population but especially growing income is difficult. Nevertheless this factor should be considered as the effect will be very important.

4: ***Extreme weather and climate change***

These are actually two different factors which have a certain influence on the price of wheat. The first is bad weather condition. This is a variable which has an effect in the short term. Bad weather is influencing the prices because a part of the normally expected supply is not present. The unexpected decline in supply is affecting the stock/inventory quantity and because demand is not declining in this situation of extreme weather is leading to a decreasing the stock to use ratio. This will lead to a mismatch between demand and supply and possibly to increasing prices. For example in 2007, adverse weather events affected yields worldwide, documented by Trostle (2008) as follows: "Floods during harvest in Northern Europe; drought in Southern Europe, Russia, Ukraine, Australia and Northwest Africa; late freeze followed by drought in Argentina; hot dry growing conditions in Canada; and late hard freeze that affected the red winter wheat crop in the United States." This had an effect on the prices as we will see in the conclusion.

The second factor is the climate change. This is a variable which is not much taken in account yet. It is difficult to use such a variable in a price forecasting model. Because it is an effect which is going slowly and will have more effect in the coming years so for the long term it will be interesting. Wheat is grown under certain climatic conditions. This has been discussed in chapter 3 extensively. There are regions which are specifically focusing on the wheat production. In the long term a small change in climate, (this can be the temperature, the humidity, the rainfall etc.) can affect the production enormously. The question is; what the effect is of this change? If the important producing areas are not able to produce wheat anymore or at least in the important quantities as they are doing presently, this will affect the total wheat production of the world. It will be the question if other regions/countries (which will get a favorable climate for the wheat production) will start investing in the production of wheat. Due to lower total production the prices could start growing. A possible reaction of increasing wheat prices is that in countries which have a more favorable climatic condition the production of wheat could become interesting. However this would take time before this new production can help to refill the gap between the demand and supply. This explanation is done with the assumption that demand would not change to large extent.

In order to see to what extent climate change can affect the wheat production we need information on the effect of the different changes which arise due to climate change.
Different models are used to calculate the different effects caused by climate change. In these different publications some feature are taken in account which are effects of the climate change. The publications of R. Adams (2010), R. Adams and R. Fleming (1995), W. Cline (1996), S. Kane et al. (1992) take the following effects as an assumption of previous research.

1 Global mean surface warming as greenhouse gases partially block or absorb heat radiating from the earth. The rate of increase of global mean temperature is predicted to be about 0.3 ~ per decade.
2 Regional climate changes, different from the global mean. Models predict that surface air will warm faster over land than over oceans and that the warming is expected to be 50-100% greater than the global mean in high northern latitudes in winter. Temperature increases in Southern Europe and central North America are also predicted to be higher than the global mean.

3 Increased precipitation in the order of 5-10% in middle and high latitude continents (35-55 ~ N) in winter. Reduced summer precipitation and soil moisture in Southern Europe and Central North America.
4 An average rate of global mean sea level rise of about 6 cm per decade over the next century mainly due to thermal expansion of the oceans and the melting of some land ice.

As discussed by S. Kane et al. (1992) there are other effects in addition to temperature and precipitation changes, climate change may also impact agriculture through greater competition from weeds, increased plant and animal disease, changes in soil nutrients and pests, and increased conflicts for available water. Carbon in the atmosphere may have an effect on plant growth. A carbon enriched atmosphere, like that under doubled CO2 concentrations, is widely believed to promote plant growth and also lead to increased efficiency in water use. This positive influence of climate change on plant growth is termed the CO2 fertilization effect. Climate change is a severe test of our economic modelling capability. Imperfect knowledge about long-term climate changes, physical crop growth changes, and changes in critical economic conditions, make empirical economic estimations of the agricultural impacts of climate change informed speculation at best.

This knowledge is used to calculate possible changes. But due to the fact that climate change is difficult to predict how and to what extent it will occur, scenarios are used to think of possible different effects of climate change.

5: ***Rising input costs***

"Input prices rose sharply in 2008, particularly fertilizer prices, but they lagged food price rises" (C. Gilbert 2009). The rapid increase in global energy prices has lead to a situation in which the costs of agricultural inputs increased, especially fertilizers, so increasing the cost-base of agricultural producers. There is a direct link between cost of energy and price of fertilizers, agricultural chemicals, propane, and diesel used in production agriculture (Abbott et al. 2008). To illustrate this point, the Arkansas State University (ASU) Farm experienced a 251% increase in fuel costs to operate the farm machinery comparing the 2007–2008 actual expenditures to those of 2005–2006 (W. Pendegraft and M. Johnson, Arkansas State University, personal communication). During the same time period, fertilizer costs increased by 329% at the ASU Farm. Livestock feed prices increased by 266% in that period
Also (DairyCo 2009) publicized that the cost of fertilizer almost tripled between mid-2007 and mid-2008 and other energy-related costs went up in virtually all parts of the food value-chain, i.e. cultivation, processing, shipping, transportation (and refrigeration in the case of meat and dairy products).

Rising cost for the production are affecting prices directly. The effect of the rising cost is important in the short term. However as explained by Abbott at al. (2008) the rising oil prices are the main cause for the increase for the input cost. This means that the cause of the increasing oil price is important.
Arable land is diminishing due to the increasing population and increasing demand for energy. This has as effect that due to the crops grown for the production of biofuel the quantity land available for human and animal consumption is reducing. In this context fertilizers play an important role in

ensuring soil fertility. This is to be sure that enough can be produced on the lower quantities of land. Increasing fertilizer prices is affecting the production cost structure as discussed above.

As seen in chapter 4 part 4.2 and 4.3 in the discussion of the different methods we saw that it is important to take in consideration the effect of different variables on each other. This is the case when looking to the input costs for wheat and the effect on the prices.

6: ***Depreciation of the US dollar***

The depreciation of the U.S. Dollar is an important variable which is affecting the wheat prices as most of the commodities are quoted in U.S. Dollars. The devaluation of the US dollar has contributed to the rise in the price of food. Abbott et al. (2008) indicate that the impact of the US dollar on the price of food has been underestimated by several previous studies and that the simultaneous movement of these variables (US dollar and price of oil) supports this trend over the past several years. Because food commodities are traded globally, the decreased value of the US dollar has resulted in worldwide food price inflation. As a result of the devaluation of the dollar relative to foreign currencies since 2002, the cost to other countries of importing agricultural commodities denominated in US dollars, such as grains, food, and oil, has declined. Consequently, countries whose currencies have appreciated relative to the US dollar imported the same amount of agricultural commodities at a lower cost, or imported more at the same cost.
As argued in the article of T. McCoy (2004) the rapid appreciation of the U.S. dollar between 1996 and 2002 is an important cause of the low wheat prices and depressed U.S. farm economy that plagued U.S. wheat producers during much of that period. Exchange rate changes also have had an important role in explaining changes in the distribution of wheat production around the world. Recently, the value of the U.S. dollar has declined dramatically, especially against the currencies of the main competitors. Since January of 2002, the dollar has depreciated 30% against the Euro, 19% against the Canadian dollar and 34% against the Australian dollar.
This depreciation of the U.S. Dollar has continued since 2002 and is presently leading to increasing food prices.

7: ***Increasing international trade and the governmental influence on the trade***

First point of this variable is the increasing international trade. Due to globalization the international trade has become more important. The import and export of all types of products has been growing and is still continuing growing.
This process of globalization has as side effect that countries become often more dependent of other countries. As is explained by Krugman (2008) countries will specialize themselves in the production of those products in which they have a relative advantage. By specializing themselves and exporting those products and importing those products in which they do have a lower comparable advantage. This can lead to a situation in which countries are more depending of each other. This practice of comparable advantage has some advantage, especially financial however it will decrease the independence of countries. This increasing dependency of countries is one of the factors which can lead to panic reaction of countries.

This is the next point; the policy which is conducted by governments has a large influence on the prices of commodities. When a government is reacting on a decreasing supply in their own country

and installs a export restriction, it can provoke a "domino effect" in which other countries are following this restriction (when they are exporter of the commodity) or are making large panic purchases in order to be sure of enough stock. According to the IFPRI (International Food Policy Research Institute http://www.ifpri.org/ Feb. 2011) these export restrictions or the race to buy enough of a commodity is very important variables which are affecting commodity prices. Pascal Lamy from the WTO sees the export restriction also as a main driver of the prices.

According to A. Broekema (chair of the committee of grain traders in the Netherlands) there is no reason for panic. After the last price peak in 2008 there have been two years with a production which was above average. Nevertheless we should be vigilant; presently many grains are being exported to from Europe and the United States to Northern Africa and the Middle East, without the security if the harvest of coming year will provide enough stock.

*8: **Decreasing stocks in a country and the solutions found by governments***

Stock depletion is generally the result of consumption exceeding production, although public policy decisions can also play an important role. Factors affecting consumption and production will affect prices in the short term but also have an impact on prices in the future through their impact on end-stock levels at the end of the year and in succeeding years.

Factors behind the reduction in international stocks included the following:

- The reduction of stocks in China due to a policy to reduce the very large grain stocks it had accumulated in the 1990s;
- A 20% increase in wheat price and a 3% reduction in wheat area (as seen in chapter 3).
- In terms of wheat domestic use, the significant impact is felt in the feed sector, with feed use increasing from 150 million bushels to 283 million bushels. This higher demand occurs despite the higher wheat price, as less corn is available for feed use and the corn price increase is larger relative to the increase in the wheat price. With higher domestic use, lower production, and higher wheat prices, wheat exports decline by 16%.

Also noteworthy is that the net importation of rice, wheat, and corn into India and China has not changed significantly over the past several years (Abbott et al. 2008), primarily due to government mandates to become self-sufficient for these staples. This willingness of being self-sufficient will become an interesting variable in the future. China has a large amount of mouth to feed and want to be self-sufficient to a large extend. This means that China is seeking for ground which they can use to produce enough of their commodities which they need. China is not the only country which has started buying and renting land in poor areas in the world, however is an important player in this new market.

According to FAO the land rent is becoming increasingly important. Especially African countries are selling or renting land. The top five countries which have rent contracts or land sold to external investors are Ethiopia, Ghana, Madagascar, Mali and Sudan in table 27 the amounts of land which is rent or sold is described. The most important findings of the FAO which are based on the available information of the five most important countries (Ethiopia, Ghana, Madagascar, Mali and Sudan), are;

- Significant levels of activity – the quantitative inventories have documented an overall total of 2,492,684 ha of approved land allocations since 2004 in the five study countries, excluding allocations below 1000 ha;
- Rising land-based investment over the past five years, with an upward trend in both project numbers and allocated land areas in all quantitative study countries and anticipated growth in investment levels in future;
- Large-scale land claims remaining a small proportion of total suitable land in any one country, but most remaining suitable land is already under use or claim, often by local people, and pressure is growing on higher-value lands (e.g., those with irrigation potential or closer to markets);
- Possible increases in the size of single acquisitions, though with considerable variation among countries – approved land allocations documented here include a 452,500 ha biofuel project in Madagascar, a 150,000 ha livestock project in Ethiopia, and a 100,000 ha irrigation project in Mali;
- Dominance of the private sector in land deals, though often with strong financial and other support from government, and significant levels of government-owned investments;
- Dominance of foreign investment, though domestic investors are also playing a major role in land acquisitions – a phenomenon that has received far less international attention so far.

Table 27: Land order investors claim 2004-early 2009 (approved projects only)

	Ethiopia	Ghana	Madagascar	Mali	Sudan	Total
total land area allocated (ha)	602.760	452.000	803.414	162.850	471.660	2.492.684
No. Of projects approved (over 1000 ha)	157	3	6	7	11	184
Largest land allocation (ha)	150.000	400.000	452.000	100.000	109.200	
Total investment commitments (US$)	78.563.023	30.000.000	79.829.524	291.988.688	439.600.000	919.981.235

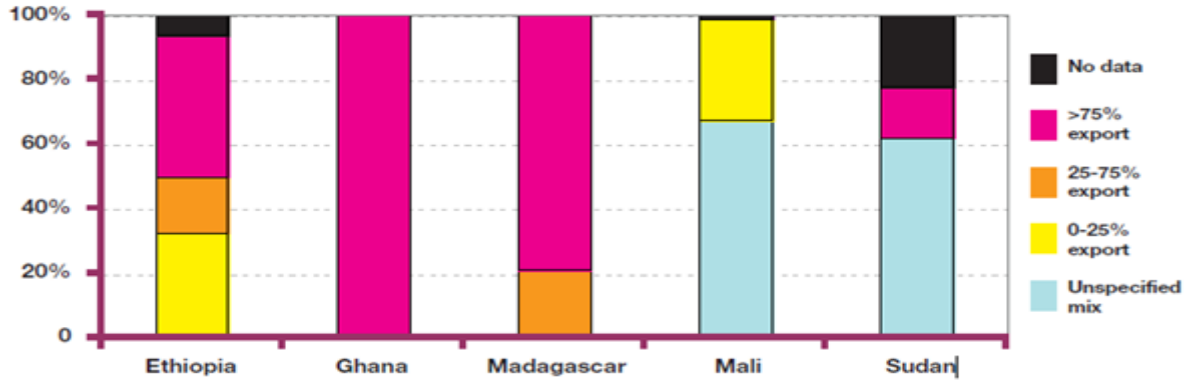
Source: Country studies FAO (2009), *denotes incomplete data

Where governments are acquiring equity stakes in land, sovereign wealth funds play a smaller than anticipated role. More common arrangements for government ownership of land assets in foreign countries are via state-owned enterprises and minority shares in private companies. Direct government-to government land deals are rare but not unknown. Government development funds play a major role in providing loans, insurance and other forms of support to state-owned enterprises and private companies operating abroad (FAO 2009).

Stated in (FAO 2009) the reasons for the countries and organizations to invest in land contracts is mainly food security concerns, particularly in investor countries, are a key driver of government-backed investment. But many government-backed deals are driven by investment opportunities rather than food security concerns (e.g. China). Related drivers behind current land deals in Africa are global demand for non-food agricultural commodities and biofuels, expectations of rising rates of

return in agriculture and land values, and policy measures in home and host countries. In figure 33 the reason of production becomes clear, what can be seen in this graph is the fact that most production is used for export.

Figure 33: Distribution of land area devoted to domestic and export markets (as % of allocated HA)



Source: country data FAO research (2009)

Reason for host country to rent their land is discussed (FAO 2009) and are especially the benefits which are mainly seen in the form of investor commitments on investment levels, employment creation and infrastructure development though these commitments tend to lack teeth in the overall structure of documented land deals. Many countries do not have in place legal or procedural mechanisms to protect local rights and take account of local interests, livelihoods and welfare. Even in the minority of countries where legal requirements for community consultation are in place, processes to negotiate land access with communities remain unsatisfactory. Lack of transparency and of checks and balances in contract negotiations; create a breeding ground for corruption and deals that do not maximize the public interest. Insecure use rights on state-owned land, inaccessible registration procedures, vaguely defined productive use requirements, legislative gaps, and compensation limited to loss of improvements like crops and trees (thus excluding loss of land) all undermine the position of local people.

Now we still have not answered the question; why the decreasing stocks and the reactions of governments (and private organizations) can influence the prices. That decreasing stocks will lead to price fluctuations is known. When the stock is decreasing it means that the supply is decreasing or that the demand is increasing, the equilibrium has changed. The fact that some governments sees this decreasing stock as a signal that the food security is in danger means that they start seeking to opportunities to secure their commodity supply. Often this is not only to be sure that their supply of a certain commodity will be large enough but also that it is seen as a good investment.
If you invest in land you can increase your capacity of a certain commodity as it becomes necessary. However when it becomes necessary it implies that there is already a situation of scarcity. We know from the economics that scarcity of a certain product can lead to increasing prices.

This effect is a new phenomenon; that governments and private organizations start investing in agricultural land. The effects are for the longer term. These are long term investments, as can be seen for the contracts which hold most for 50 years or longer terms. When the stocks of a commodity starts to decline because of e.g. climate change, political unrest, export restrictions,

increasing demand etc. than the investments will show their usefulness. As the investors can use their rented land to create new supply and make sure they can use the situation of scarcity to make profit.

5.3.1.1 Conclusion

Now that the possible affecting factors for the wheat have been discussed, the possible influence will be discussed in combination the information provided in chapter 3 on the changes of demand and supply will be used. This will be done in the following way. In table 28 the different influencing factors are listed. In the next row answer will be given on the question if it is already affecting the prices and if it is a factor which is important in the long term or the short term. In the last row we will look if in the period 2000-2010 the specific factor could possibly have affected the prices.

When looking at the different factors it is clear that some factors are already occurring. To what extend it is affecting the prices is difficult to argue. It is possible to discuss in what time range the factors can affect the wheat prices. Taking the tables from chapter 3 in account in which the changes of supply and demand are shown for the period 2000-2010 and the price fluctuations we stated already that the price fluctuations are not only caused by fluctuations between the supply and demand. It is difficult to state how much a certain factors discussed in table 28 is affecting the prices.

Looking at table 28, the factors which possibly are affecting the wheat are discussed. That the factors Are affecting the prices can be stated but to what extent is difficult to predict. The export ban of Wheat in Russia in 2010 is probably affecting the prices as a sharp increase of prices has been experienced in 2010. A similar story is holding for the increased demand for biofuels which is leading to less land availability for the production of wheat.

After having discussed the different factors which affect prices on the long term and the short term it can be stated that there is a good reason to believe that there are different factors which are having an effect on the prices. Nevertheless how large the effect of the different factors is on the price cannot be argued with this information. This means that because there are different factors which have a certain influence/effect, it is impossible to state exactly to what extent a factor is affecting the price.

Table 28: Conclusion and comparison wheat

Affecting factor	Already affecting/ time range of affection	Effects seen during period 2000-2010
Commercials and non-commercials	Yes / short and longer term	Increasing numbers of commercials and non-commercials leading to an increased quantity of money on the commodity market (increased volatility). Commodity markets are being used for hedging and speculating.
Price of Oil	Yes / short term	Increasing oil prices is leading to higher production costs and higher transportation costs. The higher oil prices are one of the factors which have lead to the use of more biofuels.
Increasing demand for biofuels	Yes / longer term	The increasing demand has as effect that farmers choose to use their land to grow corn and soybeans which have higher financial incentive than wheat.
Population growth and increasing income average per capita in the world	Yes / longer term but ongoing .	Population have experienced an growth of population and especially an increase of income, which have lead to a lower number of the population living in poverty. This implies that their budget give them the possibility of changing their diet and which lead to increased pressure on the food and feed market. FAO expects a 70% increased demand for food by the year 2050.
Extreme weather and climate change	Yes / extreme wether has an direct effect, climate change has an effect on the longer term	Climate change is an effect which is ongoing but which is an effect which is proceeding slowly. A growth of 0.3 degree per decade is the prediction. This can have important effects in the long term. Extreme weather is something which is seen more often and which have a direct effect. Most important extreme weather events affecting the wheat market have been; Drought in Russia 2008 and 2010 leading to an export ban China also has experienced several droughts.
Rising input costs	Yes / short term	The input costs for the farmers are affecting the prices in the short term. The price of oil as discussed above but also

		fertilizer costs have been growing during the last decade. Between mid 2007 and 2008 the fertilizer costs almost tripled. The higher costs will be calculated in the prices of wheat.
Depreciation of the US dollar	Yes / short term	Rapid appreciation of the dollar between 1996 and 2002 have led to low wheat prices and depressed US farm economy. Since January 2002 up to now the dollar continued depreciating leading to increased food prices.
Increasing international trade and the governmental influence on the trade	Yes / short and longer term	Export restrictions are seen presently in Russia after the extreme drought in 2010. These export bans can cause panic reactions of governments and investors, which start buying large amount of wheat.
Decreasing stocks in a country and *the solutions found by governments*	No / long term	Governments and investors have started investing in large amount of land in order to secure the food availability for the longer term. The effect of these investments will possibly been seen in the longer term.

Source: table based on information of all the chapters of this project.

5.3.2 **Oil**

The importance of oil as commodity have been seen in the previous chapters, also we saw in the previous part 5.3.1 in which have been discussed that oil is an affecting the price of wheat. Knowing what is leading to price fluctuations of oil is important as it is affecting prices of other commodities.
As have been discussed in chapter 3 in part 3.3, the oil producing countries are divided in OPEC and Non-OPEC countries and OECD and Non-OECD countries. When looking to the United States we have seen in chapter 3 that their demand is higher than their own supply, which imply that import is necessary. The top seven countries from which the United States is importing crude oil consist of five countries which are noted/seen as less stable according to the WTO, this are Saudi Arabia, Venezuela, Nigeria, Angola and Iraq. Stability of a country is important for the prices of oil. High economic and/or political instability can harm the production/export and lead to price fluctuations.

In table 16 and figure 19 and 20 in chapter 3 part 3.4 the price fluctuations have been discussed which have been seen in the past 10 years. This price fluctuation is not caused directly by a mismatch between the demand and supply. This chapter will provide a discussion on some factors which can influence the prices.

What has been seen in chapter 4 in which the price forecasting models have been discussed is that oil prices are being predicted based on the data and the prices of OECD counties because these countries are political and economical more stable than for example the OPEC countries. Another reason was the data availability. The price prediction is mostly based on the old prices and the change in demand and supply which affect the inventory. The inventory is also highly depending on the seasonality which is very important for the oil demand. During winter time in the northern part of the world the demand is increasing which lead to decreasing inventory. This inventory is again supplemented during the summer in the northern part of the world when demand is much lower.

The factors which are affecting the prices of oil will be discussed. These are factors which are not used in the model presently. However most of them have been discussed in publications and are known. One important aspect is the inventory; in most models they use the inventory as a basis for the price predictions. There is a difference between the inventory already won and the inventory which is underground. This underground inventory is sometimes taken in account in the models. Some affecting variables which will affect the inventory and the oil price are;

1 ***Inventory change due to decreasing oil availability and increased difficulty of achieving it***

The total quantity of oil is not infinite. This means that when the consumption of oil is continuing in these quantities the supply of oil will decrease fast. Reserves are those quantities of petroleum claimed to be commercially recoverable by application of development projects to known accumulations under defined conditions. Reserves must satisfy four criteria: They must be:

- discovered through one or more exploratory wells
- recoverable using existing technology
- commercially viable
- remaining in the ground

Next to these criteria you have the distinction between proved and unproved reserves of oil. Other issues are the techniques to achieve the oil. Some reserves are proved however are not achievable with the currently known methods. In table 29 the reserves of the 17 most important oil producing countries are listed. In the last row the expected reserves life is shown. This is based on the assumption of a consumption which we know currently. The data are questionable as most countries are not stable and this can harm the data reliability. Also the calculations are questionable as this is calculated assuming that the consumption stays at the current level. This is not what we expect with; first an increasing number of citizens in the world, an increasing demand of oil, and possibly the emergence of substitutes for crude oil (e.g. biofuels).

Table 29: summary of reserves data as of 2010

Country	Reserves		Production		Reserve life
	10(9) bbl	10(9) m(3)	10(6)bbl/d	10(3) m(3)/d	Years
Saudi Arabia	467	74.2	9.7	1540	127.5
Iraq	180	29	3.5	560	142
Canada	179	28.5	2.1	330	188
Iran	138	21.9	4	640	95
Kuwait	104	16.5	2.6	410	110
Venezuela	99	15.7	2.7	430	100
United Arab Emirates	98	15.6	2.9	460	93
Russia	60	9.5	9.9	1570	17
Kazakhstan	47	7.5	1.4	220	93
Libya	41	6.5	1.7	270	66
Nigeria	36	5.7	2.4	380	41
United States	21	3.3	7.5	1190	8
China	16	2.5	3.9	620	11
Qatar	15	2.4	0.9	140	46
Algeria	12	1.9	2.2	350	15
Brazil	12	1.9	2.3	370	14
Mexico	12	1.9	3.5	560	9
Total of top seventeen reserves	1243	197.6	63.5	10100	54

Source: based on Wikipedia.com (Feb. 2011)

This is for the longer term an important point which should be taken in account. This is already done in the sense that the underground inventory is taken in consideration in some forecasting models. However the effect of the decreasing supply is influenced by many other variables, these will be discussed later on. That the oil is not infinite is known just like the fact that the oil which will be won in the future will be more complex to reach (using the actually used techniques). This inventory of oil which is more difficult to reach will also lead to higher cost of winning the oil. It consist of places which are in areas with difficult conditions, e.g. on high depth in the ocean or under large quantities of ice. That higher cost for winning the oil will be calculated in the oil price which will increase. However new technologies can make it easier to reach new stocks of oil, this will be discussed later on.

A decreasing stock will affect the prices to a large extent. This decreasing amount of oil can lead to a panic reaction of governments of countries or organizations which are depending on oil. When one starts investing in oil to secure itself it can have a same domino effect as which have been seen on the wheat market and discussed in part 5.3.1.

2 ***Pressure from environmental organizations and the awareness***

Since approximately the 1960 an increasing awareness has originated on the importance of the environment (http://www.oup.com Feb. 2011). An increasing number of governments started with putting environmental issues on their agenda's. In the past some important disasters have occurred, like the disaster in the Gulf of Mexico in 2010, the Gulf War in 1991 and many more (www.wikipedia.com Feb. 2011). These have affected the way governments are thinking and acting. Often due to the increasing pressure from environmental organizations and the citizens. Strict regulation for the oil winning makes it extra difficult for the oil companies to reach the oil in a save way, which makes the process more expensive.

The effect of the actions of environmental organizations is creating awareness under the citizens. If there is an increasing awareness for the use of more environmental friendly fuels it can lead to increased pressure on the government with as effect that governments would subsidize these more environmental friendly products. This would be an effect which could affect prices in the longer term however not in all countries. Possible effects on the price are difficult to discuss here. If many countries would start subsidizing an environmental friendly substitute for oil it is possible that the demand for oil will decrease. If the oil price will be increased due to taxes it can lead to a situation in which demand could decrease without prices to lower. These effects would only be important when a majority of the countries (and the most important consumers) of oil will start with such an policy.

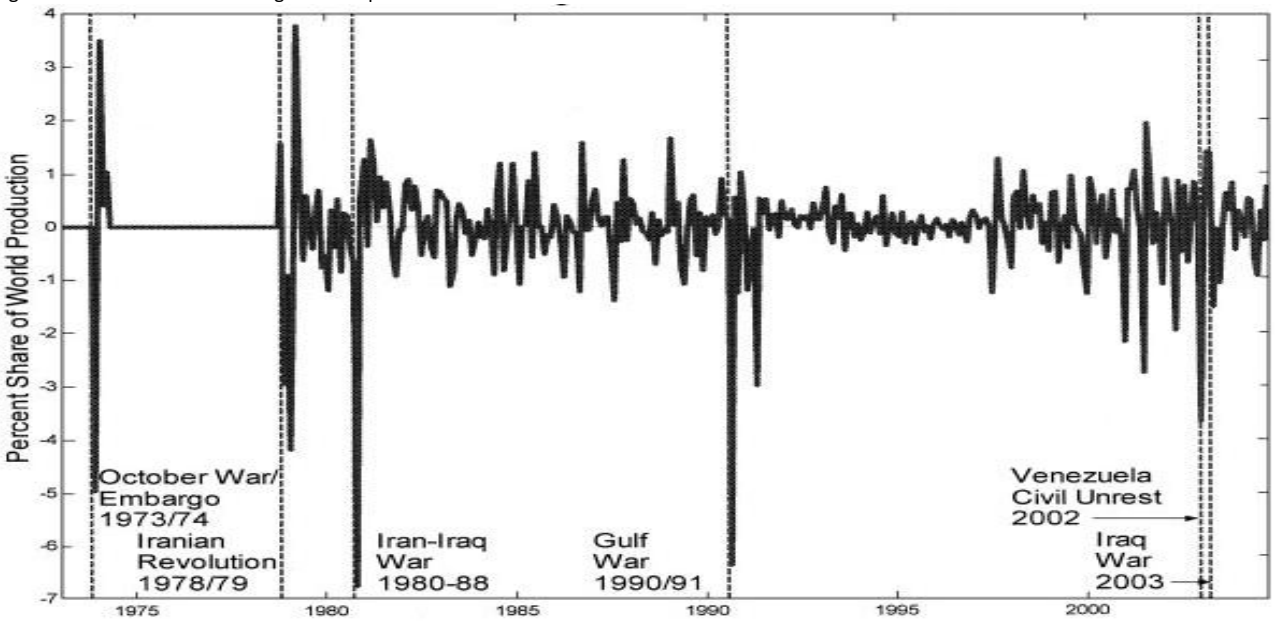
Important in the question if biofuels will continue growing is not only depending on the governments but also to some extent to the oil organizations. Trans-Atlantic responses by multinational corporations (MNCs) in the oil industry to the prospect of international controls on greenhouse gases have been strikingly different. U.S.-based companies such as Exxon and Chevron have aggressively challenged climate science, pointed to the potentially high economic costs of greenhouse gas controls, and lobbied against mandatory emission controls. In addition to these political strategies, U.S. companies have invested little in alternative energy sources and some have even divested renewable energy assets in recent years. By contrast, BP and Shell, the two largest European companies, have accepted the scientific basis for precautionary action, expressed support for the Kyoto Protocol on greenhouse gases, and announced substantial investment plans for renewable energy. These divergent strategies each represent a coherent blend of market and non-market strategies. The American firms have been investing their resources primarily in political strategies to prevent a binding protocol and to defend their existing asset and competency base.

3 ***Political and economical instability in producing countries***

L. Kilian (2008) has done a research on the effects of exogenous supply shocks and their effect on the prices and the GDP of the United States. In chapter 3 part 3.3.3 we have stated that the United States

is depending for its oil supply of some countries which are less stable according to the WTO. In the past there have been some important exogenous supply shocks which had a clear affect on the prices. When looking to figure 34 in which the disruption in some OPEC countries are shown it is clear that these disruptions have a direct effect on the production of oil. This is leading to a worldwide supply shock as these countries are all important producing counties (which can be seen in table 9 and 10 in chapter 3).

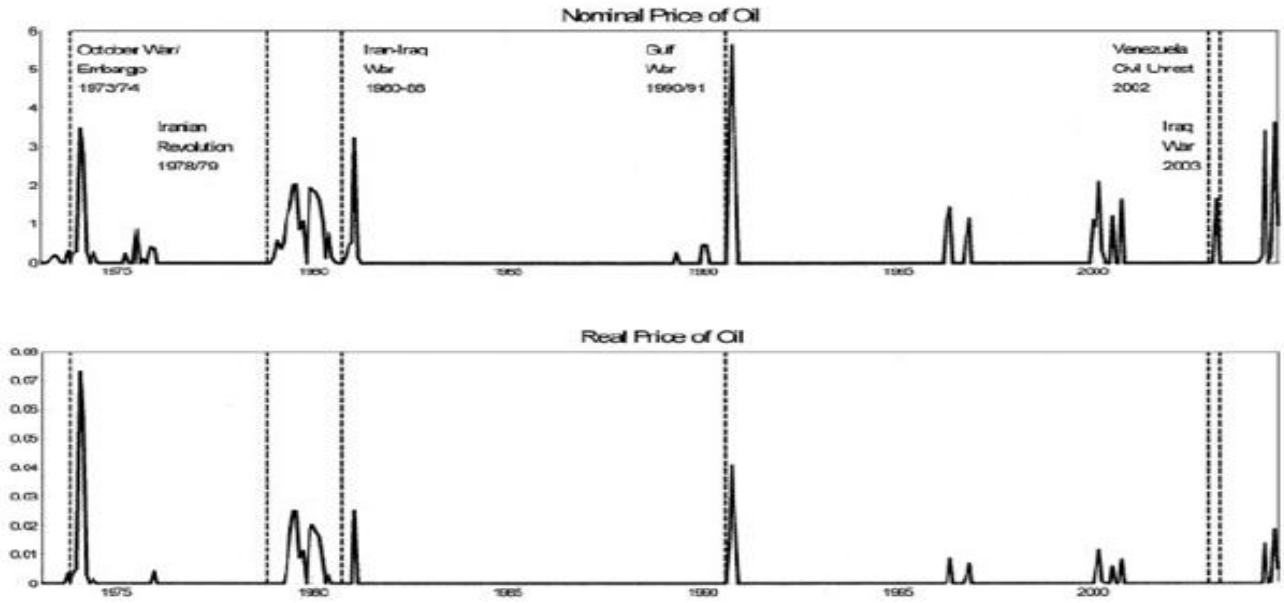
Figure 34: First difference of exogenous oil production shortfall: OPEC



Source: L. Kilian (2008)

The next question is what did these supply shocks had for an effect on the prices of oil? Following the rules of demand and supply on the price and the effect of a decreasing stock, a growing price would be expected. In figure 35 the effect on the real price and nominal price is shown. As we would expect the prices are affected by the supply shocks.

Graph 35: Oil price shocks measured by net oil price increases (relative to previous three years)



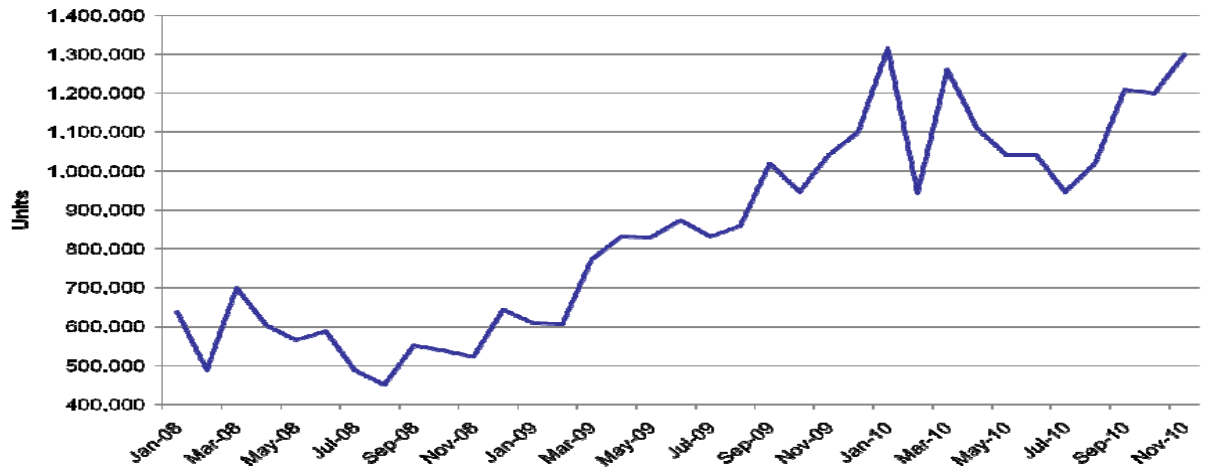
Source: L. Kilian (2008)

This research of L. Kilian (2008) has shown that political and economical unrest are a major variable which can affect prices. Because a large proportion of the oil is produced in countries which are less stable (according to the WTO) it is important to be aware that unrest in one of the important countries can cause price fluctuations which can be important. This is in fact a short term variable as the effects are felt almost directly. Interesting to follow the coming period is the effect of the unrest in Libya and the Middle East and how this can influence the oil prices. OPEC stated that they have enough production capacity to overcome the diminishing production in countries in which the unrest is leading to unworkable situations for the oil companies.
A possible side effect of the supply shocks in important production countries is the panic reaction which has been discussed previously already.

4 Increasing interest for biofuels and/or increasing demand for oil

First interesting point is the fact that the demand for oil will continue increasing. According to Mr. D. Peniket president and chief operating officer ICE future Europe, "the total consumption of oil is and will continue increasing due to the increasing number of consumers. Especially the growing number of citizens in Asia and the growing welfare pushes the demand up. China is responsible for almost 50 percent of the Asian growth. Figure 36 shows the cars sold in the last two years in china. A massive increase is seen of the total amount of cars sold. This is one of the explanations for the growing demand in China. This growth will continue as the number of citizens will continue growing and the number of citizens with a higher standard as well. This means that they can permit themselves to make use of more luxury products as for example a car.

Figure 36: Numbers of cars sold in China



source: presentation of Mr. D. Peniket president and chief operating officer ICE future Europe, during the United Nations Conference on trade and Development 31/1/2011

The aspect of biofuels has been discussed in previous chapters. This will not be discussed again; however what the effect is on the oil prices will be discussed. The utilization of biofuels will depend on different factors. Presently the costs are higher but decreasing. When the use of biofuels for consumers will be cheaper than regular fuels based on oil, than the demand for these biofuels will start accelerating. Next to the price the stimulation of government's plays a important role, as we already discussed, in the United States in most of their states the use of biofuels are encouraged.
The use of biofuels has been growing since 2001 up to 2008. The world production of ethanol experienced a growth from 4.9 billion gallons to 17 billion gallons. And Biodiesel experienced in the

same period a growth from 264 million gallons up to 2.9 billion gallons (http://thelortonshow.com Feb. 2011). The majority of the ethanol is produced in the United States and Brazil. Biodiesel is mainly produced in Europe.
There are scientists which are arguing against the use of biofuels. A main argument against the utilization of biofuels is the fact that for the production of biofuel crops as corn or soybeans are necessary. This land which is used for the production of biofuels will decrease the areas available for other crops. Less available acreas will lead to lower production and finally in increasing prices (of other crops, food or feed). According to (http://thelortonshow.com Feb. 2011) In the United States one third of the corn harvest in 2010 (335 million metric tons) has been used for the production of ethanol. The expectations are that within 5 years this will be 50 percent of the corn production. This is leading to danger for the food security, especially for the poor in the world.

Another problem is the "direct biofuel production subsidies, which raise feedstock prices for farmers by increasing the price of corn. In the U.S., blenders are paid a 45 cent-per-gallon "blender's tax credit" for ethanol — the equivalent of more than $200 per acre to divert scarce corn from the food supply into fuel tanks. The federal government also pays a $1 credit for plant-based biodiesel and "cellulosic" ethanol" (http://thelortonshow.com Feb. 2011).

In addition, "there is a 54 cent-per-gallon tariff on imported biofuel to protect domestic production from competition, especially to prevent Brazilian sugarcane-based ethanol (which can be produced at less than half the cost of U.S. ethanol from corn) from entering U.S. markets. These subsidies allow ethanol producers to pay higher and higher prices for feedstocks, illustrated by the record 2008 levels of corn, soybean, and wheat prices. Projections suggest they will remain higher, assuming normal weather and yields" (http://e360.yale.edu Feb. 2011).

It is not uncommon that in the United States water shortage occur, due to the large quantities of water necessary to process grains or sugar into ethanol, and is amplified if these crops are irrigated. Growing corn to produce ethanol, according to a 2007 study by the U.S. National Academy of Sciences, "consumes 200 times more water than the water used to process corn into ethanol" (http://e360.yale.edu Feb. 2011).

Also the production of ethanol and the increasing corn production leads to extensive fertilization, adding to nitrogen and phosphorus that run off in to lakes and streams. As a result, loadings of nitrogen and phosphorus into the Mississippi and the Gulf of Mexico encourage algae growth, "starving water bodies of oxygen needed by aquatic life and enlarging the hypoxic "dead zone" in the gulf" (http://thelortonshow.com Feb. 2011).
According to another study in science (http://e360.yale.edu Feb. 2011) noted that to replace just 10 percent of the gasoline in the U.S. with ethanol and biodiesel would require 43 percent of current U.S. cropland for biofuel feedstocks. The EU would need to commit 38 percent of its cropland base. Otherwise, new lands will need to be brought into cultivation, drawn disproportionately from those more vulnerable to environmental damage, such as forests.

A study focused on the question of greenhouse gas emissions due to land-use shifts resulting from biofuels. First one said that if land is converted from rainforests, peatlands, savannas, or grasslands to produce biofuels, it causes a large net increase in greenhouse gas emissions for decades. Second

discussed that growing corn for ethanol in the U.S., for example, can lead to the clearing of forests and other wild lands in the developing world for food corn, which also causes a surge in greenhouse gas emissions Searchinger et al. (2008).

The Nobel-Prize winning chemist Paul Crutzen in 2007 emphasized the impact from the heavy applications of nitrogen needed to grow expanded feedstocks of corn and rapeseed. The nitrogen necessary to grow these crops releases nitrous oxide into the atmosphere (nitrous oxide is a greenhouse gas 296 times more damaging than CO2) and contributes more to global warming than biofuels save through fossil fuel reductions.
What the effect will be of the use of biofuels is difficult to predict, it is depending on different factors. New technologies can make the production/winning of crude oil cheaper and possible to reach oil sources which are presently not reachable. Government policy will have a major role in the growth of biofuels.

5 Price cartels of oil producing countries or monopolistic situations

We have already seen that the oil producing countries are divided in OPEC and Non-OPEC countries, and that there is an organization named OECD. We already stated that most of the OPEC countries are especially political and some also economical less stable countries. However they possess the largest quantity of oil reserves. The OPEC is founded to make agreements between the members of the OPEC. As they are such important players on the oil market, they have the power to influence prices. When taking table 30 in consideration, the top ten of the largest oil and gas producing companies is listed. Interesting is the fact that all of these countries are member of the OPEC. To compare it with European oil organizations, Shell, is ranked 22th place with a total reserve of 10.767 million barrels.

Table 30: Top ten oil and gas companies worldwide

Rank by 2007 Oil equivalent reserves	Company	Worldwide liquids reserves, (Million barrels)	Total reserves in oil equivalent barrels, (million barrels)
1	**Saudi Arabian Oil Company** (Saudi Arabia)	259.900	303.258
2	**National Iranian Oil Company** (Iran)	138.400	300.485
3	**Qatar General Petroleum Corporation** (Qatar)	15.207	169.959
4	**Iraq National Oil Company** (Iraq)	115.000	134.135
5	**Petroleos de Venezuela S.A.** (Venezuela)	99.377	128.594
6	**Abu Dhabi National Oil Company** (UAE)	92.200	126.132
7	**Kuwait Petroleum Corporation** (Nigeria)	101.500	110.990
8	**Nigerian National Petroleum Corporation** (Nigeria)	36.220	67.671
9	**National Oil Company** (Libya)	41.464	50.028
10	**Sonatrach** (Algeria)	12.200	39.379

Source: http://www.petrostrategies.org/Links/Worlds_Largest_Oil_and_Gas_Companies_Sites.htm

What does this knowledge tell us? These largest and most important oil companies are all companies which are working under the flag of OPEC countries. The OPEC is able to make agreements on the

quantities oil produced and exported. By doing so, the prices can be influenced. Their goal is to use their power to regulate the oil prices and protect it against price influences from external factors. Since a few years the quantity of oil produced in Russia has been growing. There are rumors and discussions on the fact that Russia would be interested in entering the OPEC and get more power to influence the oil prices.

In the past we have experienced the power of some of the oil exporting countries. For example during the Iran – Iraq war the production of oil has been disrupted, which led to les export. "The Arab-Israeli War of 1973, the 1978 Iranian Revolution, the 1980 Iran-Iraq War and the 1990 Gulf War, for instance, were followed by an immediate drop of 7 to 9 percent in the world oil supply. The resulting mismatches between supply and demand led to increasing oil prices. This development, in turn, curtailed economic activity in the United States as a larger share of consumers' household incomes were diverted away from discretionary expenditures and toward energy consumption" (http://findarticles.com Feb. 2011).

This variable is one which is not predictable in advance. What can be done is making use of scenarios as discussed in chapter 4 part 4.2. By using scenarios expectations can be made on the effect of a war or the influence of Russia on the oil market. However the effects can be felt in short term is the for example OPEC decides to reduce the oil supply. This is a variable which have to be kept in mind, and possibly taken in account in the form of different scenarios. A good example as explained earlier is the situation in the Middle East and the OPEC which try to acts as a stabilizer.

6 ***Use of new technologies***

In a previous parts we talked about reserves which are not, or difficult achievable. The reason that these reserves are difficult to reach or not achievable (or not commercial interesting) is the lack of right technology to achieve these reserves or the high risks of winning the oil with currently used methods.

We have discussed in chapter 3 part 3.3.3 that the United States is world's largest consumer of oil. Their dependence on unstable and countries (mostly OPEC countries) makes depending of those countries. Oil shale refers to "any sedimentary rock that contains solid bituminous materials that are released as petroleum-like liquids when the rock is heated. To obtain oil from oil shale, the shale must be heated and resultant liquid must be captured. This process is called retorting, and the vessel in which retorting takes place is known as a retort" J. Bartis et al. (2005).
The largest known oil shale deposits in the world are in the Green River Formation in the United States. According to J. Bartis et al. (2005) the resource in the Green River Formation is around 1.5 and 1.8 trillion barrels, however not all of these reserves are achievable. The estimation for the quantity achievable shale reserves are around 1.1 trillion and 500 billion barrels. When comparing these numbers of the reserves seen in table 30, we can conclude that this is more than the reserves Saudi Arabia (largest reserves presently) posses. With the actual consumption of oil in the United States which is around 20 million barrels a day (see table 16 chapter 3), these oil shale reserves are enough to secure the oil supply in the United States for a long period and would make them less depending on unstable countries.

There are two ways of winning the oil shale explained by J. Bartis et al. (2005); first Mining and Surface Retorting which is more expensive and would approximately lead to prices between 70 and 95 dollar per barrel (2005 dollars). The second method is In-Situ Retorting, which is much cheaper and would need oil prices of approximately 20 dollar per barrel. These prices can increase when more information is gathered on the process.

Shell is one of the oil companies which is doing research to the possibilities of this technology. However before being able to start producing and getting it financial rentable it will take at least 15 years. The research of the possibilities has been increasing after the oil disaster in 2010 of BP in the Gulf of Mexico.

This new technology can become important in the future, and affecting the oil prices worldwide. As the United States is an important importer of oil, it will change prices if there is a large increase in supply in the United States. Also there dependence of OPEC countries would diminish.
However the environmental consequences are not yet completely discovered. It is known that it uses large quantities of water for this technique. More environmental effects can lead to increasing production costs, which probably would lead to higher prices.

7 ***Effect of panic reactions***

This effect is similar to the previous discussions of the effect of panic reaction for the other commodities. Panic reactions of governments can start a domino effect which leads to the effect that more countries or private organizations start increasing their oil stock. This increasing demand in a short period will lead to higher prices. This is again seen with the unrest presently in the Middle East.

5.3.2.1. Conclusion

Concluding this part on affecting factors in the oil market the graphs presented in chapter 3 are taken in consideration again. In the discussion in chapter 3 on the figure 16 and 19 we concluded that the price fluctuations cannot be caused only by a mismatch between demand and supply. To find what the effect could be of the influencing factors discussed in the previous part we will consider them all.

As have been seen in the discussion on wheat it is difficult to argue how much the effect is of a certain factor. That the most of the factors discussed in table 31 are affecting the prices is clear but to what extent it is difficult to predict. The factors of political unrest have been seen again presently with the unrest in the Middle East which is leading to growing oil prices. In order to calculate to what extent a factor is affecting the prices it is necessary to be aware of all the factors which are influencing the prices and what their weight is. Otherwise making calculations would be not useful as the prices could be affected by other factors which have not been taken in consideration.

Table 31: Conclusion and comparison oil

Affecting factor	Already affecting/ time range of affection	Effects seen during period 2000-2010
Commercials and non-commercials	Yes / as well in the short term as in the long term	Increasing numbers of commercials and non-commercials leading to an increased quantity of money in the commodity market. Commodity markets are being used for hedging and speculating.
Inventory change due to decreasing oil availability and increased difficulty of reaching it	yes already affecting / long term effect, not seen back in prices directly	The winning of oil begins to become more difficult. As the easy achievable sources are diminishing new source have to be found These are often more difficult to reach and have higher risks. This will increase prices.
Pressure from environmental organizations and the awareness	yes / longer term (a way of thinking and acting)	Due to the pressure of environmental organizations more attention is paid to the risks of achieving the oil. This is fed by disasters as BP in 2010 but also the Gulf War.
Political and economical instability in producing Countries	Yes / is affecting prices directly	Political unrest can have a large impact on the oil prices. It is also a factor which can have an effect on the short term. Good example is the current unrest in the Middle East. Prices of oil are affected directly. Prices can change daily if a new event occurs. Other events which had impact on the oil prices are the civil unrest in Venezuela in 2002 and the war in Iraq in 2003 which had impact on the oil prices
Increasing interest for biofuels and/or increasing demand for oil	Yes / This is ongoing, and will become more Important. This is an effect which occurs in the Longer term.	Increasing demand for oil will lead to higher demand and higher prices when this demand cannot be fulfilled. The growing demand is seen particularly in Asia, and especially in China where for example the numbers of cars sold explode since 2008. (in January 2008 500.000 cars were sold in China, which increased to 1.300.000 cars in December 2010). The increasing oil prices and pressure from environmental organizations will have as effect that the demand for biofuels will increase. In the US, stimulating programs are installed to motivate the use of biofuels. Taxes are used to make it more favourable to start using biofuels

		instead of regular oil. The effect of this factor will be seen in the longer term.
Price cartels of oil producing countries or monopolistic situations	Yes / decreasing effect	The large mining Organizations are often member of larger organization as OPEC. The OPEC has many power on the oil market and can regulate the amount of oil which is provided on the market. Especially for the US it is interesting as they are main consumer of oil. They are depending of some OPEC countries for the supply of oil.
Use of new technologies	Yes / not affecting directly and in the long term	In the past new technologies made it possible to achieve oil in difficult places as extreme depth or under the sea bottom. In the future this will continuo affecting the oil prices. As oil is becoming increasingly difficult to reach and existing reserves are running empty new technologies are searched in order to achieve the presently unachievable oil reserves for example; the oil shale which are available in large quantities in the US.
Effect of panic reactions	Yes / short term	This is an effect which can be seen directly. This is an reaction on event, for example political unrest or extreme weather. An reaction can be to ensure your reserves by buying excessive quantities of oil. This can cause a domino effect which leads to increasing prices.

Source: table based on information of all the chapters of this project.

5.3.3 **Gold**

The gold market has started fluctuating since the end of the gold standard in 1971. From then on the prices have seen fluctuations but have been growing especially. These high values make it interesting for organizations like hedge funds and governments to diversify their portfolio and hedge against financial risks. Since 1971 the prices of gold increased especially in periods of financial disruption as people starts changing their money into gold to secure the value of it. As the price of gold is also set by the demand and supply, this increased demand made the gold prices skyrocketing.

Looking to the forecasting model of gold prices in chapter 4 part 4.4.2 it can be seen that prices are mainly set by looking to longer term trends. In the short term there are variables which are affecting the price, however in the model proposed in chapter 4 these are not taken in consideration directly (but can be added).

Important in the gold market is the fact that gold keeps its value. This aspect has as effect that most quantity of gold which is traded is already on the market. “The quantities gold won on yearly bases is extremely low around 2% (until now) of the existing stock of gold” (S. Borenstein and J. Farrell 2007). So also in relation to the quantity gold traded. According to S. Borenstein and J. Farrell (2007) “the volume of exchange-traded derivatives was around 30 times larger than physical production in 2005”. This makes the gold mining companies’ price takers. This is due to the fact that the gold mining companies have not enough power in relation to the other companies to set prices and second as the demand of gold can be fulfilled with the actual stock of gold.

When taking in account possible variables which influences the price there is a strong distinction between variables which are affecting the gold price because of currency change or demand change due to inflation. And at the other side effects which affect the costs or demand which will lead to higher prices. However these are less important as most gold traded is already on the market.

*1 **Currency exchange (value U.S. dollar) and currency inflation***

The price of gold is affected mostly by changes in currency exchange rate (exchange rate), inflation or currency change and change in interest rates. Reason for this is the fact that gold is not loosing value over the years. Also the fact that most gold traded is gold which is already existing and above the ground. These three affecting factors are leading to a situation in which it is interesting to invest in gold. It has already been discussed that gold is used in to hedge a portfolio. These three factors will be explained in this part.

- Currency exchange or Exchange rate: The definition of a currency exchange rate provided by (www.investorwords.com Feb. 2011) is; “Marketplace used to exchange currencies from multiple countries. A currency exchange constantly monitors changes in conversion rates to determine the monetary value of each country's currency”. From the same source the definition of exchange rate is given as; “Rate at which one currency may be converted into another. The exchange rate is used when simply converting one currency to another, or for engaging in speculation or trading in the foreign exchange market.” This means that a low value of the dollar makes it cheap to trade with the dollar. When domestic currency appreciates, the domestic currencies importers need to exchange for the same amount of foreign currencies will decrease and hence the costs of imports decrease.

With the same selling price for the merchandises, the profits increase and stock prices go up. On the contrary, when domestic currency depreciates, the domestic currencies exporters will receive for the same amount of foreign currencies will decrease. With the same selling price for the merchandises, profits decrease and the stock prices go down. An appreciation (increased value) of a certain currency (U.S. dollar) provides the cheaper cost for U.S. gold importers so U.S. gold price will decrease. According to Khaemasunun (2006) it also generates price competition among countries to supply gold to the market.

This is one side of the story on how the currency exchange is affecting gold prices, at the other side presently a Currency Crisis is threatening, countries as Portugal, Italy, Greece and Spain and Ireland aren't in very good fiscal shape. And they aren't alone. Iceland has already gone over the edge. The United States, the United Kingdom, and countless other economies are struggling. And that reality has ignited a crisis of confidence about fiat currencies in the minds of many investors. Money is nothing more than paper and ink, backed by the full faith and credit of the issuer. When investors find that their faith in the issuer is shaken, the value of that currency erodes. Additional sovereign-debt downgrades from ratings agencies are but one potential trigger of a currency crisis. Under such conditions, gold the ultimate store of value, and the oldest existing form of money on earth, will soar as investors seek to protect their purchasing power. If this will happen the demand for gold will start growing which automatically will increase the price of gold.

The currency exchange is affected by different factors. Two of these factors are the interest rate and inflation. These are the following two factors which will be discussed as they are influencing the gold price.

-Inflation: A change of gold price has direct affect to inflation. Higher inflation seems to generate more demand of holding gold. Indirectly, gold is a fundamental input of many products and gold is no exception for this. Generally and easily, transportation cost is computed and included cost of all goods. In periods of inflation the value of money is decreasing. The definition of inflation is given by (http://www.investorwords.com Feb. 2011); “the overall general upward price movement of goods and services in an economy (often caused by an increase in the supply of money), usually as measured by the Consumer Price Index and the Producer Price Index. Over time, as the cost of goods and services increase, the value of a dollar is going to fall because a person won't be able to purchase as much with that dollar as he/she previously could”. The effect of the decreasing value of the dollar is that people tend to start investing in gold as the value of gold is not changing as much as the value of the dollar, this is the stability of gold which have been discussed. The increased demand for gold will again push gold prices upward.

According to S. Baker and R. Tassel (1985) another way in which the inflation is leading to rising gold prices is; “one would expect the real price of gold to go up because it is a depleting resource. Hence, the gold price should rise with a suitably chosen price index. Some investors view gold as an inflation hedge”.

-Interest rates: The definition given by (http://www.investorwords.com Feb. 2011), “a rate which is charged or paid for the use of money. An interest rate is often expressed as an annual percentage of the principal. It is calculated by dividing the amount of interest by the amount of principal. Interest

rates often change as a result of inflation and Federal Reserve policies". One would expect interest rates to affect the price of gold in two ways: first, as interest rates rise, the opportunity cost of holding gold increases and causes portfolio shifting and the gold price to fall. Second, an increase in interest rates will lead to higher value of the dollar, and a fall in the dollar gold price can be expected for the reasons given above.

We have discussed three important factors which influence the gold prices. These three factors are more or less financial factors which affect the gold price. One effect which we need to take in consideration is that of market panic.

Inflation or change of interest rates can lead to panic reactions. During the last recession quantitative easing to shorten the recession has caused America's monetary base to explode. Starting in October 2008, during a very short span of only four months, the central bank doubled the U.S. money supply, going way beyond anything ever attempted in the nation's history. Worldwide, central banks have rolled out an unprecedented $12 trillion worth of stimulus programs, with most of the money still to be spent (www.gold.org Feb. 2011).

2 ***Expansion in total investment in gold***

The first two variables have both as effect that more or less investments will be done in gold.
Investments in "Gold" which maintains its value well and can also hedge against inflation is becoming more common. Historical experience shows that in countries during period of stock market slump, the gold always trends higher. Investment demand is exploding the last decade; large institutional investors - hedge funds and pension funds - are making large allocations to gold, as are individual investors. "The proliferation of gold-focused exchange-traded funds (ETFs) bears this out. The SPDR Gold Trust (NYSE: GLD), the world's largest physically backed ETF with 1,100 tons of the lustrous metal, is the sixth-largest holder of gold bullion. Individual investors have never had an easier avenue for owning gold" (S. Borenstein and J. Farrell, 2007). This isn't just merely a U.S. manifestation. According to the World Gold Council, demand advanced 15% from the second quarter to the third last year (www.gold.org Feb. 2011).

As S. Baker and R. Tassel (1985) discuss in their publication on "Forecasting the Price of Gold" a change of gold derivative prices has impact on investors' expectation. If the derivative price is increasing, investors will have more demand to buy gold at the moment to speculate on price of the real gold asset price which is profited from the difference price of the derivatives and gold. And a change of interest rates has also effect on the investments. If the interest rate is increasing, it is becoming more attractive for investors to deposit money at a bank. Gold, as a choice among other assets, is less interesting and be left in the market since investors go to banks.

Hedging by gold-mining firms, many gold-mining firms trade in the gold futures market in order to hedge the risk associated with gold price movements. Tufano (1996, 1998) finds substantial diversity in hedging among gold-mining firms. He describes two types of financial hedging that are common in the industry: linear strategies, such as selling gold forward, which reduce the firm's overall exposure to changes in gold prices, and nonlinear strategies, which consist largely of buying options.

Another form of investment is the increasing demand for gold for jewelry on Asia. In Asia having golden jewelry is seen as an investment.
The demand of gold has been stable over the years a large quantity of the gold traded is gold which is already above the ground. However the demand starts growing and will grow even more in the coming years due to the growth of population on the Asian market. Asia, with a population that exceeds 2.5 billion inhabitants and a long-standing cultural affinity for gold, is stoking global demand in a big way. China is openly encouraging its citizens to buy gold and silver, while offering them gold-linked checking accounts. China is primed to overtake India as the world's largest consumer of gold. A quickly developing middle class whose members are experiencing rapid escalations in disposable income are a major bullish driver for the price of gold (www.gold.org Feb. 2011). Sales of gold jewelry across Asia are surging as the local economies boom and private investment grows. “China's gold investment demand grew by 20% in 2007, while Indian consumers bought a record 900 tones – well over one-fifth of the total world market” (www.gold.bullionvault.com Feb. 2011). Prevented from owning gold bullion until very recently, they buy gold to protect their savings from inflation and currency shocks.

The fact that the demand increased in two ways the last years; first increasing quantity of investments by investors as hedge funds, central banks etc. and in the second place the increasing demand for gold for jewels in Asia has lead to pressure on the gold market. With an annual mining production of 2500 tones the demand has became larger than the supply. The mining companies failed in providing enough supply. In the period 2001 up to now the worldwide production decreased with 9.6% as we have discussed in chapter 3 part 3.2.2. The production in China explodes during this same period with an increase of approximately 62 percent up to around 313 tons per annum. This mismatch between the actual quantity of gold present above ground the annum production by mining companies in relation with the increasing demand does affect the prices and makes them growing. This is an effect which has become important and will probably continue being it.

3 The role of the Central banks and IMF

Gold is held in central banks reserves for a number of reasons: diversification, economic security gold maintains its purchasing power, physical security gold is a liquid asset, confidence cushion in a crisis, maintains value, income gold leasing, insurance against market crises. (http://news.goldseek.com Feb. 2011) Most of the gold is captured by the central banks and the IMF. In 2004 the central banks hold 19% of the above ground gold reserves. Presently we have seen in chapter 3 part 3.2 that every annum approximately 2500 tons of gold is mined. Aboveground stocks account for 135,000 tones. Governments and investors account for approximately 60,000 tones, jewellery accounts for 63,000 tones and 15,000 tones is held in other forms such as electronics, industry, and medicines. The part which is used by investors and government is partly in hands of central banks and international financial institutions, which maintain 32,000 tones. These reserves are hold as a security to keep value. Because gold is not losing its value it can be used as a security in the portfolio.
“Central Banks are Becoming Net Buyers: India's recent purchase of 200 tons of International Monetary Fund (IMF) gold was the likely impetus that pushed gold up over the $1,200 level in December (2010). But more important is the change that has seen central banks turn from net sellers into net buyers of gold. BlackRock Inc. (NYSE: BLK), one of the world's largest investment managers,

said that 2009 was that turning point. If that was the case, it will have been the first time in 20 years, as central banks have been net sellers of gold since 1988" (http://www.gold.org Feb. 2011).

The fact that these Central banks have such important amounts of gold in their portfolio gives them the opportunity to sell and buy gold. This gives them the power to influence prices. The Central banks have made agreements on the quantities which can be traded each year. This is done to keep the quantities traded under control which will make sure that price fluctuations can be controlled to a certain extent.

4 Environmental damage

In chapter 3 it has been discussed that reaching and winning gold is going to be more difficulties. Also the increased awareness of the protection of the environment is leading to pressure on the mining companies. However these two facts are especially of interest in the more developed countries. In many less developed countries these points are less of interest. However an important fact is that many large mining companies are mining in other countries. For example a large mining company from the United States has large mining activities in Indonesia. This gives the company the possibility to have mining activities without the stricter U.S. regulations.

As can be read from the next passage from the website news.bbc.co.uk (Feb. 2011), the high price of gold has drawn thousands of miners to a region of south-east Peru, but deforestation and the high levels of mercury used in mining has led to fears of an imminent ecological disaster, as Dan Collyns reports. The forests seems almost endless until it is abruptly interrupted by the raw colours of sand and earth; rivers torn open and thousands of hectares denuded and pocked with dead, stagnant pools of water. Alluvial gold mining in Peru's southern Amazon rainforest has spread, driven by the high price of gold, now more than $1,100 per ounce, or $36 a gram. Close to 200 sq kms (77 sq miles) of jungle have been lost in the evocatively named Madre de Dios (Mother of God) region. "To know what we are losing, this area of Peru - the western Amazon - is the world's enclave of biological diversity," says biologist Ernesto Raez, who heads the Environmental Sustainability Centre in Lima's Cayetano Heredia University. "Counted in terms of richness of species, this is the place where world records have been obtained for butterflies, birds, amphibians; you name it." Over the years, more than 1,500 jungle mining concessions have been granted by the energy and mines ministry, although most did not get final approval. But the informal sector has grown out of control, and now almost a quarter of the gold produced in the world's sixth largest producer is illegal.

The guardian (www.guardian.co.uk Feb. 2011) discussed in an article the question of; authorities in Honduras are investigating claims that one of the world's biggest gold mining corporations has contaminated a valley with toxic heavy metals. Villagers and non-governmental organisations have accused Goldcorp of killing livestock and making people sick by polluting land and rivers in the Siria valley. The environmental prosecutor is undertaking an investigation after being presented with evidence that the Canadian corporation's San Martin opencast mine discharged highly acidic and metal-rich water in 2008. The company has denied wrongdoing. The inquiry comes at a critical time when record gold prices are encouraging other mining corporations to explore fresh sites in Honduras. Environmentalists fear the impoverished central American country will lift a moratorium on new mining after a new government takes office in January. Two studies have been done in order

to find the effects of the mining on the environment. The first study, by Paul Younger, a Newcastle university hydro-geochemical engineering professor and expert on mine water management, detected acidic mine drainage, whereby sulphides in the rock are exposed to oxygen and water and produce sulphuric acid. Younger said this can have devastating effects on animals and plants. A follow-up study by Adam Jarvis and Jaime Amezaga, also of Newcastle University, found evidence of "severe" contamination in the form of highly acidic and metal-rich water from the mine site flowing into a stream used by villagers for agriculture and domestic purposes. The data was in a previously undisclosed 2008 report by Defomin, Honduras's mining regulatory authority.

These two articles show that there is an increasing awareness for the environmental damage the mining companies are causing. This knowledge that gold mining companies, are more viewed as causing extensive environmental damage, might be required to pay disproportionately more for cleanup. These extra costs or the fact that more attention is addressed to the environmental damage which is caused will lead to stricter regulations. This can affect the costs for the mining companies. These increased costs will lead to higher prices of gold and especially with the increasing demand this will be a factor to take in consideration.

5.3.3.1. Conclusion

As explained in the conclusion of the two first commodity discussions, we will conclude in a similar way the different factors affecting gold. The factors mentioned, especially those on the change of demand and the change of the currencies, interest rates and inflation are convincing factors which have a certain effect on the gold prices. Again how large this effect is in the range of this project not possible to calculate. In table 32 an overview is provided of all the factors discussed in this chapter on gold.

Table 32: Conclusion and comparison gold

Affecting factor	Already affecting/ time range of affection	Effects seen during period 2000-2010
Commercials and non-commercials	Yes / as well in the short term as in the long term	Increasing numbers of commercials and non-commercials leading to an increased quantity of money in commodity market (increased volatility). Commodity markets are being used for hedging and speculating.
Currency exchange (value U.S. dollar) and currency inflation and interest rates.	Yes / short term	The effect of these three factors is affecting the gold prices in the short term. As explained gold is keeping its value which has as effect that it provide more security for investors. Changes in currencies makes it interesting to invest in gold. As this is a highly sensitive and reactive market, the effects of changes are seen quick in the prices. During the economical downturn which has affected many countries the investment in gold increased as it is staying more stable than some currencies.
The role of the Central banks and IMF	Yes / short and long term	The central banks and the IMF possesses large quantities of gold in their reserves. There have been made agreements on the quantities which can be sold yearly. The reserves are large enough that the central banks have the power to influence the prices of gold. In 2009 it was the first year that the central bank was a net seller and not only a net buyer. This shows their power of controlling the prices.
Expansion in total investment in gold	Yes / long term	This is a process as we have seen in other commodities which is not proceeding directly. Changes in demand for gold is a process which takes time. Before these changes in demand patterns affects the prices it takes some time. The fact that in Asia gold is seen and promoted as a good personal investment will slowly change the demand of gold. This can possibly affect the prices. However China has increased its production during the last years, in order to be able to supply their national demand. In 2007 the investment demand grew by 20% in relation to the demand in 2000. India experienced an record bought of 900 tons in 2010.

Environmental damage	Yes / starting to become more important	This is similar to the effects on oil winning. The increasing knowledge and interest on the fact that the gold mining is affecting the environment is leading to more strict regulations on the way the gold mining companies have to work. This is leading to higher mining costs which are taken in account in the price setting.

Source: table based on information of all the chapters of this project.

5.3.4 **Coffee**

Coffee is just like wheat a product which is grown in the nature and open air. This makes it dependable and sensitive for many exogenous effects. The prices of coffee have shown a strange pattern as have been discussed in chapter 3 based on the prices of the last years shown in table 12. The supply increased in relation to the demand, which would imply decreasing coffee prices. However since 2007 up to 2009 the prices have been growing and the supply increased as well in relation to the demand. To find out what a possible reason is for the price changes which are not being consecrate to the change in demand and supply we have to look to variables which are affecting in a certain way the coffee prices. Nevertheless, the coffee price is set to a large extent by the supply and demand. The fact that there is a strange pattern in the prices since 2007 implies that other factors are also influencing prices. In chapter 3 part 3.3.2 José Sette President of the International Coffee Organization (ICO) gave some possible explanations for this mismatch.

As described in chapter 3 part 3.3.2 the main reason that prices have fallen since 1998 is the massive oversupply of coffee on world markets in relation to demand. Production has increased by 15 per cent since 1990 as a result of the planting of new coffee trees, technological innovation, and the arrival of newcomers on the market. As stated Vietnam was an insignificant exporter of coffee. Today, it is the world's second largest exporter. Other factors have contributed to the steady expansion of coffee supplies.

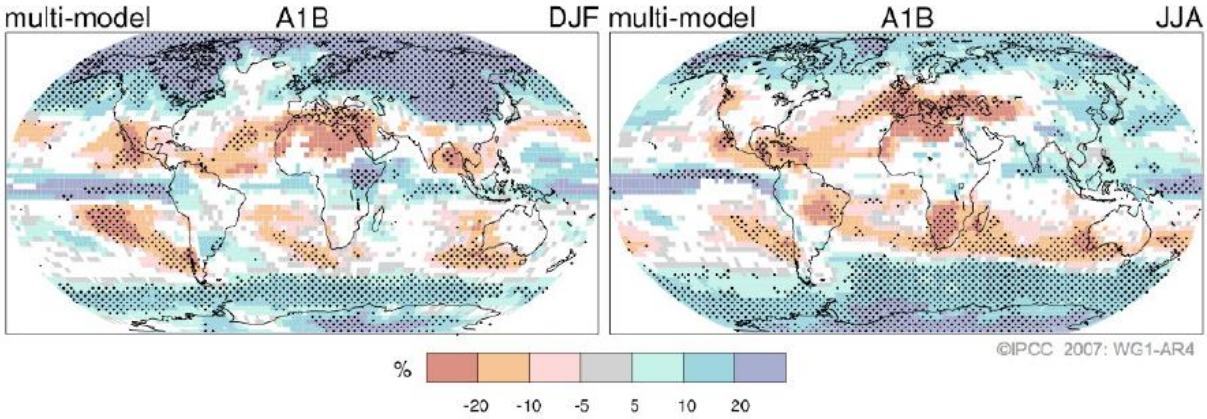
Just as have been done with the first three commodities a specific look will be taken on the possible affecting variables on the coffee prices. Interesting is the fact that coffee prices are seen as inelastic. This means that the prices of coffee are not changing to an important extent the coffee demand. When prices are increasing the clients continuo buying coffee. This low price elasticity does not means that a change in demand and supply will not affect the price.

1 ***Extreme weather and climate change in the longer term***

This is a variable which have been discussed in part 5.3.1 of this chapter when wheat price affecting factors have been discussed. The effect of climate change on coffee is a similar discussion as has been seen in part 5.3.1. That this possible effect has already been extensively discussed means that here we will just look what the effect is on coffee. In part 3.4.1 of chapter 3 it has been discussed that coffee is only grown in sub tropical areas. This means that a certain humidity and temperature is necessary for the growth of coffee plants. Most scientists now believe that the warming trend is largely irreversible; a 3 degree rise by the end of the century is no longer considered exaggerated. It is clear that coffee regions will be affected, most becoming warmer, many also becoming either wetter or drier. We can also expect a greater frequency of extreme weather events. Evidence from Central America for example, suggests that this is already happening. “Many famous American coffees come from the seasonally dry Pacific facing mountain slopes and valleys. These include Antigua, Marcala, Segovias and Tarrazu amongst others. The majority of the top ten Nicaraguan Cup of Excellence coffees come from the Segovias region, an area with a long dry season of 5 to 6 months. Climate change predictions by the Ministry of National Resources and the Environment indicate that within this century rainfall will decline by an average of 30%, and temperatures rise by 1-2 degree. These changes would effectively eliminate coffee production in these regions. The prognosis for Central America as a region is more extremes of rainfall that will cause both drought

and flood" (http://web.catie.ac.cr Feb. 2011). In figure 37 the changes in precipitation for period 2090–2099, relative to 1980–1999. Values are multi model averages for December to February (left) and June to August (right) are shown. It becomes clear that the coffee producing countries will be affected by the climate change. An increase of temperature and more rainfall is affecting as well the coffee quality as the quantity according to (http://web.catie.ac.cr Feb. 2011)

Figure 37: Projected patterns of perception changes.



Source: IPCC 2007

A change in climate is an effect which will affect the production of coffee in the longer term. The effects on the prices will also be felt in a longer term. Another inconvenience of a possible climate change is the increase of the environmental footprint of the coffee production, as result of larger quantities of fertilizer needed to continue producing the demanded quantities of coffee.

At the other side, in the short term the effect of bad or not preferable weather is very important. "Coffee is going to be pretty tight," said John Caruso, a senior market strategist at Lind-Waldock, a unit of MF Global Holdings Ltd. in Chicago. "The outlook has been fairly bullish." Brasil is effectively the "swing producer", - is stated on (www.tutor2u.net Feb. 2011) - for the global coffee markets. This implies that, since Brazil is the largest coffee producer (which can be seen in table 11 in chapter 3), changes in Brazil's supplies of coffee account for a large portion of the change in the world total supplies of coffee which then directly affects the prevailing international price.

Production in Brazil, the world's largest grower, probably produce a total of 44 million bags this year, less than the Agriculture Ministry's forecast for between 45.9 million bags and 48.7 million bags, as rainfall damages the crop, a government meteorologist said (www.businessweek.com Feb. 2011). Already in the production year 1994/1995 and 1995/1996 production fall in Brazil caused by frost. This was the reason why many coffee plant areas have been moved to places with less risk of frost.

To show this change in price due to the lower Brazilian production caused by the frost the prices paid to the growers it is interesting to compare the prices. The prices are shown in table 33.

Table 33: Price changes due to Brazilian Frost (in U.S. cent per LB)

	1990	1991	1992	1993	1994	1995
Brazil price paid to growers	54,32	43,99	45,20	52,88	114,57	115,52
World price of Coffee	71,53	66,80	53,35	61,63	134,45	138,42

Source: own table information subtracted from www.ico.org (Feb. 2011)

The effect of bad or unfavorable weather can be important for the coffee prices. Because there are a few important producers and exporters of coffee this factor can be important. When the production of one of these major producers is harmed it affects the world price. This is an effect which can be felt in a short term.

2 ***Political unrest***

In chapter 3 the producing countries of coffee has been enumerate. Looking to the main producing and exporting countries most of them can be indicated as developing countries. This means that the chance of economical or political unrest is present. As has been made clear in the discussion on the effect of unfavorable weather, the effects of a change in one (important) country can affect the world coffee prices.

According the U.N. (United Nations) the political and social unrest in Egypt at the end of February 2011 already influenced food prices. This was also seen with the cacao prices which experienced a growth due to the unrest in Ivory Coast since the end of 2010 (www.guardian.co.uk Feb. 2011).

This is a variable which is difficult to predict in the long term, and also the effect will mostly be in the short term. To what extent a disruption will affect the prices is depending of the importance of the unrest and the importance of the country where the unrest is affecting the production.

3 ***Input prices***

Crude oil and Ethanol positively influence the coffee market because of their connection with intensive inputs such as fertilizers, pesticides and fuels. When the prices for crude oil or ethanol are lower this will affect the costs of the coffee producers and companies which process the coffee beans. Costs are seen back in the price of coffee. This is also for the costs of fertilizers. As discussed in the discussion on climate change the increased necessity to use fertilizers will not only affect the environment in a negative way but also the costs as these will increase and ultimately the prices.

When looking to the cost base of coffee production it becomes clear that an important cost post are the transportation costs. This will determine the price to an important extent.

4 ***Low prices for growers of coffee***

In the history of the coffee market periods in which the coffee prices have been low are known. These are periods in which the prices are not providing a large profit for the producers. The incentive of continuing in the coffee market for producers is gone at a certain moment. Especially the incentive of producing high quantities of high quality of coffee for a low price. This can lead to a situation in which farmers turn to another crop in which more security is provided. When many producers start growing other crops this can lead to a situation of a reduced supply. This might affect prices.

The other way around we saw that since 1998 the massive oversupply of coffee on world markets in relation to demand lead to decreasing prices. This was due to planting of new coffee trees, technological innovation, and the arrival of newcomers on the market.

If there are organizations which want to help a certain region and invest in this region by helping to start up coffee plantation because prices are high at that moment, the effect can be similar to the period 1998 up to 2004 (table 12 in chapter 3) in which an oversupply pushed the prices down. This is not an effect which will be seen directly and affecting prices in the short term; however in the long term it can be of importance.

5 ***Fair trade***

As discussed in chapter 3 part 3.3.5 fair trade coffee is winning in popularity the last years. Fair trade have been explained as coffee which is sold to the consumers as being coffee for which farmers had a "good and fair" price. This provides more security to the farmers. There is a minimum price which is guaranteed for the farmers. This will help to avoid the problem of prices being not rentable during a certain period which can have as effect that farmers have none incentive anymore to continue in that market.

Although coffee is the fair trade product with the highest sales volume, the market share of Fairtrade certified coffee is estimated at only 1 percent of worldwide coffee sales. "Worldwide sales of Fairtrade certified roasted coffee reached 65 808 tonnes in 2008, up 14 percent year-on-year, for a total value of 1.2 billion euro. 52 percent of Fairtrade certified coffee sold in 2008 was also certified organic. It is estimated that global sales of Fairtrade certified coffee generated an additional income of US$30 million for nearly 400 producer organizations in 2008" (E. Pay, 2009). Looking specifically to the United States the article of E. Pay (2009) shows that fair trade currently accounts for nearly 20 percent of the market for specialty coffees, worth US$12 billion in 2006 and the fastest growing segment of the United States coffee market. The number of Fairtrade-licensed firms (roasters and importers) in the United States has risen at an average annual growth rate of 42 percent, from 31 licensees in 1999 to (11 importers and 20 roasters) to 515 licensees in 2008 (86 importers and 429 roasters).

Since June 2008, the FLO (Fair Trade Labelling Organizations International) system guarantees a Fairtrade Minimum or floor price of US$1.01 to 1.45 per pound, depending on the type of coffee (next to the different qualities of coffee there are four different types of coffee). Meanwhile, the Fairtrade premium, an additional sum of money that goes into communal funds for workers and farmers to improve social, economic and environmental conditions, stood at US$0.10 per pound. When the coffee is also certified organic, the minimum Fairtrade price is US$0.20 per pound higher N. Niemi (2009).

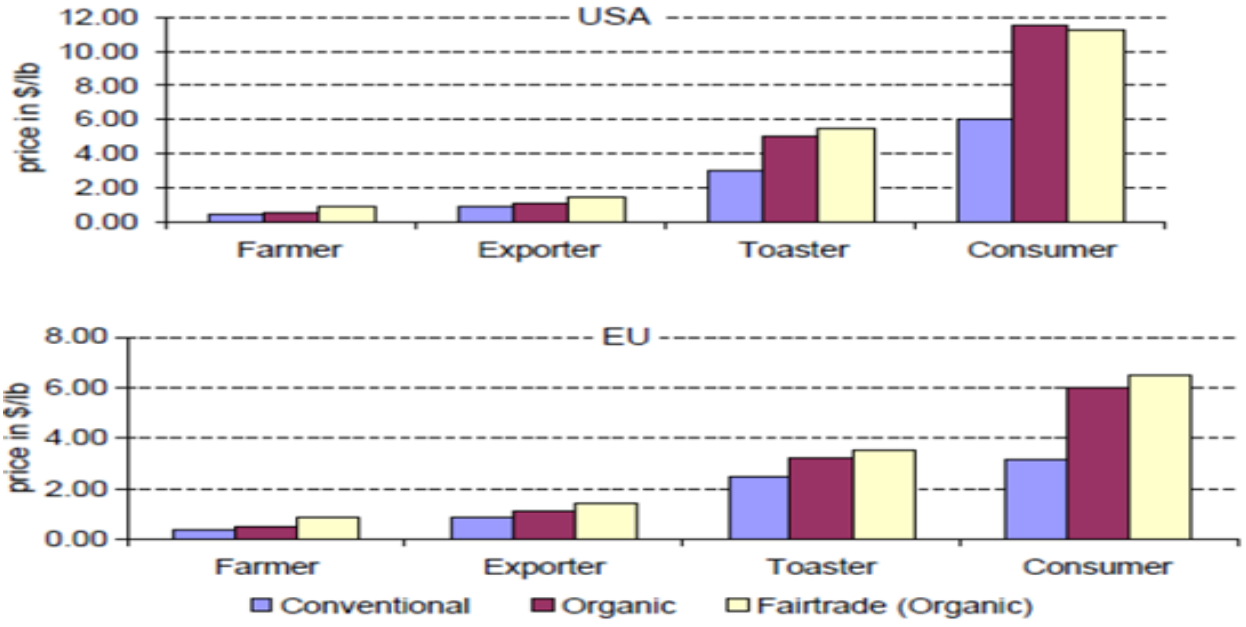
There has been a change in the consumption pattern of consumers in the Western world. Consumers are increasingly concerned about the safety of their food, as well as the environmental and social implications of its production; they are beginning to truly grasp the meaning of "organic" and "fairtrade" and demand such products from their retailers. As a result, the market share of environmentally and socially certified coffee has grown considerably in recent years, and is continuing growing. Maseland and Vaal (2002) even argue that consumers feel obliged to pay prices

above market levels for products that are produced under the Fair Trade criteria. Ottowitz (1997, as quoted in Steinrücken and Jaenichen, 2007) found that 74,8% of the purchasers of Fair Trade coffee argue that their decision is influenced by a wish to support the producers, and only for 6,5% the taste was the decisive factor to buy Fair Trade coffee. Having this knowledge it is interesting to see who is having most profit of the fair trade.

According to Stecklow and White (2004) "from the Wall Street Journal investigated the composition of retail prices in supermarkets in the UK and USA and provided strong evidence that some retailers were exploiting the ethically aware consumers' willingness to pay more for Fair Trade products. They found for example that a certain chain of stores were charging $4 extra per pound for organic Fair Trade coffee compared to organic non-Fair Trade. Out of that extra four dollars paid by the consumers, only 15% or $0.61 ended up in the producers hands".

Taking figure 38 in consideration the coffee prices along the different participants in the chain are shown. It is clearly visible that the prices paid for organic and fair trade coffee are higher than the conventional coffee. However the one which is making the highest profit are the toasters in the chain. These are the companies which provide the coffee to the consumers. For this group the profit of selling fair trade coffee (or organic coffee) instead of conventional coffee is high. This can explain why many large companies are so fanatic in focusing on the fair trade coffee.

Figure 38: Coffee prices along the trade channels.



Source: E. Pay, 2009

The problem for the prices is when the percentage of fair trade coffee or organic coffee is becoming more important as it is in the U.K. (see chapter 3.4.5). The fair trade system is affecting the coffee prices which have been seen in figure 38 and figure 15. Nevertheless there are possibly other effects of the fair trade which can affect prices. A positive effect is that producers of coffee are sure to receive a price which is high enough for them to make their business profitable. This will avoid that the farmers lose the incentive of continuing in the coffee market. This will help to avoid the problem of producers starting in another business to achieve higher profits.

Another possible effect is that due to the increasing demand (possibly pushed by the companies as e.g. Procter & Gamble) the market for prices is not functioning idealistically. Prices are not longer set by demand and supply in a proper way. As stated earlier the fair trade coffee has a very low elasticity. This means that consumers are continuing buying coffee even if prices are increasing.
The companies selling the fair trade coffee is aware of this fact and can raise prices if they want under the dictum of providing a fair price to the producers of the coffee. The natural control which is known when demand is decreasing when price are very high and vice versa is not holding in this situation.

It is clear that will this variable become important as possible influencing factor for the coffee prices, the quantity fair trade coffee traded have to increase.

5.3.4.1. Conclusion

For coffee some of the affecting factors have already shown their effect in the past. The oversupply created due to the enormous increase of production in Vietnam which affected the prices but also the bad harvest as effect of the extreme weather in Brazil which had its effect in the harvest season 1994/1995 and 1995/1996. This implies that the effect is present on the prices however that how large this effect exactly is, is only possible to argue and calculate an approximate number. Table 34 will discuss the different factors found in this chapter, in order to find out if it could possibly have already affected prices.

Table 34: Conclusion and comparison coffee

Affecting factor	Already affecting/ time range of affection	Effects seen during period 2000-2010
Commercials and non-commercials	Yes / as well in the short term as in the long term	Increasing numbers of commercials and non-commercials leading to an increased quantity of money on the commodity market. Commodity markets are being used for hedging and speculating. The effect of excessive investments have been experienced for example on the cocoa market when Armajaro a British hedge fund invested in cocoa and even bought 7% of the world inventory, pushing prices to the highest peak in 33 years.
Extreme weather and climate change in the longer term	Yes / extreme weather is affecting in the short term and the climate change on the longer term	The climate change as discussed for wheat has an important effect on the coffee. The small changes which are expected in temperature are leading to the need of new places where coffee can be grown. For growing coffee specific climate conditions are necessary. The climate changes which are expected are calculated for the long term as well as their effect on the production. In the short term extreme weather has shown that the effect is felt directly. Especially when extreme weather causes production to stay lower than the predicted production and the quantities which are missing to fulfil the demand are large it will be seen directly in the coffee prices. This is seen in the Season 1994/1995 and the season 1995/1996.
Political unrest	Yes / short term	This can affect prices in the short term. The leading coffee producing and exporting countries have shown in the past that they are politically not to stable. When the production in one of the leading exporting countries is affected and disrupted it is seen in the prices in the short term.
Input prices	Yes / short term	Rising input prices are affecting the prices directly. Especially the prices of fertilizers have experienced an important growth. These increasing costs are calculated in the

		prices. However next to fertilizers also fuel and pesticides are important factors which affect the costs of coffee production. This is an example of the short term effects. In the long term new technologies can play an important role. This has been experienced in 1990 when there was a large oversupply leading to decreasing prices. This was due to large investments on the Vietnamese coffee market and the new technologies used.
Low prices for growers of coffee	Yes / longer term	This is an factor which is also experienced in other market in which products are grown. When for a longer term prices are low, there is less incentive for the farmers of continuing producing in that market. This is similar on the coffee market. In a period of oversupply as experienced in the period of 1990 farmers can choose to start producing other crops which are more profitable. At the other side when a crop is rentable more investments are done to increase their production.
Fair trade	No / long term effect	The effect of fair trade on prices is presently not important. The total quantity of fair trade coffee is still minimal. This will grow the coming years as it has done the last decade. Especially the power of the large toasting companies which can set prices will be interesting. They can push fair trade coffee in the market which means that the demand will increase. What this will mean exactly for the prices is presently difficult to predict.

Source: table based on information of all the chapters of this project.

5.4 **Conclusion**

This conclusion will start with a recapitulation of the effect of the commercials and non-commercials. As stated in the first part of this chapter, the possible influence of these two groups is much discussed by different groups of professionals; researchers, governments, traders etc. What the exact effect is, is highly disputed. What is clear is that the possible effect of this variable is important for all the commodities traded on the commodity market. This was the reason that possible effect of commercials and non-commercials was done at the start of this chapter and not for all the individual commodities. What became clear is that the most important arguments provided arguing for the existence of the influence is;

- Due to the increased investments on the commodity market as more commercials and non-commercials are active on the commodity market there is more volatility. This increases the volatility of the commodity market and makes it more reactive and sensitive for disruptions on other financial markets.
- The second argument mentions often is that increased speculation, hedging and investments by the commercials and non-commercials in the oil market is affecting the oil prices. The oil price is of influence on many other commodity prices.

When we controlled these arguments, we could state that both arguments are correct but that the question on what the real effect on the prices is; will not be answered. In the period between 2000 and 2010 the increased activity on the commodity market (exchange and OTC market) was also reflected on the prices as the prices experienced a large growth. The argument for using oil as leader of the prices can be argued with the fact that many commodity prices are following the price fluctuations on the oil market with a small retardation. The fact that oil is used in the production process but also for the transportation is the mean reason that the price fluctuations are seen back in prices of commodities for which oil is an important component or which are depending on transportation.

The important arguments advocate against the existence of an effect on prices due to the presence of commercials and non-commercials on the commodity markets are;

- In some publication an important argument is that the price fluctuations are caused by an mismatch between demand and supply and the fact that the inventory was low made it possible for the prices to fluctuate and experience the price boom as seen in 2008
- Second argument seen in the various publications is that the price fluctuations have also occurred on the market of commodities which are not (or in unimportant quantities) traded on the commodity market.

These two arguments have been discussed and controlled with the data, and also these two arguments are not false. The mismatches seen in the quarterly periods are showing some mismatches which can be a possible cause of the price fluctuations. Again the question is not answered, if the price fluctuations are the only because a small mismatch occurred on the oil market or that also other factors had a certain influence.

The chapter continued again with the discussion of the four commodities. A closer look has been taken to the influencing factors which could affect the prices of wheat, gold, oil, coffee. A close look has been taken to factors influencing prices. This was in the short term as well as the longer term. The factors discussed were factors which are known but not taken in account in the predicting

models discussed in chapter 4, and factors which are not discussed as being of influence on the commodity prices. It became clear that the important factor affecting prices is the difference between supply and demand. However how the supply or demand could be affected is different. Interesting difference between the four commodities is the fact that the supply of wheat and coffee are highly influenced by exogenous factors as weather and climate. For gold and oil this is a less important factor. For these two commodities it became clear that political and financial situations in the producing and exporting countries are of importance on the prices.

Important to be aware of, is the fact that some of the variables can be highly important on the price of commodities, however are very difficult, or not predictable. Nevertheless being aware of the possible effect is important. This can help in being aware of the possible effects and make new predictions in the short term.

A very important variable which can affect the prices of commodities is the price of oil. Reason is that oil is used in many different ways. It is a raw material for many products but also used as fuel for many machines used in the different processes. The transportation costs are an important input cost for the commodities. Increasing oil prices is affecting in a short term many other commodity prices.
Knowing this, it becomes even more interesting to look to the affecting variables for oil. In part 5.3.2 it became clear that the price of oil was affected by different variables. Important was the fact that the most important consumer of crude oil “the United States” are depending of countries which are political not stable. This argument plus the effects of crude oil on the environment is feeding the idea of necessity of investing in biofuels. However biofuels do have some negative aspects; it is affecting in a negative way the environment but especially the food prices. Increasing demand for Biofuels is driving up food prices. Interesting fact is that the United States posses the largest known oil shale deposits in the world. The technique of achieving this oil is not really common and will be expensive and takes much time before being profitable.

After the discussion on the different factors it can be stated that some of these factors have or can have some affecting influence on the prices, however how large this effect is in reality is very difficult to predict. Calculating the effect is difficult and will not be part of this project due to a lack of time and data. As there are different factors which are affecting the prices, calculating what one specific factor is exactly would mean that you know exactly what the other factors are. When this information is not available the fluctuations which have been calculated could be caused by other factors. The calculation would consist of noise.

In the following chapter the different affecting variables will be discussed with professionals on the field of price forecasting in order to see what their opinion is of the variables.

Chapter 6. The opinion of the Professionals

In this last chapter the variables discussed in the previous chapters will be discussed with different "professionals". These people are working on the market of the different commodities. As they are working daily with these commodities their opinion on the effect of the different variables is import to take in consideration. Most of the experts have experience on different markets and can give their opinion on different commodities. To make sure that this information is useful; even if it is the opinion of one person the professionals are chosen very careful and are seen as experts on the field of the specific commodity.

- Edwin Burgers; Director of DCA (expert on the field of price forecasting of agricultural commodities as wheat)

DCA (Dienstencentrum Agrarische Markt) is a Dutch organization which provides market information and is forecasting and supplying advice on the market of some agricultural commodities. Their main focus is potatoes and wheat. This organization is especially working for the producers of the commodities. Burgers is director of DCA and one of the experts in the field of price forecasting. According to Burgers the main issue which is influencing commodity prices of commodities which are grown on the land, is the growth season. What is happening during the season is essential for the price. At the beginning of the growth season the total quantity of arable land is taken in consideration to make predictions of the total expected production. Weather can influence the growth process, the output and with this the prices. For years wheat was sold against almost cost prices. This made it less interesting for producers to invest in wheat. Rising prices is not only a negative thing, in the sense that a higher price makes it increasingly interesting for investors and producers. This means that more will be invested in the production of that commodity. In the longer term this will lead to stabilizing prices as better ways of productions are used or better input products (as fertilizers).
Globally taken, there are more factors influencing the prices of commodities according to Burgers. The influence of politics can be very important. This can be in the form of export restriction or subsidies. Also the growing number of mouths which have to be fed pressures food prices. More people to feed and a changing diet in many countries in Asia are increasing demand for feed for animals, which (as discussed in chapter 5 part 5.3.1) pushes prices up.
According to Burgers the commercials and non-commercials are influencing prices the answer. The effect is not as extreme as some researchers want to make us believe however markets which are increasing are becoming more interesting for hedgers and speculators. And this is affecting the prices as more people are active on the market.

One of the important effects of the financial crises is that many ships were empty. The effect was that for example farmers from Belgium could transport products to the other side of the world, and still be able to compete on price. The transportation costs were very low.
The effect of organizations or governments investing in land is a good long term investment especially for the commodities as industrial metals and precious metals and energy (as discussed in chapter 2). A product as biofuels will become interesting when prices of ordinate fuels continuo to increase and those of biofuels start lowering and become competitive.

- José Sette, Director of the ICO (International Coffee Organization)

The International Coffee Organization (ICO) "is the main intergovernmental organization for coffee, bringing together exporting and importing Governments to tackle the challenges facing the world coffee sector through international cooperation. Its Member Governments represent 97% of world coffee production and over 80% of world consumption. ICO's mission is to strengthen the global coffee sector and promote its sustainable expansion in a market-based environment for the betterment of all participants in the coffee sector. It makes a practical contribution to the development of a sustainable world coffee sector and to reducing poverty in developing countries" (www.ico.org march 2011).

According to José Sette there are different factors which are affecting the prices of coffee. The most important factor at the moment is the increasing demand due to the increasing population but especially due to the growth experienced in Asia. Due to the rising incomes of most of the people in Asia, the demand is growing. In the short term José sees the extreme weather as a cause of diminishing supply which affects the inventory and finally the prices.
The political unrest in the Middle East is also a factor which will affect prices on the short term.
On the question what the influence of the commercials and non-commercials is on the coffee prices, José Sette react that the increased activity on the commodity market will lead to more volatility in the market. This higher volatility in the different commodity markets has as effect that the different markets are more reactive to each other. According to a Sylvia Saes of the University of São Paulo which also reacted on the questions with José Sette, "we conducted a study aimed at assessing the ratios of the hedge and its effectiveness in Brazil's southern Minas State and São Paulo's Mogiana regions to analyze the extent to which the stock market is used to manage price risk and find out the main factors influencing the use of these derivatives". What became clear and which is interesting is that the calculation are showing that in the short term the effectiveness is very low but in the long term it is higher. According to Sylvia Saes this indicates that in the short term the financial market influences the exchange prices (showing high speculation), but in the long term the market fundamentals become more important.

The effect of changing input costs is not leading to price changes. The most important cost factor which increased is the price of fertilizers. However this is not reflected in the prices of coffee. The reason that these higher costs are not calculated in the prices is that there is a growing competition. This competition keeps the prices low.
In the long term the climate change will ask for adaptability of the producers to react to the new situation. Another factor which can be important in the long term is the price of other commodities which are also grown on land. If prices of a certain commodity are high and interesting for a longer period it becomes more interesting for farmers to switch to this commodity instead of another commodity. This could affect the coffee production.

- Prof. Francis Declerck; Associate Professor, Finance Department Director, International Agri-food Management Institute; Chair for Excellence in European Food Chains, Chair-holder

Declerck expert reported on changing food prices for the G-20 Governance. His knowledge on factors which are affecting the food prices is larger than just on one commodity. He provided us his opinion on the factors which are influencing the food prices. He agreed on the factors which have been discussed in chapter 5 of this project. However he also provided some general information on the most important factors which affect food prices in general.
The input costs of a commodity are an important factor which is affecting the prices of commodities. This factor is changing when new technologies change the input costs. This is due to new technologies which use a different way of producing (with as result for example fewer fertilizers necessary). Another important point is that governments come up with changes in regulations. This affects the way how products are produced and processed. These changes in regulation can focus on the pollution but also on the risks. This is becoming more important, especially in the developed countries.

Another important point which affects many of the commodity prices is the change in demand. First of all due to the growing population worldwide, which stimulates consumption. In relation to this growing number, we also see rising incomes worldwide, especially in developing countries. This rising income affects the choices which are made in consumption. This and the change in preferences, is affecting the demand for certain commodities. Last general point is the political influence which has a certain influence on the commodity prices. Not only the new regulations, as discussed above, but also lobbies of groups which have a certain interest and have a certain influence can affect the prices.

More specific Declerck indicates the following points in addition to the points mentioned in chapter 5. For oil he would like to add the influence of the evolution of technologies. Not only the technologies of achieving the oil but also the technologies of the products which are presently using the oil. For example cars; on what technology will the cars run in the coming years? Is this still with the use of gasoline (based on oil) or will most cars be driven on biofuels or even on electro power. This is an important issue which will affect the demand for oil in the coming years.
On the wheat market there are several aspects of importance; especially the availability of land. But also the evolution of genetic modified grains will be an important point of interest. With the use of genetic modified grains the average yield per ha. can be increased which means that less land is necessary to achieve a certain yield. Important will be the regulations in developed countries which will lead to less use of pesticides and fertilizers in order to protect the environment. This will also have a certain influence on the production and price.
Regarding the prices of coffee, Declerck indicated the higher prices of coffee as an important factor which raises the investments in coffee. Also the presence of large multinationals as Nestlé is influencing the coffee prices. These multinationals have specific programs to support the coffee production, but especially secure the coffee income of the farmers.
For gold the fact that demand is increasing due to the increasing interest in Asia is one of the facts which is leading to a larger demand but also the increased demand from the industry is pushing demand and prices up.

- D. Fousert Head of Product Line Management Cargill Refined Oils Europe.

The prime business of Cargill is the trade of different commodities. This makes their opinion very important and interesting as they are working day-in-day-out with commodities. The price fluctuations are very important for them. Fousert mentioned the following factors as important factors which can affect the prices; First farmers are making their choice on what crop to produce on agricultural reasons (crop rotations) but even more on the expected financial profitability. When a commodity is providing a farmer low prices for a longer period, it is plausible that a choice will be made to change of crop.

Second very important factor is the change of consumer behavior, as mentioned earlier with the changing demand for meat in Asia. This is an important trend; however Cargill experiences also smaller and more local trends on the quantity of fats or the amount of salt in products. Also there is an increase in demand for healthy food.

Third factor according to Fousert is political stress in a country, this is an important factor which might influence the prices, as supply can be disrupted, but also due to financial disruption which might lead to rising interest rates. A fourth point which could affect prices according to Fousert is the availability of supporting materials and related prices, i.e. fertilizers, shipping possibilities, water etc. Emerging technologies which lead to more efficient process to produce goods or get access to goods is a factor with a certain important influence on the prices.

Sixth and seventh factors which might influence prices are the stock forecasting, end of crop year developments. These forecasts are used by most of the participant's active on the market which means that their way of acting and choices are based on this information. In general there are some macroeconomic drivers/situation like current inflationary environment which are affecting the prices. A last factor mentioned by Fousert is capital availability. Many commodities are working capital intensive, which means that less capital availability will increase the prices.

According to the trading manager of Cargill of the Refined Oils Europe division factors which might influence the prices has to do with risk factors. Within the risk management of this division some of the risks are;

- Availability of a certain product (the supply)
- Price (where are the prices going to)
- Quality (which might be affected by weather)
- Freight and transport
- Duty
- Forex (buy crude in USD and sell refined in Eur)
- Interest rates
- Political unrest
- Government legislation
- Port strikes
- Weather

- Crop diseases
- Farmer economics (will choose to produce the crops with the highest financial revenue)

Interesting in the arguments provided by Cargill is the fact that many of these factors taken in account by a large participant on the commodity market are factors which affect prices in the short term.

With the knowledge from the "experts" which have been discussed previously, a link can be made with the information from chapter 5. What are important price influencing factors according to the "experts" and is this, what have been found in chapter 5? A short discussion of the four commodities will show what the most important affecting factors are. In this discussion also the possible way of measuring this effect is discussed (when possible). This will help in concluding which factors are important to take in consideration in the forecasting models.

Summarizing

After having spoken with different people and receiving some very valuable reactions by important experts in the different fields of the commodities we have a clear overview of the important factors which are important according to these experts.

Making an overview of the factors mentioned by the experts give the following factors for the four commodities which have to be considered as important.

Wheat:

- The growth season, the total arable land but also the weather plays an important role and might influence prices.
- The input costs, increasing input cost affect directly the prices of commodities.
- Political influences are can have an important effect on the wheat prices. An example is the export bans during periods of lower production and supply of wheat.
- Interest to invest in the wheat production (based on the prices of other commodities). If other commodities which are also using arable ground to grow are financially more interesting farmers will choose for a commodity which is financial more interesting.
- The influence of commercials and non-commercials is also affecting the prices of wheat on the market.
- Increased demand due to increasing population and changing eating habits.
- The use of new technologies, e.g. genetic modification. This can lead to a higher yield per acre which leads to a lower land availability.

Oil:

- Increasing population and higher incomes are leading to a rising demand for oil.
- Political instability is affecting the oil prices directly
- The effect of the commercials and non-commercials are an important factor which affect the prices.
- The use of new technologies, this is in the sense that there are new technologies which make it easier to win oil and new technologies which change the utilization of oil (using other types of energy).

- Macroeconomic drivers are also playing a role, for example inflation or the price of the dollar.

Gold:

- Prices are affected by changing demand, especially from Asia but also by the growing demand from the industry.
- Macroeconomic drivers are playing a role, for example inflation and especially the price of the dollar.
- Financial instability might affect the gold prices.
- The influence of the commercials and non-commercials acting on the gold market has an influence on the gold prices.

Coffee:

- The total arable land is important. If other commodities are financial more interesting for producers than the production of coffee they will choose for another commodity.
- Input prices can influence the price, nevertheless due to harsh competition these are at the moment not affecting the price.
- Increased demand for coffee due to changing consumer behavior. Growth in demand is especially seen in Asia.
- The increased influence of large organization affecting the demand for fair trade coffee.
- Effect of commercials and non-commercials is affecting to a certain extent the coffee prices.
- The effect of extreme weather can be affecting prices in the short term, in the long term the climate change will be interesting to follow.

When looking to the four commodities it became clear that factors mentioned are seen back as possibly affecting prices in the four different commodities. It is interesting to see again that commodities are affecting each other. In the following chapter the factors mentioned by the experts will be taken in consideration together with those found in chapter 5, which were mostly based on literature and data from chapter 3. A positive result would be if factors are mentioned in both chapters (5 and 6) as it will strengthen the findings.

Chapter 7 Analysis

In this chapter the information of the previous chapters is coming together. The markets where commodities are being traded have been discussed as well who the participants are which are active on the commodity market. The four individual commodities have been discussed extensively to understand how these commodities are produced, where and to which extents it is produced and traded. In the third chapter not only the markets of the four commodities have been discussed but also the fluctuations of demand and supply and the price fluctuations for the period 2000 up to 2010 have been subject of interest. In this part it became clear that the strong price fluctuations seen on the four commodity markets are not arguable with the fluctuations seen between the supply and demand. This made it interesting to continuo the research with a chapter on the different methods to calculate the price forecasts. The models taken in consideration finally had different components and take different exogenous variables in account. In the following chapters these exogenous variables (price affecting factors) where part of the discussion. With the help of the data from chapter 3 it has been made clear that other factors had to play a certain role in the setting of the prices. The factors discussed are based on literature. Nevertheless there is not one set of factors which are provided in literature, many different opinions are known on the different effects of factors. An important question is to what extent a certain factor is influencing the prices. This is essential when you want to add a certain factor to a model. By adding the opinion of experts in the field of the different commodities it was possible to triangulate the factors found. Data provided the information that there had to be other factors affecting the commodity prices as demand and supply couldn't be the only factor affecting the prices. Literature provided the basic information on different factors which possibly affect prices of the four different commodities. These factors has been underpins by experts.

With the use of the information found in the different chapters we can make an overview of the factors for the four commodities which seems to be most important to take in consideration when making the price forecasts. In this chapter the four commodities will again be discussed separately. The factors which are most important for the forecasting of the prices based on the data, literature and opinion of the experts will be taken in consideration.

The different methods and models discussed in chapter 4 part 4.4 are used to understand how and if new factors have to be selected and in what way new factors could be added to the existing models. The actual adding of factors will not be part of this project as this would imply another research to find the exact influence on the price for each of the factors. The possibilities of adding a factor will be discussed.

This analysis will provide a clear overview of the factors which are possibly affecting the prices of commodities as well in the short term as in the long term. It will show the importance of looking further to factors which seems less important in the first place but can be important in a longer term.

Before starting the discussion on the four commodities it is important to be aware that the effect of commercials and non-commercials as discussed in part 5.2 is affecting to a certain extent the commodities. For this reason this factor will not be mentioned extensively again in the discussion of the four commodities.

7.1 **Wheat**

After having discussed extensively the way of production of wheat, the market and the participant, in chapter 5 the possible factors which can influence the prices have been discussed. With the help of table 28 from chapter 5 it has become clear that some of the factors are already affecting prices and some will be important in the longer term. The Opinion of the experts, especially; Edwin Burgers, Francis Declerck and David Fousert showed which factors are important in their opinion.

Combining the information of chapter 5 with the opinion of the experts gives us the possibility of discussing which factors are important and can have an important influence on the prices. In addition the information of chapter 3 will be used to find if the factors have already affected the prices in the past 10 years. For wheat the following factors are seems to be most important. Before mentioning these it is important to be aware of the fact that most factors are in related to each other: they can affect each other and are often a reaction on each other.
First very important factor which is already taken in account in the forecasting model discussed in chapter 4 is the price of oil. Reason that oil is affecting the wheat price, is in the first place because oil is an important input price for the wheat production. It is used for the production of wheat (machinery) but also in the transportation costs. In chapter 3 we discussed that 15 percent of the costs for the wheat production are coming from the machinery and the fuel. 80 percent of the costs are due to the machinery, fuel, fertilizers and seed. This shows that the oil prices are affecting cost prices to a large extent and so the final price of wheat. The changes of oil prices can affect wheat prices directly, which makes it important to be taking in consideration. In figure 24 in the appendix number 3 it is shown that the nominal wheat prices have been following the nominal oil prices in the past 40 years. Second wheat prices are also affected by the oil price in another way, which is less direct than the input cost are affecting. Increasing oil prices and the increased pressure on the oil market is leading to a growing demand for other types of energy. One of these types of energy is biofuels. An increasing demand for biofuels is leading to more land which is used for the production of Biofuel (especially as the profitability is higher and the incentive of producing for biofuel is increasing). This has as effect that there will be pressure on the land availability for the production of wheat.

A second important factor which is affecting the prices is the change in the demand of wheat. Nevertheless this is a factor which is not affecting prices in the short term. This increase in demand is particularly caused by the increasing population living in the world (70 % more feed necessary in 2050 according the FAO as discussed in chapter 3). In table 16 in chapter 3.4 the changes of demand of wheat have been discussed for the past 10 years. A growth can be seen from 589400 thousand metric tons in 2000 to 665790 thousand metric tons in 2010. Next to the growing population there is also a change in preferences. As the number of people living in poverty is decreasing the possibility of changing their eating habits is a fact. More meat is consumed which leads to higher demand for feed for the livestock. This change in changing habits is particularly caused due to increasing income. As discussed in chapter 5 the number of people living under the poverty line defined by the World Bank has decreased with almost 50 percent. This is leading to an increased pressure on the wheat demand.

A third effect which is important is the pressure on the land availability which is caused by the increasing demand but also by the demand of other commodities (this is a factor which is not affecting prices in short term). New technologies make it possible to use less fertilizers and pesticides, but also to increase the yield per acre by the use of for example genetic modification (as seen in table 7 in chapter 3.1.3). This can affect the prices in different ways. The use of fertilizers is expensive and will continue to become more expensive (as is discussed in chapter 3 the fertilizers are also an important part of the production costs of wheat, and the fertilizer prices have been growing according to abbott et all 2008. This is pushed by stricter regulations of governments (especially in developed countries). Governments are installing stricter regulations on protection against the pollution and the risks. The effect of decreasing land availability has been discussed for the US in chapter 3 table 7 in which it is made clear that the planted acreage is decreasing in the past 20 years however the yield per acreage has grown in this period. This can affect the supply and so the prices, but could also compensate for the decreasing land availability caused by the increased demand for biofuel.

The fourth important factor which is of one which is affecting the wheat prices directly and in the short term is the effect caused by extreme weather in an important wheat producing and exporting country. This is something which is experienced with the drought in Russia in the summer of 2010 which had as effect that the Russian government installed an export ban for wheat. Such an export ban has in the first place an effect on the supply on the world market. This has also been experienced -as discussed by Trostle (2008) and in chapter 5- in 2007 when extreme weather worldwide affected the yields. In the second place it can lead to a panic reaction of other governments. When this starts the effect can become very important as this can lead to a “domino effect”.

Now we know which factors are critical for the wheat prices, it is important to use the information of chapter 4 in which the time frames in which effects are important and the different methods of calculating the effects has been point of interest.

According to the discussion in chapter 4 part 4.3 there is a distinction between short, medium and long term effects. In this discussion we will categorize the factors in factors which affect the prices in the short term in which the effects are seen directly and in the long term in which effects are not seen directly. In the short term the oil prices and the effect of an extreme weather. Both can affect prices within a few weeks. Especially the extreme weather is a factor which is very difficult to predict in advance. When a period of extreme weather is occurring, analysts can make prediction of the impact it can have on prices. How this will affect prices is depending on many different factors. Question as what the reaction of the government of the country which is hit by the extreme weather will be, and how other governments or private organizations going to react on the regulation installed by a government are very important.
As discussed the oil prices are affecting the wheat prices in different ways. The effect due to the increasing input costs for the wheat production are leading to a reaction in the short term. The effect of growing demand for biofuels is not interesting in the short term. The oil prices can be predicted in advance to a certain extent. This makes it possible to calculate the effect on the wheat prices. Important to understand is that the shorter the period for which you want make forecasts the more accurate the information will be which you can use to forecast.

The use of scenarios is one of the methods which are important to take in consideration as there are many possible outcomes. Taking different outcomes in account can help to be aware of different effects and anticipate early on it. Also the use of the opinion of experts is important in such a situation. Especially on the question of the reaction of governments, and how other governments or private organizations will react on the installed regulation. When looking to table 17 in the appendix, which provided information on the different models, the way of taking in account the effect of extreme weather should be based on different scenarios which have been made by the use of experts (Delphi method).

The prediction of the effect of oil for the short term can be simply added by looking how much the production costs would increase. This can be calculated in the prices. However this is again depending for what time scale you want to make the forecast.

The other factors (pressure on the land availability due to increasing demand and utilization of land for other usage and the factor technological changes which affect the yield per acre) are affecting the prices in the longer term. It will not lead to a reaction on the prices directly. Nevertheless in the long term it are very important factors and is it leading to price changes which should be taken in account if you want to make good forecasts in the first place, but secondly if you want to react on it to avoid to large impact. Again scenarios are an important tool to look to possible outcomes of the factors. The fact that these factors are not directly influencing the wheat prices makes it difficult to make a good prognosis. The factors are also depending on other factors.

7.2 **Oil**

That oil is an important commodity has become clear in the precedent chapters. Many commodities are depending on oil and are so directly affected by the oil prices. After having looked to the demand and supply of oil and the effect on the prices in chapter 3, it became clear that the price fluctuations cannot only be due to a reaction of the mismatch between the supply and demand.
In chapter 5 different factors which are possibly affecting the oil prices have been listed and discussed. These factors have been taken in consideration for the past ten years to see if there has been an effect of the factors on the prices. This has been done at the end of the discussion of the factors affecting the oil prices in chapter 5 and can be seen in table 31 in this chapter. Looking at the factors mentioned in chapter 5 and the comparison with the price changes experienced in the past ten years we have seen which factors are possibly important. These factors can be substantiating with the information provided by the experts on the field of oil. The response of Prof. Declerck and David Fousert of Cargill.

The factor which is important in the first place is the increasing demand of oil. This is a factor which is not affecting the oil prices in the short term. Even if there is also more demand for alternative types of energy the demand for oil will increase in the coming decades. This is due to the growing population (the expectations of the UN are that in 2050 9.1 billion people will be living and using the world) but also as effect of a growing income in developing countries which makes it possible that for example more people are making use of a car (as seen with the explosive growth of demand for cars in China). As seen in table 16 in chapter 3.4 in the past ten years there have been a growth of the total demand of crude oil worldwide (from 76,2 million barrels a day in 2000 to 87,8 million barrels a

day in 2010). This increasing demand is important, especially in relation with the decreasing availability of crude oil. There is not an unlimited amount of oil in the reserves. The growing demand is increasing the pressure on the reserves of crude oil. This is a factor which affects the prices. In the long term this will become more important as presently the reserves are large enough to fulfill the demand with supply. Decreasing reserves will lead to a situation in which those countries which posses of important reserves will be able to set prices and control the amount of crude oil which will be won and put on the market.

The second important factor is a factor which is in relation with this increasing demand and the increasing difficulties of achieving the oil are the new technologies. This is an effect which will affect prices in the longer term. In the first place, the utilization of new technologies for the winning of oil. As discussed in part 6 of the discussion of factors affecting the oil prices in chapter 5 there are large quantities of shale reserves (J. Bartis et al. 2005). in the US large quantities of oil are available which are with the use of actual technologies not or difficult achievable. New technologies can increase the supply in the long term. This would help to lower the pressure on the existing reserves, and make the United States less depending on "unstable" countries which are supplying presently large amounts of crude oil to the United States. At the moment there are projects of oil winning companies which are investing in new technologies. Another way in which new technologies are interesting is; new technologies which affect the products which are presently making use of oil to function. Take for example the question what type of energy the cars will be using in the future to drive. Changes in these types of technologies can be essential for the demand for oil. This is an effect which we have experienced especially the last years, in which new types of cars are being demonstrated and are starting to being used. This is a trend which will continuo and will become more important for the demand for crude oil. The awareness (of the environment and the world reserves of fossil products) of governments, organizations and people (especially in the western world) is growing.

Third factor of importance is one which we have seen in the past but again we experience it presently. Due to the fact that there are some countries which have a major role in the production of oil means that political or economic instability in those countries may affect the oil prices. This is a factor which is affecting directly the oil prices. This is experienced in the beginning of 2011 when important political unrest in the Middle East is affecting the oil prices. The oil prices have risen to records high. As discussed in chapter 5 in part 3 of the discussion of factors affecting the oil prices, it have been clear that in the past important periods of instability in oil producing countries have led to rising prices. Figure 34 and 35 show what the effect have been in the past on the oil prices due to political instability (wars). This is not only due to a lack of supply as a part of the production is missing, but also due to panic reaction of governments and private organizations which are highly depending on other countries for their supply of oil. This panic reaction can be important as others participants are affected by the reaction of others. Nevertheless in 2008 there have not been periods of political unrest of interest in the important oil producing countries, although the oil prices have been extremely high during this year.

Fourth important factor are the political influence as especially seen in developed countries, were new regulation are installed. Due to increased pressure from the environmental movements and the increased awareness of the citizens new regulation on risk and pollution are affecting the costs of winning and producing oil is increasing. Stricter regulations can lead to higher costs and higher prices.

A clear example has been the disaster in the Gulf of Mexico where BP had problems with an oil rig. The United States installed new rules on the winning of oil and winning oil in the Gulf of Mexico has been prohibited for a period. This is not affecting the cost but does affect the supply which is leading to more pressure on the supply of oil. As discussed the use of new technologies which are using other types of (cleaner) energy for cars for example are being subsidized in an increasing number of countries (especially western countries). This has the following effects; governments can increase the taxes on the utilization of crude oil which makes the oil prices higher. In the Netherlands actually on 1 liter gasoline the consumer pays actually 98 euro cent taxes, this shows that the role of the government is important. This is not directly an effect on the crude oil prices but in the longer term you are motivating consumers to use other types of energy which are less harmful. This might lower the demand for oil, but this will be especially in developed countries (and in the long term).

Fifth factor which is increasingly important is the effect of the commercials and non-commercials on the oil price. In the beginning of this chapter it have been said that the factor "the commercials and non-commercials" are affecting all four commodities, nevertheless the effect of commercials and non-commercials seems to be even more important in the oil market than on the other three commodities. The opinions of different expert are ranging on the exact effect this discussion can be found in chapter 5.2. One fact on which most of the experts are agreeing is the fact that the increased investments lead to higher volatility on the oil market. This makes the oil market more reactive to fluctuations on other financial markets. As discussed previously, the oil prices have been raising in the beginning of 2011 due to political unrest in the Middle East, this is partly caused by the unrest but to an important extent also by the presence of commercials and non-commercials on the oil market. When Osama Bin Laden, the most wanted person by the United States was killed on May second of 2011 the oil prices dropped directly with 2 percent after this news have been spread. This shows that the role of speculators (non-commercials).

In the short term the following factors affect the oil prices. The political disruptions or disasters which lead to a direct pressure on the supply of oil. This can lead in the first place a mismatch between supply and demand but more important the panic reaction of governments, private organizations and commercials and non-commercials. These effects can lead directly to price fluctuations. The other factor which can affect prices in the short term is the increased volatility which occurs due to large investments by commercials and non-commercials. When oil is interesting, prices are rising as many participants are acting on the market. This can be an effect which can go very fast.

In the long term we find the following factors which might increase the pressure on the demand and supply and finally lead to a mismatches and growing or falling prices. This are; Growing demand due to an increasing world population and the growing income in developing countries which is pushing demand up is a factor. This growing demand which is projected means that there have to be a constant search for new technologies of winning and reaching the oil but also alternatives of the use of oil. Also the pressure of the governments in order to stimulate the use of more environmental friendly energy forms is leading to a change in demand in the longer term.

To add these factors to a predicting model it is important to know in advance if a factor will occur or not. Political disorder for example is difficult, and most of the times impossible to predict in advance.

When a situation (factor) occurs it is possible to make different scenarios on the effects on the oil price. This holds as well for the environmental pressure and stricter regulations. A prediction on the effect of factors which lead to a growing demand can be made by looking to the predictions of growth. This is for the long term possible but would not be very secure. Important is the time range for which you want to make the prediction. The longer the time frame is for which you want to make a prediction the more assumptions have to be made. As we have seen in the conclusion of chapter 4, the more assumptions have to be made, the larger the change on mistakes is and the less accurate your prediction is. Again would scenario thinking be a good option to make sure you have thought off the different possible outcomes. The utilization of a simulation program would also provide interesting information. This could be used to find out how different factors are reacting to each other and how this will finally affects the oil prices.

7.3 **Gold**

In the previous chapters we have discussed that gold is an important commodity which has proved to keep a stable price during periods in which the price of other commodities experienced severe fluctuations. From the data in chapter three it have become clear that gold prices have experienced a stable growth since the 1970 when the gold standard was ended. The data also showed that the demand and supply stayed more or less stable over the years. To find what have caused the stable growth of the gold prices we conducted a study in chapter 5 to the possible factors which are affecting the gold prices, or which can affect the gold prices in the future. Taking these factors and the factors discussed by the experts in chapter 6 together, the following factors are important.

First important factor are the changes in currency exchange, inflation and interest rates which are affecting the price of gold. These changes can make it more or less attractive to invest in gold. This is because gold is not losing its value, its price is staying stable which makes it a secure investment. Periods of economic distress or instability can lead to increasing demand in gold which can affect gold prices. In part 1 of the discussion of the factors affecting gold in chapter 5 the different ways how the prices might be affected has been discussed. This is a factor which can affect gold prices in the short term.

A second important factor is the increasing demand for gold, a factor which can be divided in different parts. First of all due to the first factor and economic unrest more people and organizations want to invest in gold as it is a secure commodity to invest in. Next to this increasing demand we experienced an increasing demand of gold in Asia, where the population sees gold as a good and save investment. In 2007 the demand in China experienced a growth of 20 percent as discussed in chapter 5 in part 3 on the gold discussion. The last increase of demand is seen in the increasing demand for gold in the industry where gold is used (for example the micro chip industry). This increasing demand is leading to a mismatch between demand and supply as the supply has been decreasing in most producing countries. China is increasing enormously their production as have been seen in chapter 3.2.2 where we saw that the gold production have been risen 62 percent since 2001.

The role of the central banks and the IMF is less important as it is strongly regulated, nevertheless their power of influencing the prices can be large as the quantities of gold which they posses is

important. Similar to the factor "the role if the central banks and the IMF" the influence of environmental pressure is less important for the prices. This is mentioned because it could possibly become more important in the future.
In the short term especially the changes of currency exchange inflation and interest rates as well as the increasing demand in economical unstable periods are factors which can affect prices in the short term. As gold is a commodity which showed its stability in the past it is interesting to invest in gold, to hedge for example.

In the longer term the important factor which can influence prices is the increasing demand for gold, especially in Asia but also for industrial uses. This is something which is proceeding in the longer term. The reaction to make sure that the supply fits the demand is one which can take some time. This means that in the longer term it can affect prices but it can take even more time before the stability is recovered. The fact that the winning of gold is affecting the environment is a factor which can have a certain influence on the mining cost of gold (which will be calculated in the gold prices) however this is presently not important enough.

Adding these factors to models is difficult. A possibility for adding the factor of increasing demand due to changes in currency exchange, inflation, interest rates or increased investment in economic difficult situations could be done by the use of a regression analysis. The increasing demand can also be added to the model presented in chapter 4, however assumption will have to be made, especially when you are forecasting for the longer term. The assumption made on the increasing demand can be made with the use of scenario thinking.

7.4 **Coffee**

The research on the coffee market done in the previous chapters have shown that next to changing demand and supply other factors are affecting the prices. The most important factors are selected by comparing the factors found in chapter 5 and the opinion provided by experts in chapter 6. Those factors which are important are the following factors.

First factor is the changing price of coffee. If there is a moment when prices are low, the growers will lose their incentive to grow coffee. This can have an important effect on the supply of coffee; however this can also be the other way around as we have seen in the past. The oversupply caused by the enormous investments in Vietnam (see part 3.3.2) but also due to technological innovations which increased the production have led to an oversupply and decreasing prices. That there have to be other factors which are affecting prices is logical when looking to the changes in supply demand and the prices in table 14 in chapter 3. The oversupply has lead to decreasing prices since 1998 nevertheless the prices have been rising again since 2004 with a record high in 2010 (with a situation of oversupply). The fact that prices have been rising again can show that other factors are also affecting the prices.

Second important factor are periods of extreme weather. As there are some very important coffee producing and exporting countries, the effect of extreme weather in such a country are affecting the world supply directly. This mismatch which occurs between demand and supply is reason for price fluctuations, and the effect of speculation. As seen in table 33 in chapter 5 in the discussion on

affecting factors, the frost in Brazil in the production year 1994/1995 and 1995/1996 caused world prices of coffee to rise. The effect of climate change is less important as producers/growers of coffee have time to adapt themselves to the new conditions.
Third factor of importance is that of political instability or unrest in a producing or exporting country. This can have an important effect on the price. This is similar to the effect of extreme weather. There are no clear examples in which political unrest in a producing country have been rising the coffee prices. The unrest in the Middle East have although been affecting the food prices. As the coffee market can be compared with the cacao market, the example of the unrest in Ivory Coast in 2010 which have been reason for cacao prices to rise enormously. This shows that unrest in an important producing country can affect the prices.

Fourth factor is a factor which is seen back in most commodities, this is an increasing demand due to the population growth, for coffee it is especially the growing demand which is coming from Asia. This growth can be seen in table 16 in the comparison of the four commodities in the third chapter (3.4). Looking to the demand in the United States it becomes clear that the demand hasn't changed much (23766839 bags of coffee in 2000 which declined to 23575458 bags of coffee in 2009). The total demand does have experienced changes in the period 2000 to 2010 (from 85214905 to 98497468). This is mainly caused due to growing demand in Asia.

Fifth factor is a group which is becoming more important in the coffee market, this are the multinationals which are focusing on fair trade. Some of these multinationals have the power to influence the demand of the consumers and in this case the demand for fair trade coffee. This might lead to increasing demand for a certain type of coffee. When the quantity of fair trade coffee will become more important, it can affect the price mechanism as a minimum price is guaranteed for the coffee growers. This effect is shown in figure 15 in chapter 3.3.5, which shows that the market working is not functioning idealistic anymore with the implementation of such a minimum price for coffee.

In the short term the factors which should be considered are the effect of extreme weather, the effect of political instability or unrest in important producing countries. The effect of commercials and non-commercials can as well be seen as a factor which can influence prices in a short term.

In the long term we find the other factors mentioned above which are affecting prices. This are the price of the coffee for the producers/growers of coffee, the influence of multinationals which are pushing the consumption of fair trade coffee and the increasing demand as effect of growing population and increased popularity of coffee in Asia.

When you want to add these factors to a model, the most important difficulty is to predict the factors in the short term in advance. The effect of these factors could be more or less calculated when they occur. Than it is possible to make an estimation of the effect it will have on the production of coffee. The mismatch between the demand and supply can be used in the models. The factors affecting prices in the longer term can be taken in account by the use of experts making different scenarios. For these different scenarios calculations can be made to find out what the effect will be on the prices.

7.5 Conclusion

Concluding this chapter with the analysis of the previous chapters we provide two tables. In table 35 an overview is provided of factors which are most important for the four commodities and factors which are important in generals (for all four commodities) in the short term.

Table 35: Important factors in the short term

Wheat	**Oil**
- Oil price (affecting the input cost). - Reaction of government on events, installing export bans after a bad harvest and the reaction of other governments on such a ban. - The effect of extreme weather.	- The growing environmental pressure (seen with the disaster of BP in the Gulf of Mexico in 2010 for example). This can affect directly prices when direct rules are installed. - Economic or political instability or unrest in important producing countries (as experienced in the beginning of 2011 due to unrest in the Middle East).
Gold	**Coffee**
- The effect of changes in currency exchanges, inflation, interest rates or investments in economic difficult and unstable periods.	- The effect of extreme weather in important producing and exporting countries. - The effect of political or economic instability or unrest in an important producing and exporting country. - Effect of commercials and non-commercials.
General factors important in the short term	
- Effect of commercials and non-commercials. This can affect prices very fast as there are participants active on the market with as goal to speculate and earn money or to hedge their portfolio. - Government reactions are in general very important to keep in mind. An export ban of one country can lead to speculation of other governments and lead to a panic reaction in which there will be an domino effect.	

In table 36 we find information on the factors which are important for wheat, oil, gold and coffee and in general for the long term.

Table 36: Important factors in the long term

Wheat	**Oil**
- Government regulations (stricter regulations for fertilizers or other environment issues) - Oil price (affecting the demand for other fuel forms as Biofuel which affects the land availability for wheat production). - Changing demand due to growing world population and the growing income.	- Increasing demand for oil due to growing population and higher incomes. - The use of new technologies (as well for other fuels which are used for example increasing demand for biofuels but also new technologies which make it possible to achieve new oil reserves). - The growing environmental pressure (seen with the disaster of BP in the Gulf of Mexico in 2010 for example). Can affect prices in the long term as the whole process of becoming aware of the

	environment is becoming more important. -
Gold	**Coffee**
- Expansion in the demand of gold (as well in Asia as in the industry) - The role of the Central banks and the IMF (is less important due to strict regulations, however they posses important quantities). In the long term it can be important if new regulations are accepted which gives the banks more freedom to trade their gold.	- Changing prices for the producer/grower for a longer period can lead to more or less incentives of growing coffee beans. - The growth of the population and especially the growing demand in Asia. - The power of large multinationals affecting the consumption pattern of consumers and stimulating the demand for fair trade coffee.
General factor important in the long term	
- Effect of commercials and non-commercials (are increasing the volatility of markets) -The population growth and the higher average incomes are increasing the pressure on demand of commodities - Less land availability, is an effect on the increasing demand of commodities. However more land is necessary which is becomes scarcer.	

Most of the factors are not taken in account in the existing models but can difficult be added to a model as it is affecting prices at the moment that the factor is occurring. His means that being aware of the fact that these factors can have a certain influence on the prices of commodities is most important. This means that being aware of a factor will help to react directly and predict how it might influence the prices. The factors which are already being taken in account are the oil price in the wheat models and the growing demand in the four commodity models. Some of the other factors are affecting the demand or supply so doesn't need to be added in a model but need to be taken in consideration.

Finally I would like to end with a citation of Mr. David Peniket, President and Chief Operating Officer, ICE Futures Europe, London which stated at the UNCTAD conference in February 2011. "There are different ways to look to changes in supply and demand;

- Micro Current supply and demand
- Macro Current and forward supply and demand
- Broadscope Current and forward supply and demand and financial drivers such as currencies"

Reason for mentioning this at the end is that Mr. David Peniket citation is perfectly fitting my conclusion. In his point of view a broader scope is becoming increasingly important to forecast prices and look to the commodity market. He implies what I stated earlier, it is important to be aware of all the possible factors which can influence the commodity prices. Due to changing market atmospheres it is not longer possible to just look to the direct influencing factors for one commodity as done in the past.

Conclusion

In this final chapter of this project, the conclusion the main question and its sub questions will be answered. These answers are based on the information from the different chapters in this project.
After having answered the questions a short final conclusion will be provided, which is based on all information of this project. This will be followed by a recommendation and a reflection on the total project. The main question was described in the beginning as;

Are the common used predicting models still accurate enough, or are new factors playing an increasingly important role in the price setting of commodities which lead to a necessity to change the standard models?

Before answering this main question the sub questions will be briefly answered.

What are the characteristics of the commodity markets?
The commodity market can be seen as markets in which the trading has been changing from physical trading to trading on exchanges and the OTC market during the last decade as discussed in chapter 2 (part 2.1.3.). This has as effect that new participants are active on the commodity market with different purposes i.e. hedging, investing or speculating. Part 2.1.4 discussed the different participant's active on the commodity market. Chapter 3 provided specific information on the four commodities. In table 16 at the end of this chapter a clear overview is provided in which the specific data on the different commodity markets are being discussed. Main point of this table is the changes of prices which are seen. These price fluctuations are not directly caused by the differences between demand and supply as these have been often stable during the last 10 years.

What do the commonly used price predicting models consist of?
Most models as we have seen in chapter 4 are based on the differences between demand and supply. In the different models which are used, historical data is used for these predictions. The use of exogenous variables which can influence the prices is rarely used, and mostly it is done by adding the calculation of the effect with the use of a regression analysis. In the appendix 3 the specific models have been discussed. It became clear that the difference between the short, medium and long term are important to be taken in account.

What are new or not yet used price influencing factors, which are increasingly important?
Important point is the time range for which you are predicting the prices. The longer the time range for which you want to make a prediction the less accurate it will be. Important factors for the different commodities have been discussed in chapter 5. It became clear that many factors can affect prices however how to calculate the exact effect is often difficult. What became clear in chapter 5 and 6 is the fact that many factors are in relation with each other. The occurrence of one factor might stimulate the appearance of another factor; this makes it such a difficult discussion. Being aware of the effects of a factor is for that reason even more important.

What are the most important factors influencing the prices according to "the professionals?
The use of the opinion of the experts is allowing us to triangulate the arguments. The factors provided by the experts are mostly similar to those provided in chapter 5. As the answer is listed already several times I will not list here again (see the summarizing part of chapter 6).

Is one of the new factors important to take in consideration in the forecasting models and for which reason and time scale?
Comparing the arguments provided by the information in chapter 3 and 5 in combination with the arguments provided by the experts in chapter 6 and taking in consideration the time ranges and different methods in chapter 4, the following factors should be taken in consideration in models, commodity specific:

Wheat:

- Oil price (affecting the input cost but also the demand for other fuel forms as Biofuel).
- Government regulations (stricter regulations for fertilizers or other environment issues)
- Reaction of government on events, installing export bans after a bad harvest and the reaction of other governments on such a ban.
- The effect of extreme weather.
- Changing demand due to growing world population and the growing income.
- Effect of commercials and non-commercials

Oil:

- Increasing demand for oil due to growing population and higher incomes.
- The use of new technologies (as well for other fuels which are used for example increasing demand for biofuels but also new technologies which make it possible to achieve new oil reserves).
- The growing environmental pressure (seen with the disaster of BP in the Gulf of Mexico in 2010 for example).
- Economic or political instability or unrest in important producing countries (as experienced in the beginning of 2011 due to unrest in the Middle East).
- Effect of commercials and non-commercials. New participants acting on the oil market with other purposes.

Gold:

- The effect of changes in currency exchanges, inflation, interest rates or investments in economic difficult and unstable periods.
- The role of the Central banks and the IMF (is less important due to strict regulations, however they posses important quantities).
- Expansion in the demand of gold (as well in Asia as in the industry)
- Effect of commercials and non-commercials

Coffee:

- The effect of extreme weather in important producing and exporting countries.
- The effect of political or economic instability or unrest in a important producing and exporting country.

- Changing prices for the producer/grower for a longer period can lead to more or less incentives of growing coffee beans.
- The growth of the population and especially the growing demand in Asia.
- The power of large multinationals affecting the consumption pattern of consumers and stimulating the demand for fair trade coffee.
- Effect of commercials and non-commercials.

In general the effect of commercials and non-commercials and the effect of reactions of governments but also increasing demand due to the growing population should be seen as important factors which influence the prices. Important is to recognize that many of the factors discussed are affecting the demand or supply. Demand and supply are leading in the setting of prices. It is important of knowing which factors are affecting the demand or supply. This shows that many of the factors are influencing the demand and supply.

After the short answers on the sub question, we can answer the main question. The question if the models are still accurate enough is difficult to answer. It all depends what you want to achieve with your forecast. The time scale on which you want to make a forecast is crucial. The effects of the factors which can affect prices are also different in the time scale in which they will affect prices. Important is that you are aware of the factors which are influencing the prices and the factors which might influence the prices. Being aware of situations in which an insecure factor is occurring is important, and could be done with the use of scenario thinking as discussed in chapter 4 and appendix 1 and 2. The fact of thinking in advance of possible factors will help to react quicker and more adequate. The factors which can be seen in general as important factors which affect prices are difficult to calculate in advance, as they change as the situation is changing. That there is a model which is based on historical data is in my opinion the best way of searching for seasonality's and trends. Nevertheless a model should provide the possibility to adjust prices for the effect of affecting factors. Making use of a regression analysis would be most suitable in most of the cases.

Next to these facts it is also increasingly important in this highly globalized world to be aware of the effects which have a certain effect on each other. One factor can have many side effects which mean that there are other factors which are stimulated to occur and to affect the prices (as seen in chapter 7). This research showed that a growing amount of factors are potentially affecting prices. Due to the globalizing commodity market, the increasing population, and the start of trading on exchanges and OCT markets, the commodity market has experienced changes. This has led to a new situation in which new factors can affect the prices. Being aware of the possible influence of a certain factor is important. This can help the forecasters to understand why prices are fluctuating even is demand and supply are staying stable (as could be seen in table 16 in chapter 3). The effects of most of the affecting factors are difficult to predict or calculate in advance. Fact is that you have to be aware of the fact that when a certain factor is occurring it can affect prices in a specific way. Creating a perfect model is an illusion as so many factors can have an impact in one way or another. Adding all the different factors which might have an affecting role (but not necessary in all situation) would make the model less accurate (discussed in chapter 4 part 4.2 "more factors will increase complexity which might affect the accuracy").

Some important points to conclude with in this discussion of the main question are some important general facts which are important to be aware of, this are;

- Speculation, panic reactions and also the reaction and action of governments (export ban for example) can affect prices in an important way (as seen in the beginning of 2011 with the political unrest in the Middle East).
- Due to the growth of the world population the demand for many commodities has grown. But also due to the increasing incomes of the population, which provides them more possibilities (this growth will continue according to the FAO with an additional need of 70% of extra food in 2050. A 50 percent decline of people living in poverty according to the World Bank during 1970 and 2000. And finally more than 80 % of the increase in Chinese grains and oilseeds demand stems from diet changes).
- This growing demand for commodities but also for crops which are used for biofuels for example are increasing the pressure on the land availability for the production of many commodities. This lowering of acreage available is important to keep in mind.

A last remark is actually a question; to what extent are higher prices harmful for the society? Higher prices make it interesting to invest in a certain commodity. If prices are staying low for a certain commodity, producers lose their incentives of producing that commodity and tend to start producing commodities which have better financial possibilities for them. To get this broader view scenario thinking is very useful, as well as the use of simulation programs.

Recommendations

After having done this research on factors which could possibly affect commodity prices I have some recommendations. I would like to make a distinction between business and research. Starting with the business recommendation (which is more practical), most important is the fact that as a traded, or forecaster in an organization, you should be aware that factors which can affect commodity prices are ever changing. You should constantly be in search of new factors which could affect your commodity prices. Next to this awareness it is important to understand that a factor can have a direct influence on the commodity price but also a side effect which has to be kept in mind; this might be that it influences other factors which might start affecting prices. For that reason, if you want to forecast it is important to be aware for which time scale you make a forecast and which factor is important in that time scale. Especially when you act in a specific market it is important to keep a broad view when searching for possible affecting factors. Looking to other commodities has become increasingly important, as those factors can affect each other in this highly globalized world.

Especially professionals who start working in the field of commodities (as trader or forecaster) can be surprised by the enormous complexity of some of the commodity market. Getting a clear overview of what is happening in a certain market and what can possibly influence the prices would help to understand the market and make the right decisions (or decisions which have been well thought off).

As stated in the beginning of the recommendation, there is a difference between a practical recommendation for the business and one for other researchers, or student which want to continuo on this topic (the research). This topic is extremely broad and has many other possibilities which could be part of this topic. This research has provided a basis on the extremely interesting world of

commodities and can be used to continuo in this field. Due to a lack of time and data, it was not possible to modulate new forecasting models. Due to the extreme complexity of calculating the specific effect of a certain factor it would need another research for the factors to find out in which way and to which extent they are influencing the commodity prices. Nevertheless this would be very interesting to do. This project can be used as a large map with information on four specific commodities which provides the necessary information on what is happening on the commodity market.

However, the fact that many publications are known in the field of commercials and non-commercials and their possible effect on the prices of commodities shows that there is not a logic answer which can simply be stated. So many factors should be taken in consideration as they affect each other. Important in further research is that it is important to be aware of the effect of other commodities and the side effects of factors. If these are not taken in account you might miss some crucial information which can lead to less accuracy. For this reason it was interesting to look to four commodities and not only to one.

Reflection

The last part is my reflection on this project. In this part I will focus on the project and how I look back on it and on choices I have made. To start with the strong points, I think it was good to start with a clear description of the definition of commodities, the market where commodities are being traded and the participants. As this was a new area for me to work with, it was important to create a clear overview of the whole scale of the topic commodities and their market.

Another strong point is the fact that I have chosen to work with four commodities. This gave me the possibility to compare the different commodities and see if there are similarities which can be interesting and see if factors are seen back in different markets. This comparison is very interesting. As stated in the recommendation, keep a broad view on the market in order to find out which factors are important will increase your forecast ability (as many factors are affecting each other and have important side effects). Other points which I am content with are the fact that I have chosen to take a broad look to the possible factors which can affect the commodity prices and have thought out of the box when thinking of factors.

Points which are less strong are the fact that my ambitions where too high. Due to a lack of knowledge of the field I have started with too much which I wanted to cover. Reducing (or especially changing) the work which I planned to do has as effect that I lost time. This had as effect that I have been discussing the different factors which are important to take in consideration but was not able to translate these effects into the models discussed in chapter four. My ambition of creating new models which would be more accurate in predicting the prices was too high. The calculation of specific effects of factors would take much more time and is difficult to add as the effect of a factor is changing over time and is difficult to predict in advance. The time scale is also difficult to take in consideration as this is leading to different factors which are important than looking in the short term. Another weaker point is that the factors found have been explained with the use of literature, in relation to the data found in chapter three and the arguments provided by some experts. It would be stronger when new calculations and possibly regression analysis had shown the effect. Problem is that some of the factors discussed are becoming important in the future, which means that there is a

lack of data. For this reason I have chosen to be straightforward and discuss all factors in a similar way.

After this discussion on the stronger and weaker points I have some points which I would do differently when I would do this project again. Important point is that I would try to go in more depth into the factors and calculate how these could possibly have affected the prices in the past ten years. To create time to spend more time to this part I would put less energy in the forecasting models which are used presently. However I am aware of the fact that for many of these factors it would not be possible to calculate what their effect is on the prices. Secondly I would make use of statistical programs to find correlations between fluctuations in the prices and in the supply/demand and different factors.

Now that I am finishing this long and interesting project my advice for students which are at the start of such a project is in the first place that you should be sure of how you want to structure your project. Having a clear research objective has been leading for the rest of my work. A clear plan makes it easier to work on your thesis. I think next to a good plan you should dare to take some risks and be hard for yourself, which I mean with that I think it is better to try to do more than make it too easy. Last point is keep thinking out of the box, especially when you are stuck at a certain moment. Try and dare to be creative in solutions which you are searching for. The sky is the limit.

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Appendix 1: different methods

Trend extrapolation: these methods examine trends and cycles in historical data, and then use mathematical techniques to extrapolate the data to the future. The assumption which is behind this method is that the forces which were responsible for the past will continue operating in the future. This is often a valid assumption, especially when forecasting the short term. When making a forecast for the medium or long term, this method is less useable. In part 4.3 the differences between long-, medium-, and short term will be covered. The longer we attempt to make a forecast the less predictable it becomes. Most important key factor for using trend extrapolation as forecasting method is the stability of the environment. Some demand for products are not changing much or the production process is not easy changed. These are stable products for which this method is more useable than products for which trends change very quick. There are many different mathematical methods which can be used to forecast trends and cycles. Which method should be used is depending on the historical data. In table 17 the different models are presented and discussed. The most common mathematical models involve various forms of weighted smoothing methods. Another type of model is known as decomposition. This technique mathematically separates the historical data into trend, seasonal and random components. A process known as a "turning point analysis" is used to produce forecasts. The last two methods are the ARIMA models such as Box-Jenkins analysis and a simple linear regression and curve fitting. With these methods the forecasts can differ from each other because the forecaster has to determine the parameters. Trend extrapolation is a method which is much used for the prediction on the commodity market. Trends from the history are much used for the forecasts of the future, however often they have to be adapted with parameters which are also influencing the prices (Walonick 1993). This definition corresponds to the definition of www.businessdictionary.com (Jan.2011).

For this project this model will be important. For predicting the prices we saw that trends are important, as discussed in chapter 2 the prices of the commodities have shown fluctuations but often also clear trends. Next to these trends the exogenous parameters seem to be important. Something we also saw in chapter 2 in which we discussed that prices of commodities could affect the prices of other commodities, and many factors should be taken in consideration when predicting the prices. When using this method the weaker points of this method should not be forgotten. Forecasting commodity prices which are not stable and which are tangible for fluctuations. Also the time ranges for which the forecasts are made are influencing the results. Longer periods, will weaken the forecast.

Simulation methods: This method involves using analogs to model complex systems. Analogs can take on different forms. You can have a mechanical analog, mathematical analog, a metaphorical analog, and a game analog. An important danger with mathematical analogs is the fact that these techniques often begin with a set of assumptions and when these are incorrect the forecast will be based on these wrong assumptions.

One of the most common mathematical analogs in societal growth is the S-curve. The model is based on the concept of the logistic or normal probability distribution. All processes experience exponential

growth and reach a possible upper limit. The disadvantage of this S-curve model is that it is difficult to know at any point in time where you currently are on the curve, or how close you are to the possible limit. The advantage of the model is that it forces planners to take a long-term look at the future.

Another common mathematical analog involves the use of multivariate statistical techniques. These techniques are used to model complex systems involving relationships between two or more variables. Multiple regression analysis is the most common technique. Unlike trend extrapolation models, which only look at the history of the variable being forecast, multiple regression models look at the relationship between the variable being forecast and two or more other variables. Multiple regressions are the mathematical analog of a systems approach. The object of multiple regressions is to be able to understand how a group of variables affect another variable. Problem is that strong correlations between predictor variables create unstable forecasts, where a slight change in one variable can have dramatic impact on another variable. Gaming analogs are also important to futures research. Gaming involves the creation of an artificial environment or situation. Players (either real people or computer players) are asked to act out an assigned role. The "role" is essentially a set of rules that is used during interactions with other players (Walonick 1993).

This method will be used in the last part of this chapter in which we will actually discuss specific forecasting models for the four commodities. Regression models are commonly used for forecasting the prices of commodities. Especially for the question how exogenous variables are influencing each other. The combination of trend extrapolation in combination with simulation methods is what will form the basis for our models. Especially when we are completing existing models with possible new affecting variables, it will be essential to know how these variables are affecting each other and the model. As stated making assumptions is often necessary however, more assumptions means that the quality of the results will be less precise, especially when wrong assumptions are made.

Cross-impact matrix methods: this method is recognizing that a certain event can affect the likelihoods of other events. Probabilities are assigned to reflect the likelihood of an event in the presence or absence of another event. The resultant inter-correlational structure can be used to examine the relationships of the components to each other, and within the overall system. The advantage of this technique is that it forces forecasters and policy-makers to look at the relationships between system components, rather than viewing any variable as working independently of the others (Walonick 1993). This method is again important for the forecasting of the prices on the commodity market. For example, looking to the food market, a possible effect of increasing crude oil prices is the growing demand for bio-fuel. More demand for biofuels means that demand for grains will go up and pushes the grain prices up (what we will see in chapter 5).

Consensus method: For forecasting complex systems often the opinion of several experts is used. For this method more than one expert is used. Each of the experts is an expert in its own discipline. It is through the synthesis of the different opinions that the final forecast is obtained. One well known method in the consensus methods is the Delphi technique. This method seeks to rectify the problems of face-to-face confrontation in the group, so the responses and respondents remain anonymous. The classical technique proceeds in well-defined sequence. In the first round, the participants are asked to write their predictions. Their responses are collated and a copy is given to each of the participants. The participants are asked to comment on extreme views and to defend or modify their

original opinion based on what the other participants have written. Again, the answers are collated and fed back to the participants. In the final round, participants are asked to reassess their original opinion in view of those presented by other participants (Walonick 1993).

This Delphi technique is interesting because in chapter 5, 6 and 7 the goal is to define factors which might influence prices with the use of the opinion of the experts. We will not use this model as extensive as discussed by Walonick; nevertheless the opinion will be important. These experts who will be asked for their opinion on the question, which factors are of importance for the setting of the prices and to what extent? These experts are working with these commodities, which mean that they have more knowhow on the possible influencing factors which can be important. Downturn of this method is the fact that it takes more time to gain the information of all the experts and to formulate a conclusion.

Scenario: The scenario is a forecast that describes a potential course of events. Like the cross-impact matrix method, it recognizes the interrelationships of system components. The scenario describes the impact on the other components and the system as a whole. It is a prediction for a uncertain future, it give possible outcomes to different possible situations.

When making scenarios different events can be considered as; new technology, population shifts, and changing consumer preferences. Scenarios are written as long-term predictions of the future. A most likely scenario is usually written, along with at least one optimistic and one pessimistic scenario (Walonick 1993). Scenarios force the forecaster to think about possible outcomes for the future and how they could react on the different possible outcomes. The strong point of scenarios is the fact that you are not only focusing on one outcome and one forecast but also think of possible outcomes which are less realistically which means that if this outcome indeed does occurs you are better prepared and can react quicker. Other possible definitions of scenarios are; Scenario planning advocates the telling of multiple stories that cover a variety of plausible future occurrences. This method opens organization eyes to a vast future landscape. With a focus on long and short term stories about the future, scenario planning forces organizational planners to considers paradigms that challenge their current thinking. Scenario planning encourages organizational leaders to think the unthinkable (Chermack et al. 2001). Scenario planning has proven to be an effective method for identifying critical future uncertainties and investigating 'blind spots' in the organization (Kahane, 1999). The concept uncertainty here in is "the result of incomplete knowledge" (Hardaker et al. 2004; Meuwissen et al. 2001).
Scenario planning has been defined in several ways. Michael Porter (1985) defined scenarios as 'an internally consistent view of what the future might turn out to be – not a forecast, but one possible future outcome'. Schwartz (1991) defined scenarios as 'a tool for ordering one's perceptions about alternative future environments in which one's decisions might be played out'. Ringland (1998) defined scenario planning as 'that part of strategic planning which relates to the tools and technologies for managing the uncertainties of the future'. Shoemaker (1995) offers 'a disciplined methodology for imagining possible futures in which organizational decisions may be played out' as a definition for scenario planning. Scenarios are not concerned with getting the future 'right', rather they aim at challenging current paradigms of thinking and broadcast a series of stories in which attention is directed to aspects that would have otherwise been overlooked.

Scenario thinking will be seen back in chapter 5 in which we will look to possible influencing factors which are not yet taken in account presently but which could be important or will become more important. For this we need to think broader to possible new situations on a market and new influencing factors. The weakness of this method is the fact that it is a forecast which is not based on a calculation, but which is based on possible outcomes due to external influences.

Decision trees: Decision trees originally evolved as graphical devices to help illustrate the structural relationships between alternative choices. These trees were originally presented as a series of yes/no choices. As our understanding of feedback loops improved, decision trees became more complex. Their structure became the foundation of computer flow charts.

Decision theory is based on the concept that an expected value of a discrete variable can be calculated as the average value for that variable. The expected value is especially useful for decision makers because it represents the most likely value based on the probabilities of the distribution function. The application of Bayes' theorem enables the modification of initial probability estimates, so the decision tree becomes refined as new evidence is introduced.

Utility theory is often used in conjunction with decision theory to improve the decision making process. It recognizes that dollar amounts are not the only consideration in the decision process. Other factors, such as risk, are also considered (Walonick 1993). This is a method which will not be used in this project. But which could be used when continuing working with the new factors to see if you can choose for a certain model with different factors in a certain situation.

Genius forecasting: this method is based on a combination of intuition, luck and insight. This method is mostly used by psychics and Chrystal ball readers. This is the most extreme form of genius forecasting. There have been users of this method which had remarkably good forecast; however also the other way around, there are many examples. The main problem with this forecast is the fact that it is impossible to recognize a good forecast until the forecast has come past. Another problem with this method is that there are psychics who have been giving accurate forecast but the mainstream science has difficulties to accept it and to understand how it is possible (Walonick 1993). For this project this method is less interesting due to the low academic level of the method.

Appendix 2: different models used for forecasting

Table 17: different forecasting methods

Extrapolative methods	Explanation	Source
Simple moving average	This method averages the last *n* observations of a time series. It is appropriate only for short or irregular data sets, where futures like trend and seasonality cannot be meaningfully determined, and where the mean changes slowly.	– Wikipedia. Moving average. from http://en.wikipedia.org/wiki/Moving_average – Makridakis, S. G., Wheelwright, S. C., & Hyndman, R. J. (1998). *Forecasting: Methods and Applications* (3rd ed.). New York: John Wiley & Sons.
Exponential smoothing, such as the Holt-Winters method.	A more complex moving average method, involving parameters reflecting the level, trend and seasonality of historical data, usually giving more weight to recent data. Widely used in general business because of its simplicity, accuracy and ease of use. This method's robustness makes it useful even when historic data are few or volatile. It is a frequent winner in forecasting competitions.	– Makridakis, S. G., Wheelwright, S. C., & Hyndman, R. J. (1998). *Forecasting: Methods and Applications* (3rd ed.). New York: John Wiley & Sons. – Armstrong, J. S. (2001). *Principles of Forecasting: A Handbook for Researchers and Practitioners* (Section 8: "Extrapolation of time-series and cross-sectional data"). Boston, MA: Kluwer Academic. – Gardner, E. S. (1985). "Exponential Smoothing: the State of the Art," *Journal of Forecasting*, 4(1), 1-28. – Wikipedia. "Exponential Smoothing." from *http://en.wikipedia.org/wiki/Exponential_smoothing*
Autoregressive moving average (ARMA) Box-Jenkins	An even more complex class of moving average models, capable of reflecting autocorrelations inherent in data. It can outperform exponential smoothing when the historical data period is long and data are non-volatile. But it doesn't perform as well when the data are statistically "messy."	– Makridakis, S. G., Wheelwright, S. C., & Hyndman, R. J. (1998). *Forecasting: Methods and Applications* (3rd ed.). New York: John Wiley & Sons. – Wikipedia. "Autoregressive Moving Average Model."from h*ttp://en.wikipedia.org/wiki/Autoregressive_moving_average_model* – Teräsvirta (1994) – http://www.duke.edu/~rnau/411arim.htm
Autoregressive integrated moving average (ARIMA)	ARIMA models are, in theory, the most general class of models for forecasting a time series which can be stationarized by transformations such as differencing and logging. In fact, the easiest way to think of ARIMA models is as fine-tuned versions of random-walk and random-trend models. They are applied in some cases where data show evidence of non-stationarity, where an initial differencing step (corresponding to the "integrated" part of the model) can be applied to remove the non-stationarity. ARIMA models form an important part of the Box-Jenkins approach to time-series modelling.	– *-http://en.wikipedia.org/wiki/Autoregressive_integrated_moving_average* – Tong (1983) – Tong and Lim (1980) – Teräsvirta (1994) – http://www.duke.edu/~rnau/411arim.htm – http://en.wikipedia.org/wiki/Autoregressive_integrated_moving_average
Explanatory variable methods		
Regression analysis	Fitting a curve to historical data using a formula based on independent variables (explanatory variables) and an error term. Although these methods are relatively simple, and are helpful both in analyzing patterns of historical data and for correlation analysis, they are not generally recommended for forecasting. They have performed poorly in	– Venables and Ripley (2002) – Makridakis, S. G., Wheelwright, S. C., & Hyndman, R. J. (1998). *Forecasting: Methods and Applications* (3rd ed.). New York: John Wiley & Sons. – Sykes, A. O. "An introduction to Regression Analysis."from *http://www.law.uchicago.edu/Lawecon/WkngPprs_01-25/20. Sykes.Regression.pdf* – Wikipedia. "Regression Analysis."from

	forecasting competitions.	*http://en.wikipedia.org/wiki/Regression_analysis*
Predictive modelling	An area of statistical analysis and data mining, that deals with extracting information from data and using it to predict future behaviour patterns or other results. A predictive model is made up of a number of predictors, variables that are likely to influence future behaviour.	– Cousins, M., & Stark, J. W. C. (2003). "A Predictive Modeling Primer." Paper presented at the Annual Meeting, Orlando. – Cumming, B., et al. (2002). "Predictive Modeling." Paper presented at the Health Spring Meeting, San Francisco. – Senensky, B. (2008). "Predictive Modeling." *CompAct* (SOA Technology Section newsletter), July 2008.
Artificial neural networks	An artificial neural network is a mathematical model or a computational model. That is inspired by the structure and/or functional aspects of biological neural networks. In most cases an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase. Modern neural networks are non-linear statistical data modelling tools. They are usually used to model complex relationships between inputs and outputs or to find patterns in data.	– Makridakis, S. G., Wheelwright, S. C., & Hyndman, R. J. (1998). *Forecasting: Methods and Applications* (3rd ed.). New York: John Wiley & Sons. – Armstrong, J. S. (2001). *Principles of Forecasting: A Handbook for Researchers and Practitioners* (Section 8: "Neural Networks for Time-SeriesForecasting"). Boston, MA: Kluwer Academic. – Shapiro, A. F., Pflumm, J. S., & DeFilippo, T. A. (1999). "The Inner Workings of Neural Networks and Genetic Algorithms." *Actuarial Research Clearing House,* 1, 415-426. – Wikipedia. "Artificial Neural Network."from *http://en.wikipedia.org/wiki/Artificial_neural_network*
Econometric modelling	Systems of simultaneous equations to represent economic relationships.	– Armstrong, J. S. (2001). *Principles of Forecasting: A Handbook for Researchers and Practitioners* (Section 11: "Econometric Forecasting"). Boston, MA: Kluwer Academic. – Wikipedia. "Econometrics."from *http://en.wikipedia.org/wiki/Econometrics*
Simulation modelling Methods		
Multi-agent simulation	A computer representation that employs multiple interacting agents and behavioural rules to mimic the behaviour of a real system. This method is especially useful for modelling complex adaptive systems.	– Epstein, J. M., Axtell, R., & 2050 Project. (1996). *Growing Artificial Societies: Social Science from the Bottom Up.* Washington, D.C.: BrookingsInstitution Press. – Gilbert, G. N. (2008). "Agent-Based Models." Los Angeles: Sage Publications. – Wikipedia. "Agent-Based Model."from http://en.wikipedia.org/wiki/Agent-based_model – Dai et al. (2010)
Judgmental methods	These methods rely on expertise and intuition, rather than on statistical analysis of historical data. Such methods are particularly useful when historical data is scarce. Many of the methods of "futurism"—such as the Delphi method, visioning and scenario building—fall under this category.	– Makridakis, S. G., Wheelwright, S. C., & Hyndman, R. J. (1998). *Forecasting: Methods and Applications* (3rd ed.). New York: John Wiley & Sons. – Adler, M., & Ziglio, E. (1996). *Gazing Into the Oracle: the Delphi Method and Its Application to Social Policy and Public Health.* London: Jessica Kingsley Publishers. – Lawrence, M., Goodwin, P., O'Connor, M., & Onkal, D. (2006). "Judgemental Forecasting: A Review of Progress Over the Last 25 Years."*International Journal of Forecasting*, 22, 493-518. – Surowiecki, J. (2004). *The Wisdom of Crowds: Why the Many are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies,* – *Societies, and Nations* (1st ed.). New York: Doubleday
Composite methods		
Bayesian forecasting	This family of methods combines statistical methodology with structured integration of human judgment: new evidence is used to	– Geweke, J., & Whiteman, C. (2004). "Bayesian Forecasting" in *The Handbook of Economics Forecasting*. from *http://www.biz.uiowa.edu/faculty/cwhiteman/bayesianforecasting.pdf*

	update a statistical forecast, based on application of Bayes' theorem. These methods are good for highly seasonal data with short history.	
New models		
Error correction model (ECM)	The ECM approach differs from the conventional one by eliminating prior restrictions on the lag structure of the model. It determines them according to direct information from economic data, thus, estimating the models after the variables have been rearranged to reflect current economic theories.	– Tochukwu and Festus (2007) – http://en.wikipedia.org/wiki/Error_correction_model
Support vector machine (SVM) and Structural vector autoregressive model (SVAR)	SVM represent a novel neural network technique, which has gained ground in classification, forecasting and regression analysis. One of its key properties is that training SVM is equivalent to solving a linearly constrained quadratic programming problem. Therefore, unlike other networks' training techniques, SVM circumvent the problem of getting stuck at local minima. Another advantage of SVM is that the solution to the optimization problem depends only on a subset of the training data points, which are referred to as the support vectors. The main strength of the SVAR methodology is that one does not have to impose a fully specified theoretical structure and the data are allowed to speak. The only assumptions are that the variable of interest can be decomposed into one or more permanent components and one or more transitory components, and that the transitory shocks are uncorrelated with the permanent shocks. However, the SVAR methodology has its own weakness. Notably, the results are often sensitive to the choice of variables included in the estimation. Also, results can be affected by the number of lags chosen in the reduced form, assumptions on the order of integration of variables, and the presence of co-integrating relationships among variables.	– Chang and Lin (2005), – Teräsvirta (1994) – http://en.wikipedia.org/wiki/Support_vector_machine
Treshold autoregressive model (TAR)	This nonlinear time series model was proposed as an alternative model for describing periodic time series. The model has certain features, such as limit cycles, amplitude dependent frequencies, and jump phenomena, which cannot be captured by a linear time series model. Reason that this model is not often used is the fact that it is such an complex model.	– Venables and Ripley (2002) – Tong (1983) – Teräsvirta (1994) – http://en.wikipedia.org/wiki/SETAR_(model)
Smooth transaction	Special type of nonlinear model. The STAR model nests a linear	– Venables and Ripley (2002)

autoregressive model (STAR)	autoregressive model, and the extra parameters give the model added flexibility, which may be useful in econometric modelling and forecasting. The STAR model is a tool for understanding and, perhaps, predicting future values in this series, assuming that the behaviour of the series changes depending on the value of the transition variable. The transition might depend on the past values of the x series, or exogenous variables.	– Teräsvirta and Anderson (1992) – Teräsvirta (1994) – http://en.wikipedia.org/wiki/SETAR_(model)
Support vector regression (SVR)	Support vector regression is an artificial intelligent forecasting tool based on statistical learning theory and structural risk minimization principle. It has been applied in different kinds of numerical value forecasting problem.	– Venables and Ripley (2002) – Chang and Lin (2005) – http://en.wikipedia.org/wiki/Support_vector_machine

Appendix 3: The four forecasting models discussed extensively

Wheat forecasting models

Wheat is a commodity which is affecting a large amount of people, as wheat is part of the diet of many people and is used as feed for livestock. Price increases can harm many citizens (http://www.wfp.org Dec.2010). In chapter 3 part 3.1 the different purposes of wheat have been discussed.

The most common used models for forecasting wheat prices are based on supply and demand. In most models the previous price development are taken in account just as the amount of wheat produced. Next to these factors the inventory is playing an important role, when there is no inventory the possibility of scarcity grows, scarcity will affect directly the prices and can lead to an increasing prices. This is based on the principal of scarcity explained by Lionel Robbins (1932). When forecasting wheat, it is necessary to be aware of the fact that wheat prices can be influenced by the prices of other commodities. These exogenous factors which can influence the prices of the wheat are very important in this research. Possibly a problem of the forecasting models is that exogenous factors are influencing prices but are not taken in account in the forecasting models.

The discussion on what possible influencing factor are or can be will be hold in chapter 5. In this part we focus only on the existing model and look which variables are taken in account as yet. The OECD and the FAPRI use both ARMA models which are completed with macro economic assumptions, technological progress and various elasticity's, this makes the model difficult to use as a basis for our research, because much data is required for using these models (information which could be not achievable during this project). In the research of Holst (2010), the models used by FAPRI and OECD are compared with an autoregressive model. These predictions tend to show not much difference than those made by the two large predicting organizations. Because this model is more simplified and easier to adapt, this autoregressive model presented by Holst (2010) is going to be used as basis for the wheat forecasting.

A simple econometric model is used which takes the previous wheat price development, the stocks-to-use-ratio and the crude oil prices into account. The model is based on the prediction of wheat prices for the last 10 years. The time range of 10 years is chosen because it is long enough to adjust to the variations in the average yields per hectare due to weather effects and it is not biased by higher rates of technological progress during the decades before. The wheat price x in period t is given as functions of the following determinants:

$$X_t = \delta + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \alpha_3 stur_t + \alpha_4 cop_t + \mu_t$$

$X_t = average\ wheat\ price\ in\ period\ t$
$stur_t = stocks - to - use - ratio\ at\ the\ end\ of\ period\ t$
$cop_t = average\ crude\ oil\ price\ in\ period\ t$
$\delta, \alpha_1, \alpha_2, \alpha_3, \alpha_4 = coefficients$
$\mu_t = error\ term\ in\ period\ t$

The prediction of the wheat price development is based on the estimated coefficients of this model. These coefficients are subtracted from all available information about these variables in period t. This

information can be found in the data base of of the OECD or the FAPRI. The forecast is calculated step by step. For that reason the wheat price prediction for the year after generating this forecast can be calculated as follows:

$$\hat{x}_t + 1 = \delta + \alpha_1 x_t + \alpha_2 x_{t-1} + \alpha_3 \widehat{stur}_{t+1} + \alpha_4 \widehat{cop}_{t+1}$$

$\hat{x}_t + 1 = predicted\ average\ wheat\ price\ in\ period\ t + 1$
$\widehat{stur}_{t+1} = predicted\ stock - to - use - ratio\ at\ the\ end\ of\ period\ t + 1$
$\widehat{cop}_{t+1} = predicted\ average\ crude\ oil\ price\ in\ period\ t + 1$

The predicted wheat price for period t + 1 is then needed for generating the price forecast for period t + 2 and so on. In addition to the autoregressive model separate forecasts for the development of the stocks-to-use-ratio and crude oil price are necessary. Thus, the stocks-to-use-ratio at the end of a market year in period t is defined as a function of the ending stocks in the previous period t – 1 and the world production and consumption in the current period.

$$stur_t = f(ending\ stocks_{t-1}, production_t, consumption_t)$$

Forecasting the stocks-to-use-ratio involves predicting the world wheat production and consumption in the future. The value of production again is the product of the world wheat acreage and the yield per hectare and can be calculated based on forecasts of these factors:

$$production_t = f(acreage_t, yield_t)$$

It can be shown that the wheat acreage depends on the wheat acreage and the wheat price of the previous period.

$$acreage_t = f(acreage_{t-1}, wheat\ price_{t-1})$$

Farmers are not changing their overall acreage very much from one year to the next. Consequently, the wheat acreage should be nearly constant over time, even though certain price developments in the months before planting can influence the farmer's decision about decreasing or increasing the wheat acreage in favor or in account for other crops. The yield per hectare in turn is predicted by extrapolating the linear trend of the last 10 values before generating the prediction.

$$yield_t = f(yield_{t-1}, \dots, yield_{t-10})$$

The values of the world wheat consumption are predicted as well by the method of linear trend extrapolation accounting for the last 10 years.

$$consumption_t = f(consumption_{t-1}, \dots, consumption_{t-10})$$

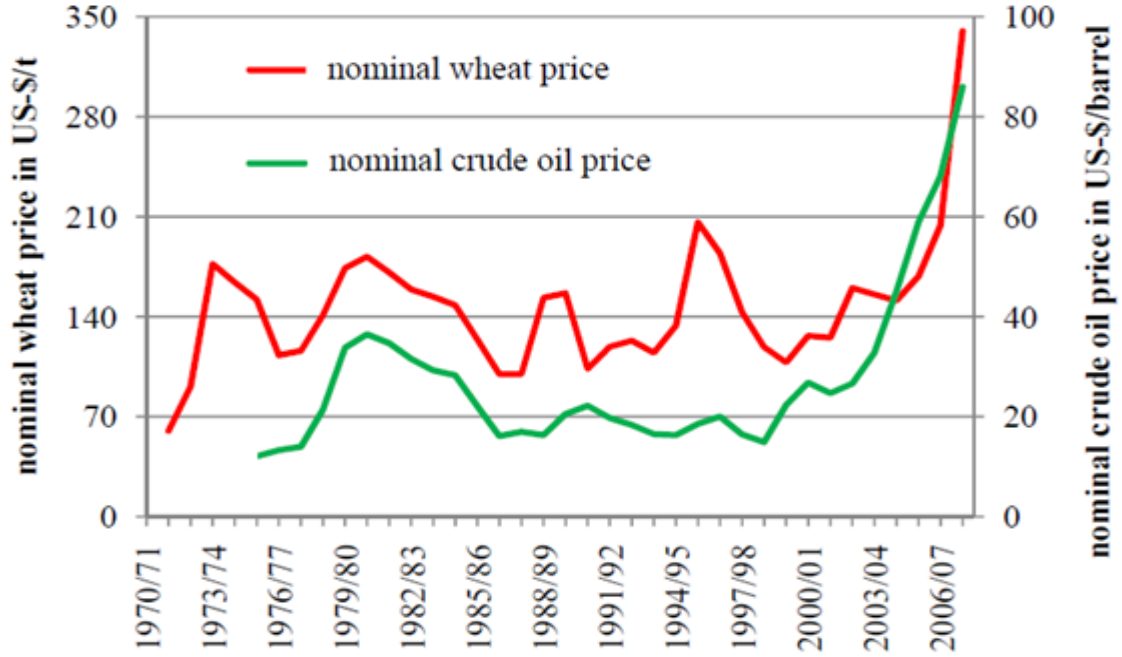
As mentioned in chapter 3 in part 3.1, the world wheat consumption shows an increasing trend which slows down over time. Hence, using data from more than the last 10 years can influence the

accuracy of the world wheat consumption forecast negatively. Altogether predictions of the development of the stocks-to-use-ratio can be calculated in this way, which is necessary for the wheat price forecasts. Finally, the method of projecting the crude oil prices must also be determined. Nevertheless, there is no common way to solve this problem since predicting crude oil prices might be more difficult than forecasting wheat prices. It is not necessary to use another method; the trend extrapolation can be transferred also to the crude oil price prediction

$$crude\ oil\ price_t = f(crude\ oil\ price_{t-1}, \dots, crude\ oil\ price_{t-10})$$

This model is a relatively simple model which consists of the average prices of the previous period as a basis. These prices are adapted to changes in the inventory (stock-to-use-ratio) which are depending on the consumption and production (supply and demand). These numbers have to be calculated which is done with the use of data of FAPRI, OECD or WTO. Using these numbers will make sure the same data are used as these organizations have done while making their forecast. The use of similar data makes it possible to compare the different models. In this model there is one exogenous variable which is affecting the prices; this is the 'crude oil price'. Reason for this factor to be taken in account in this model is the fact that there are publications which argue that the price of oil is affecting the price of wheat (Brümer et al. 2008). Figure 24 is showing the gradient of the nominal prices of wheat and oil. It is interesting to see that the wheat prices follow often the curve of the oil prices. One of the reasons for this is the fact that increasing oil leads to higher transportation cost which are affecting the wheat prices, how wheat prices are build up have been discussed in chapter 3. However this variable is dangerous, the wheat prices followed the oil prices during the last price peak, but looking back to more historical data have shown that wheat prices have not always been following the oil prices.
The reason of using this model is in the first place the argument of the data availability; a second argument is the simplicity of the model of Holst (2010). Adding new variables which could possibly affect the wheat prices is possible.

Figure 24: Nominal wheat and crude oil price



Source: (Carsten Holst 2010) based on BP (2008) and OECD (2008)

Gold forecasting models

Looking to the literature, different forecasting models are found for the gold price predictions. There are a number of price forecasting models that have been discussed in literature. Some of these models are "The geometric Brownian motion and mean reversion are two classical approaches which form the basis for some newer methods, such as stochastic price forecasting and mean reverting jump diffusion models. These models focus on historical price movements and a random term to estimate future prices. They do not consider price jumps or dips in the models. The mean reverting jump diffusion model seeks to introduce a number of jumps per period in the model" (Shafiee and Topal 2010, pg 5).

The major problem with most of these models is that they were introduced specifically for the stock market, and thus initially applied primarily to forecast share prices or interest rate. None of the models used unit root test for time series data and econometrics methods to estimate their parameters (Shafiee and Topal 2007). According to microeconomics theories, in the long- term, the price of a commodity should be tied to its long-term marginal production cost (Dias and Rocha 2001). In other words, commodity prices have random short-term fluctuations, but they tend to revert to a long-term trend. As discussed earlier in this chapter trends are seen in the long term and fluctuations more in the short term. Taking these different time periods in mind is essential for a good forecast.

Another model which is known is proposed by Shafiee and Topal (2010) "it adds two dummy variables in the long-trend reverting model as jump and dip. These two variables distinguish long-term trend between normal period with jump and dip period. In analyzing the historical trend of gold prices in the previous section, gold prices have different jump and dip sizes, which should be considered when predicting. The jump and dip forecasting is based on an extrapolation of the historical sinusoidal trend and not statistical probabilities jump and dip".

With this model they try to take in account the dips and the jumps which are seen in the historical data from the gold prices. However, this model does not give us the possibility to take exogenous factors in account which could possibly affect the prices as well. Due to the fact that this model is not adaptable for these possible new variables, the model will not be used. However the new elements which are added in this model, 'the dip and jump' can be taken in account in chapter 7, when analyzing the factors and the models.

It became clear from the literature that presently the most common used model is the ARIMA model. This model is used to predict the future price based on historical data. The ARIMA model which we will use is the model proposed by Selvanathan (1991). This ARIMA model is not taking in account exogenous variables which could possibly affect the prices of gold. The fact that the ARIMA model is not taking in account exogenous factors makes it less useable for our research. Nevertheless it provides us more possibilities than other models, and especially in combination with the use of an multiple regression it can be the basis for the following chapters.

The ARIMA model is built up in the following form;

$$DGP_t = \alpha + \beta \times DGP_{t-1} + \mu_t$$

$$DGP_t = daily\ gold\ price$$

$$\mu_t = white\ noise$$

$$t = sample\ size$$

When looking at this model it becomes clear that the price prediction is based on the price in the previous period (t-1), which will be accomplished with an α and an β which stand for the affecting factor which will influence the price. Finally the model is completed with the white noise, An unpredictable time series is called white noise. This is added to the model to calculate possible unpredictability's in the historical data.

The problem with the forecasting of gold is the fact that many models are used, each model has his stronger and weaker points. Important for our research is the search for the exogenous variables which are used. In the models which are currently much used the forecast is based on the price of the previous period. Affecting factors are not specifically taken in account. The white noise is taken in account to correct the model for possible unpredictability's in the historical prices.

In the publication Khaemasunun (2006) the ARIMA model is complemented with an multiple regression model which aims to find factors which affect the gold price. To answer the question whether a factor is influencing the price or not, a simple linear regression is used. The goal is to find what the exact effect is of a certain factor in a certain period of time, e.g. an increase of the US dollar currency lead to a decrease of the price of gold with an certain factor.

As stated earlier the model can be adapted with possible influencing factors, which can be found with the use of a multiple regression with simple linear regression methods. These factors can affect the movement of gold prices in an economy. Known and used affecting factors discussed in the article of Khaemasunun (2006) are;

- currency exchange (import and export function theory

- oil price (inflation theory)
- Interest rates (portfolio theory)
- Gold derivatives (demand and supply theory)

The choice of using this model is based on the fact that the data used are available and the fact that the model can be adapted. The white noise can be caused by exogenous effects in the past. However the possibility of adding effects which are calculated with the help of a regression analysis gives us the possibility to add new variables which could have an affecting effect on the prices in the future. Other models use an estimation on the drop and dips periods, this means that these models are looking to historical data to correct the price predictions. We want a model which gives us the possibility of adding data for the future.

By using the (more or less simplistic) ARIMA model we have a prediction based on the historical data. By adding effects of possible influencing variables calculated with a regression analysis data can be added which predicts exogenous variables in the future.

Oil forecasting models

The forecasting models for crude oil are mostly not related to one country but to OECD region or non-OECD regions or OPEC and non-OPEC countries (discussed in chapter 3 part 3.3). The OECD provides a forum in which governments can work together to share experiences and seek solutions to common problems. “We work with governments to understand what drives economic, social and environmental change” (http://www.oecd.org Jan. 2011). The OECD consists of a number of countries which are member of this organization. Important fact is that most of the countries which are member of the OECD are political and economically relatively stable countries.

Reason that we will use a forecasting model which is focusing on OECD countries is the fact that the higher degree of stability makes it reasonable to use a forecasting model. If a country is suffering much corruption and political instability the price shocks are unpredictable and a model would not be very useful, as well as the historical numbers. Much of the data from the OPEC countries are not available (or less reliable), which makes it difficult to use those data and find patterns which can be added to the model. The fact that we are looking especially to the situation of the United States would make us think that using a model of the OPEC countries (which are the major supplier of the United States) would be logic. However data availability is very important in this research, which means that a model will be used which is provided by the OECD (and the fact that the United States are member of the OECD). In the distinction between OPEC and OECD there are in both groups stable and less stable countries. However in the OECD most of the members are stable, this is based on the knowledge of http://www.scdigest.com/assets/Reps/2010_PE_Risk_Map.pdf (Jan. 2010).

Basis for the different models which are known is again the demand and supply. A pattern is known in the oil inventory which shows an increase in the summer period, in which supply exceeds demand and a decrease of the inventory during the winter months in which demand is exceeding supply. Oil is a commodity which is not used in same quantities during the whole year.

The most common used models are econometric forecasting models. The model which will be presented below and which will serve as the basis for the rest of the research on oil forecasting is a;

short-term monthly forecasting model for West Texas intermediate crude oil spot price using Organization for Economic Cooperation and Development (OECD) petroleum inventory levels. A short term model is used due to the fact that oil is affected by many exogenous variables and is difficult to find trends. However seasonality's are seen back as stated earlier. Reason why the inventory level of the OECD is used has been discussed.

The model is extracted from Ye et al. (2001), but which is again explained in a slightly different way in 2004 by Zamani.

As said previously the model is based on supply and demand, which is translated in inventory. This basis is calculated with the following model;

$$Demand_t = production_t - inventory\ change_t$$

Because inventory change is calculated as follow,

$$inventory\ change_t = inventory_t - inventory_{t-1}$$
Means that,

$$inventory_t = inventory_{t-1} - (demand_t - production_t)$$

In this model the assumption is made that is a relationship between price and the supply and demand fundamentals. The relative inventory is an explicit measure of the balance between production and demand. This means that this relative inventory is a useful variable to indicate the state of the supply-demand balance as its impacts price. The relative inventory is denoted as RIN and is defined as follow;

$$RIN_t = IN_t - IN_t^*$$

$$IN_t = the\ actual\ total\ OECD\ petroleum\ inventory\ level$$
$$IN_t^* = is\ the\ normal\ or\ desired\ inventory\ level$$

In order to calculate the normal or desired inventory level the formula below is used;

$$IN_t^* = a_0 + b_1 t + \sum_{k=2}^{12} b_k D_k$$

In which a_0, b_1, b_k , k = 2,..., 12 are estimated coefficients from de-trending and de-seasonalizing the observed total OECD petroleum inventory.

These values calculated up to now are the value which will form the basis for the forecasting model. This is as stated earlier the demand and supply which is seen back in the inventory. The forecast model is will be presented below;

$$WTI_t = a + \sum_{i=0}^{5} b_i \, RIN_{t-i} + \sum_{i=0}^{5} c_i \, LIN_{t-i} + dAIN_t + eWTI_{t-1} + \varepsilon_t$$

This model is composed of different variables which are affecting the prices of oil.

$WTI_t = the\ nominal\ West\ Texas\ Intermediate\ crude\ oil\ spot\ price$

$t = stands\ for\ the\ t\ th\ month$

$i = is\ for\ the\ ith\ month\ prior\ to\ the\ tth\ month$

$a, b_i, b_i, d, e = 0,1,2 \ldots,5, are\ the\ coefficients\ to\ be\ estimated$

$RIN = the\ relative\ OECD\ inventory\ level$

$LIN = a\ low\ inventory\ variable$

LIN is defined to capture the asymmetric market behavior characterized by a different price response to inventory changes when the inventory level is below the desired normal level than when the inventory level is above normal, which is:

$LIN_t = RIN, if\ IN_t < IN_t^*\ and\ LIN_t = 0\ otherwise$:

AIN is defined as the annual differences in monthly inventory to reflect cyclical market behavior not captured by the monthly seasonal variables in the de-trending and de-seasonalizing estimation, that is:

$AIN_t = IN_t - IN_{t-12}$

And ε is the random term.

This model exists of different parts which are influencing the price of oil. This model is useable for this research, due to the fact that new (exogenous) factors can be added if necessary. At the moment the exogenous factors are not much represented in the model, however a regression is used to define the average prices and inventory. Changes in demand and supply are in this way taken in account. Exogenous factors which affected the prices are taken in consideration. Nevertheless new exogenous factors which could affect prices in the future cannot be taken in consideration with the help of this model, as these effects are not seen in the historical data. Reason for using this model is the fact that only the OECD countries are captured in the model. By using only these data it means that we will miss the data from a few important producing countries. However by using only the OECD countries the data availability can be guaranteed. The instability in some Non-OECD countries would lead to incorrect data which can affect the forecasts and lead to less accuracy for the final results.

Coffee forecasting models

The last model which will be discussed is the coffee forecasting model. Coffee is a product which is not produced in the United States as we saw in chapter 3, although the United States is the largest consumer and importer of coffee. As we discussed in chapter 3 part 3.4 coffee is very important for many developing countries which produce it. Often a large part of their GDP is based on and depending on the coffee production and export. The trend we have seen the last decade is the increasing popularity of fair trade. Most of the import is going to developed countries with higher GDP per person. The trend of the last years is the increased awareness for corporate social responsibility and sustainability. This gave fair trade the space and the possibility to enter the coffee market and take a position in this market in which they aim to achieve fair prices for the coffee farmers. However by taking in this position and increasing their influences they are affecting the trade market. By setting the prices (in order to guarantee a fair price) the market working is harmed and not working idealistic anymore. This is a new issue which has not yet been taken in account in the price forecasting models.

The model which will be used in this research as a basis is a vector error correction model used in the publications of J. Otero and C. Millas (1998) and in Millas et al. (2004). Reason that a VECM model is used is based on a research of C. Brownan and A. Husain (2004) in which different models have been tested for different commodities. Three types of forecasts are considered: (1) judgmental forecasts, or those based on quantitative and qualitative analysis of a variety of factors—including, possibly, analysis of supply and demand fundamentals—thought to determine the price of the commodity in question; (2) forecasts based on statistical models relying exclusively on historical price information; and (3) forecasts based on models that purport to systematically incorporate all available information—as captured by commodity futures prices—at the time of the forecast, together with historical price data.
The models used in to test the three types of forecasts are a unit root model with trend and drift. An auto regressive process, an ARMA model and an ECM model. According the research of C. Brownan and A. Husain for coffee the ECM model was most suitable. When looking to the different publications on the forecasting of coffee the VECM model presented by Johansen's (1988, 1995) is used in most of the publications.

This model takes the different types of coffee in account which is very useful because these different types of coffee do have a substitution effect on each other. Using one type of coffee means that you are not using another type. In chapter 3 part 3.4.1 the different types of coffee have been discussed. This model is a long term price prediction model.

The model uses P = 4 endogenous variables, Y = [P^{UA}, P^{OM}, P^{ROB}, P^{COL}], where P^{UA}, P^{OM}, P^{ROB} and P^{COL} refer to the spot price of unwashed Arabic, Other Milds, Robusta and Columbian coffees in the New York market, respectively. In the model used in the publications of Milas et al. (2004) data are used from 1962 up to 1998. This is done to make the trends in the price clear and get a better and more trustful comparison. The prices in these publications are subtracted from the International Coffee Organization (ICO). Data used in chapter 3 were also subtracted from the ICO.

The P-dimensional Vector Error Correction Model demonstrated by Johansen's is as follow;

$$\Delta Y_t = \sum_{i=1}^{K-1} \Gamma_i \, \Delta Y_{t-i} + \prod Y_{t-1} + \mu + \varepsilon_t$$

t = 1,…..,t

Where Δ is the first difference operator, Y_t is the set of variables, the four different types of coffee. $\varepsilon_t \sim n.i.i.d\ (0, \Sigma)$, μ is a drift parameter. Π is a (p*p) matrix of the form Π = α β', where α and β are (P*R) matrices of full rank, with β containing vectors and α carrying the corresponding loadings in each of the R vectors.

This model is taking in account the differences between the four types of coffee. This is necessary as the quality is not similar. Preliminary analysis of the data using the Augmented Dickey-Fuller (ADF) test suggested that all series are I (1) without drift when considered in levels. Applying the Johansen (1988, 1995) cointegrating approach to find the number of cointegrating vectors and using a lag length of k = 4 in the linear VAR.

Reason for using this model is the fact that the research done by C. Brownan and A. Husain (2004) in which the different models for coffee price forecasting have resulted in an advice to use VECM model. Next to this important argument also the differentiation between the different types of coffee which is used in this model is important. However the model is not making use of exogenous factors which could affect the prices.

Appendix 4: discussion of different authors on the influence of commercials and non-commercials.

Table 19: Authors with an view which is pro the existence of influence of the commercials and non-commercials on the commodity prices and the creation of bubbles

Authors	Opinion and explanation
US Senate's Permanent Subcommittee on Investigations, 2009	Speculation in wheat futures by commodity index traders, who control billions of dollars worth of contracts, is ruining the price-hedging system used by the farm sector and could translate into higher prices for food manufacturers and consumers. This investigation is based on information of USDP.
Masters, M.W., Masters Capital Management, LLC, Testimony, June 2008	You have asked the question "Are Institutional Investors contributing to food price inflation?" And my unequivocal answer is "Yes". Institutional Investors are one of, if not the primary, factors affecting commodities prices today.
Masters 2008; Masters and White, 2008	It is commonly asserted that speculative buying by index funds in commodity futures and over-the- counter (OTC) derivatives markets has created a "bubble," with the result that commodity prices, and crude oil prices, in particular, far exceed fundamental values (e.g., Masters 2008; Masters and White, 2008). The main thrust of bubble arguments is that: 1) a large amount of speculative money has been invested in different types of commodity derivatives over the last several years, and 2) this 'titanic' wave of money resulted in significant and unwarranted upward pressure on commodity prices.
Sanders and Irwin, 2009	Increase in speculative money and investment by long only commodity index funds into agricultural futures markets has caused increased market volatility; distorted historical price relationships and fuelled more rapid increases and decreases in commodity inflation.
Robles et al., 2009	Speculators have an undesirable and somewhat unexplainable impact on market prices. "Changes in supply and demand fundamentals cannot fully explain the recent drastic increase in food prices".
Wahl, 2008	Food speculation was the main factor of the price bubble in 2008.
Agricultural and Food Policy Center (2008, p.32)	Declares that the "…large influx of money into the markets, typically long positions, has pushed commodities to extremely high levels" and also shows a graphical depiction of investment funds in the S&P GSCI Index.
Childs and Kiawu (2009, p.1)	Report that "the primary cause of the rise in prices for these commodities from 2006-2008 was rising global incomes, dietary changes, increased use of biofuels, tight grain supplies, and increased participation in futures markets by non traditional investors".
Tang and Xiong (2010)	Do not test for bubbles in commodity futures prices. Instead, they begin by arguing that commodity markets were not fully integrated with financial markets prior to the development of commodity index investments and that the "…increasing presence of index investors in commodities markets precipitated a fundamental process of financialization amongst the commodities markets, through which commodity prices now become exposed to shocks to financial markets and to other commodities." (p. 2) Statistical tests confirm that the correlation of commodity futures returns (as measured by the S&P GSCI Index™) with stock, bond, and dollar returns increased significantly starting in 2004.
Aulerich, Irwin, and	Conduct a comprehensive time-series test of the impact of index fund trading in commodity futures markets. Studies such as those by Stoll

Garcia (2010)	and Whaley (2009) and Sanders and Irwin (2010b) are based on CIT data from the CFTC that is available only on a weekly basis and aggregated across all contracts. These two will be seen in the next table with the arguments against the influence of commercials and non-commercials. Using these data may limit the power of statistical tests because positions cannot be tracked over higher frequency daily intervals, changes in prices and positions cannot be matched precisely to contract maturity months, and aggregate positions mask very large changes in positions for specific contracts during the roll period of index funds. Daily positions of index traders in 12 commodity futures markets over January 2004-July 2008 period are drawn from the internal large trader reporting system used by the CFTC. Index trader positions are disaggregated by contract maturity. Over 1,100 daily observations are available for analysis in each of the 12 markets. The only other comparable study is Buyuksahin and Harris (2009), who use data from the CFTC's large trader database to test the relationship between positions of various trader groups and price changes in the crude oil futures market. Several Granger causality-type tests are performed by Aulerich, Irwin, and Garcia on nearby and first deferred contracts separately and for the 2004-2005 and 2006-2008 periods. There is no evidence that index positions (net long CIT contracts or net long CIT contracts/Total long market open interest) had a greater impact on returns during 2004-2005, when their positions were growing most rapidly. A total of 31 out of 192 estimated cumulative impacts (16%) are statistically significant, barely more than what one would expect based on randomness. The signs of the relatively few significant coefficients are as likely to be negative as positive and the magnitudes of the economic effects are very small. These test results provide negligible evidence that index traders impact commodity future returns. Some evidence is found that price volatility has been influenced by the presence of index traders in several markets, but only using one of the measures of index position changes. These effects appear to be small in economic magnitude, except in several traditionally less liquid markets.
Kilian and Murphy (2010)	Develop a structural VAR (vector auto regression) model of the global market for crude oil that explicitly allows for shocks to the speculative demand for crude oil as well as shocks to the flow demand and flow supply. Their median estimate of the short run price elasticity of demand for crude oil is -0.41, about seven times higher than typical conjectures in the recent literature. In a related fashion, their median estimate of the short-run price elasticity of demand for gasoline is -0.20, several times higher than previous estimates. This leads Kilian and Murphy to reject Hamilton's second theoretical requirement for a speculative impact in crude oil (zero or near-zero short-run price elasticity). The model estimates also imply that the surge in crude oil prices over 2003-2008 was caused by fluctuations in the flow demand for oil driven by the global business cycle. As with all structural modeling exercises, Kilian and Murphy's structural VAR model depends on a fairly lengthy list of identifying restrictions. The impact of these restrictions on elasticity estimates will undoubtedly be the subject of further research.
the Global Food Markets Group HM Government (The 2007/08 Agricultural Price Spikes: Causes and Policy Implications)	• That speculators may have caused a bubble in futures markets with prices overshooting at the top of the spikes. • That speculators, specifically index funds have caused a more general financialisation of commodity markets (correlation between the movement of prices of different asset classes) and in particular that a wall of money hit agricultural commodity markets, contributing to the price spike • That in addition, index funds have distorted futures markets so that when futures contracts expire, convergence of futures and spot prices is disrupted. • That speculators/index funds have increased volatility in the market, so increasing the costs for hedgers wishing to manage their price risk; and/or

	• That speculation in oil futures markets may have driven oil prices higher, and as a result of the impact of energy prices on arable costs of production and international freight rates, driven agricultural prices higher.

Table 20: Authors with a view which is against the existence of influence of the commercials and non-commercials on the commodity prices and the creation of bubbles

Authors	**Opinion and explanation**
Krugman, 2008	States that there is a lack of empirical evidence of the bubble theory. And asserts, if a bubble raises the market price of a storable commodity above the true equilibrium price, then stocks of that commodity should increase (much like a government imposed price floor can create a surplus). Stocks were declining, not building, in most commodity markets over 2006-2008, which is inconsistent with the depiction of a price bubble in these markets.
Gilbert, 2009	Speculation does not appear directly to be the main cause of price (oil and metals) movements over the recent boom. There does not appear to be any strong evidence for extrapolative expectations or for bubble behaviour. Index-based investment appears more likely to be the major culprit.
Stoll and Whaley, 2009	"Commodity index investing is not speculation; inflows and outflows from commodity index investment do not cause futures prices to change".
Hamilton (2009)	"It is hard to deny that the price rose too high in July 2008, and that this miscalculation was influenced in part by the flow of investment dollars into commodity futures contracts. It is worth emphasizing, however, that the two key ingredients needed to make such a story coherent—a low price elasticity of demand and the failure of physical production to increases—are the same key elements of a fundamentals-based explanation of the same phenomenon. I therefore conclude that these two factors, rather than speculation per se, should be construed as the primary cause of the oil shock of 2007-08".
Einloth (2009)	Devises a test of bubbles based on the joint behaviour of convenience yields and prices in a storable commodity futures market. Convenience yield is the flow of benefits that accrue to inventory holders from having stocks of the commodity on hand the basic theory of storage predicts that low inventories lead to a rising commodity price and an increasing marginal convenience yield. So, the combination of a falling marginal convenience yield and a rising futures price is a violation of this theory. Einloth uses this condition as a test for speculative impact in crude oil futures markets. He finds that marginal convenience yields (derived from spreads between futures prices) rose for most of the increase in crude oil futures prices up to $100/barrel, but fell as crude oil increased from about $100 to $140/barrel. While this indicates that speculation may have played a role near the peak in crude oil prices the technique cannot attribute this to a particular group of market participants, such as index funds. There is no doubt that Einloth is correct in arguing that the basic theory of storable commodity markets rules out the combination of falling marginal convenience yield and rising futures prices.
Irwin, Sanders, and Merrin (2009) summarize the counter arguments of Krugman, 2008; Pirrong, 2008; Sanders and Irwin,	**The first** possible logical inconsistency within the bubble argument is equating money inflows to commodity futures markets with demand. With equally informed market participants, there is no limit to the number of futures contracts that can be created at a given price level. Index fund buying in this situation is no more "new demand" than the corresponding selling is "new supply." Combined with the observation that commodity futures markets are zero-sum games, this implies that money flows in and of themselves do not necessarily impact prices. Prices will only change if new information emerges that causes market participants to revise their estimates of physical supply and/or

2008; Smith, 2009	demand. What happens when market participants are not equally informed? When this is the case, it is rational for participants to condition demands on both their own information and information about other participants' demands that can be inferred from the futures price (Grossman, 1986). The trades of uninformed participants can impact prices in this more realistic model if informed traders mistakenly believe that trades by uninformed participants reflect valuable information. Hence, it is possible that other traders in commodity futures markets interpreted the large order flow of index funds on the long side of the market as a reflection of valuable private information about commodity price prospects, which would have had the effect of driving prices higher as these traders revised their own demands upward. Of course, this would have required a large number of sophisticated and experienced traders in commodity futures markets to reach a conclusion that index fund investors possessed valuable information that they themselves did not possess. **The second** possible logical inconsistency is to argue that index fund investors artificially raised both futures and cash commodity prices when they only participated in futures markets. These contracts are financial transactions that only rarely involve the actual delivery of physical commodities. In order to impact the equilibrium price of commodities in the cash market, index investors would have to take delivery and/or buy quantities in the cash market and hold these inventories off the market. Index investors are purely involved in a financial transaction using futures markets; they do not engage in the purchase or hoarding of the cash commodity and any causal linkages between their futures market activity and cash prices is unclear at best (Headey and Fan, 2008). Hence, it is wrong to draw a parallel (e.g., Masters and White, 2008) between index fund positions and past efforts to "corner" commodity markets, such as the Hunt brother's effort to manipulate the silver market in 1979-80. **A third** possible logical inconsistency is a blanket categorization of speculators, in particular, index funds, as wrongdoers and hedgers as victims of their actions. In reality, the "bad guy" is not so easily identified since hedgers sometimes speculate and some speculators also hedge. For example, large commercial firms may have valuable information gleaned from their far-flung cash market operations and trade based on that information. The following passage from a recent article on Cargill, Inc. (Davis, 2009) nicely illustrates the point: Wearing multiple hats gives Cargill an unusually detailed view of the industries it bets on, as well as the ability to trade on its knowledge in ways few others can match. Cargill freely acknowledges it strives to profit from that information. "When we do a good job of assimilating all those seemingly unrelated facts," says Greg Page, Cargill's chief executive, in a rare interview, "it provides us an opportunity to make money without necessarily having to make directional trades, i.e., outguess the weather, outguess individual governments." The implication is that the interplay between varied market participants is more complex than a standard textbook description of pure risk-avoiding hedgers and pure risk-seeking speculators. The reality is that market dynamics are ever changing and it can be difficult to understand the motivations and market implications of trading, especially in real-time.
(Wright, 2009). Smith (2009)	The relationship between prices and inventories for storable commodities is highly convex (Wright, 2009). This means that a given reduction in the quantity of inventories due a supply and/or demand shock will have a much larger impact on price when inventories are already low compared to when inventories are high. It also implies that relatively minor reductions in inventories can result in very large increases in price when inventories are small. Smith (2009) argues that it is plausible that a series of seemingly small supply disruptions in the spring and summer of 2008 could explain the large increase in crude oil prices during this time period in view of the extreme convexity of the pricing function for crude oil in the short-run. This increase in crude oil price is affecting the prices of other commodities, as we have discussed in the

	previous chapter (chapter 4) in the discussion on the prediction models.
De Long, Shleifer, Summers, and Waldmann 1990	Theoretical models that show uninformed or noise traders impacting market prices rely on the unpredictable trading patterns of these traders to make arbitrage risky (De Long et al., 1990). Because the arbitrage necessary to drive prices to fundamental value is not riskless, these noise traders can put a block between market prices and fundamental values. It is therefore important to mention that index fund buying is very predictable, which means that institutional investors widely publish their portfolio or market weights and roll-over periods. Therefore, it seems highly unlikely that other large rational traders would hesitate to trade against institutional investors if they were driving prices away from fundamental values.
Headey and Fan (2008); Irwin, Sanders, and Merrin (2009)	If index fund buying drove commodity prices higher then markets without index fund investment should not have seen prices advance. Again, the observed facts are inconsistent with this notion. Irwin, Sanders, and Merrin (2009) show that markets without index fund participation (fluid milk and rice futures) and commodities without futures markets (apples and edible beans) also showed price increases over the 2006-2008 period. Stoll and Whaley (2009) report that returns for CBOT wheat, Kansas City Board of Trade (KCBOT) wheat, and Minneapolis Grain Exchange (MGEX) wheat are all highly positively correlated over 2006-2009, yet only CBOT wheat is used heavily by index investors. In a similar fashion, Commodity Exchange (COMEX) gold, COMEX silver, New York Mercantile (NYMEX) palladium, and NYMEX platinum futures prices are highly correlated over the same time period but only gold and silver are included in popular commodity indexes. Headey and Fan (2008) cite the rapid increases in the prices for "non-financialized" commodities such as rubber, onions, and iron ore as evidence that rapid price inflation occurred in commodities without futures markets. While certainly instructive, the limits of these kinds of comparisons also need to be kept in mind. Bubble proponents have pointed out that commodity markets selected for the development of futures contracts may be more naturally volatile than those commodities without futures markets.
Working (1960); Buyuksahin and Harris (2009); Till (2009)	Speculation was not excessive when correctly compared to hedging demands. The statistics on long-only index fund trading reported in the media and discussed at hearings tend to view speculation in a vacuum focusing on absolute position size and activity. Working (1960) argued that speculation must be gauged relative to hedging needs. In particular, speculation can only be considered 'excessive' relative to the level of hedging activity in the market. Utilizing Working's speculative "T-index," Working (1960) demonstrate that the level of speculation in nine agricultural futures markets from 2006-2008 (adjusting for index fund positions) was not excessive. Indeed, the levels of speculation in all markets examined were within the realm of historical norms. Across most markets, the rise in index buying was more than offset by commercial (hedger) selling. Buyuksahin and Harris (2009) use daily data from the CFTC's internal large trader database to show that Working's Tindex in the crude oil futures market increased in parallel with crude oil prices over 2004-2009 but the peak of the index was still well within historical norms. Till (2009) reports similar results for crude oil, heating oil, and gasoline futures over 2006-2009 using recently available data in the CFTC's DCOT report.
Irwin, Sanders, and Merrin (2009)	Observable fact revolves around the impact of index funds across markets. A priori, there is no reason to expect index funds to have a differential impact across markets given similar position sizes. That is, if index funds can inflate prices, they should have a uniform impact across markets for the same relative position size. It is therefore difficult to rationalize why index fund speculation would impact one market but not another. Further, one would expect markets with the highest concentration of index fund positions to show the largest price increases. Irwin, Sanders, and Merrin (2009) find just the opposite when comparing grain and livestock futures markets. The highest

	concentration of index fund positions was often in livestock markets, which had smallest price increases through the spring of 2008. This is difficult to reconcile with the assertion that index buying represents demand. Several studies have been completed recently that do not find compelling evidence of a speculative impact in commodity futures price movements during recent years, and therefore, corroborate the previous no-bubble arguments.
Irwin, Sanders, and Merrin (2009)	If index speculators' buying drove commodity prices higher, then markets without index speculators should not have seen prices advance. But Irwin, Sanders, and Merrin (2009) have shown that the observed facts are inconsistent with this notion. They state that markets without index speculators participation (fluid milk and rice) and commodities without futures markets (apples and edible beans) have also showed price increases over the period of 2006-2008. Therefore, this would suggest that there were other macroeconomic factors potentially influencing the increase in commodity prices.
Buyuksahin and Harris (2009)	Assume that swap dealer positions are linked to commodity index investing, and hence, the results for swap dealers can be interpreted as a failure to reject the null hypothesis of no relation between crude oil futures prices and index fund trading. A key question, then, is whether it is reasonable to assume that swap dealer positions in crude oil futures are generally linked to commodity index investments. Calculations found in CFTC (2008b) suggest that no more than 50 percent of swap dealer positions can be considered index fund positions. Hence, the measurement error inherent in using swap dealer positions to represent index fund positions in crude oil futures may be substantial and limit the conclusions that can be drawn with this data.
Sanders and Irwin (2010)	Investigate the relationship between index fund trading and futures prices using a cross-sectional regression approach. They note that modeling market returns with traditional time-series approaches, such as those used by Stoll and Whaley (2009) and Buyuksahin and Harris (2009), can be criticized for a lack of statistical power due to the considerable volatility of the dependent variable (returns). An alternative approach to testing for speculative impact that may have greater power is the cross-sectional approach of Fama and MacBeth (1973), which is widely used to test for factors impacting asset prices. A bubble scenario suggests that returns on a given date should be positively correlated with relative position size (market share) of index funds across commodity futures markets. Sanders and Irwin examine all 12 grain, livestock, and soft commodity markets included in the CIT report over January 2006-Decmeber 2008 and test if the relative size of index fund positions (net long CIT contracts/total long market open interest) is correlated to subsequent returns across the 12 markets. The null hypothesis of no cross-sectional impact is only rejected in one of twelve models, leading the authors to conclude that the evidence linking index fund positions and returns across commodity futures markets is scant. Overall, the authors conclude that data trends and statistical test results are not consistent with the widely-touted bubble theory.
Scott H. Irwin* 2008	**First**, the arguments of bubble proponents are conceptually flawed and reflect fundamental and basic misunderstandings of how commodity markets actually work. **Second**, a number of facts about the current situation in commodity markets are inconsistent with the existence of a substantial bubble in commodity prices. **Third**, available statistical evidence does not indicate that positions for any group in commodity futures markets consistently lead futures price changes. **Fourth**, there is a historical pattern of attacks upon speculation during periods of extreme market volatility.
the Global Food Markets	• Levels of index-fund open interest (as measure by numbers of contracts rather than values) for key agricultural commodities were relatively

Group HM Government (The 2007/08 Agricultural Price Spikes: Causes and Policy Implications)	stable between 2006 and 2008. • Many commodities for which futures markets are either negligible or non-existent (edible beans, durum wheat), or which are not traded by popular commodity index funds (rough rice, fluid milk) also saw very significant price increases. • Futures markets can affect spot prices through changing physical stock levels. However, the standard transmission mechanism involves changing physical stock levels rather than levels of open interest on the futures market, with the available evidence pointing to low and falling (expected) levels of stocks as a cause of the price spike. • High levels of open interest in futures markets are not analogous to physical stock holdings. • All the empirical results reported need to be viewed with caution both because of issues around the appropriateness of proxy selection and because even where results are positive, this could be explained by one or more unidentified factors that affect prices and the proxy for speculation in similar ways. • The procedures by which index funds roll over their long positions are typically published. To the extent that the market is temporarily moved away from fundamentals as a result of index funds executing large and predictable trade, this suggests an additional cost to the index fund and its investors, rather than a persistent distortion of the market. • There is no doubt that the lack of convergence between spot prices and near-dated futures prices at expiry is a serious problem that undermines the quality of hedging so increasing risks and costs faced by hedgers and, ultimately, threatening the future of the contract. However, it is not at all clear that the problem is caused by the activities of index funds. It is quite possible that such problems have been caused by a disconnect between (1) CBOT maximum storage rates and market storage rates, and (2) in the case of wheat, between the delivery points for futures for the CBOT contract and the commercial realities of the spot market. • As with price levels, it is very difficult to be sure whether speculation is attracted to volatility (caused by tight markets) or whether speculation has increased volatility. • It is important to note that market fundamentals do provide a convincing explanation for movements in both futures markets and spot markets. The issues examined in this paper means that there is not a 'gap' in the story which can only be filled by looking to speculation.

Source: Own table based on different sources