ENERGY MARKETS OF TURKEY AND APPLICATION OF VARIANCE - COVARIANCE METHOD IN VALUE AT RISK METHOD FOR TURKEY ELECTRICITY STOCKS

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ENERGY MARKETS OF TURKEY AND APPLICATION OF VARIANCE - COVARIANCE METHOD IN VALUE AT RISK METHOD FOR TURKEY ELECTRICITY STOCKS

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ABSTRACT

ENERGY MARKETS OF TURKEY AND APPLICATION OF

VARIANCE - COVARIANCE METHOD IN VALUE AT RISK METHOD FOR

TURKEY ELECTRICITY STOCKS

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MA in Financial Economics, Department of Social Sciences

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Energy markets have been important for Turkey in recent years. The energy sector is a fast developing sector in Turkey. Nowadays, to hedge against the volatility of markets, market risk management methods become important. One of the risk measurement approaches, namely value at risk, is used for testing and measuring market risk and investment performance in electricity stocks.

The purpose of thesis, is to examine the structure of Turkish energy market and analyze the efficiency of variance-covariance method for value at risk a portfolio consisting of calculations of electricity transmission and distribution stocks. Calculations of value at risk will be based on different statistical techniques. Which would produce different results. Variance-covariance method and Exponentially Weighted Moving Average (EWMA) method are used to calculate the volatility of

the portfolio. In the EWMA method, the initial standard deviation is based on monthly returns of the previous two years. Then value at risk is calculated for different portfolios, each of which consists of all the electricity market stocks in the Turkish stock market but with different weights. The variance-covariance calculations are based on historical date for two years and twelve years.

Key Words: Energy markets, Market risk measurement, Value at risk, Variance-covariance method, EWMA method

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ÖZET

TÜRKİYE 'DE ENERJİ PİYASALARI VE TÜRKİYE ELEKTRİK HİSSE SENETLERİ ÜZERİNE RİSKE MARUZ DEĞER METODUNDA YER ALAN

VARYANS-KOVARYANS METODUNUN UYGULANMASI

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Mayıs 2013, 166 Sayfa

Son yıllarda, enerji piyasaları Türkiye için büyük önem kazanmaktadır. Enerji sektörü Türkiye'de yeni ve gelişmekte olan bir sektördür. Günümüzde piyasa oynaklıklarının etkilerini kontrol etmek amacıyla, piyasa risklerinin yönetiminin önemi artmaktadır. Risk ölçümünün bir yaklaşımı olan Riske Maruz Değer (RMD) piyasa riskini ve yatırım performansını ölçmek amacıyla kullanmaktadırlar.

Bu tezin amacı, Türkiye enerji piyasalarının yapısı ve işleyişini incelemek ve enerji piyasalarında işlem gören elektrik iletim ve dağıtım hisse senedi portföyünde piyasa riski ölçümü olarak Riske maruz değerin (RMD) varyans-kovaryans metodunun etkinliğini analiz etmektir. RMD 'in hesaplamaları farklı istatistiksel tekniklere dayanmaktadır ve farklı sonuçlar vermektedir.

Portföyün volatilitesini hesaplamak için varyans-kovaryans yöntemi ve üssel ağırlıklı hareketli ortalama (EWMA) yöntemi kullanılmıştır. EWMA metodunda, başlangıçtaki standart sapma, önceki iki yılın aylık getirilerine baz alınarak hesaplanır. Daha sonra Türkiye hisse senedi piyasalarında, her bir elektrik hisse senetleri için farklı ağırlıklar kullanarak farklı portföyler için riske maruz değer hesaplanır. Varyans-kovaryans hesaplamaları iki ve on iki senelik geçmiş tarihlere dayanır.

Anahtar Sözcükler: Enerji piyasaları, Piyasa risk ölçümü, Riske maruz değer, Varyans-kovaryans metodu, EWMA yöntemi.

To My Parents

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I express sincere appreciation to my thesis advisor, Prof. Dr. Ayla Oğuş Binatlı help me in preparing this thesis, in process of revision, in choosing a subject for thesis and especially for her guidance and her support throughout this research. Her ideas are about the thesis expanded and enriched the content of this thesis. So, I would like to indicate that thanks again.

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LIST OF ABBREVIATIONS

ADF: Augmented Dickey Fuller

API: American Petroleum Institution

BC: Before Christ

BCM: Billion Cubic Meters

CFAR: Cash Flow At Risk

EWMA: Exponentially-Weighted Moving Average

EU: European Union

EMRA: Energy Market Regulatory Authority

KWH: Kilowat-Hour

LPG: Liquefied Petroleum Gas

LNG: Liquefied Natural Gas

MW: Molecular Weight

ISPO: International Ship and Port facility Security Code

OECD: Organization of Economic Co-operation and Development

PAR: Profit At Risk

SPO: State Planning Organization

USA: United States of America

VaR: Value at Risk

WWI: World War 1

1. INTRODUCTION

Energy is basic resources which is required for social and economic development. The importance of energy in social life will increase. Technological progress, energy usage in transportation, increasing demand on raw materials as inputs in industries will continue; and will essential for survival of human life. Delivering energy to consumers safely and reliably is important. Production is essential to economic growth and growth of production should continue. It is impossible to think of life without energy in modern communities. Increasing of energy consumption depends on rising population, industrialization, urbanization, becoming widespread of technology and increasing welfare of society. Hence, energy should be used thriftly and efficiently.

Energy markets a rapidly grown and newly developed market in Turkey. Turkey with its growing economy, becomes a crucial energy consumer and an energy center that distributes energy to its region. Turkish energy markets have undergone vital changes in recent years. These changes include liberalization, privatization and restructurings for more competitive entities. Turkey is behind developed countries in energy consumption per person. This situation is normal, because the economy of Turkey has been growing rapidly and in a stable fashion. Per capita energy consumption of Turkey will reach the level in developed countries in the short on medium term.

Turkey, in the past, became dependent on imported energy due to wrong implementations of policies. When energy needs increased rapidly, production would not respond and energy needs were compensated by continually increasing imports. When we look at the current situation, energy is becoming globalized. Following liberal economic models with changing market conditions, policies which bring external-dependency down and energy policies which maintain economic growth should be implemented. Economy which is witness a rapid and continuous increase in the demand for energy requirements, need a great amount of investment to respond to these demands. Turkey's energy policy in response to increasing energy demand required capital from domestic and foreign private sectors.

Like other sectors, the energy sector is also under risk. Energy markets encounter the following types of risks: market risk, liquidity risk, operational risk, credit risk, political risk and legislation risk. Energy markets generally face market risks. The reason is that energy exporting countries reflect price fluctuations on to energy prices. These price fluctuations translate into an increase in market risk. Energy demand, especially in developed countries is conducing to increasing market risk. Energy demand also responds to deregulation in the world energy markets. Prices are determined freely in liberal markets conditions. This creates exposure to price risk in markets. Risk management instruments need to be used to dampen the effects of price volatility in energy markets.

Market risk is measured by three methods; value at risk, profit at risk and cash flow at risk. In this study, value at risk methods are applied to measure market risks. The reason for using value at risk method to measure market risk to be able to express, in a single monetary value, a possible losses that are caused by different risk factors such a interest rate, exchange rate and stock prices. What's more, it is the most common method employed in the calculation of market risks. To measure value at risk variance-covariance method is applied after creating a portfolio consisting of electricity markets. In this way, we can observe the losses in the portfolio.

In summary, the main subject of this thesis, is the main structure and functions of world electricity, natural gas and LPG and petroleum markets as well as energy markets which developed and grew rapidly in Turkey. In addition, an investigation of risk measures will be applied to energy stocks which are selected from risky assets. In this thesis, variance-covariance method incomputing value at risk is the market risk method which is used for the electricity stocks portfolio. It is based on prices and returns of five electricity market stocks for twelve years.

The thesis consists of four main chapters; in the first chapter, supply, demand, price, production and consumption of natural gas, electricity, petroleum and LPG products in Turkey energy markets, will be discussed. Besides that, world electricity, natural gas and LPG market is analyzed and price movements, restructurings and characteristics of world energy markets are also emphasized. In the second chapter, definition of risks and potential characteristics of risk which one may face in the

market are investigated. The third chapter of the thesis provides information about value at risk which is used to measure energy market risks; profit at risk, cash flow at risk models are also discussed. Following this discussion, the most suitable risk measurement method is selected for risks that one may encounter mostly in the market and the application of these methods is described. In the fourth chapter, a portfolio consisting of five electricity stocks is created and variance-covariance method is applied for computing value at risk. The variance-covariance matrix is computed based on two years and twelve years of data, and for each variance-covaiance matrix different portfolios are compared which are created with the five electricity market stocks but with different shares. In addition, the value at risk of the portfolio is computed by the EWMA method for the same portfolios analyzed with the variance-covariance method.

2) ENERGY MARKETS

Energy refers to the capability of doing or being ready to make any movement. Shortly, energy is defined as the ability to do work. Energy is the most important and most necessary resource to subsist life of societies. Nowadays, the importance of energy increases in every phase of social life. When we research its economic meaning, we see that energy is an important factor to provide needs of economic and social development. Energy sources are included as basic materials at the root of economic development of countries.

The main objectives of economic development of countries include important factors such as, sustainable energy policies, the provision of security of supply, diversification of sources of energy supply, being a low-cost energy user, being able to supply quantity demanded but at the same time managing the quantity of energy demand.

Nowadays, 87 percent of the world's total energy production consists of fossil fuels, 6 percent of renewable resources and 7 percent of nuclear energy. Therefore, when we look at the distribution of the world's total energy production, global energy policy is determined by fossil fuels, mostly by oil, and natural gas. Energy markets consist of the sum of energy products based on different amounts in nature.

Given the geological and natural structure of Turkey, there is almost every kind of energy source. However, reserves of fossil fuels is quite small and production of fossil fuels is also quite low. The primary energy consumption in Turkey consists of 39% oil, 27% natural gas, 27% coal and 13% renewable energy sources. Currently, Turkey imports half of its energy consumption. Energy policies applied in Turkey, are greatly affected by the general structure of the energy sector.

Turkey is situated at a strategic location close to production regions with important reserves and between countries which energy and export requirements. This increases Turkey's strategic importance day by day, especially as for reducing EU countries, candidates are prime as growing energy markets. Thus, Turkey is important variations on exports of petroleum and natural gas, developing energy transportation projects, providing supply security and sustainability. Turkish government understands the importance of the subject and since 2001. Her main policy is the liberalization of the sector and energy sector reforms. Related laws are enacted and the majority of secondary statutes and regulations are completed. So the main steps for a competitive and transparent sector are being taken.

Energy markets in Turkey are examined under four main topics.

1) Electricity Market

2) Natural Gas Market

3) Petroleum Market

4) LPG Markets

In the following sector, the structure of energy markets in the world and in Turkey are studied.

2.1 ELECTRICITY MARKET

Electricity is an important energy source which is used in many areas. Electricity is used in different operations; industrial production, heating in residential and commercial areas, home-usage and lightening. Electricity has an important place in the economy. Managing energy resources is important for governments and corporations.

Preliminary research about electricity started in 1878. Since that year, the usage of electricity has continued to and has become important in daily life.(1)

Primary electricity generation includes steam power plants, nuclear power plants and hydraulic power plants. In steam power plants, it is obtained from coal, natural gas and fuel oil. In hydraulic power plants, it is obtained from potential energy in water. In nuclear power plants, thermal energy is used by obtained nuclear fusion.(2)

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(1), (2) ETİMENKUL KIYMETLER A.Ş. 2008. 'Enerji Sektörü Raporu'. Eti Menkul Kıymetler A.Ş. Araştırma Bölümü

Functionally, electric energy consists of five stages, input supply, production, transmission, distribution and supply. (Ünal,2007)

Production means the process of converting some other type of energy (oil, natural gas, coal, nuclear power, hydropower, renewable fuels, and wind turbines, etc..) into electrical energy. **(**Başoğlu ,2005)

Transmission refers to the transportation of electricity produced in electric power-plants through the high power lines to distribution lines or transportation of electricity to consumers connected to the transmission line directly. **(**Başoğlu, 2005)

Distribution is the transportation of low-voltage electricity. **(**Başoğlu, 2005)

Supply is the process whereby the electricity is sold to the ultimate user. Supply includes measuring, billing and marketing. Supply operations may be in the form of wholesale or retail. **(**Başoğlu, 2005)

Moreover, the risk management practices in the different countries in the world for transmission, generation and distribution project. (Burchett, Rao Tummala and Leung, 1999.)

2.1.1. Turkey Electricity Market

Electric energy which is a pillar stone of Turkish economy is in a change process and is developing continually. The first energy power plant was operated by Swiss-Italian partners in Tarsus 1902. (Zenginobuz – Ogur, 2000) Primarily, the electricity sectors institutional structure was shaped when the Turkish Electricity Administration was founded. Until 1984, the Turkish electricity industry was a public entity until the year of 1984, when, in accordance with law number 3096 , corporatization, distribution and production of electricity was opened to the private sector. In 1993, by council of ministers decision, the Turkish Electricity Administration was split into two bodies, namely Turkey Electricity Corporation which is responsible for production and transmission markets and Turkish Electricity Distribution Corporation which is responsible for distribution markets. Turkey Electricity Corporation was separated into three entities, namely the Electricity Generation Corporation, Turkish Electricity Transmission Corporation and Turkish Electricity Trading and Contracting Corpoaration by law number 3996, in the framework of a build-operate-transfer model on some services, and the council of ministers decision by the number 2000/1312. (3)

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(3) EMRA, Electricity Market Department. 2012. 'Electricity Market Report 2011'.Ankara

The electricity market which in the domain of the public sector was vertically-integrated; is transformed to a competitive entity, by enforcement of electric market law no 4628 in 2001. It has new regulations to support the equalization mechanism from a single receiver model to one of a retail receiver. The main goal in the electricity market is to run all operations by the private sector, except for the transmission of electricity for which transparent and stable a entity is created. (4)

The distribution of resources of Turkey installed capacity is shown in this below figure. Approximately 36% of the installed capacity is renewable energy sources. in large part of the installed capacity forms the hydraulic capacity. The share of wind and geothermal energy is very limited. The share of natural gas is observed as 30.2%.

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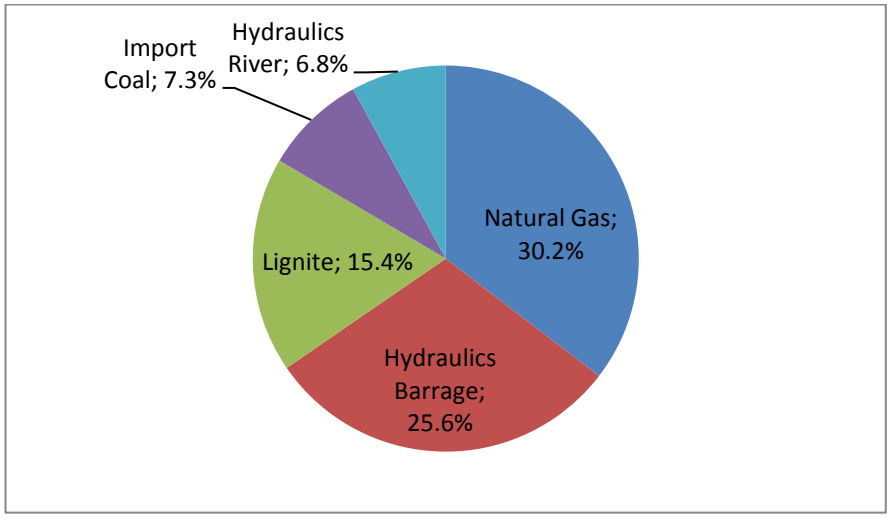
(4) EMRA, Electricity Market Department. 2012. 'Electricity Market Report 2011'.Ankara

Figure 2.1.1 As to resources distribution of installed power

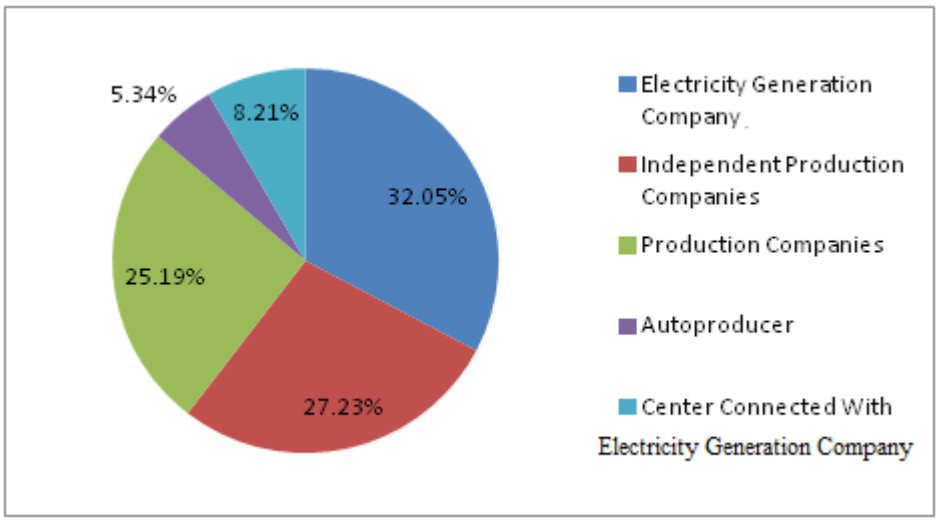


Resource: EMRA, 'Electricity Market Report 2011'.

In 2002, the installed power capacity was 31.846 MW, the installed power capacity reached 53.211 MW level by the end of 2011. More than 3/4 of these capacity additions are carried out by the private sector. (5)

(5) EMRA. 2012. 'Turkish Energy Market: An Investor's Guide 2012'.

Figure 2.1.2 As to establishments distribution of installed power



Source: EMRA, 'Electricity Market Report 2011'.

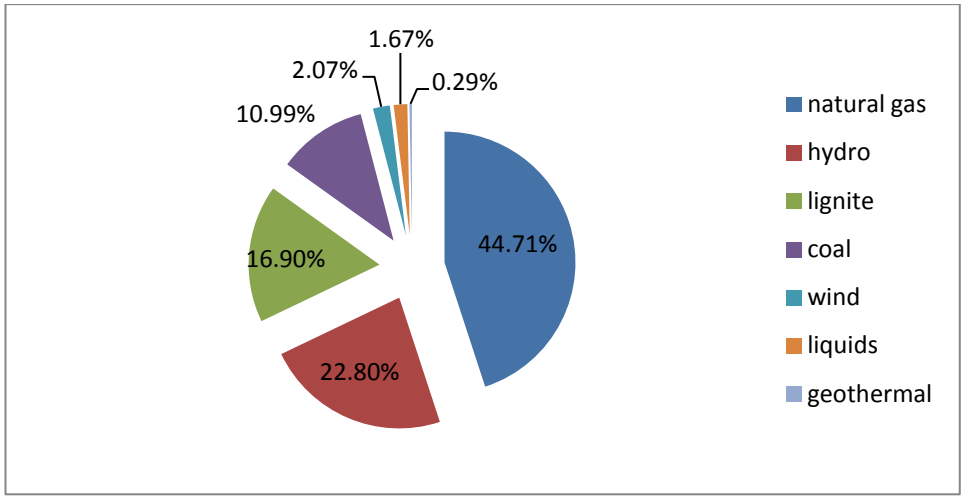
The distribution of the installed power capacity of the country are shown in the above figure. While it is owned 40% of Electricity Generation Corporation and shareholdings of Electricity Generation Corporation, the sum of the Independent Generation Companies and auto producer are 33%.

2.1.2. Turkey Electricity Generation

Provincial population increase as a result of migration to cities in Turkey, in consequence of advanced development of country's technology, the need for electricity has increased. In terms of obtaining electrical energy, Turkey has become a country that produces this energy expensively and not using her resources efficiently.

When electricity power generation in Turkey is seen in terms of resources in 2011, natural gas has the highest share making up 44.71% of electricity generation. Geothermal resource has the lowest share with 0.29% of electricity generation. The total share of lignite and imported coal was 27.89% in Turkey electricity generation. Total share of hydraulic and wind was 24.87%. In figure 2.1.3, electricity power generation in Turkey by resources is presented for 2011.

Figure 2.1.3 Electricity Power Generation in Turkey (2011)



Source: EMRA, Turkish Energy Market: An Investor's Guide, 2012

44% of production has been by domestic since 2011. Electricity generation by imported resources was quite high in the past. Imported resources used in electricity generation are mainly natural gas and coal. (6)

(6) EMRA. 2012. 'Turkish Energy Market: An Investor's Guide 2012'.

2.1.3. Electricity Consumption in Turkey

The installed capacity of Turkey reached 52.911 MW by year-end of 2011. Generation of electricity reached 229.4 billion kWh. Electricity consumed was approximately 233.875 billion kWh including imports. In 2011, per capita gross annual electricity consumption was 2865 kWh. As of 2010, energy consumption of per capita in Turkey, which has a population of 74 million, has been 1482 kep in an increase of 1.3%. As to electricity consumption; it is calculated 2347 kWh in an increase of 8.56%.

Table 2.1.1 Per Capita Energy and Electricity Consumption by Years in Turkey

	2009	2010	2009-2010 (change)
Population	73 000 00	74 000 00	1.37%
Energy Consumption	1463 kep	1482 kep	1.30%
Energy Consumption(net)	2162 kWh	2347 kWh	8.56%
Energy Consumption(gross)	2685 kWh	2865 kWh	6.70%

Source: Electricity Generation Company, Electricity Production Sector Report 2010.

Table 2.1.2 General Production and Consumption

	unit	2009	2010	2009-2010 (change)	2011	2010-2011 (change)
Installed Power	MW	44761	48591	8.6%	52911	8.9%
Peak Demand	MW	2987	33392	11.8%	36122	8.2%
Production	GWh	194813	210182	7.9%	229395	9.1%
Import	GWh	812	1883	131.9%	4556	142%
Export	GWh	1546	2675	73%	3645	36.3%
Consumption	GWh	194079	210434	8.4%	229319	9%

Source: EMRA, Turkish Energy Market: An Investor's Guide, 2012

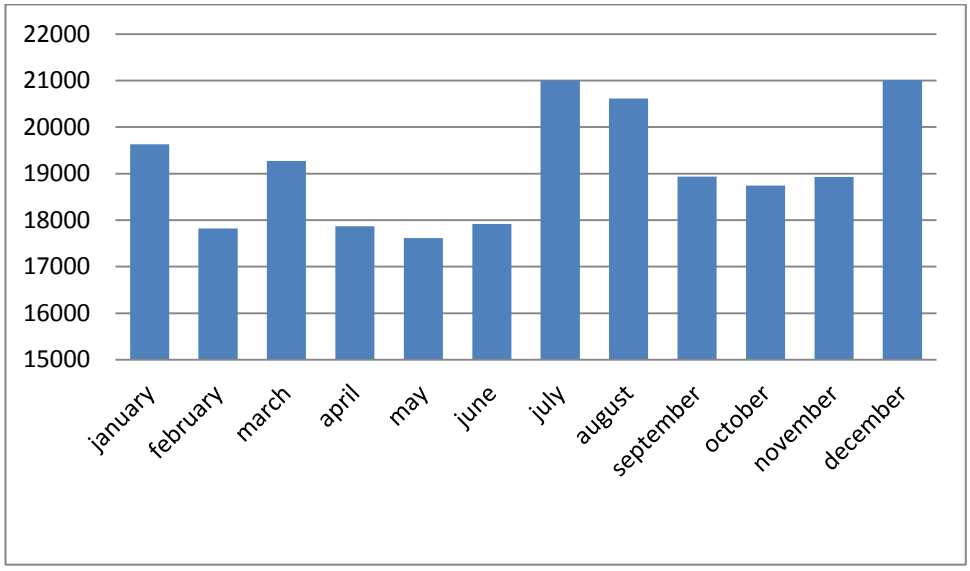
When we look at the table, production and consumption show a significant increase over time. Especially the amount of imports shows increase more than one and a half. By the time we look at the exports, exports rise from 2009 to 2011. As it is seen in table, values of consumption and production are close to each other. Proportional value of imports and exports is a small.

Table 2.1.3 Development of Consumption Data

Months	Electricity Consumption in 2011
January	19632
February	17818
March	19274
April	17870
May	17615
June	17917
July	20999
August	20612
September	18932
October	18742
November	18928
December	21005

Source: EMRA, Turkish Energy Market: An Investor's Guide, 2012

Figure 2.1.4 Development of Electricity Consumption in 2011



Source: EMRA, Turkish Energy Market: An Investor's Guide, 2012

When we observe development of electricity consumption in 2011, consumption follow a fluctuating course. Especially, in the spring, (including April, May and June) consumption decreased. In the summer months (July and August), consumption reached its highest level.

2.1.4 Electricity Prices

Electricity prices are determined by the Turkish Electricity Corporation and Turkish Electricity Distribution Corporation. Factors of determining electricity prices are supply-side factors and demand-side factors.

Demand-side factors depend on the growth rate, the population, urbanization, climate and efficiency of energy. Supply-side factors depend on coal prices, natural gas prices, Euro / TL exchange rate, hydrology, wind and solar.

2.2.NATURAL GAS MARKET

Natural gas is a sort gas which is formed by plants and animals wastes which lived for million years ago ingrained in soil, and defused by effect of temperature, pressure, radioactivity, bacterial activities. (7) Natural gas is sallow, scentless, lighter than air and methane, ethane propane, nitrogen components combustible gas. Natural gas is primarily energy sources and consumable when its obtained.

Natural-gas which is essential needs for human life, responses 10% percent world consumption in 1950s, increase shares in world resources by taking advantages (cheaper than petroleum, practical, easier to access, nonhazardous to environment) world petroleum crisis in 1972 between 1979 afterwards. (Bayraç,1999)

When basis data are examined related to world natural gas market, natural gas will be most used petrifaction gas in world consumption is predicted until year of 2030. Natural gas consumption will be increase, except Europe is anticipated.

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(7) İGDAŞ Web Site

When we investigate increasing energy requirement of Turkey's development; these factors play important role for selection; industries needs about buying electricity requirements cheaply, prevent production shortage which is incurred by electricity cutting, reducing environment pollution.

2.2.1. Historical Development of Natural Gas Sector in the World

Natural gas is well known energy resources all of the world. First natural gas leakages were detected in Iran between BC 6000-2000 years, first usage was started between BC 900-1100 years and usage method was developed by natural gas well ruined and transported with bamboo reeds. Years of BC 50, Uesta temple in ancient Rome, Love of God, was lightened by that method is thought. (Dokuzlar, 2006)

Findings about leaked underground natural gas transportation with bamboo reeds is used in fuel of salt cupping process. Natural gas is commonly used in England 1790, in Europe 1659. Lightening on streets and dwellings, activation in fuel-injection engine are utilized by natural gas. (8) First production and consumption methods in natural gas is occurred in USA, in the late of nineteenth century.

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(8) TMMOB, MMO, Mart 2006, 'Türkiye'nin Doğal Gaz Temin ve Tüketim Politikalarının Değerlendirilmesi Raporu'.

After years of 1920's, natural gas transportation with pipeline, advancements through to world continued to increase post-world war two. (Öztürk, 1991)

2.2.2. Current Situation of Natural Gas Sector in the World

Natural gas whose percentage increases over world by owning featured advantage itself, subjected to important international trade waves. After 2009 economical recession, year of 2010, by increasing to 7.4 percent natural gas consumption indicates highest increase since 1984. By 2009 recession year, when two years gas consumption are compared 2008 - 2010, World gas consumption increases approximately 4.7 percent over the world. When we are looking in case of quantity, highest increment occurred in USA, also highest increment happened in Russia and China in their regions. Despite consumption increment happened 7.2 percent in Europe and Eurasia region, consumption in quantity year of 2011, is lower than consumption in quantity year of 2008. (9)

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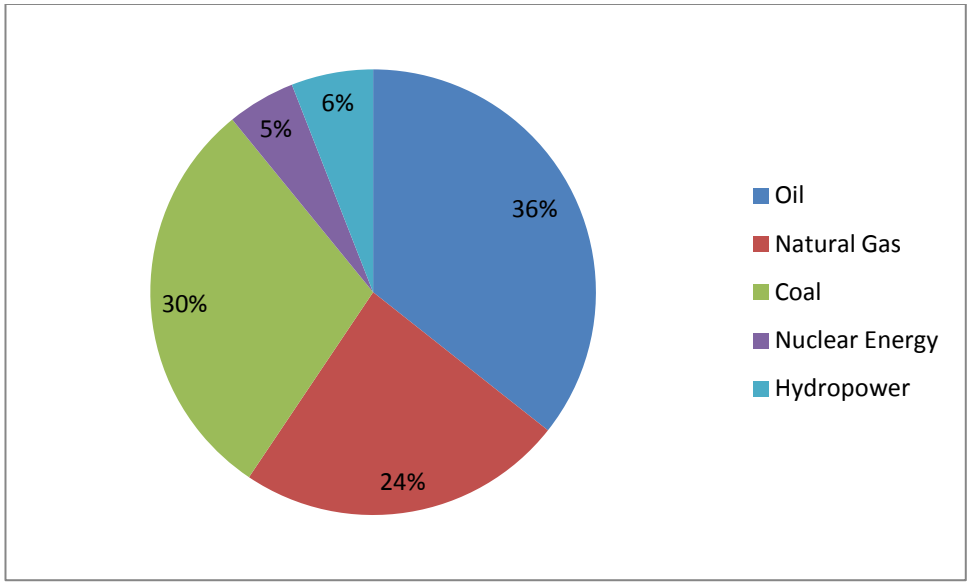
(9) EMRA , Natural Gas Market Department. 2012. 'Natural Gas Market Report 2011'. Ankara.

Figure 2.2.1 Word's Primary Energy Consumption on Energy Resources Basis in 2010



Resources: BP statistical Review of World Energy 2011.

2.2.3. Reserves of Natural Gas in the World

When looking on natural gas world reserves, totally 208.4 trillion cubic meter proved reserves are found in the end of 2011 year. 10.8 trillion cubic meter in North America, 78.7 cubic meter in Europe and Asia, 80 trillion meter cube in Middle East and 14.5 meter cube in Africa proven natural gas resources are found over the world.

Table 2.2.1 Proved Reserves in Natural Gas

	At end 2010	At end 2011
	Trillion cubic meter	Trillion cubic meter
Total North America	10.3	10.8
Total Europe & Eurasia	68.0	78.7
Total Middle East	79.4	80
Total Africa	14.5	14.5
Total World	196.1	208.4

Sources: BP Statistical Review of World Energy, June 2012

2.2.4. Production of Natural Gas in the World

When looking on world natural gas production, at sum, 3276.2 million cube meter production located at the end of 2011 year. 864.2 million meter cube in North America, 1036.4 meter cube in Europe and Eurasia, 526.1 meter cube in Middle East and 202.7 million meter cube in Africa natural gas are produced.

Table 2.2.2 Production in Natural Gas

	2010	2011
	Billion Cubic Meter	Billion Cubic Meter
Total North America	819.1	864.2
Total Europe & Eurasia	1026.9	1036.4
Total Middle East	472.3	526.1
Total Africa	213.6	202.7
Total World	3178.2	3276.2

Sources: BP Statistical Review of World Energy, June 2012

2.2.5. Consumption of Natural Gas in the World

When looking on natural gas world consumption, totally 3222.9 million cube meter consumption is located around world at the end of 2011.When is proportioned over regions; 863.8 million meter cube in North America, 1101.1 million meter cube in Europe and Eurasia, 403.1 million meter cube in Middle East and 109.8 million meter cube natural gas consumption in Africa is recorded.

Table 2.2.3 Consumption in Natural Gas

	2010	2011
	Billion Cubic Meter	Billion Cubic Meter
Total North America	836.2	863.8
Total Europe & Eurasia	1124.6	1101.1
Total Middle East	377.3	403.1
Total Africa	106.9	109.8
Total World	3153.1	3222.9

Sources: BP Statistical Review of World Energy, June 2012

When observed world natural gas consumption and production, although ongoing production increment in North America, is got behind other regions. Middle East is come in secondly about natural gas production and consumption in the world. Production in Africa increases only to respond their exportation demands, and case of Eurasia is world's most rapid natural gas production and consumption.

2.2.6. Prices of Natural Gas in the World

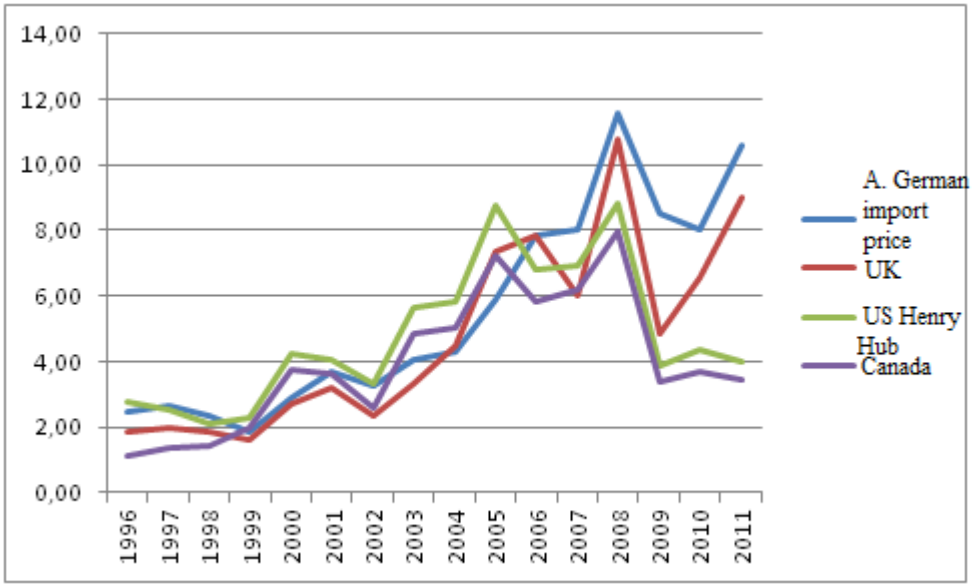
Natural gas production, generally, is operated by public and private ownership for these reasons; categorized as a public sector by reason of highest platform costs and private corporations can not response project by virtue of insufficient capital. Reasons which causes price instability on natural gas markets are reserves quantity and inequality of natural gas supply and demands. Middle East countries have 30 percent in natural gas production. Producers who are kept most of resources, have significant effects to determine prices. Together this, available natural gas resources around world is located far away from potential consumption zones. This events cause attracting price and costs incurred by gas transportation problems and weakened huge amount of reserve owner countries control powers. Prices on domestic contracts with international natural gas purchasing, is determined within private and hidden pricing instead of open-pricing. This circumstances especially is valid in international agreement. Except USA, prices on agreement are generally kept in hidden, because the natural gas market is not in existence such a developed petroleum markets. (Bayraç, 1999)

Table 2.2.4 Natural Gas Prices Data In The World Between 1996-2011

YEARS	Average German Import Price	UK (Heren NBP Index)	US Henry Hub	Canada (Alberta)
1996	2.46	1.87	2.76	1.12
1997	2.64	1.96	2.53	1.36
1998	2.32	1.86	2.08	1.42
1999	1.88	1.58	2.27	2
2000	2.89	2.71	4.23	3.75
2001	3.66	3.17	4.07	3.61
2002	3.23	2.37	3.33	2.57
2003	4.06	3.33	5.63	4.83
2004	4.32	4.46	5.85	5.03
2005	5.88	7.38	8.79	7.25
2006	7.87	7.87	6.79	5.83
2007	8.03	6.01	6.95	6.17
2008	11.56	10.79	8.85	7.99
2009	8.52	4.85	3.89	3.38
2010	8.01	6.56	4.39	3.69
2011	10.61	9.03	4.01	3.47

Sources: BP Statistical Review of World Energy, June 2012

Figure 2.2.2 Natural Gas Prices In The World Between 1996-2011



It is seen above the table; US Henry Hub, UK, Canada and German import natural gas prices increased rapidly in 2008. But these natural gas prices decreased rapidly in 2009. When we look at the 2011 year, US Henry Hub and Canada natural gas prices are observed decreased trend. Because of decreasing US Henry Hub prices, non-conventional methods based production and natural gas markets operations shaped within the frame of free-market mechanism. UK and German import prices indicate highest trend during 2011 period.

2.2.7. Natural Gas Market in Turkey

Usage of natural gas in Turkey, began in cement factory in Pınarhisar by Turkish Petroleum Corporation in 1976s. (10) We can examine natural gas markets in Turkey two eras. Primarily, it's enough to look up statutory decree law number 397 before, 4646 law no about the natural gas markets comes into force. Petroleum Pipeline Corporation was only entitled board which was responsible for natural gas exportation, distribution, sale and pricing issues. It's clearly viewed that natural gas markets were monopolistic structure in those times. Petroleum Pipeline Corporation monopoly on natural gas markets has ended by 4646 law no come into force in 2001 and intended to being the natural gas markets transparent and competitive structure by mentioned law. (11)

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(10), (11) EMRA , Natural Gas Market Department. 2012. 'Natural Gas Market Report 2011'. Ankara.

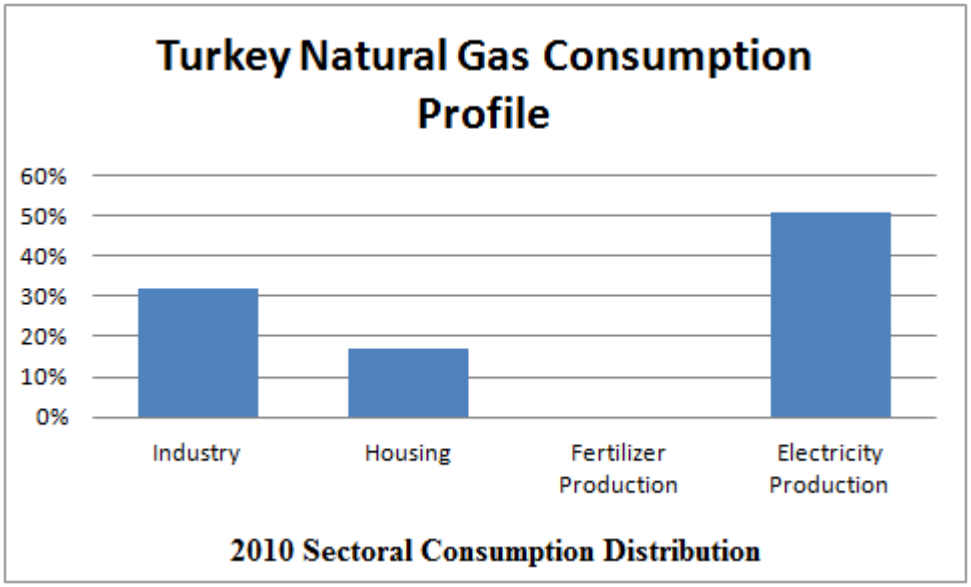
Turkish natural gas usage is projected to support increase remarkably in the future years. In 2001, a reform process was started to support to a competitive natural gas market. (Erdogdu, 2009)

Studies about restructure on natural gas markets continue and rapid liberalization occurred in Europe natural gas. One of the main requirements which is parallelly to EU gas direction are assortment of natural gas supply resources and routes. EU promote natural gas market to enter new player with this politics. Important player will be Caspian and Middle East gasses, neither abundance of resources and geographical connection, with Russian exportable pipe after North Africa gasses. This situation is implemented by EU back-up and monetary subsidies made which serves this project aim.

2.2.8. Sectoral Consumption of Natural Gas in Turkey

Main condition of our countries gas consumption profile, is occupying greatest portion, 51 percent, in using natural gas in electricity production by primarily energy resources. 32 percent in industrial consumption and indicate increment of 17 percent in household consumption.

Figure 2.2.3 Turkey Natural Gas Consumption Profile



Source: Deloitte, April 2012. 'Turkey's Natural Gas Market, Expectations and Developments 2012'.

2.2.9. Demand and Supply in Turkey Natural Gas Market

2.2.9.1 Supply

About 98 percent rate addictiveness of importation continues. Natural gas drill and production Investments which goals are reduction importation addictiveness, is started in 2004 and accelerated to present. On importation side twenty-five years agreements about natural gas consumption which is based on demand-forecast studies and in 1990s, was signed. Consequently, natural gas importation which excess domestic consumption rate liabilities are revealed.

Table 2.2.5 Natural Gas Purchase Contracts

Contracts	Quantity	Contract Year	Time	Years of Gas Delivery Commencement
Russian Federation(Westward)	6	1986	25	1987
Algeria(LNG)	4	1988	20	1984
Nigerya(LNG)	1.2	1995	22	1999
Iran	10	1996	25	2001
Russian Federation(Blue Stream)	16	1997	25	2003
Russian Federation(Westward)	8	1998	23	1998
Turkmenistan	16	1999	30	-
Azerbaijan	6.6	2001	15	2007

Source: EMRA, Natural Gas Market Report 2011.

2.2.9.2 Demand

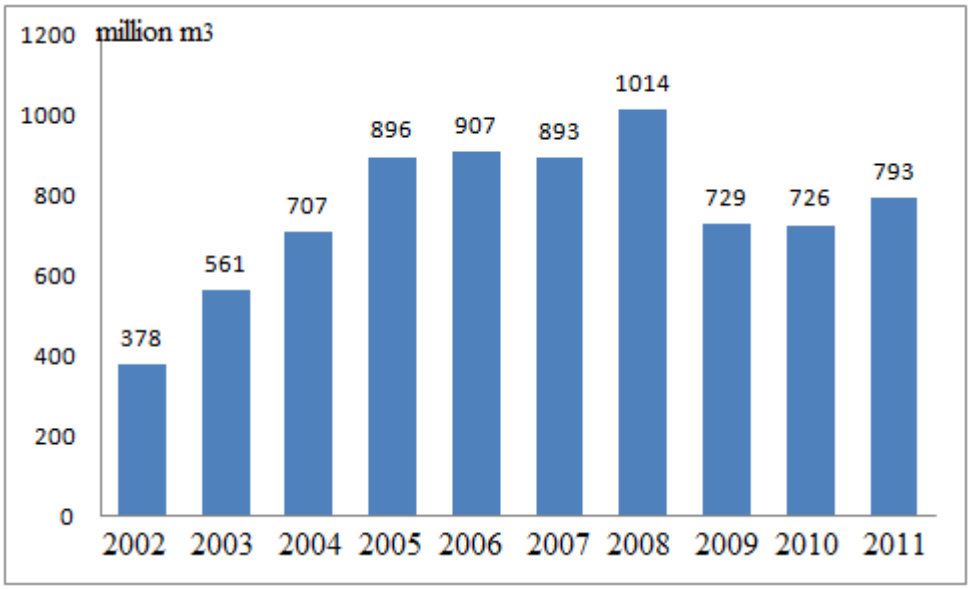
Natural gas importation was started in 1988, since that date to present, consumption increased rapidly, in 2007 to 35.8 billion cubic meters (bcm), 2010 to 37.4. Last decades natural gas consumption increases approximately 230 percent over 100. In Turkey, natural gas percentage reaches 33 percent in total energy consumption and passed EU averages. (12) In EMRA's natural gas estimation reports express consumption in made 43 bcm.

(12) EMRA , Natural Gas Market Department. 2012. 'Natural Gas Market Report 2011'. Ankara.

2.2.10. Production in Turkey Natural Gas Market

Declined natural gas consumption in 2001, is risen again with new natural gas exploration with founded partnership by Turkish Petroleum Corporation since 2002 and activation of new production well in previous zone, reaches the highest level in history with 1.014 million cubic meter production in 2008. 2011s production resulted 793 million cubic meter. 2011 year domestic-producible natural gas reservoir is 7168 billion cubic meter. (13)

Figure 2.2.4 Turkey Natural Gas Production By Years



Source: World Energy Council, Turkish National Committe, Energy Report, 2011

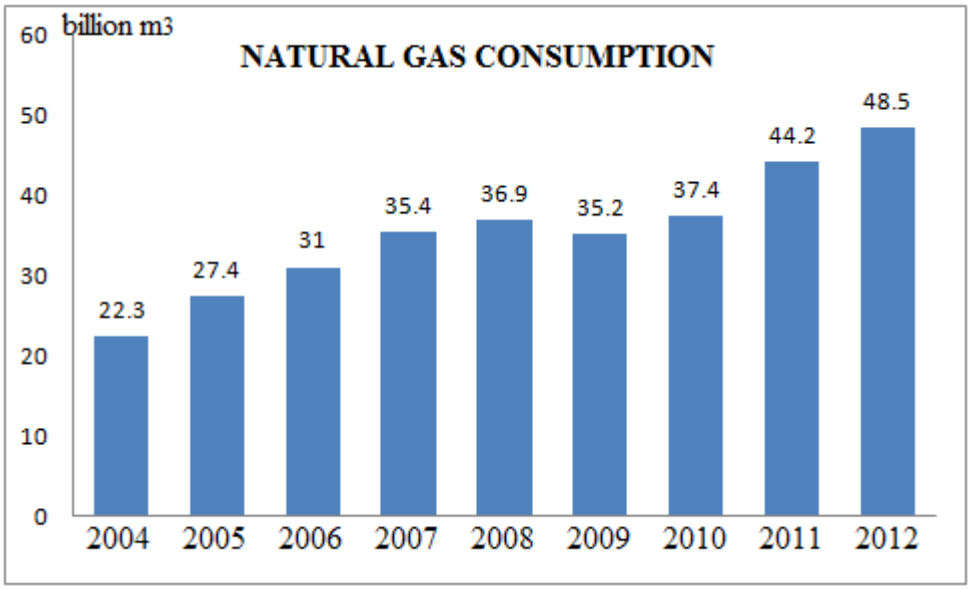
(13) Turkish Petroleum Corporation General Directorate, May 2012. '2011. Oil and Natural Gas Sector Report'.

2.2.11. Consumption of Natural Gas in Turkey

Turkey, in 2012 year, with operated 48.5 billion bcm natural gas consumption, becomes crucial country for exporter countries whose aim to sell its product and lucreative opportunity penetrated markets for investors.

In diagram which is illustrated in below, shows actual consumption natural gas quantities between 2004 and 2011 years. In 2012 year, Turkey's natural gas consumption is risen compared by other years.

Figure 2.2.5 Natural Gas Consumption Between 2004 and 2012

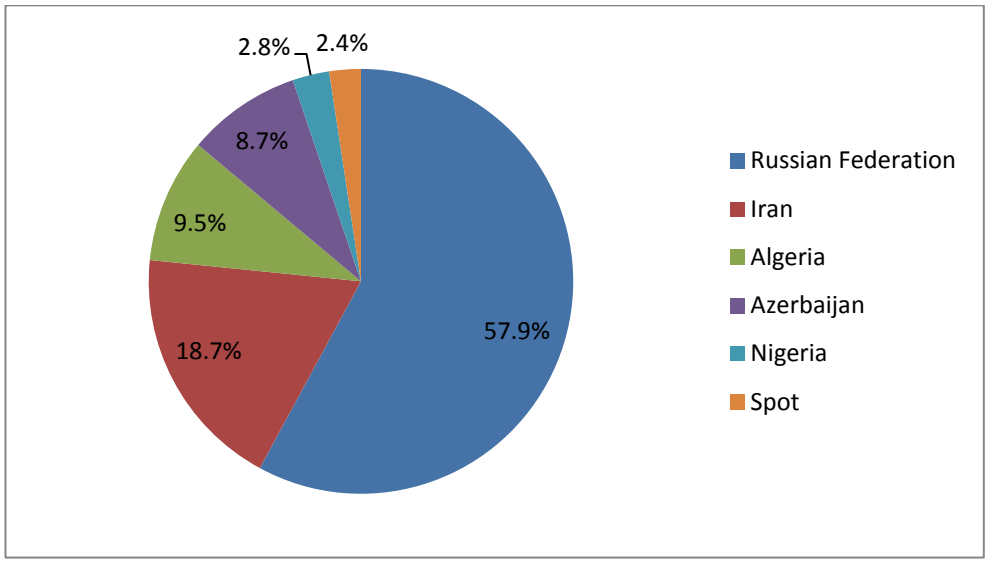


Source: EMRA, Turkish Energy Market: An Investor's Guide 2012

These data express natural gas percentage augmentation latidutelly in aggregate energy consumption.

Turkey imported natural gas deficiency from Russia, pipeline connection on Azerbaijan and Iran, LNG form from Algeria and Nigeria.

Figure 2.2.6 Imports According To Countries 2011



Source: EMRA, Turkish Energy Market, An Investor's Guide 2012.

43.9 billion meter cube, 58 percent, majority of natural gas is imported from Russia Federation, is seen.

According to all gathered data, Turkey have insufficient natural gas resources and most of consumed part of natural gas is imported. This import agreements which is harmony and global economy integration process of EU criteria place suitable for private sector and dominant position in market of Petroleum Pipeline Corporation put away. For these purposes, implementation is speeded up by natural gas procurement cession to private sector investors.

Diagram, indicates exported countries which supply required natural gas to Turkey between 2005 and 2011 years.

Table 2.2.6 Natural Gas Imports Between 2005-2011(million Sm^3)

Years	Russia	Iran	Azerbaijan	Algeria	Nigeria	Spot LNG	Total
2005	17524	4248	0	3786	1013	0	26571
2006	19316	5594	0	4132	1100	79	30221
2007	22762	6054	1258	4205	1396	167	35842
2008	23159	4113	4580	4148	1017	333	37350
2009	19473	5252	4960	4487	903	781	35856
2010	17576	7765	4521	3906	1189	3079	38036
2011	25406	8190	3806	4156	1248	1069	43874

Source: EMRA, Natural Gas Market Report 2011.

2.3 PETROLEUM MARKET

Petroleum is one of the main energy resources which has an important place in the lives of human beings. Petroleum word, which means stone in Greek-Latin with 'petra' , means oil consists of the oleum word. (Bayraç, 1999) Petroleum is dark-colored sticky and flammable liquid. Petroleum is considered to occur collapsing animals and plants on the sea bottoms millions of years ago, in the natural phenomena that occur through the accumulation of layers, with the help of anaerobic bacteria under suitable temperature and pressure. (Bayraç, 2007)

In classification of the oil, produced the specific gravity (API Gravity) of the oil, liquidity and including the amount of sulfur are taken into consideration in the world. When the specific gravity of the oil decreases, API (American Petroleum Institute) gravity is high.

Petroleum gravity classification; light gravity > 31, mid-gravity = 20-31, heavy gravity = 10 - 20 and natural Bitumen < 10. By reason of easy to be produced, transported and processed, at the present time, 90% of world oil demand is met with light petroleum and medium petroleum. 25% of world oil sources constitute light petroleum and medium petroleum. (14)

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(14) Production of Petroleum ,General Directorate of Petroleum Affairs web site.

2.3.1 Petroleum Market in the World

2.3.1.1. Historical Development of Petroleum Market in the World

At the present time, different sources say that use of petroleum based on thousands of years. The first oil well was drilled in China in fourth century. Petroleum is a industry product which started purification of the light gas oil and seeking drill of petroleum. When crude oil was introduced into the market with aim of trade as wide scale in USA for the first time, crude oil was started to measure as barrels due to storage in wood barrels in nineteenth century. In this result, it is accepted that 1 barrel is 159 liter or when 42 USA gallons is 1 tone, it is 7.33 barrel. (Yücel, 1994). Refinery fuel gas, liquefied petroleum gas (LPG), on the shelf, solvents, jet fuel, kerosene, diesel fuel, heating oil, fuel oil, asphalt, lube oil and et cetera products are obtained with crude oil refining. (Bayraç ,2007)

2.3.1.2 Current Situation of Petroleum Sector in the World

Petroleum market include research, development, production, transportation, refining and retail sales activities. All petroleum companies in the world are organized within vertically integrated system oil companies.

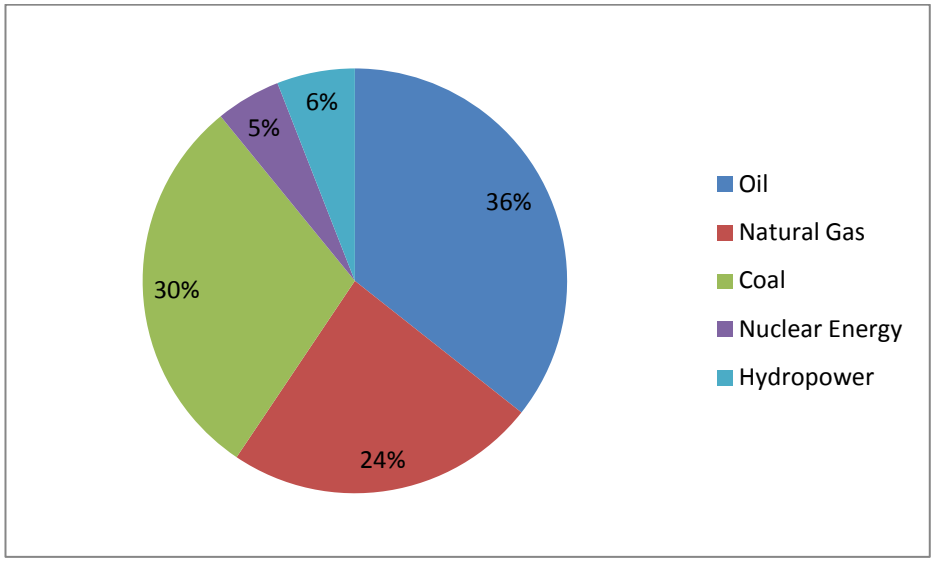
Strategy, power and policy offer exhibit more activity than other economic areas in petroleum economics. The petroleum sector is capital-intensive and large-scale. Therefore, working firms in industry find opportunity to apply strategy.

Twenty five petroleum sector is one of the main factors in determining the world's economic mapping. Determining the world's economic map causes redraw political boundaries. Petroleum is the one of the main reasons for the war. (Ercan, 1996)

A share of the world's energy is 33.6% for petroleum. And petroleum is the highest rate in the energy sources. The share of petroleum in total energy consumption has declined year on year. But, increase of petroleum consumption continues.

Figure 2.3.1 shows the distribution of the world's energy consumption by primary energy source.

Figure 2.3.1 On The Basis of Resources (%), End of 2010



Resource: BP Statistical Review of World Energy, 2011

2.3.1.3. Reserves of Petroleum in the World

When we look at the world petroleum reserves in the table, at the end of 2011, there are total of 1652.6 trillion barrels of proven reserves in the world. North America has total of 217.5 billion barrels of proven reserves. In Europe and Eurasia, there are total of 141.1 billion barrels of proven reserves. The Middle East has total of 795 billion barrels of proven reserves. In addition, in Africa, there are total of 132.4 billion barrels of proven reserves.

Table 2.3.1 Proved Reserves in Petroleum

	At end 2010	At end 2011
	Thousand Million Barrels	Thousand Million Barrels
Total North America	217.8	217.5
Total Europe & Eurasia	139.5	141.1
Total Middle East	765.6	795.0
Total Africa	132.7	132.4
Total World	1622.1	1652.6

Sources: BP Statistical Review of World Energy, June 2012

2.3.1.4. Demand and Supply of Petroleum

Demand and supply of petroleum was watched arguments sensitively applying low stock- keeping strategy by the reason of climate change, industrialization reduction in OECD countries, petroleum demand owing to rapid economic growth as China and India, the use of cars, increase airplane trips and high petroleum prices. Demand elasticity and supply elasticity of petroleum prices are quite low. Change of low demand and low supply has impact of high rate.

In 2011, the world petroleum demand increased in 0.8% of rate as to previous year. And the world petroleum demand occurred average 89 million barrel.

Table 2.3.2 World Oil Demand (million barrel/day)

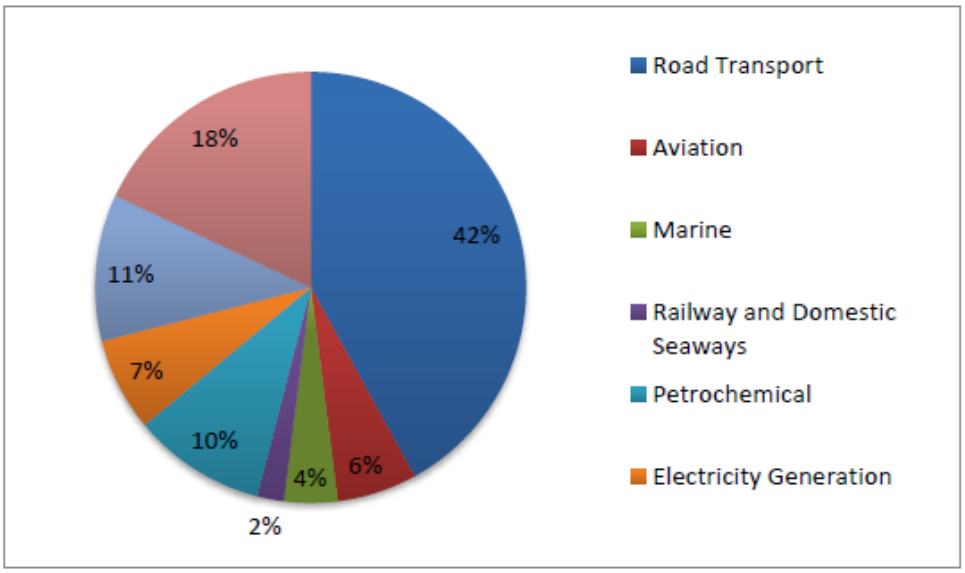
	Crude Oil Demand	2008	2009	2010	2011	2011 share%	Difference% (2010-2011)
OECD	Total	47.6	45.6	46.2	45.6	51.2	1.3
Non OECD	Total	38.9	39.9	42.1	43.4	48.8	3.1
	World Total	86.6	85.6	88.3	89	100	0.8

Source: EMRA, Petroleum Market Report 2011.

In table 2.3.2, petroleum consumption separation on years, it seems that aggregate consumption tend to decline in OECD countries. In contrast, Non-OECD member countries demand continually increase. As increment in daily 1.3 million barrel from non-OECD member countries in 2011, OECD member countries daily demand reduces 0.6 million barrel and net increment in world demand is resulted 0.7 barrel.

Inelasticity petroleum consumption to price increment, recent years rapid increase on price did not cause consumption quantity. In another words, 10 percent increment in petroleum consumption reduces petroleum demands 0.2 rate percentage in short-term. Highest increase occurred in transportation sector with 56 percent as seen in illustration 2.3.2.

Figure 2.3.2 Sectoral Distribution of Oil Consumption



Source: OPEC World Oil Outlook 2011

Petroleum consumption related to following years depends on world car park and each car number per person and these circumstances are monitored by petroleum-products countries.

Table 2.3.3 World Oil Supply (million barrel/day)

	Oil Supply	2009	2010	2011	2011 share%	Difference% (2010-2011)
OECD	Total	18.8	18.9	18.9	21	0
Non OECD	Total	63.2	64.7	65.6	74	1
	World Total	85,6	87.5	88.4	100	1

Source: : EMRA, Petroleum Market Report 2011.

2.3.1.5. Consumption of Petroleum in the World

The total consumption is 23156 million barrels / day in North America such as United States of America, Canada and Mexico. Asia and Eurasia are the total of 18924 million barrels / day.

Middle East has total of 8076 million barrels / day. Moreover, Africa is total of 3336 million barrels/ day. And Asia Pacific has 28301 million barrels / day. As a result, total consumption is 88034 million barrels in the World.

Table 2.3.4 Consumption in Petroleum

	2010	2011
	Thousand Barrels Daily	Thousand Barrels Daily
Total North America	23491	23156
Total Europe & Eurasia	19039	18924
Total Middle East	7890	8076
Total Africa	3377	3336
Total World	87439	88034

Sources: BP Statistical Review of World Energy, June 2012

2.3.1.6. Production of Petroleum in the World

The total consumption is 670 million tone in United States of America, Canada and Mexico. Daily production in North America is 14301 million barrels. Total production is 838.8 million tone in Asia and Eurasia within Kazakhstan, Russia, Azerbaijan. Besides, daily production is 17314 million barrels. The total of production is approximately 1301.4 trillion tone in the Middle East region which

includes countries such as Iran, Iraq, Arabia. Middle Eastern bloc has a daily production of 27690 million barrels. the total production is 417.4 million tone in Africa region which includes some countries such as Algeria and Nigeria. In addition, daily production is 8804 million barrels. At the end of 2011, the total production is approximately 39956 trillion tone in the world. And total daily production is 83576 million barrels.

Table 2.3.5 Production in Petroleum

	2011	2011
	Million Tone	Thousand Barrels Daily
Total North America	670.0	14301
Total Europe & Eurasia	838.8	17314
Total Middle East	1301.4	27690
Total Africa	417.4	8804
Total World	3995.6	83576

Sources: BP Statistical Review of World Energy, June 2012

2.3.1.7. Prices of Petroleum in the World

Petroleum prices are influenced by petroleum supply and demand for example; increases in oil demand without increases in supply lead to higher oil prices (Basher and Sadorsky, 2006), substitution products of petroleum, technological developments, OPEC decisions, international politics instability, global growth and crisis.

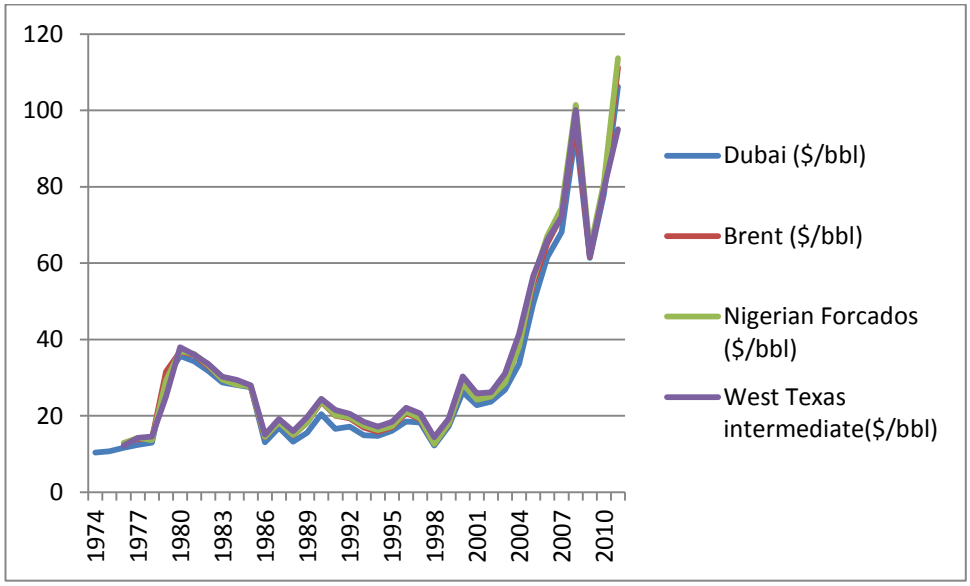
In recent years, petroleum prices have systematic fluctuations. The reason is that the political developments affecting the oil producing countries and in addition to this, growth in the demand by new emerging countries. (Med and Raggad, 2012)

Table 2.3.6 Spot Crude Prices Data Between 1974-2011

YEARS	Dubai ($/bbl)	Brent ($/bbl)	Nigerian Forcados ($/bbl)	West Texas intermediate($/bbl)
1974	10.41	-	-	-
1975	10.7	-	-	-
1976	11.63	12.8	12.87	12.23
1977	12.38	13.92	14.21	14.22
1978	13.03	14.02	13.65	14.55
1979	29.75	31.61	29.25	25.08
1980	35.69	36.83	36.98	37.96
1981	34.32	35.93	36.18	36.08
1982	31.8	32.97	33.29	33.65
1983	28.78	29.55	29.54	30.3
1984	28.06	28.78	28.14	29.39
1985	27.53	27.56	27.75	27.98
1986	13.1	14.43	14.46	15.1
1987	16.95	18.44	18.39	19.18
1988	13.27	14.92	15	15.97
1989	15.62	18.23	18.3	19.68
1990	20.45	23.73	23.85	24.5
1991	16.63	20	20.11	21.54
1992	17.17	19.32	19.61	20.57
1993	14.93	16.97	17.41	18.45
1994	14.74	15.82	16.25	17.21
1995	16.1	17.02	17.26	18.42
1996	18.52	20.67	21.16	22.16
1997	18.23	19.09	19.33	20.61
1998	12.21	12.72	12.62	14.39
1999	17.25	17.97	18	19.31
2000	26.2	28.5	28.42	30.37
2001	22.81	24.44	24.23	25.93
2002	23.74	25.02	25.04	26.16
2003	26.78	28.83	28.66	31.07
2004	33.64	38.27	38.13	41.49
2005	49.35	54.52	55.69	56.59
2006	61.5	65.14	67.07	66.02
2007	68.19	72.39	74.48	72.2
2008	94.34	97.26	101.43	100.06
2009	61.39	61.67	63.35	61.92
2010	78.06	79.5	81.05	79.45
2011	106.18	111.26	113.65	95.04

Source: BP Statistical Review of World Energy, June 2012

Figure 2.3.3 Spot Crude Prices Between 1974-2011



When we analyzed crude-oil prices changes between 1974 and 2011 years, price routes are decreased by Pennsylvania oil reservoir activation. Crude oil prices which goes with fix trend until 1970s, increased rapidly by the reason of Yom Kippur war and rapid reduction happened by Iran revolution. Prices increased with Asia economic recession at the end of 1990s. Prices has changed by global economic crises in 2008-2009 years. Civil uprising which started in Tunisia in at the end of 2011, Arab Spring, and spreading of other petroleum-produced countries causes increment petroleum prices suddenly. Through to end of 2011 year averages of Brent oil prices increase 111.26 dollar per barrel.

2.3.2. Petroleum Market in Turkey

Importance of petroleum which takes important places in developments of Turkey among other energy resources, will last at present and future. Non-cutting energy resources are needed for sustainally economic growth for these events. Owning Petroleum or desire of being controlled, is signed indispensable resources in matter of politics aspects. Despite, Turkey is rich about energy raw materials, recent studies till present shows that, Turkey does not have enough petroleum reservoir.

About 97 percent of crude-oil which processes in Turkish refineries obtained from abroad. High rate of Turkeys foreign dependence in petroleum, consideration on developments on worlds importantly takes place. (15)

2.3.2.1. Historical Development of Petroleum Sector in Turkey

Although petroleum leakage known in Turkey since old times and producing in Romania, Russia and USA in 1860s, ottoman empire did not interested petroleum. (16)

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(15) EMRA. 2012. 'Turkish Energy Market: An Investor's Guide 2012'.

(16) EMRA , 'Petroleum Market Department. 2007 Petroleum Market Report 2005-2006'. Ankara

Oil exploration rooted back to Ottomans. First drilling exploration operation is shallow well where is located Çengen, İskenderun in 1890. At the same year, petroleum and gas symptomys are found in Trakya, Ganos in shallow well. Oil exploration activities which are collaborated of foreign-capital partnership, cancelled because of WWI in Musul 1914. Following to foundation of republic, government appropriated principles of exploation oil resources decision in their national borders. For these goals, Exploration and operation rights of all petroleum reservoirs, components and equals was delegated to government by enacted of 792 law number about petroleum law in 24 March 1926. (17)

First deep well which is drilled in order to oil exploration, is Bapirin-1 exploration well in 20 May 1933. First explored commerce-oriented oil well is Raman-1 well in 1940s. Oil exploration in Turkey speeded up with foundation of General Directorate of Mineral Research and Exploration (MTA) and Turkish Petroleum Corporation between years of 1942 and 1958. By enforcing 6326 law number about petroleum law, oil exploration and operation rights had given to domestic and foreign companies. (18) When petroleum markets came into force, oil exploration was separated into 18 region. In Turkey 1934-2010 period, at sum 3932 well is activated and 7348 million meter drilling operation has been made.

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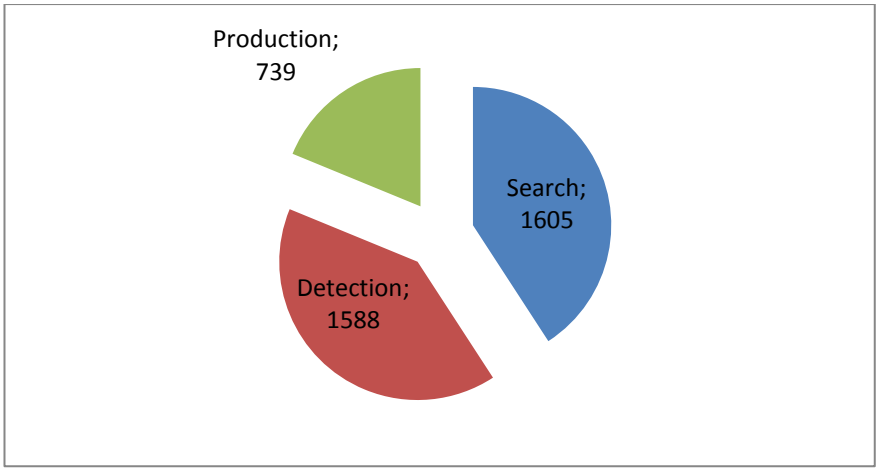
(17) (18) EMRA , 'Petroleum Market Department. 2007 Petroleum Market Report 2005-2006'. Ankara

Figure 2.3.4 Opening Petroleum and Natural Gas Wells In Turkey Between 1934 and 2010



Total: 3932 number - 7348676.18 m

Source: World Energy Council, Turkish National Committe, Energy Report, 2011

2.3.2.2 Reserve of Petroleum in Turkey

Petroleum reserves of Turkey is not rich and easy produced as the Middle East countries. However, even it is proved the existence of oil in South East Anatolia region, it is not probed adequate geological-geophysical survey and exploration in two-thirds of area. (Karaağaçlı - Erden, 2008)

In Turkey petroleum reserve, there were total of 7044008 million barrel reserve in Turkey at the end of 2011. Turkish Petroleum Corporation has 5503849 million barrel reserve of this total petroleum reserves. (19)

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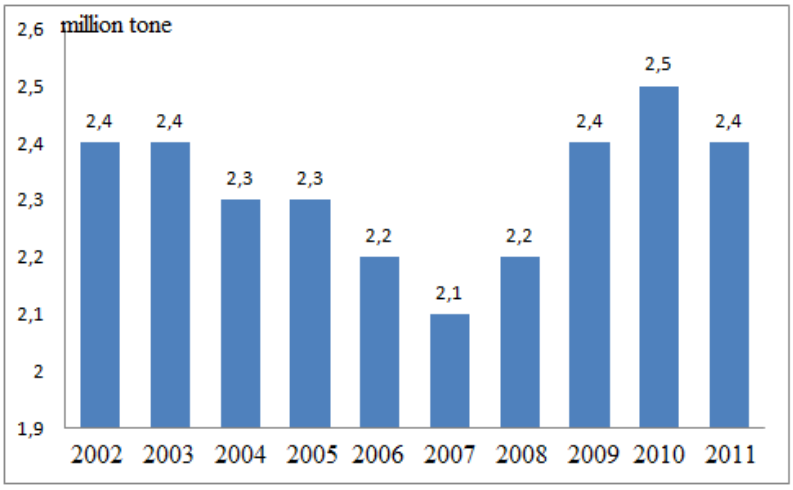
(19) Turkish Petroleum Corporation General Directorate, May 2012. '2011. Oil and Natural Gas Sector Report'.

2.3.2.3. Production of Crude Oil in Turkey

Petroleum was produced total of 2.4 million tone in 2011. Production of petroleum has been actualized sum of 137.9 million tone until today. Turkey petroleum production declined in 5.1% of rate in recent years. 93% of petroleum areas is little area class whose reserve is smaller than 25 million barrel in Turkey. 7% of petroleum areas is the middle area class whose reserve is 25-250 million barrel in Turkey.

Producing of crude oil amounts are seen in below the graph from 2002 to 2011.

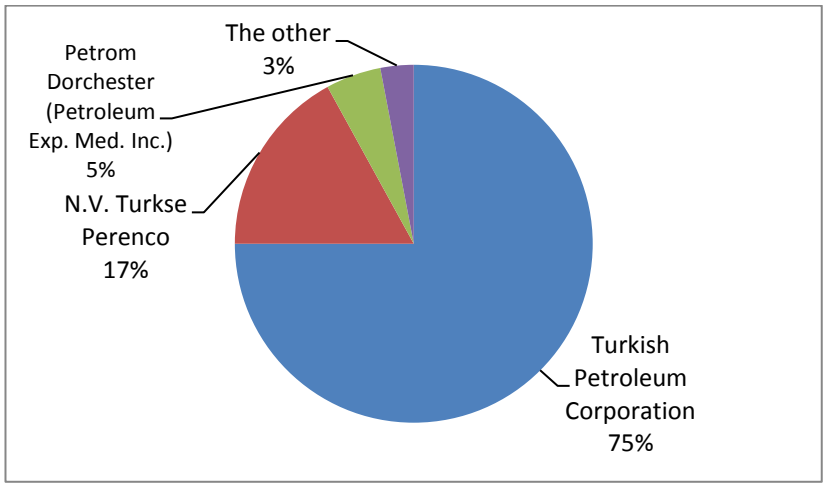
Figure 2.3.5 Turkey Crude Oil Production By Years



Source: Turkish Petroleum Corporation, 2011 Oil and Natural Gas Sector Report.

75% of Turkey crude oil production was became reality by Turkish Petroleum Corporation , and Turkey crude oil production occurred 2.4 million ton in Turkey in 2011.

Figure 2.3.6 Crude Oil Production Share of Petroleum Companies in Turkey in 2011

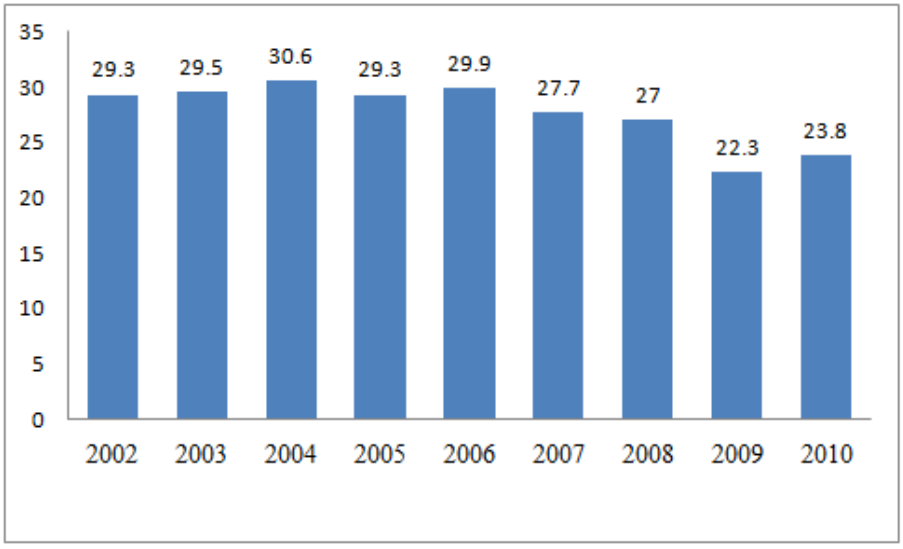


Source: : Turkish Petroleum Corporation, 2011 Oil and Natural Gas Sector Report.

2.3.2.4 Consumption of Petroleum in Turkey

There were not huge changes in petroleum consumption between 2002 and 2008 in Turkey. The reason of crisis in 2009, there were 30% of decrease in petroleum consumption. Petroleum consumption increased again in 2010.

Figure 2.3.7 Petroleum Consumption Between 2000 - 2010 (Million Tone)



Source: World Energy Council, Turkish National Committee, Energy Report 2011.

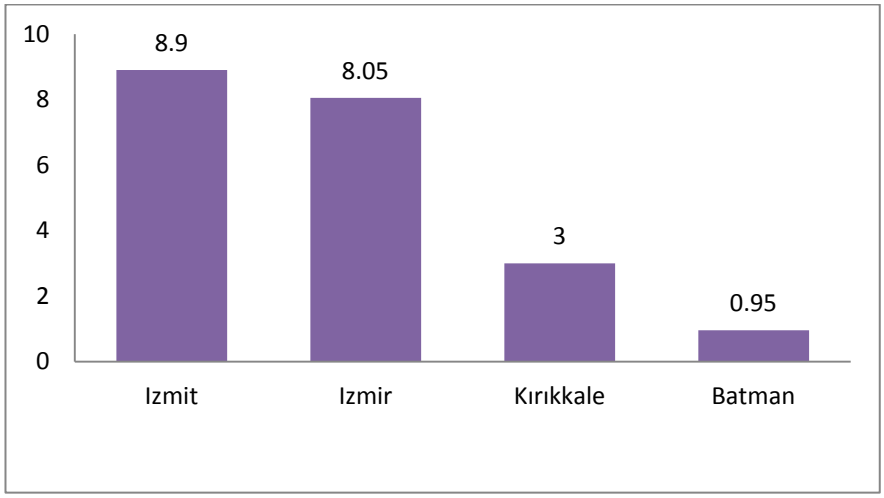
2.3.2.5 Refining Sector

There are four items refineries which are operated in İzmit, İzmir, Kırıkkale and Batman belonging to Turkish Petroleum Refineries Corporation in Turkey.

2.3.2.6 Crude Oil in Processed Refines

In our country, in 2011, crude oil was processed as 20.9 ton and petroleum products was produced as 20.2 ton.

Figure 2.3.8 Operand Crude Oil Amount In Refinery

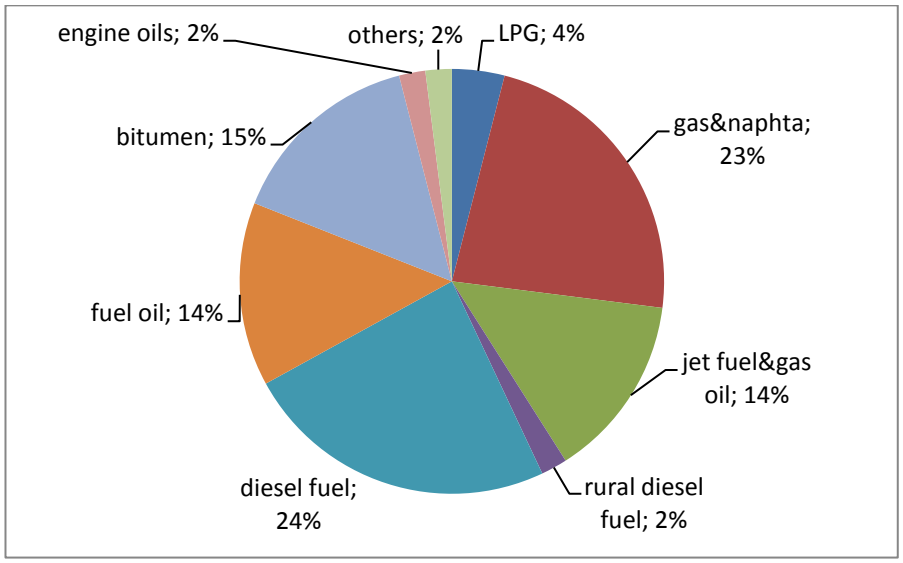


Source: Turkish Petroleum Corporation. 2011 Oil and Natural Gas Sector Report.

2.3.2.7 Petroleum Products in Produced Refines

In comparison with 2010, 7.5% increasing of production of petroleum products occurred 20.2 million ton in 2011.

Figure 2.3.9 Distribution of Petroleum Products in Producing Petroleum Refineries in 2010



Source: Turkish Petroleum Corporation. 2011 Oil and Natural Gas Sector Report.

2.4 LPG MARKET

Liquified Petroleum Gas (LPG) is mixture of butane gas and propane gas. LPG was used firstly in England in the world. LPG is produced by natural gas deposits or processing of oil refineries. (20) LPG has three area of usage. They are tube gas, auto gas and casting LPG. LPG satisfies all demands because of feature of easy portability and high grade fuel. LPG use many field from industry to housing use. LPG has the characteristics of parallel as resultant heat and amount of energy in burning event.

2.4.1 LPG Market in the World

After petroleum crisis between 1970 and 1980, alternative fuel seeking gained speed in an important dimensions due to economic and environmental in all over the World. LPG Production increase by 2% on average each year depending on increasing in natural gas production in the world.

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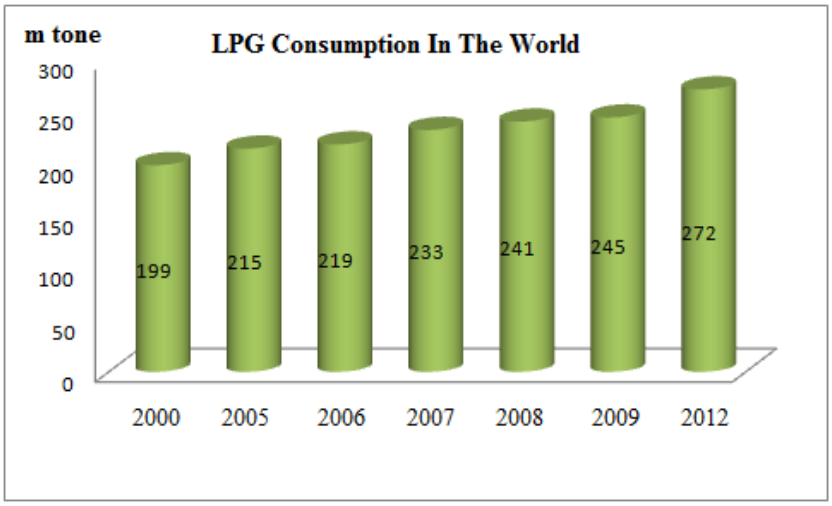
(20) IPRAGAZ web site

Increase of LPG consumption in the world over the years appears in figure 2.4.1.

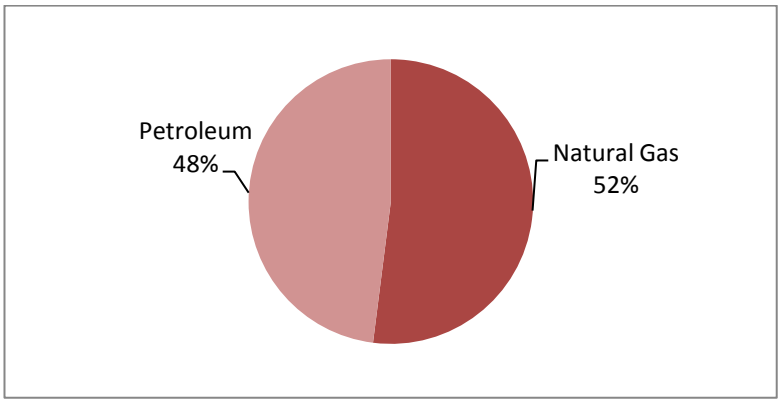
Figure 2.4.1 LPG Consumption in the World



Resource: AYGAZ, Investor Presentation, November 2011

52% of LPG production resources occurs natural gas and 48% of LPG production resources occurs petroleum in the World.

Figure 2.4.2 LPG Production Resources in the World



Resource: AYGAZ, Investor Presentation, November 2011

2.4.2. LPG Market in Turkey

LPG markets open to the participation of the private sector in Turkey time out of mind and LPG markets has provided some degree of competition in markets. At the beginning of 2000, the liberalization of energy markets took effect. And, the existing limits were abolished by 5307 numbered the law of the LPG market in 2005. It comes to the law, the market is re-defined activities, activities outside the chain of production factors are under the jurisdiction of the regulation and supervision of EMRA. Import, transmission, storage, distribution and retail sales are mandatory getting license from institution for the market activities getting license from institution. Market players can compete to provide a fair framework was put into effect an arrangement of the second. (21)

Turkey LPG market is an important role for market investors. Because the laws of 5015 and 5307 were adopted with compatible with the structure of a regulatory framework by all market participants in sectors. (22)

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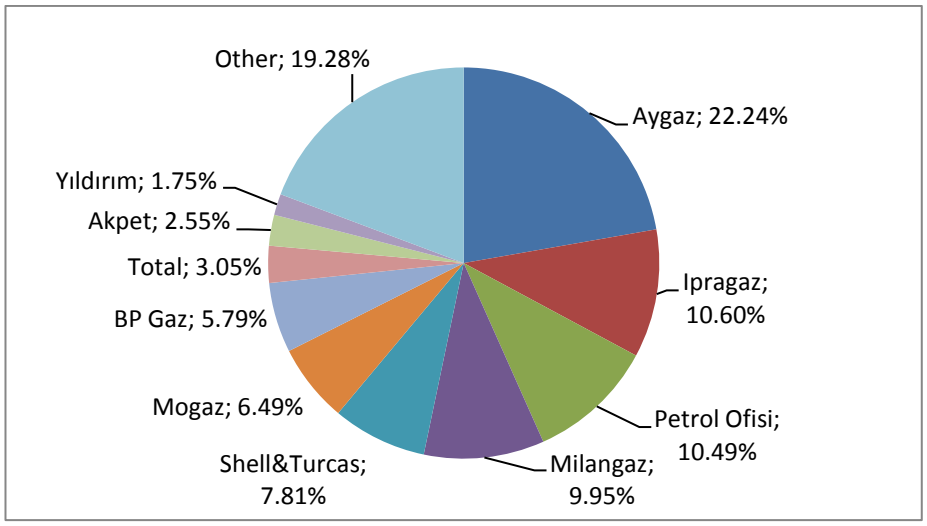
(21),(22) EMRA. 2012. 'Turkish Energy Market: An Investor's Guide 2012'.

LPG market in Turkey is the center of investment both domestic and foreign with developing and deepening structure. The distributor licensee is the number of legal entity who has reached 70 since April 2012 in LPG market. Figure 2.4.3 shows the market shares of the companies in March, according to the data.

Figure 2.4.3 Market Shares of Distribution Companies on March 2012



Resource: EMRA, LPG Market March 2012 Summary Market Number.

2.4.2.1. Production of LPG

Total of LPG production became fact 739 tone in 2011 in our country. Total of LPG consumption exceeded 3.7 million tone in the same year. (23)

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(23) EMRA. 2012. 'Turkish Energy Market: An Investor's Guide 2012'.

Need of LPG is imported by Algeria, Kazakhstan, Russia, Norway and Nigeria for removal of deficit.

Table 2.4.1 Distribution of Import According as Country of Origin

Country of Origin	March 2011 import amount tone	March 2012 import amount tone
Algeria	48.931	67.216
Russia	51.015	56.259
Kazakstan	45.781	44.864
Norway	37.194	42.364
Ukraina	12.840	25.874
Nigeria	21.001	-
UAE	16.751	-
Equatorial Guinean	383	-
Total	233.897	236.577

Source: EMRA, LPG Market March 2012 Summary Market Number.

2.4.2.2. Export of LPG

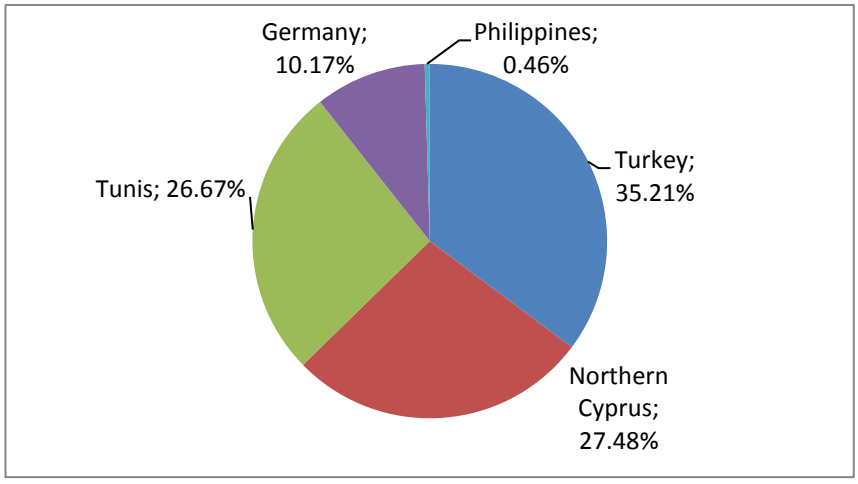
When we look at the distribution of LPG exports into countries, Turkey take place on the top as 4.153 tone in 2012 according to other countries in spite of low rate.

Table 2.4.2 Distribution of Export as to Countries

COUNTRY	MARCH 2011	MARCH 2012
	EXPORT AMOUNT(TONE)	EXPORT AMOUNT(TONE)
TURKEY	6.655	4.153
NORTHERN CYPRUS	3.300	3.241
TUNIS	-	3.146
GERMANY	-	1.200
PHILIPPINES	-	54
SWITZERLAND	5.501	-
GEORGIA	165	-
GREEK	75	-
TOTAL	15.696	11.794

Source: EMRA, LPG Market March 2012 Summary Market Number.

Figure 2.4.4 Distribution as to Countries of Export on March 2012

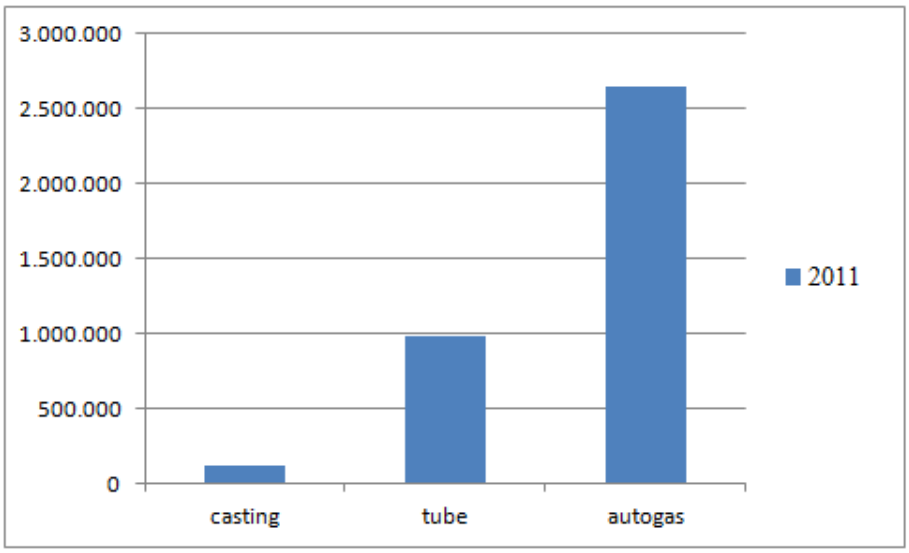


Source: EMRA, LPG Market March 2012 Summary Market Number.

2.4.2.3. Consumption of LPG

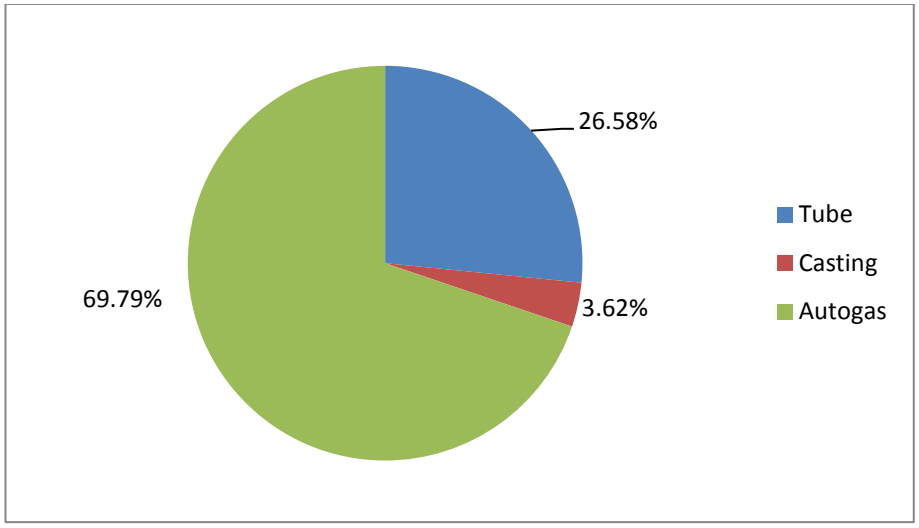
LPG consumption in Turkey exceeds 4 million tone yearly. Turkey has a crucial LPG market in the World. Turkey takes place on the top from the point of view using LPG amount and LPG tool number in Turkey transportation. The world is ranked at the second after South Korea. 122.182 tone of consumption of LPG occur as casting sale, 981.710 tone of consumption of LPG occur as tube sale and 2.642.133 tone of consumption of LPG occur as auto gas sale in 2011.

Figure 2.4.5 Consumption of LPG



Source: EMRA. Turkish Energy Market: An Investor's Guide 2012.

Figure 2.4.6 Distribution on The Basis of Product of LPG Consumption On March 2012



Source: EMRA, LPG Market March 2012 Summary Market Number.

2.4.2.4. LPG Price

Prices accessible on the purpose of product is cheaper than the consumer and quality and safe transmittal in LPG market. LPG market occurs with demand and supply based upon world free market price.

3. DEFINITON OF RISK AND RISK CLASSIFICATION FOR ENERGY MARKETS

When one looks up references to risk in different sources, one draws the conclusion that the best definition relates to the closest correlation between expectation and uncertainty. For this reason it's possible to suggest that risk falls or rises depending on the probability of expected outcomes. (Altay, 2004) When risk is defined in a broad sense, we are able to talk about the probability of failure for plans, danger of faulty decisions, incurring a loss. (Bolak, 2004) McNeil et al, (2005) define risk that any event that may adversely affect an organization's ability to achieve its objectives, the quantifiable likelihood of loss or less than expected returns. The main point is that the difference between expected outcomes and realizations does not need to be negative, positive differences also represent risk.

Every energy company makes investments in their companies with specific growth plans. There are risks in that investment process. The theory of 'no risk, no expected yield', in mind, which was proposed by Harry Markowitz in 1950's and later helped him to win the Nobel Prize, is accepted by many big US companies and corporate risk management perspectives are developed.

Companies applied these perspectives successfully, and they grew and became world leaders. In the year of 2000, Enron with 101 billion USD of revenues and approximately 90 billion USD of share value, announced bankruptcy in 2001. The subsequent in their shares to under 1 USD is a significant indication of risks in energy markets. Enron workers, who were responsible for energy trade, took very large risks and provided misleading reports to the shareholders through a big accounting firm which brought the company to bankruptcy. Bankruptcy of large companies proved the importance and necessity corporate risk management.

It's possible to categorize risks in the energy sector as market risk, liquidity risk, operational risk, credit risk, political risk and legislation risk.

3.1. MARKET RISK

Market risk can be defined as a probability of loss caused by changes of financial assets values in response to movement of prices in the market. Market Risk is, as a whole, are fluctuations in prices of stocks, changes and movements in interest rate, exchange rate and ambiguity in commodity markets. (24) Market risk includes exchange rate, interest rate, stock values and precious metal-raw material price risks.

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(24) 24657 number official newspaper, 2002.

Market risk is expressed as risk of corporate loss and capital-loss regarded changes in movement of interest rates and exchange rates in financial markets. (Bodie, Kane and Marcus, 2011)

3.1.1. Exchange Rate Risk

Exchange rate risk refers to the effect of changes in foreign exchange rate on investments that are made in foreign currency, as well as, on the value of income and expenditures expressed in foreign currency. (Ceylan and Korkmaz, 2004; Bodie, Kane and Marcus, 2011)

The energy sector makes a huge amounts of foreign currency-based transactions when purchasing raw materials. For this reason, the energy sector faces exchange rate risks, and this risk, especially affects investors who penetrate the market intending to speculate and exploit arbitrage opportunities in the international energy sector. For Example, Turkish Petroleum Refineries Corporation keeps a sufficient quantity of foreign currency assets by pricing their current stocks in foreign exchange. In this way, they keep their short position in foreign currency, at an acceptable level. (25)

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(25) Turkish Petroleum Refineries Corporation Annual Report 2010.

3.1.2. Interest Rate Risk

Interest rate risk is tampering on financial assets value as a result of expected and unexpected changes in interest rates. In the energy sector interest rate risk plays an important role both for investors and exporters. Because, if we examine the case from the exporters side, changes in interest rates may affect return on financial asset which is sensitive to foreign currency. (Bodie, Kane and Marcus, 2011)

3.1.3. Stock Values and precious metal-raw material price risk

Prices of electricity, crude-oil, natural gas, when compared to prices of other commodities and other financial products, indicates more volatility and fluctuations. For this reason price risks are present in energy markets. Energy companies' investors and company managers should predict price changes correctly. Anticipating price volatility is at least as important as electricity generators performance and potential refinery losses for shareholders' success in the energy sector. Assortment, long-term agreements, stock-protection and insurance are effective instruments to manage these risks. However, some traditional approaches are not enough to manage price-risks. When prices increase, governments interfere to protect consumers, for all these reasons price risks in the energy industry are very important. Therefore, to avoid intensive fluctuations from energy prices, energy companies, investors and consumers make transactions on the counter, over- the counter markets or derivative markets.

In oil markets, companies whose inputs are affected by oil prices, encounter price/cost risks (26) due to fixed costs and due to contracts which set prices in advance. For example, companies which serve in air transportation, are faced with price/exchange rates/cost risks on ticket sales on future dates with fixed costs.

3.2. LIQUIDITY RISK

Liquidity risk is the potential loss due to time varying liquidity costs. (Stange and Kaserer, 2009) Liquidity risk is described as a situation in which required funds don't exist at the required time and proper costs and being unable to liquidate financial assets at the desired time and price; or the probability of loss due to the inability to make a transfer. As a shorter definition, liquidity risk is the danger of being unable to cash input and output synchronize. (Bolak, 2004). Liquidity risk, the difficulty or cost of trading assets in crises, has been recognized as an important factor in risk management.(Ernst, Stange and Kaserer, 2012) In addition, inflation is among the factors that induce liquidity risk. Liquidity fund cost may increase when inflation rate is high and this makes holding liquid assets costly.

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(26) PETDER. Ekim, 2009. Petrol Sektöründe Risk ve Risk Yönetimi.

In the energy sector; liquidity risk occurs due to liquidity inadequacy on derivatives markets and losses. During the Gulf War, uncertainty in markets affected firms that trade on oil greatly. Moreover, firms in this market had difficulties in setting a price. In this era, firms could not close their position from time to time and this situation brought high cost to firms. (Eydeland ve Wolyniec, 2003). Nowadays, energy companies are confronted with payment risk which arise from sales to private sector customers. In the energy sectors, most part of receivables and sales are obtained from the public sectors and due to this fact liquidity risks are reduced at minimum.

3.3. OPERATIONAL RISK

Operational risk can be described as a financial loss caused by transaction process and the disarray in management systems (Bolak, 2004). In addition, operational risk is commonly defined as the risk of some adverse outcome resulting from disregarded in carrying out business activities, misconduct by people or from external events and inadequate or failed processes, controls and information systems. (Jobst, 2007) For this reason, operational risks consists of staff, related, technical, organizational and legal risks. Operational risk is sometimes revealed by external factors such as fire, earthquake and flood. Losses that arise from not giving enough attention to operational risk sometimes are more harmful than other risks. Operational risk can be considered as a kind of risk which reveals unexpected loss as a result of information systems and internal controls. Risks also occur from the complexity of agreements. Electricity sectors operational risk is higher than that

caused by lack of management. (Unger, 2002). Operational risk is a kind of risk that despite causing large damages in the energy sector and being known for a long time, has always been neglected. Main reasons that retard the integration of operational risk in risk management are lack experience and the lack of operational risk culture in the energy sector, difficulties about gathering quantitative data from the energy sector and complexity in establishing historical databases.

Firms which operate in the energy sector also strive to diminish their effects on mankind and the environment. To this end, energy companies invest in innovations handle environmental risks seriously, such as emission standards, waste, noise, water, sea and soil pollution. The aim is the determination of risks beforehand and taking control of risks. Therefore, protective precautions are taken for sustainability and result-oriented practices are implemented to risks at the refinery, came into implication. Environmental performances of refinery are regularly audited by internal audit departments, insurance companies, provincial directorate of environment and forestry, municipalities environmental protection and supervision office units.

One of critical phases of operation is the physical supply of commodities which are used in generating energy. There are a variety of products among this supply which if not transported carefully, threatens the nature and mankind. Firms tend to go optimization stage in procurement of crude oil devote to enchance companies

operational ability and assortment of supply sources, distribution risk on all level of supply chain, providing price and shipping charge. For example, Tüpraş has to use oil tanker which meets ISO 9001 and "ISPS" (International Ship and Port facility Security Code) restrictions and general accepted by havens standards, on imports of crude oil. Thus high risks that are taken during transportation, will be minimized. To respond to leakage and accidents despite of all precautions, all required equipments are kept at refineries and regularly controlled. Hereby, risks that threaten the nature and mankind are reduced. (27)

Firms supply a great number of equipment, except raw materials, on production of energy. Those all supply operations are came into action by conditions which are prepared by specialists. Suppliers conditions which include, production of goods and delivery time of demanded product, which match standards of procurement policy, are all expected qualifications. Among all of those qualifications, the environmental effects of purchased products are also important. Samples of every type of product purchased are tested in internal or external laboratories with miscellaneous methods. If any of samples are faulty, external procurement of product is stopped. (28)

All the equipments used in Turkish Petroleum Refineries Corporation are made to fit exact specifications by laboratories that have accreditation certificate given by Turkish Accreditation Agency or they are with these specifications order

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(27), (28) Turkish Petroleum Corporation General Directorate, May 2012. '2011. Oil and Natural Gas Sector Report'.

the licence of class certificates that are given by international institutions. In this way, risks that are caused by quality of product are minimized. (29)

When we look at the petroleum sector, risks such as fuel-supply risk, maintenance plan faults, estimation mistakes on manufacturing quantity, uncertainty, wrong trade transactions, control deficiency on processes, risks on storage and handling, risk in carriage of inflammable and combustible materials, risks related to threats to nature and human life, damage that occur in accidents, physical damage and inflicting a third person are all categorized as a operational risks. (30)

The biggest operational risk for companies which operate in the electricity distribution sector, is non-reservoir hydroelectric power station and uncertainty in quantities of production for wind power-plant. This situation is called as a volume risk due to reduced capacity caused by wrong maintenance plan on natural-gas plant. Results of cutting exports to our country, natural gas power plants encounters risk of fuel suppy.

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(29) Turkish Petroleum Corporation General Directorate, May 2012. '2011. Oil and Natural Gas Sector Report'.

(30) PETDER. Ekim, 2009. Petrol Sektöründe Risk ve Risk Yönetimi.

3.4. CREDIT RISK

Credit risk refers to a situation where companies or persons whose deal with financial transactions, are unable to fulfill their liabilities to opponents (Bolak, 2004). Credit risk, consequently, means debtors can't pay debts to creditors. Credit risk is seen extensively during economic crisis and contradiction eras. (Aloğlu, 2005) .We can take, as an example, the Enron crisis, caused by credit risk, in the energy sector in USA. Enron company went bankrupt because it was unable to comply with credit liabilities. Negative effects of the Enron crisis on companies, was that it provoked other companies which operate in the energy sector, to revise their credit policies and to take control and minimize credit risks. (James, 2003).

In the energy sector, at electricity producing companies, especially in which liberalization and an increasing number of shareholders have take place, face credit risks in all value chain. Risk which influences chain value affects all other actors through dominos effect. (Gunaydın, 2012)

Credit risk starts with the liabilities process on agreements where manufacturer company purchases raw materials from other companies, and this process continues with supply contracts between retail company and production company. The main risk on a supply contract is being unable to meet obligations on purchased merchandise as a contract condition. These risks end when payments for purchases are collected from final consumer. The main risk on the final consumer is realized when the retailer company cannot collect payment from the final consumer in the

framework of the sales contracts conditions. Up to final consumers level, obtained electricity cost even for a single consumer can crash the wholesaler companies cash flows, and financial balance. Beyond all of these, delays on collections and possible collection risk might affect spoiling this balance and profitability of company.

A good example of credit risk is absenteism of under protection by any financial intermediaries on bilateral aggrements between free consumers. In over the counter markets, similiar structures and risks of electricity sales with standart contracts, are overtaken by financial intermediaries. There is high collection risk settled on electricity distribution companies because of absenteism of financial structures on electricity-distribution markets and deficiency in regulations and legistations. Sometimes the consumer who receives electric energy may overtake more responsibility beacuse they do not know regulations, market intelligence and contracts.

3.5. POLITICAL RISK

Political risk is, in general, losses caused by wrong policies implemented by authorities or crisis that arise in a foreign country and spread over to countries. Major political risk can be listed as; intergovernmental problems, war situations, nationalisation, shortage of convertibility, increasing on tax rates, obstacles for exports, cancellation of foreign-based investment incentive, limitations of foreigners

ownership rights, compulsion on usage of domestic raw materials and equipments.

In recent years, political concerns related to energy security has carried this issue to the top of the world political agenda. In 1999, as a result of the closing nuclear power plants in Switzerland all wholesaler companies in the region are affected negatively and Russians cut off natural gas-pipeline to Turkey beacuse invasion of Georgia by give justification of Ukraines attitudes show matter of importance. (Unger, 2002). Our countries energy needs will increase day by day depending on developing industries. This situation causes requirements of making assortment on energy. By providing this, despite a lot of agreements made in country borders, our country has to export most of the energy from outside. It is assumed that every year, the country spends most of its budget on energy imports. (Yücel,1994)

Turkey is between energy-producer and exporter countries. This location gives Turkey the transition role on the delivery of energy resources to target countries with the dissolution of the USSR, a new competition on energy was born and Turkey's location as a key country for transportation of resources and host to the most of projects that deal with energy transfers. The EU which imports half of its energy needs required alternative routes to reduce risks on imports to a minimum. For this reason, these interests are related to closely Turkey's supply security policy. USA and Russia who are the biggest actors in the energy sector challenge each other for

the domination in the Middle East region where Turkey is located. (Kona,2004)

Turkey who settles on strategical area influences deeply this dominance challenge. Turkey takes over like a bridge role that deliver energy resources (crude oil, natural gas) east to west region, passing by Turkey to international markets. At this point, USA and Russia show constructive efforts to this structure if its serves their interests, in other circumstances, they tend to block this structure. The USA doesn't lean towards collaboration between Russia and Turkey. Also Russia doesn't want the USA as a rival because of contraction of domain and power axis in the Middle East region. Consequently, Turkey remains in a tight situation regarding the USA-Russia energy policy. (31)

In view of these, Turkey have indispensable importance for Eurasia Pipeline Projects. However, the unstable environment on that line potentially carries a great deal of disadvantage for our country. These circumstances are big obstacles for developing relationships between countries. (Sönmezoğlu and Eraydın, 1995)

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(31) Stratejik Araştırmalar Enstitüsü (SAE), Ekim2007, "Türkiye'nin Enerji Satrancı", Turksae, Ekonomi, Istanbul p:(1-6)

3.6. LEGISLATIOANAL RISK

The energy sector reform in Turkey and restructure roots nowadays. In previous years, despite of suitable fields exist, by 2000s more comprehensive structural projects programs are started. Primarily, after basis regulations on electricity, secondarily more comprehensive regulations legislated. Assignments about legal and regulative structure quoted from noticifications of advancement in EU candidates process. In new market structure production and retail sales will develeop competitive ways. Transmission and distribution are arranged in providing access not discriminatorily for all participants. With this regulations, some concerns in energy sector, doubts and 2001 year which sector is being restructured completely and lose their effects following over-one years. And necessary basis steps had taken for more competitive and liberal energy markets and by establishing proper infrastructure for energy markets, and still a lot of restoration exists to create perfectly-run energy markets. As for some regulation restoration is designed after seeing results of regulations on force. In addition, to decline infringement of market rules; market cultures should have penetrated as far as quality of audience restoration.

In spite of we explain, changes in market as a normal, mistakes that is made in beginning, changes that made pure-liberalization incentives without tested market simulations, faults and not based on entire structure bring together new-necessity and will so on. Point of that, revoking some uncertainty in aspects of see clearly markets future and removing contradictions between regulations on force and truths.

It's impossible to explain that market which is independent, stability, contestable market, financially, transparent and legislation-oriented. It still relegates Supply securitization and regulation risk with dominant public power and prices that doesn't reflect cost (cross subsidies). In other words, preamble presented before legislation published; absenteeism of competitive power, running operation simultaneously, unable to perform sufficient supplementation, public pressure, high cost, prices that doesn't reflect cost, limited entrance of private sector to market, high loss and defect rates, privatization that doesn't prepared legal entity still continues. Deficiency of free supply and competition, incomplete of privatization, inadequacy of bilateral agreements and circumstances where prices that have no signal specialty, they allcause seriously distress on electric markets on electric stock-exchange.

Consequently, we can't claim the regulatory board and market where precautions taken with audit results, realize targets that emphasizes in law. In enforced arrangements still have missing regulations, e.g. incentives. Regulations on privatization haven't integrated yet. Arrangements about audience of distribution companies, boards agreements opinion about findings on audience report haven't cleared yet.

Energy Markets Regulation Boards (EMRB) semi-judiciary speciality has faded away. Audiance regulation and intra vires of ministry audience to Energy Markets Regulation Boards, EMRB went under banner of execution is expressed.

Energy sector investments which is in application of incentive about supplementation security should be involved strategic investment. License owner who received incentives about transfer purpose before, become more advantageous by not giving incentives to natural gas based power plants. Energy investments not based on natural gas and which aims afford energy requirements, aren't possible by application that proportioned by premises power incentives regulation.

Ministry circular about terrain allotment, which is not based on legal regulations,causes results of detention on application of investment. Privization on distribution tender for a contract on big firms together in moreover market share and adding that privization on it carries qualification of increasement on financial needs in market-wide.Conditions in which financial markets goes on with uncertainty causes distress financing on alienation fees.

Energy sector regulations need permanent regulations in which regulate market rotation,provides run in market efficiently, aims to enchancment on investments. Retroactive practises on legislations amendments, causes effects diretcly companies cash flow. This circumstances are seem big risk on market.

4. RISK MEASUREMENT

Risk management necessitates measurement. Primarily, we started with calculation of risk sizes and magnitudes. Subject of risk measurement and management requires taking account of energy sector features. An energy as a pyhsical product has characteristics of transportation, stockpiling, weather conditions, technology, short-term inequaliton of supply and demand, effectiveness of feedback on prices, low liquidity, market segmentation, price skipping, abnormal distribution and extravagancy, high and instability on variances, non-standard agreements and high risk of opponents side. For these reasons, all these characteristics are taken into account in risk management. (Khindanova and Atakhanova, 2002)

Risk measures are used to determine the risk capital which the holder of a portfolio of assets and liabilities has to hold. It can be invested with low risk.(Tsanakas, 2008)

All companies have the ability to measure their risks. It is important to select the appropriate risk measurement. The most common tools for assessing market risk are based on at risk measures in the manner Value-at-Risk (VaR). (Ivănuş, 2003) Loss is measured on a mark-to-market basis. So, it is estimated via simulation of large loss probabilities or of risk-measures as Value-at-Risk (VaR). (Gordy and Juneja, 2008)

Besides, the key component of risk measurement is the measurement of financial asset return volatilities and correlations. (Andersen, Bollerslev, Christoffersen and Diebold, 2011)

A market risk measures uncertainty in the future value of a portfolio and in the portfolio's return or profit and loss. (Alexander, 2008.) According to my studies, market risk on energy markets; can be measured with profit at risk, value and cash flow. In this thesis, variance and co-variance methods to assess the value of risk on electric markets stocks that traded in energy markets will be applied.

An important point is applying the right modelling in estimation of values under risk and applying the proper methods among alternatives for values in risk measurement. In calculations the value at risk, three different models are applied which depend on the probability distribution of price changes that might occur in the future and the correlation between risk factors which are included in the model. These models are variance-covariance, historical simulation and Monte Carlo simulation methods. Management performance and estimation of risk which is dependent on the prediction of risks of electricity price changes are examined by selecting variance and covariance among these three methods. The reason for selection variance and covariance method is that it is more efficient than other models in the speed of calculation and the parametric value at risk method performs better in detecting risks.

4.1. PROFIT AT RISK - (PAR)

Main purpose of profit-at-risk is managing price risks by volume risk at long-term, and it's used for long-term analysis. Maximum profit at the end of the year is taken into account, and PAR is calculated with reference to minimum loss.

Profit-at-risk method is used to detect and explain expected profit reduction which is caused by spot market fluctuations in the mid and long-term. An increase in profit at risk simultaneously increases expected profit for speculative purposes too. While value at risk for the portfolio decreases, expected profit is reduced as well. (Balkoç, 2012)

4.2. CASH FLOW AT RISK

CFAR (cash flow at risk) express maximum loss that is occurred by cash flow that planned for specific period in specific time and confidence interval depending on market conditions. Cash flow at risk is method that referenced by internal financial estimation of institution that is used on non-financial institutions. (Sarı, 2012)

CFAR was developed due to increased interest from the business community. CFAR is based upon a forecasted probability distribution of cash flow at some future point in time. (Andrén, Jankensgård and Oxelheim, 2005)

By using cash flow at risk calculation methods, cash flow at specific date in boundaries of confidence interval reduction and increase. If perfect market conditions are reached can be calculated. With outcomes of analysis, we can draw conclusion that sufficient cash level coverage on payments, probability of specific changes emergence on cash flow and cash planning that contains market risks by detected requirements working capital is being made. In this frame, cash flow at risk is used on risk assessment which is occurred by cash variation in midterm. Maximum, minimum and expected cash level values are calculated for each of day of year. By providing this, effective management of cash flows can be reached. (Balkoç, 2012)

4.3. VALUE AT RISK

Rapid developments that have started since 1970s have caused increases in risks in the market. Just like the rest of the world, in Turkey, market risk which financial instutions and investors carry has become one of the most important risks. Risk measurement also became complex due to the definition of risk. Therefore, risk measurement becames important for financial instutions and investors. This process that started with risk measurement,continued with the evaluation of internal model for risk measurement that are used by financial instutions in the early of 1980s. Each firm prefered to establish a different risk management system and this caused the regulations board to create standard methods which are not always helpful because of risk diversity that companies experience, the difficulties inherent in risk

measurement and changes in risk factors over time. Value at risk was developed by JP Morgan in the mid 1990s, by introducing the Risk Metrics approach.(* Anis, Roth and Apolzan, 2011) This method is used commonly the reason of calculation of value at risk, comprehensible and giving integrated outcomes. (Eser, 2010). In Turkey, value at risk method commonly used to evaluate market risks assisted by official statement and decisions are published by regulatory and auditory boards.

Value at risk, in normal market conditions, is risk measurement method that determines expected maximum quantity of loss in specific level, specific period and specific confidence interval. (Şahin, 2004). It quantifies the possible loss of investments as a sole number. Value at risk is the measurement of loss that is caused by market fluctuations. It is the most commonly used method about risk measurement in the market. The greatest advantage of value at risk is that it is able to express as a single monetary value the consequences of different risk factors, such as the interest rate, exchange rates and stock prices of different positions.

(Candan and Özün, 2006) Statistically, for securities held for a specific period of time, the maximum value of the expected loss within a certain probability is referred to as VaR, which comprises risk factors, and risks related to the bridging between the different positions and all this is expressed as a single figure.

The calculation of value at risk (VaR) is explained below.

Value at risk calculation parameters consist of value of portfolio, volatility of risk factors, determined confidence interval and the holding period.

$$VaR = M * \sigma * \sqrt{t} * \alpha \qquad (1)$$

M: Market value of portfolio

σ : volatility of risk factors (standard deviation of portfolio)

t : lock -up period

α : Confidence Interval

VaR (on VaR) value increases proportional to the square root of the time interval. The selection of the time interval depends on the portfolio structure. The time intreval which is used in the calculation of value at risk is the duration of holding the investment. The important point in the matter of selecting the time interval is that, if it's used with the intention of comparison, it's better to select a short-time range, if it is used for the purpose of determination of firms quantity of capital reserves that can be used in times of crisis, a longer time range should be selected.

VaR calculation can be made with three different models depending on whether the probability distributions of future price changes realization in future are standard or not the correlation between risk factors in the model. Two different approaches are applied, estimation by simulation and parametric estimation (variance and covariance). The specific methods applied are called covariance-variance, historical simulation and Monte Carlo simulation.

4.3.1. PARAMETRIC METHOD (VARIANCE-COVARIANCE METHOD)

The variance-covariance on the parametric method is commonly used in the calculation of value at risk. The main assumption of parametric methods which is used in calculation of market risks, is that financial assets returns have a normal distribution. (Uysal,1999)

In this method, parameters which determine values of trade portfolio are set and highest value lost which is based on assumptions of fluctuations with a certain probability is calculated. (Rodoplu, 2008) .Variance and covariance matrix is constructed by parameters are derived from standard deviation and data obtained from correlations which are gathered from past-return series. Thereby portfolios expected loss is obtained by calculation of futures risk factors of value at risks.

The variance-covariance method, the mean which is obtained from past data related to price changes and standard deviations which is so important for VaR, and that define a normal distribution, are used. Its assumed that the standard deviation is independent from time.

It doesn't reflect current market situations. Hence to calculate volatility a more exact and up to date, the EWMA (Exponentially Weighted Moving Average) method is preferred which provides more current estimates in the calculation of value at risk. EWMA method concentrate on latest data; on the data set to provide more volatility up to date estimates and aims to reflect tight movements in volatilities.

To apply this method; each risk factors' estimation of volatility and correlation is required.

$$VaR = \sigma \times \sqrt{T} \times PV \times Z_{\alpha} \qquad (2)$$

calculated by equation (2).

Using parameters in this method.

PV = Present value of portfolio

Z_{α} = Value that corresponds to a confidence level in normal distribution table

σ = Return Volatility (Standard Deviation)

t = lock-up period

(Duman, 2000)

In the above equation, when only one financial asset is invested, this result give value at risk.

When there are more than two assets, standard deviation of the portfolio is calculated based on the variance-covariance matrix of financial assets in the portfolio.

The volatility of the portfolio is:

$\sigma_p=\sqrt{(x * C * x')}$ (3)

calculated by equation (3).

σ_p = Volatility of Portfolio (Standard Deviation)

x = Column vector is that including weight in portfolio of each investment

C = Variance-covariance matrix

x' = Row vector is that including weight in portfolio of each investment

The standard deviation of the portfolio is calculated in the following steps. First the covariance matrix is created. Then the column vector that includes weights in the portfolio of each investment and the covariance matrix is multiplied. Thirdly, this matrix that results from the second stage is multiplied with a row vector that includes weights in the portfolio of each investment. And finally, the square root of the resulting matrix is calculated which gives the standard deviation of the portfolio.

After volatility of portfolio is calculated, value at risk of portfolio is calculated by the equation (4).

$$VaR_p = PV * \sqrt{(x * C * x')} * \sqrt{t} * Z_\alpha \qquad (4)$$

Volatility in this formula is scaled with square root of lock-up period.

In this formula, the volatility was scaled with square root of lock-up period. (t). "Brownian" motion based on scaling the square root of time of risk is the basis of the random walk model. Followed by a random Brownian motion, the distance traveled by the particle, the square root of time until the unit has increased. For example, if VaR calculated for a time period of 30 days, daily volatility multiplied by the square root of 30 daily volatility.

When portfolio variety increase, Value at risk amount decrease due to correlations. (Dowd, 2002).

4.3.2. HISTORICAL-SIMULATION METHOD

Unlike the variance and covariance method, it is a non-parametric method that doesn't contain correlation or covariance measures account among assets. Fundamental idea of the method is that past events might repeat in the future. Circumstances, happened in the past and repeating at the present reveal the highest loss in specific confidence interval. (Gökgöz, 2006)

Historical simulation method, doesn’t assume the distribution of portfolios returns or financial assets and it doesn’t need of parameters, such as volatility and correlation. Grum, (2008) researches the historical simulation methodology of VaR calculation is commonly used because of its independence to risk factor distribution. (Grum, 2008)

This method can be applied to all portfolios; linear and non-linear. To calculate portfolio's return, assets weight in the portfolio should be calculated. To apply of this method, the historical returns of assets in the portfolio should be gathered and Value at risk is calculated by using historical price movements. Portfolio's profit and loss distribution in the future is determined by using historical changes of risk factors in assets in portfolio and we can reach value at risk at selected confidence interval. Related confidence interval, if we assume that portfolios returns reflect the future, is giving value of expected value at risk in portfolio.

Probability of possible profit and loss distribution in historical simulation method, is obtained by appliance of market factors changes which is occured during past period on portfolio. By applied this,we can reach assumptional value of portfolio that is assessed by market prices. Following that,each of assumptional portfolio value is compared to current value of portfolios. Gathered differences bring assumptional profit and loss and portfolio returns distribution.

$$R_{p,k} = \sum_{i:1}^{N} W_i R_{ij} \qquad (5)$$

$k \in 1,2,.....t$

calculated by equation (5).

W_i : Present Weights of Risk Factors in Portfolio

R_{ij} : Return Changes in k time of stocks in Portfolio

$R_{p,k}$: Return in k time of Portfolio

(Linsmeier - Pearson, 1996)

Current weight (w) is used in portfolio with this formula. Historical portfolio value is calculated by return change for past k value. By constructed portfolios of profit and loss, a series in which is implies loss to profit are obtained, and value at risk which is equal to 95% and 99% confidence interval level, is selected.

The biggest one of deficiency on historical simulation method is assumption of events might be similar as past events when risk on future is estimated. Because data on estimation period may contain different price movements. Thanks to that, high risks can be calculated. (Gökgöz, 2006)

4.3.3. MONTE CARLO SIMULATION METHOD

The other VaR calculation method is Monte Carlo simulation method. This calculations are done based on simulation. This method based on determination new market prices and calculation distribution of market value of portfolio. Monte Carlo simulation is defined benefit from probability distribution that values of dependent realization time of cases of changing event of system. This method is statics simulation model in certain time period and for reflecting specific event of minute. This simulation method based on probability theory. (Esen, 2008).

Monte Carlo simulation method is very similar to historial simulation. For example like historical simulation methods, values which matches desired confidence level derived by price movements listed as biggest lost to biggest profit, brings value at risk. However differences between those two methods take place. These are; historical simulation method emphasizes assumption of historical observation reflects future, in spite of this Monte Carlo simulation method includes many randomly price movements. In historical simulation method,real datas which reflect price changes in historical period to construct portfolios profit and loss, are utilized. Therefore, in Monte Carlo simulation method, statistical distribution which reflects possible changes in prices, is selected and random datas which is regardless real datas, are used. (Duman, 2000) Creating random numbers are feature of this methods. This numbers are reassessed by market prices. To create random numbers primarily, a distribution which represents changes in market factors should be

determined. (Uysal, 1999). Such as a historical simulation method, portfolios profit and loss are listed as a highest loss to highest profit. Value which is equal to selected confidence level, is set as a value at risk amount. Additionally, such as variance and covariance method, returns on assets have normal distribution is assumed.

Monte Carlo simulation is originated by financial assets which is formed by non-linear returns, like options and complex portfolios are used comprehensively in Value at risk calculation. Most comprehensive value at risk methodology is used. VaR involves non-linear correlations in portfolio, effects of possible changes which may reveal in future.

Moreover, a Monte-Carlo simulation where the distributions reflecting ”variability” and the distributions representing ”uncertainty” are sampled separately in the simulation. (Fenyves, Tóth and Tarnóczi, 2010)

Monte Carlo method is calculated like that; portfolios potential market risk factors are determined, formulas which reflects price changes of financial assets in portfolio, are determined, distribution which is related to changes in basis risk factors, is determined and these distribution parameters are calculated. After determination of distribution, many presumptive random values which is suitable for that distribution, are created. Portfolio values are calculated by using presumptive

values and calculation between portfolios current values and profit and loss among this presumptive values. Obtained presumptive profits and losses are listed as lowest to highest, losses which is equal to desired confidence level in final phase, are detected.

5. APPLICATION OF VARIANCE-COVARIANCE METHOD FOR HISTED STOCKS IN THE ELECTRICITY MARKET

In this application, a portfolio is formed for electricity market stocks. There are a very few number of electricity stocks in the stock exchange. Therefore, a total of five stocks of electricity producing companies in the stock market are used in creating a portfolio. This portfolio constitutes of Ak energy (AKENR) , Aksu energy (AKSUE), Ayen energy (AYEN), Işıklar energy (IEYHO) and Zorlu energy (ZOREN). In this application, monthly closing prices of electricity equities is used between 07.2000 and 09.2012. (32)

First of all, price movements of these five equities of Turkey's electricity market are examined. (These graphs are in Appendix A.) When we analyze price movements of equities one by one, prices of Zorlu energy stock show volatility between 2000 and 2002. The prices of this security started to decrease from the middle of 2002. Especially, ZOREN prices have remained quite low since 2005. The Işıklar energy stock price reached its maximum level in 2000. And then it started to decrease suddenly. Prices exhibited high volatility until 2005. IEYHO prices have remained low since the beginning of 2005. When we look at the price movement of Ayen energy stock, we observe an increasing and decreasing pattern in price movements

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(32) These data were used in ISE web site.

between 2000 and 2005. AYEN prices have stayed at their low level from 2005 to until today. When we look at the distribution of the price changes of Aksu energy stock, we see that AKSUE prices exhibited a massive increase, but then it suddenly decreased again in 2011. Prices showed volatility up until 2005. Aksu electricity stock prices have stayed constant at a low level 2005 up until today. The Ak energy stock prices follow a decreasing and increasing pattern until 2002. From 2002, onwards, especially after 2005, AKENR prices show a stable structure.

Generally, when we look at price movements of all these equities, we see an increasing and decreasing pattern until 2005. In particular, price movements were very strong between 2000 and 2001 because of financial crisis in Turkey between 2000 and 2001. However, we see that the prices stabilize at a relatively low level in 2005 after moving up and down with decreasing intensity after the 2001 crisis. The electricity price movements are also affected by seasons, energy efficiency and increase in industry production. In general, electricity prices rise in June and July.

Following the convention in applied financial time series analysis, logarithmic returns are used in calculations. First of all, returns of equities were calculated as in equation (6) below. In this equation, r_t is return in t time of the equity and P_t and P_{t-1} show in $_t$ and $_{t-1}$ time electricity prices.

$$r_t = \ln (P_t / P_{t-1}) \qquad (6)$$

This return was calculated in excel. In addition, when we observed prices and returns of five stocks, stock split and capital increase were occurred in these stocks. Stock splits and capital increases that have taken place in the sample period were taken into account in the calculation of returns. For AKENR, returns in May 2002, January 2005 and April 2010; for AKSUE returns in December 2000, January 2005, and January 2006 as; for AYEN returns in January 2005 and May 2005 as well as September 2011; for IEYHO returns in March 2001, April 2002, April 2003, April 2004, January 2005, April 2007 and October 2011; for ZOREN returns in December 2002, January 2005, September 2009 and March 2012 reflect these changes.

The returns were read into the Gretl programme and descriptive statistics of electricity equities were obtained. A variety of tests and analysis were applied for these stocks. A description of the statistical tests employed are presented below. The Augmented Dickey-Fuller (ADF) test is a test of stationarity. The presence of unit root is tested against the alternative of stationarity.

In time series, data in a stationary series, the mean, variance and covariance of the series do not change over time. If a time series is stationary, it would move in a similar fashion in the future. If a time series is not stationary, it becomes difficult to make predictions for the future based on historical information.

We also apply the Jarque- Bera test. The most important assumption in value at risk calculations is that returns are normally distributed. Applicability of the normal distribution of calculated monthly return is tested by the Jarque-Bera test.

Distribution structure of returns were analyzed taking account of skewness sizes and kurtosis measurements. In addition, it informed us about whether the normality assumption holds or not.

After the tests, the variance-covariance method (parametric method) was applied to calculate value at risk for this portfolio. In the first application, variance-covariance matrix is calculated based on data between 07.2000 and 09.2012. In the second application, the variance-covariance matrix is calculated sets of between 09.2010 and 09.2012 on more recent data, to be exact. These two results are compared.

We have analyzed how much value at risk is affected when stocks are given equal weight or different weights matrices for both variance-covariance matrices. In calculation of value at risk, value at risk measurement rules are determined. After then, data set is created. Statistical assumptions are formed. After volatility and correlation prediction method are identified, calculation method is formed.

In this application, calculation of value at risk used a one-sided confidence interval of 99%. 1 month and 1 year (12 month) is used as the lock-up period. EWMA method is used for volatility prediction.

EWMA (Exponential Weighted Moving Average) is one of the most popular models of volatility which associate time and volatility to calculate future volatility with average movement of past volatility. This model is founded on the principle of asset returns whether distributed symmetrically or independently, depending on the time-varying volatility assumption. (Bolgün and Edremit, 2005). Methods that use a standard deviation that does not change over time, do not represent the market conditions of the day. Therefore, EWMA, which is variable variance modelling method as to time, is preferred to calculate contemporary of volatility.

5.1.Data Analyses of Application Tests

In the electricity market, monthly closing prices of equities were obtained between 07.2000 and 09.2012. The results of the ADF test are presented in Table 5.1.1 (Results of ADF test statistics for five equities are given in appendix B.) Before calculating value at risk, stationarity of the return series were analyzed with the ADF test.

Table 5.1.1 ADF Test Results

	Augmented Dickey Fuller Test Statistics	Probability
AKENR	-6.2	0
AKSUE	-6.3	0
AYEN	-6.7	0
IEYHO	-13.1	0
ZOREN	-12.2	0

In the above table, because of the fact that calculated ADF test statistics according to test results is less than critical value, hypothesis is rejected and return series of equities are determined to be stationary. In time series data, stationary series would not be decreasing on increasing continuously in a given time period but rather would oscillate around the horizantal axis.

Table 5.1.2 Jarque-Bera Test and Test Statistics Results

	Mean	Median	Min	Max	Stand.Dev.	Skewness	Kurtosis	Jarque Bera Prob.	P value
AKENR	0.0012	-0.0027	-0.42	0.53	0.140	0.247	1.52	15.75	0.00
AKSUE	0.0029	0	-0.429	0.424	0.154	-0.146	0.427	1.64	0.00
AYEN	0.0025	0	-0.554	0.587	0.151	-0.025	2.188	29.36	0.00
IEYHO	-0.091	-0.033	-0.619	1.275	0.245	1.116	5.149	192.93	0.00
ZOREN	0.002	0	-0.643	0.575	0.157	0.042	3.53	76.37	0.00

Whether the returns of equities have a normal distribution or not were determined by the Jarque-Bera test. The Jarque-Bera test reflects the null hypothesis that the returns follow a normal distribution since the Jarque-Bera test statistics are large and probability values are less than the significance of the first.

Statistics of electricity stocks are in Table 5.1.2. (Summary statistics test and normality test was used in Gretl program to find this test results.)

The skewness and the kurtosis play an important roles in risk measurement. (Dowd,2005) Skewness coefficient and kurtosis coefficient must be looked at to analyze the distribution of return series noninclusive normal distribution.

Skewness measures the symmetry of the distribution. Kurtosis measures the acuity of the distribution. In the normal distribution, coefficient of standard skewness is zero. The coefficient of standard kurtosis is three. When coefficient of skewness is bigger than zero, the left hand tail of the distribution is longer or fatter. When the coefficient of skewness is less than zero, the right hand tail of the distribution is longer or fatter. Kurtosis shows us whether the probability mass of the distribution is around the average or far from the average. When the coefficient of kurtosis is more than three, the distribution is pointed. When the coefficient of kurtosis is less than three, distribution is more rounded. When we observe skewness value and kurtosis value of five stocks, skewness coefficient of AKENR return, IEYHO return and ZOREN return is more than zero. This case show us that distribution of returns is skewed to the left. The skewness coefficient of AKSU return and AYEN return is less than zero, so the distributions of their returns are skewed to the right. Kurtosis coefficients of AKENR, AYEN, IEYHO and ZOREN are more than three. Therefore the return of distributions of these stocks are pointed. But AKSUE is less than three so the return distribution of this stock is more rounded.

The most important measure which is indicative width of the distribution is the standard deviation. Standard deviation is a measure of how far the observations lie from the mean of the distribution. The distribution becomes widespread as the standard deviation sets bigger. When the standard deviation is small, the average of deviations and risk become less. When the standard deviation is large, the average of deviations and risk increases. In addition, it is an indication of volatility.

The electricity market equities do not conform to the assumption of normally distributed returns. However, as the histograms show, the returns have a symmetric distribution, but the probability mass.

In the tails are different compared to normal distributions. In the value at risk analysis that we will undertake in the next section, we will be creating a portfolio and hence using the return of the portfolio as a basis of our analysis.

The average return of the portfolio has a closer slope to a normal distribution, especially given the flexibility of choosing different weights for the equities in our portfolio. So even though, the individual stocks do not have normally distributed returns, we proved under the assumption that the portfolio return is normally distributed and we choose the portfolio weights accordingly.

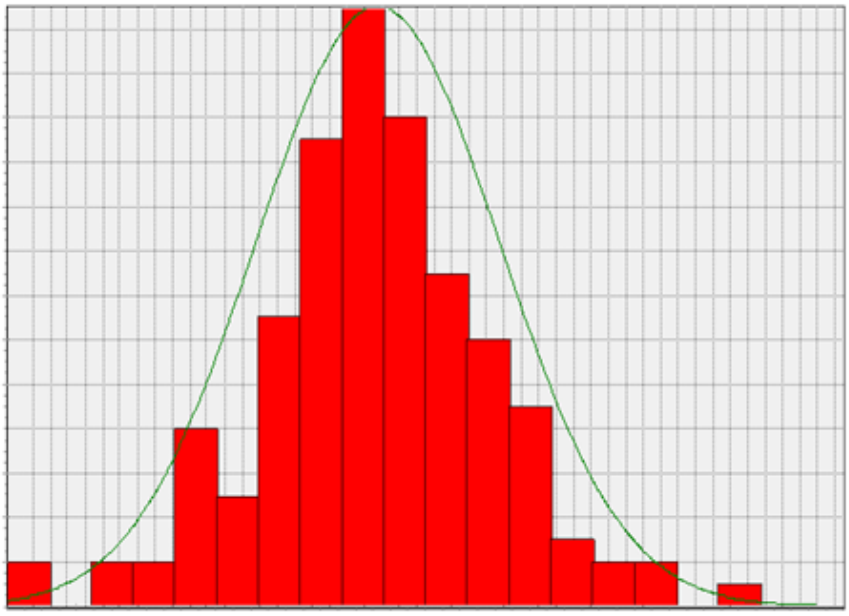
5.2.Interpretation of Financial of Stocks in Portfolio

Value at risk calculation assumes a normal distribution for the financial asset returns. Although Jarque-Bera test statistics of each stock are high and thus reject the normality assumptions. Skewness values are approximately zero. And as you may see below, the histograms show a symmetric distribution, like a normal distribution.

5.2.1. Ak Energy (AKENR) Stocks

When we look at the returns histogram of AKENR, it is skewed to the left, producing a skewness coefficient is more than zero. In addition, skewness value is 0.2 and this value is approximately zero. So, it is quite symmetric, as it can be seen in the below figure. It has a thicker tail and is pointed due to a kurtosis coefficient which is quite a bit large than three.

Figure 5.2.1 AKENR Histogram

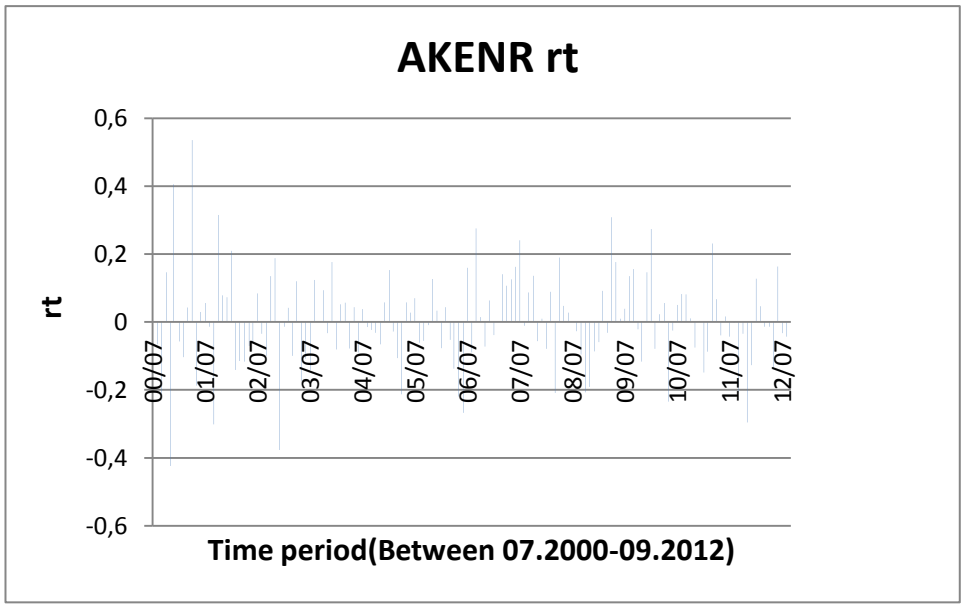


Standard Deviation = 0.140

Coefficient of skewness = 0.247

Coefficient of kurtosis = 1.52

Figure 5.2.2 AKENR Return Chart



When we analyze the monthly returns graph, we see that AKENR returns are quite volatile.

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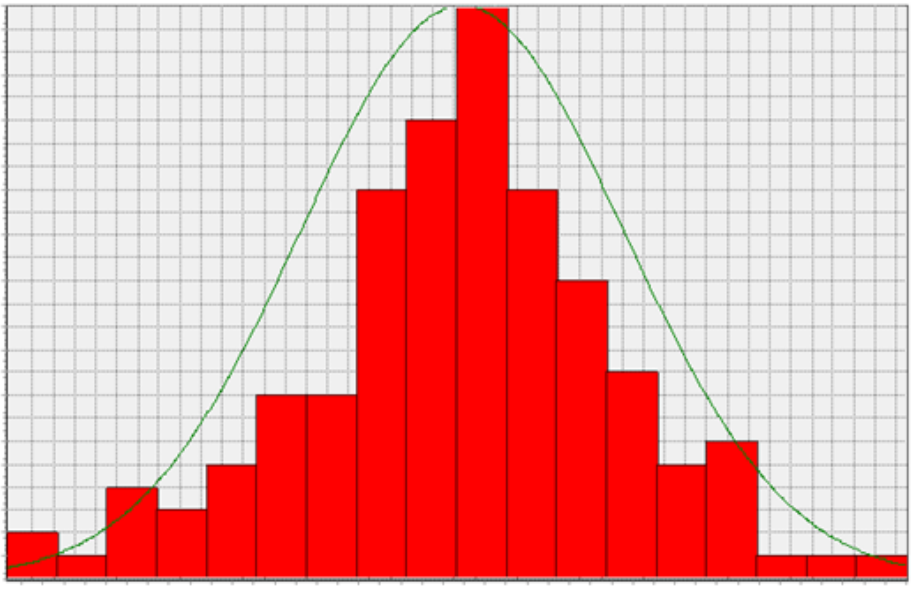
5.2.2. Aksu Energy (AKSUE) Stock

When we look at the return histogram of AKSUE, it is skewed to the right with a skewness coefficient which is less than zero. Besides, skewness value is -0.14 and this value is approximately zero. So, it is also quite symmetric, as it can be seen in the below figure.

Figure 5.2.3 AKSUE Histogram

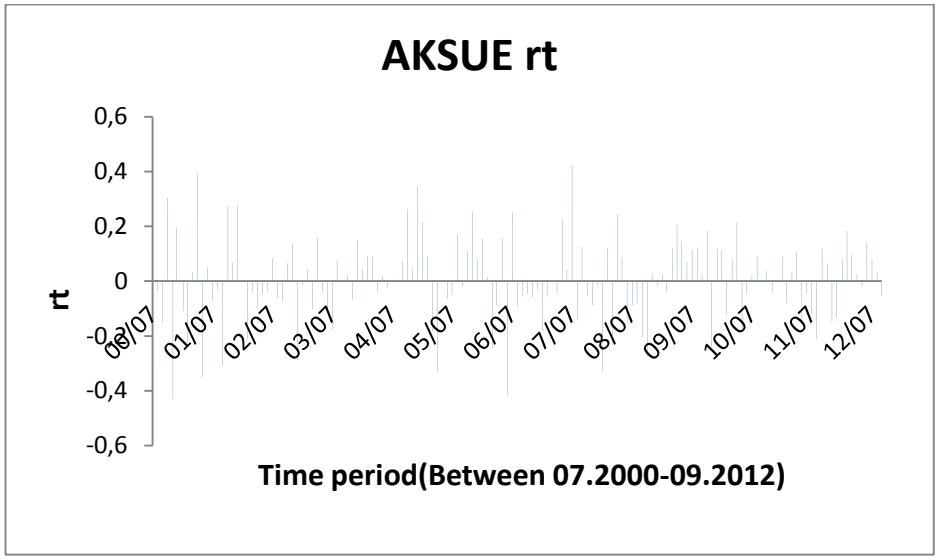


Standard Deviation = 0.154

Coefficient of skewness = -0.146

Coefficient of kurtosis = 0.427

Figure 5.2.4 AKSUE Return Chart

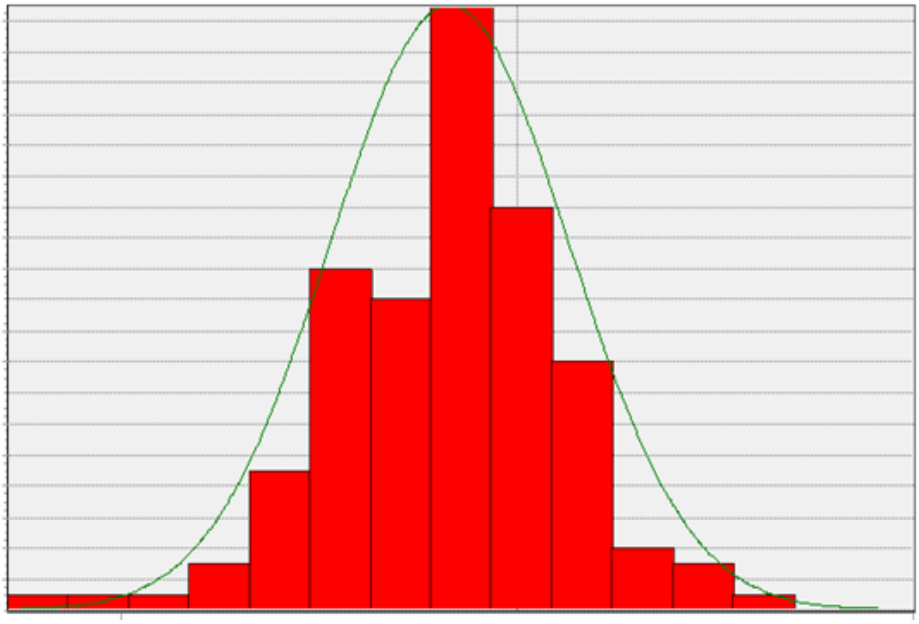


AKSUE returns have high volatility in this above monthly return graphic.

5.2.3. Ayen Energy (AYEN) Stock

When we look at the return histogram of AYEN, it is skewed to the right with a skewness coefficient which is less than zero. In addition, skewness value is -0.02 and this value is approximately zero. So, it is also quite symmetric, as it can be seen in the below figure.

Figure 5.2.5 AYEN Histogram



Standard Deviation = 0.151

Coefficient of skewness = -0.025

Coefficient of kurtosis = 2.188

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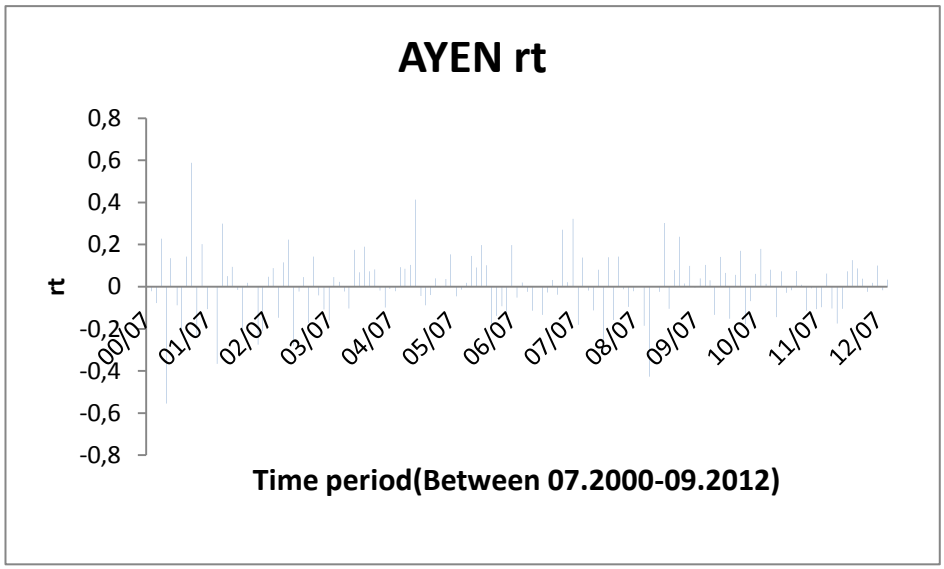
Figure 5.2.6 AYEN Return Chart

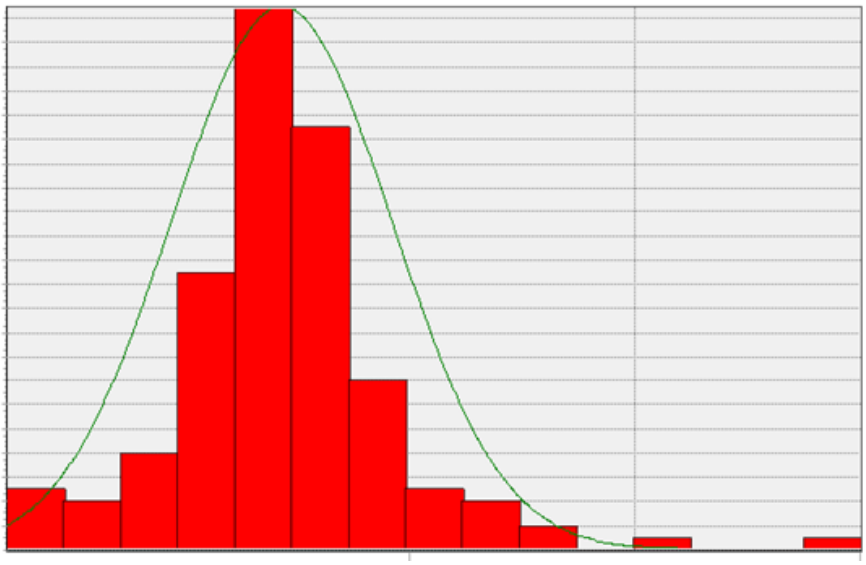


When we analyze the monthly returns graph , we see that AYEN returns are quite volatile.

5.2.4. Işıklar Energy (IEYHO) Stock

When we look at the return histogram of IEYHO, it is skewed to the left with a skewness coefficient which is more than zero. It has a thicker tail and is pointed due to a kurtosis coefficient which is quite a bit large than three.

Figure 5.2.7 IEYHO Histogram

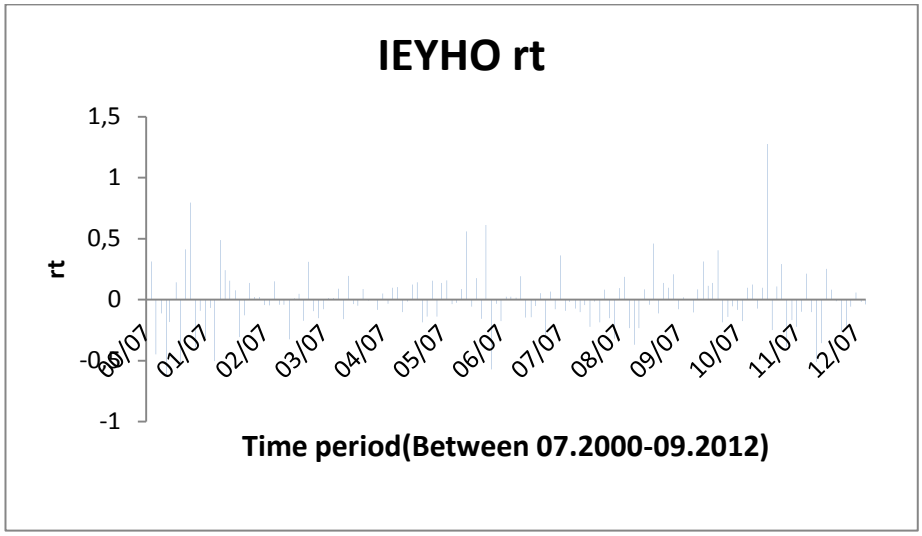


Standard Deviation = 0.24

Coefficient of skewness = 1.116

Coefficient of kurtosis = 5.149

Figure 5.2.8 IEYHO Return Chart

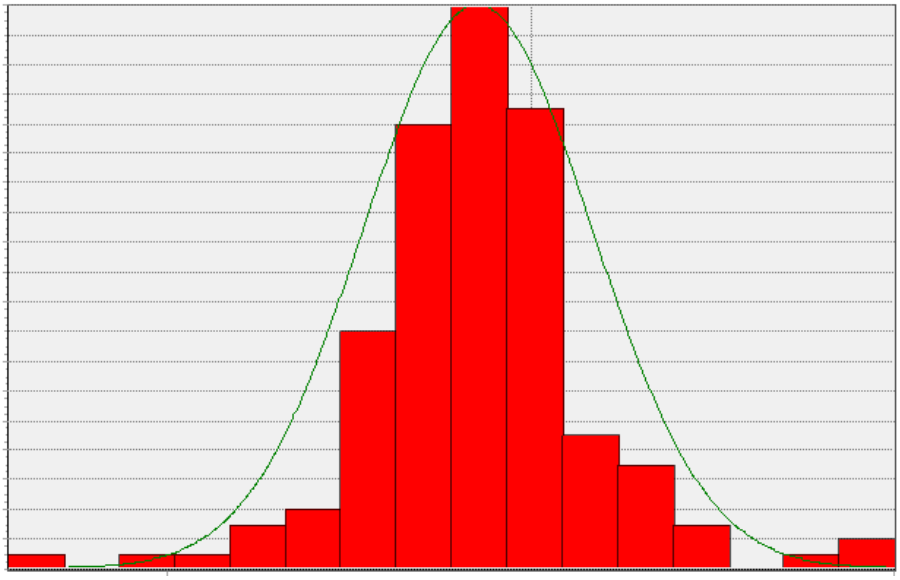


When we examine the monthly returns graph of IEYHO, IEYHO returns are high volatile.

5.2.5. Zorlu Energy (ZOREN) Stock

When we look at the return histogram of ZOREN, it is skewed to the left with a skewness coefficient which is more than zero. In addition, skewness value is 0.04 and this value is approximately zero. So, it is not more left sloping, as it is seen below the figure. It has a thicker tail and is pointed due to a kurtosis coefficient which is quite a bit large than three.

Figure 5.2.9 ZOREN Histogram

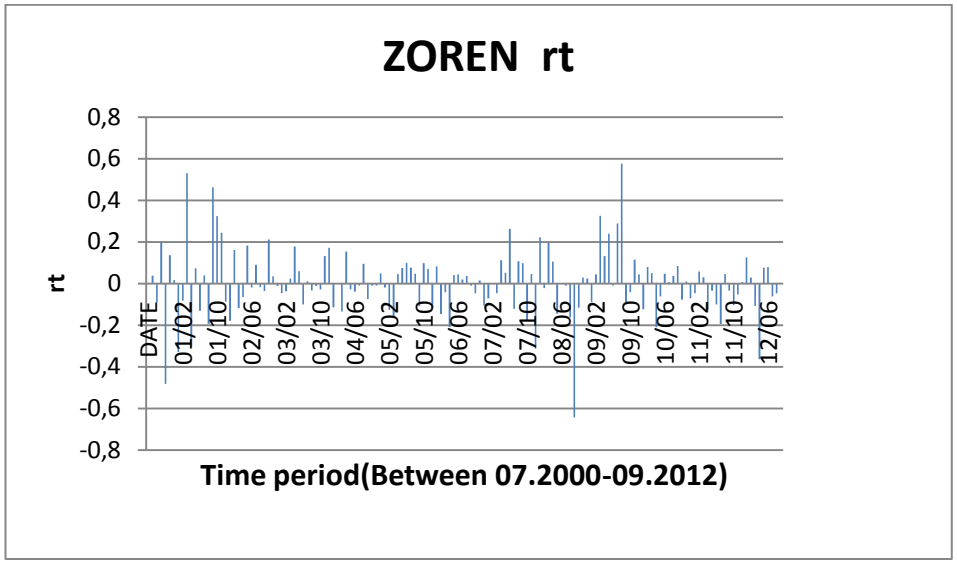


Standard Deviation = 0.157

Coefficient of skewness = 0.042

Coefficient of kurtosis = 3.53

Figure 5.2.10 ZOREN Return Chart



When we analyze the monthly returns graph, we see that ZOREN returns are highly volatile.

5.3.Value at Risk Calculation for Determined Portfolio

Variance-covariance method is used in calculation of value at risk. Aggregate investment is 1000 TL and primarily, value at risk is calculated by giving different weights assumed to recent twelve years stocks in portfolio. And then, portfolios value at risk is computed by giving different weights to each stocks for calculation of standard deviation. Comparison is made by using three different weights. Finally, risk at value method is used for last two years. Again, comparison is made among this three weights by selected different weights and recent risk at twelve years measurement are compared by measuring risks in last two years.

In variance and covariance method EWMA method is applied in volatility computations. EWMA method is calculated for based on two years. According to outcomes, analysis are made relatively to low - medium - high volatility period.

5.4. Value at Risk Calculation by Constructed Portfolio with Variance-Covariance

Value at risk calculation in variance-covariance method is made with equation (7) below, as its mentioned in risk measurement section in my thesis,

$$VaR = \sigma \times \sqrt{T} \times PV \times Z_{\alpha} \qquad (7)$$

Portfolio volatility is one of vital parameters in these methods. Stock weights are computed by auxiliary of covariance matrix. One of reason to use covariance matrix; when any firms risk factor of financial positions, some of ones have negative and positive correlations are observed. Reason of these, upwards and downwards routed versatility on interest rates or exchange rates. This correlation between risk factors are also measured by correlation theory. Depending on this, if it increases when correlation is positive, portfolios risk will rise. When correlation is negative, if correlation declines, portfolios risk will reduce. (Bolgün ve Akçay, 2005)

Concept of correlation takes crucial place in risk management. Because many estimated calculations can be made by correlation effects. For example; if negative correlation between two risk factor exist; these factors balanced each other (hedging), if correlation between factor is zero, they diversify each other, if correlation between factors is positive; they incur leverage effect each other. (Bolgün, 2002)

It is possible to measure stock risks with variance. Yet, risk is measured by covariance, because constructed portfolios involve more than two stocks.

Stock weights are computed by using this equation (8) with covariance matrix, as clarified in risk measurement above,

$\sigma_p=\sqrt{(x * C * x')}$ (8)

Application of variance-covariance method is made according to fixed-standard computations. Covariance between stocks ,standard deviation for each stocks among 07/2000 and 09/2012 and between 09/2010 and 09/2012 years from logarithmic return data sets are computed. Application of methods; Matrices with transpose are calculated in excel by giving weights to each stocks after computations of stocks returns covariance. And if we extract square root of result, we can get portfolios standard deviation by using Formula above. Then, we put data which are in value at risk formula, into place, we can gather value at risk of portfolios which includes AKENR, AKSUE, AYEN, IEYHO, ZOREN in 1 month and 12 months period at 99% confidence level.

First of all, value at risk of portfolio was formed and examined for twelve year. Three scenarios were created. In other words, three times different weights was given and compared for each of equities. The reason of this implementation is how risky change occurs and determined expected maximum quantity of loss for 1000 TL in 1 month and 12 months period and 99% confidence interval.

For the first scenario, each of equities are given equal weights in the below the portfolio. (each of stocks weights are 0.2)

Table 5.4.1 Value at Risk of Portfolio For The First Scenario Twelve- Year

Portfolio VaR	
PV	1000
Standard Dev.	0.338
Confidence level	99%
Alpha	2.33
VaR (1 month)	788.074
VaR (12 month)	2729.971

According to variance -covariance method, calculating value at risk is 788.074 TL with constant standard deviation in 1 monthly lock-up period. Calculating value at risk is 2729.971 TL with constant standard deviation in 12 monthly lock-up period. So, exposed maximum loss is 788.074 TL in 1000 TL value portfolio as of 09.2012 date in 99% confidence interval in 1 month. In other words, loss of portfolio can exceed 788.074 TL in 1 month with 1% probability. Encountered maximum loss amount of portfolio in 99% confidence interval is 2729.971 TL in 12 monthly lock-up period.

For the second scenario, weights of stocks is as below in the below creating portfolio;

Weights of AKENR is 0.1, weights of AKSUE is 0.2, weights of AYEN is 0.1, weights of IEYHO is 0.2, weights of ZOREN is 0.4. Value at risk of portfolio was found with these data.

Table 5.4.2 Value at Risk of Portfolio For The Second Scenario Twelve -Year

Portfolio VaR	
PV	1000
Standard Dev.	0.355
Confidence level	99%
Alpha	2.33
VaR (1 month)	828.347
VaR (12 month)	2869.481

According to variance -covariance method, calculating value at risk is 828.347 TL with constant standard deviation in 1 monthly lock-up period. Calculating value at risk is 2869.481 TL with constant standard deviation in 12 monthly lock-up period. So, exposed maximum loss is 828.347 TL in 1000 TL value portfolio as of 09.2012 date in 99% confidence interval in 1 month. In other words, loss of portfolio can exceed 828.347 TL in 1 month with 1% probability. Encountered maximum loss amount of portfolio in 99% confidence interval is 2869.481 TL in 12 monthly lock-up period.

For the third scenario; weights of stocks is as below in the below creating portfolio;

Weights of AKENR is 0.5, weights of AKSUE is 0.1, weights of AYEN is 0.2, weights of IEYHO is 0.1, weights of ZOREN is 0.1. Value at risk of portfolio was found with these data.

Table 5.4.3 Value at Risk of Portfolio For The Third Scenario Twelve - Year

Portfolio VaR	
PV	1000
Standard Dev	0.272
Confidence level	99%
Alpha	2.33
VaR (1 month)	635.840
VaR (12 month)	2202.616

According to variance -covariance method, calculating value at risk is 635.840 TL with constant standard deviation in 1 monthly lock-up period. Calculating value at risk is 2202.616 TL with constant standard deviation in 12 monthly lock-up period. So, exposed maximum loss is 635.840 TL in 1000 TL value portfolio as of 09.2012 date in 99% confidence interval in 1 month. In other words, loss of portfolio can exceed 635.840 TL in 1 month with 1% probability. Encountered maximum loss amount of portfolio in 99% confidence interval is 2202.616 TL in 12 monthly lock-up period.

Secondly, value at risk of portfolio was formed and examined for last two year. Three scenarios are formed. Three times different weights was given (including used same values in twelve years.) and compared for each of equities.

For the first scenario, each of equities are given equal weights in the below creating the portfolio. (each of stocks weights are 0.2)

Table 5.4.4 Value at Risk of Portfolio For The First Scenario Two - Year

Portfolio VaR	
PV	1000
Standard Dev.	0.188
Confidence level	99%
Alpha	2.33
VaR (1 month)	440.181
VaR (12 month)	1524.835

According to variance -covariance method, calculating value at risk is 440.181 TL with constant standard deviation in 1 monthly lock-up period. Calculating value at risk is 1524.835 TL with constant standard deviation in 12 monthly lock-up period. So, exposed maximum loss is 440.181 TL in 1000 TL value portfolio as of 09.2012 date in 99% confidence interval in 1 month. In other words, loss of portfolio can exceed 440.181 TL in 1 month with 1% probability. Encountered maximum loss amount of portfolio in 99% confidence interval is 1524.835 TL in 12 monthly lock-up period.

For the second scenario, weights of stocks is as below in the below creating portfolio;

Weights of AKENR is 0.1, weights of AKSUE is 0.2, weights of AYEN is 0.1, weights of IEYHO is 0.2, weights of zorlu ZOREN is 0.4. Value at risk of portfolio was found with these data.

Table 5.4.5 Value at Risk of Portfolio For The Second Scenario Two - Year

Portfolio VaR	
PV	1000
Standard Dev.	0.194
Confidence level	99%
Alpha	2.33
VaR (1 month)	453.752
VaR (12 month)	1571.844

According to variance -covariance method, calculating value at risk is 453.752 TL with constant standard deviation in 1 monthly lock-up period. Calculating value at risk is 1571.844 TL with constant standard deviation in 12 monthly lock-up period. So, exposed maximum loss is 453.752 TL in 1000 TL value portfolio as of 09.2012 date in 99% confidence interval in 1 month. In other words, loss of portfolio can exceed 453.752 TL in 1 month with 1% probability. Encountered maximum loss amount of portfolio in 99% confidence interval is 1571.844 TL in 12 monthly lock-up period.

For the third scenario; weights of stocks is as below in the below creating portfolio;

Weights of AKENR is 0.5, weights of AKSUE is 0.1, weights of AYEN is 0.2, weights of IEYHO is 0.1, weights of ZOREN is 0.1. Value at risk of portfolio was found with these data.

Table 5.4.6 Value at Risk of Portfolio For The Third Scenario Two - Year

Portfolio VaR	
PV	1000
Standard Dev.	0.185
Confidence level	99%
Alpha	2.33
VaR (1 month)	431.582
VaR (12 month)	1495.046

According to variance -covariance method, calculating value at risk is 431.582 TL with constant standard deviation in 1 monthly lock-up period. Calculating value at risk is 1495.046 TL with constant standard deviation in 12 monthly lock-up period. So, exposed maximum loss is 431.582 TL in 1000 TL value portfolio as of 09.2012 date in 99% confidence interval in 1 month. In other words, loss of portfolio can exceed 431.582 TL in 1 month with 1% probability. Encountered maximum loss amount of portfolio in 99% confidence interval is 1495.046 TL in 12 monthly lock-up period.

5.5. Compare with value at risk for last twelve year and last two year for portfolio

Table 5.5.1 Comparing with Value at Risk of Portfolio Twelve - Year and Two - Year

	FOR 12 YEARS (07.2000 - 09.2012)			FOR 2 YEARS (09.2010-09.2012)		
Stocks	AKENR-AKSUE-AYEN-IEYHO-ZOREN	AKENR-AKSUE-AYEN-IEYHO-ZOREN	AKENR-AKSUE-AYEN-IEYHO-ZOREN	AKENR-AKSUE-AYEN-IEYHO-ZOREN	AKENR-AKSUE-AYEN-IEYHO-ZOREN	AKENR-AKSUE-AYEN-IEYHO-ZOREN
Weight	0.2-0.2-0.2-0.2-0.2	0.1-0.2-0.1-0.2-0.4	0.5-0.1-0.2-0.1-0.1	0.2-0.2-0.2-0.2-0.2	0.1-0.2-0.1-0.2-0.4	0.5-0.1-0.2-0.1-0.1
Portfolio VaR						
PV	1000	1000	1000	1000	1000	1000
Standard Dev.	0.338	0.355	0.272	0.188	0.194	0.185
Confidence level	99%	99%	99%	99%	99%	99%
Alpha	2.33	2.33	2.33	2.33	2.33	2.33
VaR (1 month)	788.074	828.347	635.840	440.181	453.752	431.582
VaR (12 month)	2729.971	2869.481	2202.616	1524.835	1571.844	1495.046

When we looked at results between 07.2000-09.2012, if we give different and same weighted values to each five stocks, portfolio outcomes of standard deviation are approximately similar values. For the first scenario, standard deviation value is 0.33, for the second scenario, standard deviation value is 0.35, for the third scenario, standard deviation value is 0.27. When we look at these results, for three scenario, standard deviation is low that's why these outcomes represent security. Variability

inter-data is so low. Too much price-fluctuations is not occurred between those years. Therefore their standard deviation is low. Estimation about futures with considering these data is less risky.

We observe at the standard deviation of portfolio between 09.2010 and 09.2012 and when we give different and same weights each of stocks, results of standard deviation is approximately similar value. For the first scenario, standard deviation value is 0.188 , for the second scenario, standard deviation value is 0.194 , for the third scenario, standard deviation value is 0.185. However, in comparison with twelve year, standard deviation of two years is less than standard deviation of twelve years. For two years, it is seen in the table, risk is less. Between these years, different of among data is little. There are not price fluctuations in stocks. And therefore, standard deviation ensue small number. Consequently, last two year is less risky than last twelve year.

When we compare value at risk between each other for last twelve years, encountering maximum loss amount of portfolio is 828.347 TL in 99% confidence interval in the event of holding 1 month within given three scenario. Encountering maximum loss amount of portfolio is 2869.481 TL in 99% confidence interval in the event of holding 12 month within given three scenario. In addition, encountering minimum loss amount of portfolio is 635.840 TL in 99% confidence interval in the

event of holding 1 month within given three scenario. Encountering minimum loss amount of portfolio is 2202.616 TL in 99% confidence interval in the event of holding 12 month within given three scenario. To sum up, for 1000 TL in 99% confidence interval in 1 month and 12 month period of portfolio, applied second scenario is more maximum amount of loss than the other scenarios for last twelve years. And it is more risky than the others. But applied third scenario is less amount of loss than the other scenarios. And it is less risky than the others.

By the time we compare value at risk between each other for last two years, encountering maximum loss amount of portfolio is 453.752 TL in 99% confidence interval in the event of holding 1 month within given three scenario. Encountering maximum loss amount of portfolio is 1571.844 TL in 99% confidence interval in the event of holding 12 month within given three scenario. In addition, encountering minimum loss amount of portfolio is 431.582 TL in 99% confidence interval in the event of holding 1 month within given three scenario. Encountering minimum loss amount of portfolio is 1495.046 TL in 99% confidence interval in the event of holding 12 month within given three scenario. In brief, for 1000 TL in 99% confidence interval in 1 month and 12 month period of portfolio, applied second scenario is more maximum amount of loss than the other scenarios for last two years. And it is more risky than the others. But applied third scenario is less amount of loss than the other scenarios. And it is less risky than the others.

If we made comparison between last two and last twelve years for portfolio; both of last two years and last twelve years are resulted from same scenario for maximum amount of loss of portfolio between three scenario. As a result of these, in portfolio, results of last two years is more meaningful than results of the last twelve years. Because last twelve years is long- term period. But last two years is more current. Moreover, last two years is less risky than last twelve years. So, for constituted portfolio, last two years is significant than last twelve years. In addition, in constituted portfolio, the third scenario is meaningful than the other scenario for both of last two years and last twelve years. Since the third scenario give minimum amount of loss for portfolio.

5.6. Interpreted of EWMA Method for Stocks

EWMA method was implemented stocks two yearly. At the end of results of applied calculations, these five stocks decreased gradually in 2012. Briefly, the highest volatility term is 2005. The lowest volatility period is 2004. The middle volatility term is 2010. (33)

Stock market is observed increment between 2005 and 2007. Because at the beginning of 2005 year, policies were implemented to overcome to crisis in 2001. And this case was continued till the midst of 2007.

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(33) It is seen in appendix F.

The biggest economy in the world is USA whose residential sector started problems. In the midst of 2007, issues increase gradually and creation of financial crisis accelerated. Financial crisis occurred in mortgage market. As from September 2008, this financial crisis took hold of real sector and this situation spread from developed economy to developing economy. Developing our countries is Turkey which under the influence of occurred this financial crisis. Therefore, our stock market decreased rapidly.

5.7. Calculation Value At Risk Method Using EWMA Method

In this application, after EWMA method is applied for equities return, covariance matrix is formed. In addition, EWMA method is applied two yearly. Three scenarios are formed. Three times different weights was given (including used same values in twelve years.) Acquired results with used value at risk calculation of EWMA volatility is in below table.

For the first scenario, each of equities are given equal weights in the below creating the portfolio. (each of stocks weights are 0.2)

Table 5.7.1 Value at Risk of Portfolio with EWMA Method For The First Scenario

Portfolio VaR	
PV	1000
Standard Dev.	0.181
Confidence level	99%
Alpha	2.33
VaR (1 month)	423.025
VaR (12 month)	1465.402

According to these results, holding 100 TL worth portfolios at 09/2012, maximum loss will be 423.025 in one month at 99% confidence level and its maximum loss will be 1465.402 in twelve months at 99% confidence level. Excessive possibility of loss quantity is one percent.

For the second scenario, weights of stocks is as below in the below creating portfolio;

Weights of AKENR is 0.1, weights of AKSUE is 0.2, weights of AYEN is 0.1, weights of IEYHO is 0.2, weights of ZOREN is 0.4. Value at risk of portfolio was found with these data.

Table 5.7.2 Value at Risk of Portfolio with EWMA Method For The Second Scenario

PORTFOLİO VaR	
PV	1000
Standard Dev.	0.1704
Confidence level	99%
Alpha	2.33
VaR (1 month)	397.204
VaR (12 month)	1375.957

According to these results, holding 100 TL worth portfolios at 09/2012, maximum loss will be 397.204 TL in one month at 99% confidence level and its maximum loss will be 1375.957 TL in twelve months at 99% confidence level. Excessive possibility of loss quantity is one percent.

For the third scenario, weights of stocks is as below in the below creating portfolio;

Weights of AKENR is 0.5, weights of AKSUE is 0.1, weights of AYEN is 0.2, weights of IEYHO is 0.1, weights of ZOREN is 0.1. Value at risk of portfolio was found with these data.

Table 5.7.3 Value at Risk of Portfolio with EWMA Method For The Third Scenario

Portfolio VaR	
PV	1000
Standard Dev.	0.168
Confidence level	99%
Alpha	2.33
VaR (1 month)	392.929
VaR (12 month)	1361.149

According to these results;holding 100 TL worth portfolios at 09/2012, maximum loss will be 392.929 TL in one month at 99% confidence level and its maximum loss will be 1361.149 TL in twelve months at 99% confidence level. Excessive possibility of loss quantity is one percent.

Table 5.7.4 Comparing Value at Risk of Portfolio with EWMA Method For Three Scenario

PORTFOLİO VaR	First Scenario	Second Scenario	Third Scenario
PV	1000	1000	1000
Standard. Dev	0.181	0.1704	0.168
Confidence level	99%	99%	99%
Alpha	2.33	2.33	2.33
VaR (1 month)	423.025	397.204	392.929
VaR (12 month)	1465.402	1375.957	1361.149

When we look at above the table, for each scenario, results of standard deviation is approximately similar value. For the first scenario, standard deviation value is 0.181, for the second scenario, standard deviation value is 0.1704 , for the third scenario, standard deviation value is 0.168. Standard deviation values are less. Thus, risk is less for portfolio. When we observed the value at risk result of portfolio in EWMA method, exposure maximum loss amount of 1000 TL portfolio in 99% confidence level is 423.025 TL in 1 monthly time period. Exposure maximum loss amount of 1000 TL portfolio in 99% confidence level is 1465.402 TL in 12 monthly time period. In other words, first scenario give portfolio maximum loss amount according to the other scenarios. In addition, Exposure minimum loss amount of 1000 TL portfolio in 99% confidence level is 392.929 TL in 1 monthly time period. Exposure minimum loss amount of 1000 TL portfolio in 99% confidence level is 1361.149 TL in 12 monthly time period. In other saying, third scenario give portfolio minimum loss amount according to the other scenarios. Thereby, the third scenario for portfolio is more meaningful than the other scenarios.

As a consequence, the applied third scenario for all of VAR results of portfolio is more suitable and more meaningful results than the other applied scenarios. Because, this applied third scenario give more minimum loss amount than the other applied scenarios. Besides, third scenario is less risky than the other scenarios. If we compare with between each of stocks according to given weights, the second scenario has maximum loss amount for portfolio for last twelve and last two years. In EWMA method, the first scenario has maximum loss amount for portfolio. In the first

scenario, each of stocks weights are 0.2. But in the second scenario, each of stocks weights are different. High weight value is given ZOREN which is 0.4. So, ZOREN is more risky than the other stocks. When we invest ZOREN, we suffer a loss. The third scenario has minimum loss amount for portfolio for last twelve, last two years and applied EWMA method. High weight value is given AKENR which is 0.5 in the third scenario. Low weight value is given AKENR which is 0.1 in the second scenario. Thus, when we invest AKENR, we are more profitable than the other stocks.

6. CONCLUSION

The use of energy takes an important place nowadays. Energy has a significant effect on economic growth and human development. Vitality of Turkey's energy markets with a rapid liberalization process in recent years, life standards rise and the energy sector which is a pillar stone of the Turkish economy changes substantially and progresses. As a result of this, energy demand pursues rising routes and competition enhances. Because of this, new challengers join markets every day. Price discrimination on products which is seen in competition areas creates price risks in these markets. Consequently, increased volume in financial markets, fast changes in market conditions and over-volatility in price create open risks for all financial institutions in the world.

Increment in taking risk with speculative purposes in the financial markets and crisis lead to boosting market risks. Thus, to correct the estimation of market risks and keeping them at an optimum level, risk measurement methods become important. Different variety of risk measurement methods are used in financial markets. Value at risks which is suggested by Risk-Metrics in 1994, is crucial for measurement of market risks. Value at risk is a statistical method. Value at risk is used for determining related decision through evaluating market risks. Different types of methods can be used in calculation of value at risk process. Selection of value at risk, depends on property of financial assets and markets. Application of variance-covariance method is more ideal for stock contained portfolios.

In this study, variance-covariance method is applied by giving different weights for the last twelve and two years for electricity stocks included in the portfolio. Outcomes of value at risk are examined and compared. In addition, the EWMA volatility estimation methods to estimate in the variance-covariance matrix is used. This application started out with an initial estimation based on two years of date and low standard deviation number is observed, close to the standard deviation computed in the variance-covariance method.

Despite value at risk calculation does not show time series normal distribution, calculations is made under the normal distribution assumption. So, outcomes need to be evaluated with some concern given kurtosis and skewness of series.

Applying different methods to compute value at risks, causes different outcomes. That's why, a sensitivity analysis is performed with different weights. EWMA method is used to predict volatility and compute the variance- covariance matrix and the probability of potential losses for the stocks portfolio are calculated. Moreover, standard deviations are smaller than with the EWMA method. In this case, this result gives us confidence, because the variation in the outcomes is low.

As a consequence, the main goal of this thesis is to identify the structure and working of energy markets in Turkey and to observe risk and loss for three different scenarios for a portfolio which constitutes of energy stocks based on data for the last two years and the last twelve years. If we look at the results of the analysis made, the

EWMA method, for all three scenarios, and for both two year and twelve year windows into history, gives us less risk. The third scenario is more realistic and constitutes our recommendation.

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APPENDIX A

Price Volatility Graph of Five Stocks

Figure A.1 ZOREN Price Volatility

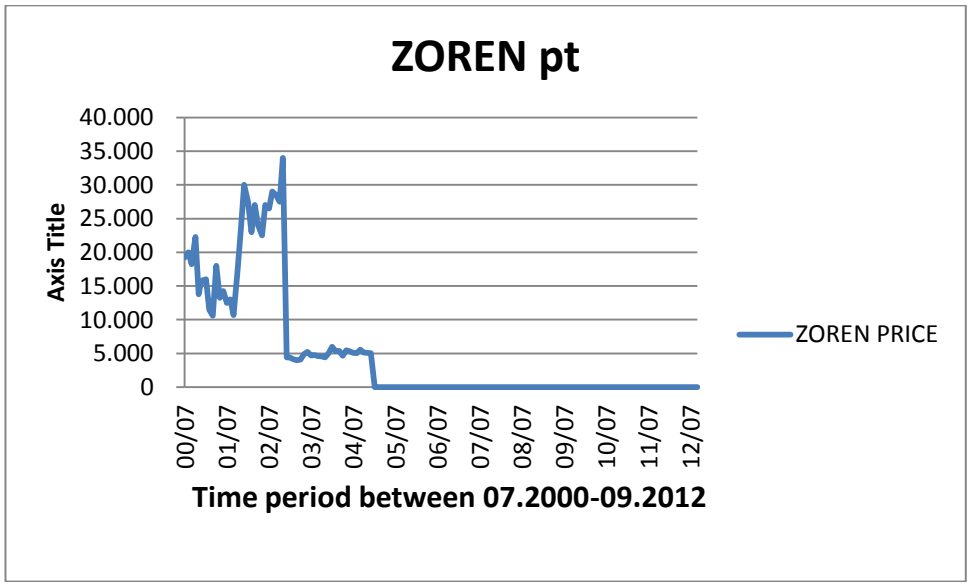


Figure A.2 IEYHO Price Volatility

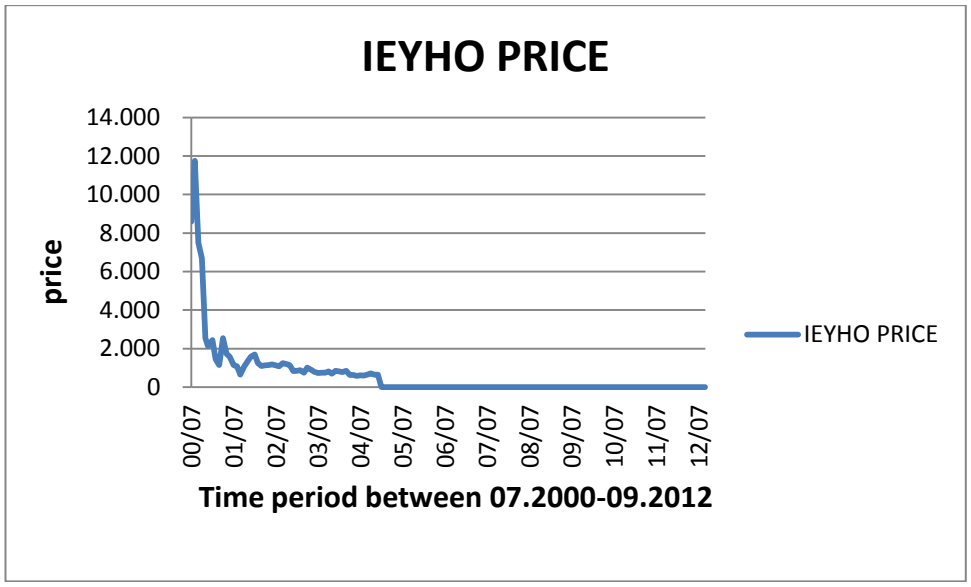


Figure A.3 AYEN Price Volatility

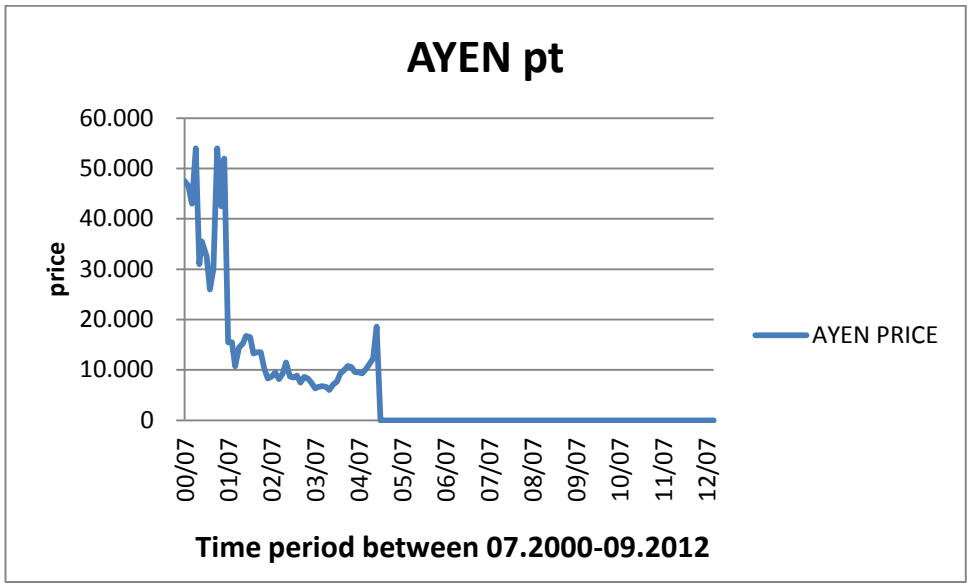


Figure A.4 AKSUE Price Volatility

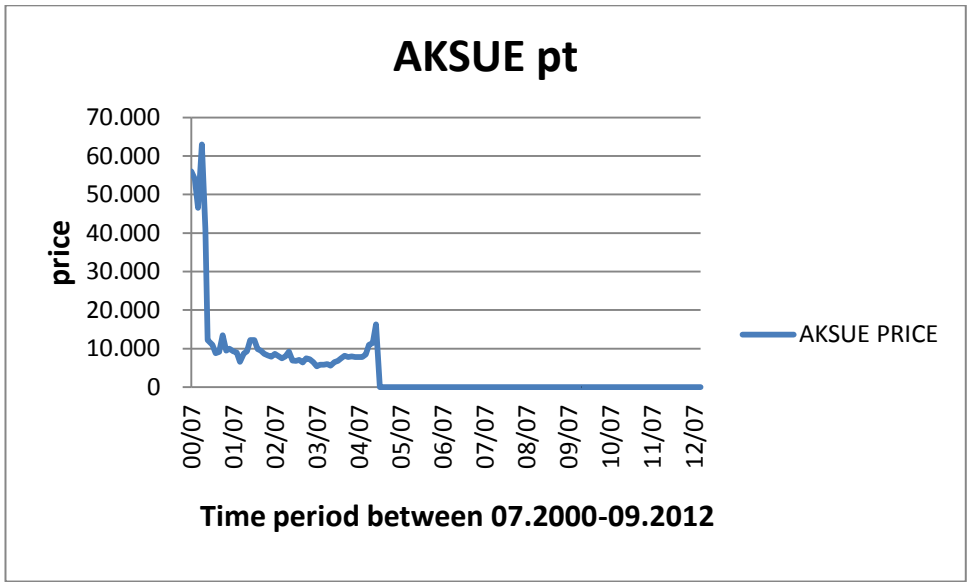
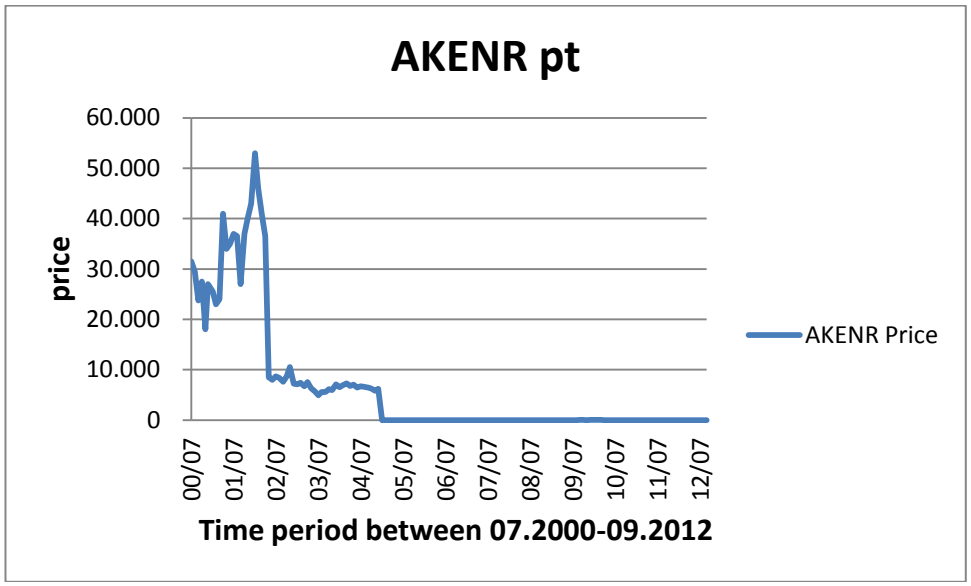


Figure A.5 AKENR Price Volatility



APPENDIX B

ADF Test Results of Five Stocks

These data are monthly, so 12 lags is used to calculate ADF test. (Brooks, 2008)

AK ENERGY

```
Augmented Dickey-Fuller test for AKENR rt
including 4 lags of (1-L) AKENR rt (max was 12)
sample size 142
unit-root null hypothesis: a = 1

   test with constant
   model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: 0.029
   lagged differences: F(4, 136) = 1.870 [0.1193]
   estimated value of (a - 1): -1.1322
   test statistic: tau_c(1) = -6.20984
   asymptotic p-value 3.685e-008

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: 0.030
   lagged differences: F(4, 135) = 1.855 [0.1219]
   estimated value of (a - 1): -1.13267
   test statistic: tau_ct(1) = -6.18768
   asymptotic p-value 3.97e-007
```

AKSU ENERGY

```
Augmented Dickey-Fuller test for AKSUE rt
including 4 lags of (1-L) AKSUE rt (max was 12)
sample size 142
unit-root null hypothesis: a = 1

   test with constant
   model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: -0.002
   lagged differences: F(4, 136) = 2.078 [0.0870]
   estimated value of (a - 1): -1.15518
   test statistic: tau_c(1) = -6.33117
   asymptotic p-value 1.837e-008

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: -0.002
   lagged differences: F(4, 135) = 2.070 [0.0882]
   estimated value of (a - 1): -1.16507
   test statistic: tau_ct(1) = -6.33833
   asymptotic p-value 1.633e-007
```

AYEN ENERGY

```
Augmented Dickey-Fuller test for AYEN rt
including 4 lags of (1-L)AYEN rt (max was 12)
sample size 142
unit-root null hypothesis: a = 1

   test with constant
   model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: -0.004
   lagged differences: F(4, 136) = 1.746 [0.1434]
   estimated value of (a - 1): -1.32758
   test statistic: tau_c(1) = -6.77115
   asymptotic p-value 1.352e-009

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: -0.004
   lagged differences: F(4, 135) = 1.734 [0.1460]
   estimated value of (a - 1): -1.32795
   test statistic: tau_ct(1) = -6.74338
   asymptotic p-value 1.33e-008
```

IŞIKLAR ENERGY

```
Dickey-Fuller test for IEYHO rt
sample size 146
unit-root null hypothesis: a = 1

   test with constant
   model: (1-L)y = b0 + (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: 0.013
   estimated value of (a - 1): -1.08052
   test statistic: tau_c(1) = -13.0867
   p-value 5.057e-020

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: 0.013
   estimated value of (a - 1): -1.08175
   test statistic: tau_ct(1) = -13.0647
   p-value 4.775e-019
```

ZORLU ENERGY

```
 Dickey-Fuller test for ZOREN rt
sample size 146
unit-root null hypothesis: a = 1

   test with constant
   model: (1-L)y = b0 + (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: 0.001
   estimated value of (a - 1): -1.02293
   test statistic: tau_c(1) = -12.2805
   p-value 5.462e-019

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: 0.000
   estimated value of (a - 1): -1.02652
   test statistic: tau_ct(1) = -12.2799
   p-value 5.084e-018
```

APPENDIX C

Normality-Test Statistics of Five Stocks

AK ENERGY

NORMALITY RESULTS:

Test for normality of AKENR rt:

Doornik-Hansen test = 13.911, with p-value 0.00095337

Shapiro-Wilk W = 0.980677, with p-value 0.0362788

Lilliefors test = 0.0574018, with p-value ~= 0.27

Jarque-Bera test = 15.7576, with p-value 0.00037869

TEST STATISTICS RESULT

Summary Statistics, using the observations 2000:07 - 2012:10
for the variable AKENR rt (147 valid observations)

Mean	Median	Minimum	Maximum
0.00120463	-0.00278940	-0.423814	0.535518
Std. Dev.	C.V.	Skewness	Ex. kurtosis
0.140442	116.585	0.247624	1.52558

AKSU ENERGY:

NORMALITY RESULTS:

Test for normality of AKSUE rt:

Doornik-Hansen test = 2.54546, with p-value 0.280066

Shapiro-Wilk W = 0.990735, with p-value 0.447928

Lilliefors test = 0.0626034, with p-value ~= 0.16

Jarque-Bera test = 1.6438, with p-value 0.439596

TEST STATISTICS RESULT

Summary Statistics, using the observations 2000:07 - 2012:10
for the variable AKSUE rt (147 valid observations)

Mean	Median	Minimum	Maximum
0.00294809	0.000000	-0.429563	0.424883
Std. Dev.	C.V.	Skewness	Ex. kurtosis
0.154070	52.2608	-0.146120	0.427751

AYEN ENERGY:

NORMALITY RESULTS:

Test for normality of AYEN rt:

Doornik-Hansen test = 25.3319, with p-value 3.15682e-006

Shapiro-Wilk W = 0.97212, with p-value 0.00432134

Lilliefors test = 0.0831515, with p-value ~= 0.01

Jarque-Bera test = 29.3632, with p-value 4.20597e-007

TEST STATISTICS RESULT

Summary Statistics, using the observations 2000:07 - 2012:10
for the variable AYEN rt (147 valid observations)

Mean	Median	Minimum	Maximum
0.00252087	0.000000	-0.554997	0.587787
Std. Dev.	C.V.	Skewness	Ex. kurtosis
0.151198	59.9784	-0.0252371	2.18894

IŞIKLAR ENERGY:

NORMALITY RESULTS:

Test for normality of IEYHO rt:

Doornik-Hansen test = 36.9081, with p-value 9.67184e-009

Shapiro-Wilk W = 0.923414, with p-value 4.45451e-007

Lilliefors test = 0.104629, with p-value ~= 0

Jarque-Bera test = 192.936, with p-value 1.2721e-042

TEST STATISTICS RESULT

Summary Statistics, using the observations 2000:07 - 2012:10
for the variable IEYHO rt (147 valid observations)

Mean	Median	Minimum	Maximum
-0.00913804	-0.0333364	-0.619400	1.27590
Std. Dev.	C.V.	Skewness	Ex. kurtosis
0.245247	26.8380	1.11629	5.14930

ZORLU ENERGY:

NORMALITY RESULTS:

Test for normality of ZOREN rt:

Doornik-Hansen test = 49.9011, with p-value 1.45921e-011

Shapiro-Wilk W = 0.937275, with p-value 4.05682e-006

Lilliefors test = 0.0917993, with p-value ~= 0

Jarque-Bera test = 76.3786, with p-value 2.59771e-017

TEST STATISTICS RESULT

Summary Statistics, using the observations 2000:07 - 2012:10
for the variable ZOREN rt (147 valid observations)

Mean	Median	Minimum	Maximum
0.00252573	0.000000	-0.643699	0.575800
Std. Dev.	C.V.	Skewness	Ex. kurtosis
0.157104	62.2014	0.0421720	3.53028

APPENDIX D

Covariance matrix of five stocks returns and standard deviation results between 07.2000 and 09.2012.

Table D.1 Covariance Matrix of Five Stocks Between 07.2000 and 09.2012.

	AKENR	AKSUE	AYEN	IEYHO	ZOREN
AKENR	0.019724	0.014863	0.014719	0.327571	0.331173
AKSUE	0.014863	0.023737	0.018824	0.328493	0.329633
AYEN	0.014719	0.018824	0.022861	0.41943	0.424441
IEYHO	0.014567	0.01751	0.016908	0.060146	0.33967
ZOREN	0.013451	0.014855	0.015804	0.018513	0.024682

Table D.2 Standard Deviation Result Between 07.2000 and 09.2012 for the First Scenario

x'
0.2
0.2
0.2
0.2
0.2

x	0.2	0.2	0.2	0.2	0.2

x.C	0.015465	0.017958	0.017823	0.230831	0.28992
x.C.x'	0.114399				
sqrt(x.C.x')	0.33823				

Each of stocks weights is 0.2.

Covariance Matrix is the same above the table. Weights of each of stocks; AKENR: 0.1, AKSUE: 0.2, AYEN: 0.1, IEYHO: 0.2 and ZOREN: 0.4. And these are standard deviation results.

Table D.3 Standard Deviation Result Between 07.2000 and 09.2012 for the Second Scenario

x'
0.1
0.2
0.1
0.2
0.4

x.C	0.0147107	0.01756	0.017226	0.159833	0.219295
x.C.x'	0.1263902				
sqrt(x.C.x')	0.355514				

x	0.1	0.2	0.1	0.2	0.4

Covariance Matrix is the same above the table. Weights of each of stocks; AKENR : 0.5, AKSUE: 0.1, AYEN: 0.2, IEYHO: 0.1 and ZOREN: 0.1. And these are standard deviation results.

Table D.4 Standard Deviation Result Between 07.2000 and 09.2012 for the Third Scenario

x'
0.5
0.1
0.2
0.1
0.1

x.C	0.0170938	0.016806	0.017085	0.288387	0.319873
x.C.x'	0.0744706				
sqrt(x.C.x')	0.2728929				

x	0.5	0.1	0.2	0.1	0.1

APPENDIX E

Covariance matrix of five stocks returns and standard deviation results between 09.2010 and 09.2012.

Table E.1 Covariance Matrix of Five Stocks Between 09.2010 and 09.2012.

	AKENR	AKSUE	AYEN	IEYHO	ZOREN
AKENR	0.04441	0.038036	0.007295	0.005652	0.005568
AKSUE	0.038036	0.041687	0.004373	0.018242	0.006466
AYEN	0.042313	0.042887	0.054546	0.007382	0.004016
IEYHO	0.049351	0.050943	0.060317	0.115444	0.011346
ZOREN	0.037952	0.042698	0.045403	0.061953	0.055947

Table E.2 Standard Deviation Result Between 09.2010 and 09.2012 for the First Scenario

x'
0.2
0.2
0.2
0.2
0.2

x	0.2	0.2	0.2	0.2	0.2

x.C	0.042412	0.04325	0.034387	0.041735	0.016668
x.C.x'	0.03569				
sqrt(x.C.x')	0.188919				

Each of stocks weights is 0.2.

Covariance matrix is the same above the table. Weights of each of stocks; AKENR: 0.1, AKSUE: 0.2, AYEN: 0.1, IEYHO: 0.2 and ZOREN: 0.4. And these are standard deviation results.

Table E.3 Standard Deviation Result Between 09.2010 and 09.2012 for the Second Scenario

x'
0.1
0.2
0.1
0.2
0.4

x.C	0.0413303	0.043697	0.037283	0.052822	0.026899
x.C.x'	0.037925				
sqrt(x.C.x')	0.1947434				

x	0.1	0.2	0.1	0.2	0.4

Covariance Matrix is the same above the table. Weights of each of stocks; AKENR: 0.5, AKSUE: 0.1, AYEN: 0.2, IEYHO: 0.1 and ZOREN: 0.1. And these are standard deviation results.

Table E.4 Standard Deviation Result Between 09.2010 and 09.2012 for the Third Scenario

x'
0.5
0.1
0.2
0.1
0.1

x.C	0.043201	0.0411282	0.025566	0.023867	0.010963
x.C.x'	0.03431				
sqrt(x.C.x')	0.185229				

x	0.5	0.1	0.2	0.1	0.1

APPENDIX F

EWMA Results

Table F.1 EWMA Results

DATE	AKENR rt	AKSUE rt	AYEN rt	IEYHO rt	ZOREN rt	EWMA rt AKENR	EWMA rt AKSUE	EWMA rt AYEN	EWMA rt IEYHO	EWMA rt ZOREN
00/07										
00/08	-0.0656	-0.03637	-0.02128	0.312091	0.038221					
00/09	-0.21681	-0.14953	-0.07825	-0.44895	-0.09157					
00/10	0.146603	0.303682	0.227784	-0.1128	0.198177					
00/11	-0.42381	-0.42956	-0.555	-0.6194	-0.4813					
00/12	0.405465	0.1951	0.135545	-0.18232	0.135802					
01/01	-0.05716	-0.10763	-0.08829	0.142316	0.015748					
01/02	-0.10318	-0.22314	-0.22314	-0.52452	-0.33024					
01/03	0.04256	0.033523	0.143101	0.4138	-0.08149					
01/04	0.535518	0.394415	0.587787	0.796331	0.529518					
01/05	-0.18721	-0.3514	-0.23948	-0.39087	-0.30637					
01/06	0.028988	0.051293	0.20174	-0.09097	0.072759					
01/07	0.05557	-0.07257	-0.1058	-0.31449	-0.13103					
01/08	-0.01361	-0.03279	0	-0.06744	0.039221					
01/09	-0.30148	-0.31015	-0.36593	-0.5031	-0.19471					
01/10	0.315081	0.276253	0.299243	0.489052	0.46297					
01/11	0.077962	0.066691	0.050431	0.241836	0.323787					
01/12	0.072321	0.275512	0.093819	0.154151	0.244197					
02/01	0.209092	0	-0.01504	0.076373	-0.08701					
02/02	-0.14165	-0.21299	-0.21936	-0.30748	-0.17869					
02/03	-0.11507	-0.04124	0.018692	-0.12783	0.160343					
02/04	-0.11626	-0.09953	0	0.1364	-0.11778					
02/05	-0.07095	-0.04763	-0.27541	0.021979	-0.06454					
02/06	-0.06062	-0.03727	-0.21102	0.021506	0.182322	0.21942077	0.212035433	0.24343509	0.35487759	0.246949864
02/07	0.083881	0.084899	0.047068	-0.04349	-0.01869	0.21635935	0.20893044	0.24252575	0.34953374	0.24525893
02/08	-0.03509	-0.0599	0.087969	-0.04546	0.090151	0.21358397	0.206297378	0.23899924	0.34433319	0.241573729
02/09	-0.10008	-0.07696	-0.14716	0.150823	-0.01739	0.2104436	0.203444056	0.23587957	0.33922027	0.238434366
02/10	0.135175	0.064539	0.115069	-0.04082	-0.03572	0.20798657	0.200812074	0.23370849	0.33511298	0.234849937
02/11	0.188052	0.139762	0.223144	-0.04256	0.212175	0.20617669	0.198092608	0.23103743	0.33012373	0.231383084
02/12	-0.37729	-0.28768	-0.27902	-0.32609	0.0353	0.2056562	0.196594666	0.23080455	0.32521772	0.230830086
03/01	-0.01399	-0.0146	-0.02326	0.011976	-0.01143	0.21282896	0.199932009	0.23239675	0.32524397	0.227423471
03/02	0.041385	0.043172	0.045985	0.0476	-0.04707	0.20962622	0.196926427	0.2289197	0.32033488	0.22399489
03/03	-0.09937	-0.1038	-0.17115	-0.17327	-0.03681	0.20658228	0.194094132	0.2256004	0.31560097	0.22075996
03/04	0.11944	0.158605	0.142656	0.311055	0.024693	0.20418667	0.192004087	0.22415937	0.3122764	0.217516825
03/05	-0.17309	-0.04082	-0.0413	-0.09333	0.178248	0.20216184	0.191087072	0.22214979	0.31223984	0.214271916
03/06	-0.10799	-0.11	-0.10804	-0.15234	0.059423	0.20135084	0.188331713	0.21890909	0.30794517	0.213279753

03/07	-0.14108	-0.17768	-0.15976	-0.07899	-0.1011	0.19918771	0.186461189	0.21641105	0.30443645	0.210308202
03/08	0.123379	0.080043	0.046162	0.013606	0.010582	0.19769311	0.186203812	0.21492888	0.3001471	0.207868387
03/09	0	0	0.022306	0.013423	-0.03209	0.19587435	0.183912775	0.21183134	0.29562	0.204734823
03/10	0.093685	0.025318	-0.02231	0.089231	-0.01093	0.19291386	0.181133077	0.20866545	0.29116122	0.201716998
03/11	-0.03306	-0.06899	-0.10286	-0.15822	-0.02786	0.19068978	0.17844928	0.20554794	0.28717673	0.198677221
03/12	0.176704	0.149036	0.175353	0.194156	0.132118	0.18789493	0.176157946	0.20322364	0.28416088	0.195733848
04/01	-0.08063	0.04512	0.067593	-0.03593	0.172371	0.18756891	0.175405306	0.20244335	0.2818792	0.194128931
04/02	0.052056	0.091291	0.189918	-0.05001	-0.11466	0.18526108	0.172930871	0.19972701	0.27768856	0.193511797
04/03	0.056353	0.089804	0.072949	0.085942	0	0.18268364	0.171049576	0.19943975	0.27362866	0.191618994
04/04	-0.07833	-0.0375	0.081974	-0.0068	-0.13487	0.18018708	0.169180852	0.19683134	0.26990377	0.188722822
04/05	0.043485	0.018928	-0.01869	0	0.153386	0.17798157	0.166750392	0.19437564	0.265827	0.187332568
04/06	-0.08895	-0.02532	-0.09909	-0.08269	-0.02791	0.17545325	0.16426281	0.19146518	0.26180923	0.186404153
04/07	0.038027	0.00639	-0.01047	0.050431	-0.03847	0.17348682	0.161839526	0.18935078	0.25824966	0.183650429
04/08	-0.01504	0	-0.02128	-0.03334	-0.00985	0.17099161	0.15939729	0.18649771	0.25449636	0.180997363
04/09	-0.02299	0.073653	0.092373	0.09685	0.09441	0.16842734	0.156988125	0.18371591	0.25071635	0.178269896
04/10	-0.0315	0.263729	0.084557	0.102279	-0.0748	0.16592948	0.155140761	0.18164519	0.24749611	0.176335325
04/11	-0.06614	0.044452	0.102654	-0.10228	-0.00976	0.16351263	0.159477845	0.17949825	0.24439829	0.174152747
04/12	0.058108	0.348818	0.413562	-0.0155	-0.00985	0.1614482	0.157256053	0.17767715	0.24135541	0.171528888
05/01	0.1532	0.2147	-0.0444	0.125	0.0495	0.15932624	0.166246214	0.18908492	0.23772268	0.168944981
05/02	-0.02837	0.09163	-0.0888	0.142174	-0.01905	0.15914589	0.167903402	0.18638577	0.23512861	0.16661225
05/03	-0.10616	-0.1814	-0.04008	-0.18473	-0.12696	0.15681753	0.166125522	0.18421185	0.23288045	0.164127199
05/04	-0.21319	-0.33096	0.040078	-0.13976	-0.16072	0.15553805	0.166604144	0.18156039	0.23158175	0.163135428
05/05	0.057708	0	-0.0036	0.154151	0.04512	0.15757495	0.17381116	0.17895093	0.22936261	0.163063558
05/06	0.027652	-0.06351	0.036944	-0.13762	0.075508	0.15551487	0.17118414	0.17624733	0.22746838	0.160789017
05/07	0.070204	-0.05043	0.15341	0.137621	0.099434	0.15323925	0.168955344	0.17370139	0.22529491	0.158897943
05/08	-0.06115	0.173663	-0.04546	0.158224	0.07719	0.15141221	0.166630817	0.17312726	0.22316642	0.15744114
05/09	-0.05557	-0.02198	-0.01405	-0.03727	0.04652	0.14949945	0.16684611	0.1706923	0.22149537	0.155636848
05/10	-0.00957	0.112005	0.018692	-0.02564	-0.10738	0.14755413	0.164368452	0.16813004	0.21824314	0.153496146
05/11	0.126294	0.25572	0.146183	0.087011	0.09825	0.14533342	0.163042425	0.16562053	0.21499044	0.152316009
05/12	0.033336	0.078859	0.091667	0.559616	0.070826	0.14479866	0.166574682	0.1650707	0.21227669	0.150976009
06/01	-0.07663	0.1564	0.198013	-0.05596	-0.11778	0.14272698	0.164624637	0.16334923	0.23044446	0.149199304
06/02	0.043297	0.015625	0.102362	0.177514	0.082997	0.14119505	0.164383885	0.16449546	0.22716833	0.148353648
06/03	-0.05219	-0.24469	-0.17693	-0.15616	-0.14651	0.13926305	0.16192197	0.16297648	0.2258376	0.146816877
06/04	-0.13762	-0.08899	-0.13815	0.612517	-0.04185	0.13745571	0.165010261	0.16341244	0.22406277	0.146807689
06/05	-0.21905	0.156004	-0.09309	-0.57113	-0.2083	0.13746069	0.163245613	0.16271166	0.24485369	0.144770364
06/06	-0.26748	-0.41664	-0.15822	-0.03437	0.041243	0.14059911	0.163033052	0.1610615	0.26065397	0.147075947
06/07	0.159849	0.251938	0.19807	-0.17535	0.044452	0.14601857	0.176039796	0.1609771	0.25678339	0.145029044
06/08	-0.08908	-0.09139	-0.05212	0.024693	0.019139	0.14645248	0.178786182	0.16221334	0.25471953	0.143044397
06/09	0.275182	-0.05407	0.020367	0.024098	0.037214	0.14506183	0.176793992	0.16001642	0.2509061	0.14092139
06/10	0.014052	-0.04652	-0.02449	0.015748	-0.00917	0.15061009	0.174373536	0.15763738	0.24714909	0.138941061
06/11	-0.07232	-0.05996	-0.11366	0.191395	-0.04718	0.1483537	0.171926931	0.15531275	0.24342891	0.136850302
06/12	0.062975	-0.03429	0	-0.14559	0.014389	0.14664742	0.169646609	0.15422692	0.24203071	0.135029402
07/01	-0.03828	-0.17768	-0.13353	-0.14425	-0.10536	0.14484224	0.167188053	0.1518959	0.23970263	0.133011888

07/02	0	-0.05716	-0.02681	-0.05311	-0.07126	0.14280708	0.16751241	0.15137738	0.23739813	0.132266483
07/03	0.140822	0	0.032088	0.05311	0	0.14064867	0.165277367	0.14916174	0.23399093	0.13085084
07/04	0.106419	-0.04512	-0.03754	-0.2924	-0.04652	0.14065386	0.162779328	0.14701237	0.23063786	0.128873132
07/05	0.125163	0.226216	0.271153	0.065958	0.112478	0.1397489	0.160509414	0.1449363	0.23272932	0.127180812
07/06	0.162519	0.042048	0.020619	-0.07739	0.051825	0.13933355	0.162866758	0.15027325	0.22949633	0.126764542
07/07	0.240141	0.424883	0.321788	0.362406	0.262753	0.14008495	0.160570405	0.14804507	0.22642475	0.12517087
07/08	-0.0113	-0.14458	-0.18114	-0.09212	-0.12167	0.14410105	0.17442804	0.1560969	0.23166842	0.131411124
07/09	0.087011	0.125163	0.138836	-0.0177	0.107989	0.14193657	0.173607313	0.15690632	0.22872408	0.131129534
07/10	0.136132	-0.05647	-0.01869	-0.07411	0.097455	0.14060135	0.172352222	0.1563946	0.22528796	0.130495028
07/11	-0.05609	-0.08663	-0.11308	-0.1011	-0.1752	0.14046935	0.170028774	0.15406484	0.22225387	0.129626425
07/12	0.009569	-0.01367	0.081126	-0.04349	0.045746	0.13868695	0.168129876	0.15299506	0.21959393	0.131224289
08/01	-0.07925	-0.32825	-0.30956	-0.22314	-0.31237	0.13660086	0.165605645	0.1513364	0.21640605	0.129483592
08/02	0.088728	0.119904	0.140147	-0.01399	0.223144	0.13523466	0.172727821	0.15839992	0.21661122	0.138529271
08/03	-0.20909	-0.23451	-0.158	-0.18514	-0.02247	0.13407439	0.171380167	0.15788303	0.21335106	0.141804229
08/04	0.190044	0.245743	0.1425	0.081346	0.195492	0.13692423	0.173608286	0.15788667	0.21255928	0.1397152
08/05	0.046957	0.085614	-0.01179	-0.15155	0.106295	0.13881389	0.176202543	0.15744695	0.2098202	0.141708295
08/06	0.027151	-0.15501	-0.09531	-0.31845	-0.14439	0.13695753	0.174171776	0.1550807	0.20830939	0.140775567
08/07	0	-0.08756	-0.02198	0.09531	0	0.13496947	0.173627581	0.15362632	0.21244624	0.140885488
08/08	-0.02715	-0.08168	0	0.186102	-0.00976	0.13292952	0.171674465	0.15135226	0.2098855	0.138756113
08/09	-0.09623	-0.20383	-0.18499	-0.23262	-0.16137	0.13100482	0.169670555	0.14906469	0.20921134	0.13666937
08/10	-0.20686	-0.27329	-0.42709	-0.37037	-0.6437	0.13009685	0.170794692	0.15026753	0.20995166	0.137474844
08/11	-0.19106	0.028171	0	-0.2318	-0.11614	0.13304586	0.174746615	0.16545403	0.21650083	0.175393276
08/12	-0.08633	-0.01681	-0.0249	0.083382	0.029128	0.13514891	0.172174609	0.16295332	0.21697555	0.173909659
09/01	-0.05909	0.027857	0.302281	-0.04082	0.023642	0.13394345	0.16959731	0.16054833	0.2141836	0.171355438
09/02	0.09135	-0.03922	-0.10467	0.459532	-0.08786	0.1323154	0.167103652	0.16656442	0.21106484	0.168815206
09/03	-0.03226	0.118418	0.079512	-0.11123	0.044895	0.13127257	0.164718152	0.16504567	0.22259159	0.166958692
09/04	0.307967	0.205734	0.237059	0.137201	0.325964	0.12940918	0.16352	0.16313349	0.22007213	0.164619004
09/05	0.176279	0.145852	0.014963	0.097638	0.131769	0.13816526	0.16494369	0.16583145	0.21804475	0.171679978
09/06	0.01005	0.068993	0.098904	0.209092	0.24028	0.13946032	0.164403198	0.16334559	0.21541403	0.170618548
09/07	0.039221	0.113329	-0.00449	-0.07847	-0.00976	0.13736352	0.162358737	0.16178625	0.21522707	0.173116724
09/08	0.134733	0.12306	0.03974	0.020203	0.289519	0.13545783	0.161105092	0.15934288	0.21240938	0.170508573
09/09	0.15535	0.025975	0.10276	0	0.5758	0.13543613	0.160095342	0.15708541	0.20922824	0.175258692
09/10	-0.02182	0.182322	0.030772	-0.10536	-0.09844	0.13607597	0.157739801	0.15573162	0.20606592	0.19935022
09/11	-0.11686	-0.24039	-0.13353	0.085158	-0.04226	0.13407256	0.158532722	0.15347044	0.20377019	0.197076149
09/12	0.145852	0.117783	0.141079	0.312872	0.115382	0.13358857	0.161592694	0.1529101	0.20123166	0.194235462
10/01	0.273293	0.114019	0.065478	0.112795	0.043894	0.1339728	0.160452542	0.15256851	0.20546539	0.192340799
10/02	-0.07914	-0.12373	-0.15181	0.136859	-0.12394	0.14018177	0.159256632	0.15068993	0.20330084	0.189586219
10/03	0.023257	0.079667	0.055791	0.405465	0.080043	0.13874178	0.158306818	0.15072354	0.2016264	0.187950678
10/04	0.0557	0.214094	0.170626	-0.18698	0.05001	0.13670417	0.156523557	0.14875966	0.2106316	0.185628388
10/05	-0.2344	-0.17435	-0.17841	-0.14023	-0.20952	0.1349832	0.158555097	0.14946219	0.20996091	0.183027847
10/06	-0.02548	-0.04879	-0.06871	-0.05526	-0.06204	0.13900417	0.159051879	0.15041162	0.20820904	0.183878063
10/07	0.050325	0.022473	0.060871	-0.08289	0.046884	0.13697434	0.156875714	0.14861559	0.2052854	0.181417363
10/08	0.0824	0.093288	0.179693	-0.17494	0.007605	0.13518539	0.154553683	0.14674861	0.20269174	0.178859816

10/09	0.081346	0.00404	0.013072	0.09798	0.037179	0.13390492	0.153072907	0.14784381	0.20191473	0.176161414
10/10	0.010363	0.037591	0.081041	0.125163	0.083965	0.13263154	0.150760954	0.14562686	0.19958576	0.173618336
10/11	-0.0749	-0.04366	-0.14471	-0.0732	-0.07669	0.13063925	0.148625003	0.14411106	0.19776101	0.171611574
10/12	0.002774	-0.00203	0.073366	0.09646	0.010811	0.12931713	0.146573837	0.1441292	0.19518426	0.16953899
11/01	-0.14909	0.08938	-0.02937	1.2759	-0.07053	0.12736351	0.144358917	0.14251844	0.19295887	0.16698704
11/02	-0.0873	-0.08128	-0.01669	-0.24772	-0.04725	0.12806877	0.143017393	0.14045651	0.29146828	0,16491624
11/03	0.230833	0.035647	0.074589	0.10904	0.058725	0.1270363	0.141557625	0.13836384	0.29025189	0.162629734
11/04	0.06732	0.106916	0.009331	0.291806	0.029965	0.13134913	0.139554744	0.1368836	0.28648816	0.160494353
11/05	-0.03985	-0.15473	-0.11469	-0.38712	-0.12566	0.12988832	0.138687382	0.1348244	0.28664912	0.158153789
11/06	0.016129	-0.04594	-0.00697	-0.16788	-0.03405	0.12811119	0.139195685	0.13426436	0.2901697	0.15727657
11/07	-0.0436	-0.12019	-0.10692	-0.2218	-0.10008	0,12620581	0.137322548	0.13224057	0.2872595	0.155011663
11/08	-0.00279	-0.21117	-0.09804	-0.09867	-0.19484	0.12452754	0.136839779	0.13155177	0.28551417	0.15364979
11/09	-0.20721	0.120425	0.0618	0.212719	0.045462	0.12264636	0.139646414	0.13067148	0.28171772	0.155044789
11/10	-0.03497	0.063879	-0.10344	-0.1018	-0.0339	0.12601167	0.139108422	0.12914086	0.27989535	0.152904299
11/11	-0.29602	-0.14921	-0.17466	-0.51083	-0.10281	0.12425481	0.13745193	0.12844457	0.27622828	0.150707705
11/12	-0.1274	-0.13517	-0.10451	-0.35667	-0.0523	0.13268354	0.137819346	0.13007012	0.28607916	0.14949422
12/01	0.127398	0.07903	0.073502	0.251314	0.006689	0.13252805	0.137740748	0.12937688	0.28844853	0.147513129
12/02	0.046737	0.182828	0.125626	0.082888	0.125163	0.13237706	0.136347757	0.12805586	0.28740433	0.145288203
12/03	-0.01379	0.09646	0.086433	-0.01143	0.028988	0.13062736	0.137970185	0.12798364	0.28342428	0.144725175
12/04	-0.01399	0.024973	0.037504	-0.26122	-0.10854	0.12867521	0.136908131	0.12693517	0.27914756	0.142626167
12/05	-0.13555	-0.0181	-0.02485	-0.2344	-0.3631	0.12675354	0.13490823	0.12518529	0.27862639	0.141722919
12/06	0.163325	0.140357	0.018692	-0.05827	0.076961	0.12702615	0.132906177	0.1233683	0.27740223	0.153094979
12/07	-0.03249	0.080043	0.099789	0.058269	0.080043	0.12826467	0.133135781	0.12154681	0.27339586	0.151369153
12/08	-0.04338	0.032435	-0.0169	-0.01905	-0.06169	0.12645129	0.131854416	0.12095105	0.26945277	0.14972457
12/09	0	-0.05466	0.033523	-0.03922	-0.04652	0.12476653	0.129983002	0.11915893	0.26540071	0.147848254
	0.001213	0.002948	0.002521	-0.00914	0.002526					

APPENDIX G

Covariance matrix of five stocks returns and standard deviation results with EWMA method.

Each of stocks weights is 0.2.

Table G.1 Covariance Matrix of Five Stocks with EWMA Method

	AKENR	AKSUE	AYEN	IEYHO	ZOREN
AKENR	0.000694	0.071682	0.095267	0.067802	0.068351
AKSUE	0.000365	0.000304	0.102284	0.072591	0.073277
AYEN	0.000771	0.000463	0.000925	0.096501	0.097327
IEYHO	0.000721	0.000223	0.00066	0.001606	0.069112
ZOREN	0.000614	0.000286	0.00071	0.000655	0.000875

x'
0.2
0.2
0.2
0.2
0.2

x.C	0.000633	0.014591	0.039969193	0.047831	0.061788
x.C.x'	0.032963				
sqrt(x.C.x')	0.181556				

x	0.2	0.2	0.2	0.2	0.2

Table G.2 Standard Deviation Result for the First Scenario with EWMA Method

EWMA covariance matrix is the same above the table. Weights of each of stocks; AKENR: 0.1, AKSUE: 0.2, AYEN: 0.1, IEYHO: 0.2 and ZOREN: 0.4. And these are standard deviation results.

Table G.3 Standard Deviation Result for the Second Scenario with EWMA Method

x'
0.1
0.2
0.1
0.2
0.4

x.C	0.0006091	0.007434188	0.030492	0.031531	0.045395
x.C.x'	0.0290614				
sqrt(x.C.x')	0.1704741				

x	0.1	0.2	0.1	0.2	0.4

EWMA covariance matrix is the same above the table. Weights of each of stocks; AKENR: 0.5, AKSUE: 0.1, AYEN: 0.2, IEYHO: 0.1 and ZOREN: 0.1. And these are standard deviation results.

Table G.4 Standard Deviation Result for the Third Scenario with EWMA Method

x'
0.5
0.1
0.2
0.1
0.1

x.C	0.0006713	0.03601484	0.058184	0.060686	0.067968
x.C.x'	0.0284393				
sqrt(x.C.x')	0.1686395				

x	0.5	0.1	0.2	0.1	0.1