DERIVATIVES MARKETS AND FUTURE PRICE VOLATILITY:

AN ECONOMETRIC APPLICATION TO TURKDEX CONTRACTS

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DERIVATIVES MARKETS AND FUTURE PRICE VOLATILITY:

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DERIVATIVES MARKETS AND FUTURE PRICE VOLATILITY: AN ECONOMETRIC APPLICATION TO TURKDEX CONTRACTS

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ABSTRACT

This thesis investigates whether trading volume is a determinant of price volatility in the futures market for a sample of TURKDEX contracts. The first part of this thesis discusses the derivative markets, futures markets and its price determination, and future price volatility. Derivative market is an essential instrument for the financial markets. The establishment and usage of derivative markets in emerging economies allows the investors to avoid suffering from the negative effects of the market. The first issue in the first part of the thesis is the derivative market and its main components. The nature of derivative markets and its importance for the economy is discussed. Specific requirements, technical issues and options that a trader may possibly face are mentioned in compliance with the theoretical and empirical approaches. The second issue is future and forward pricing. The nature and the valuation of derivative instruments such as forward, futures, options, are discussed. Next, future price determination is discussed. The price determination, the reasons of the volatility may occur within derivative markets is explained. The nature of risk is defined while the relation of trader behavior relevant to risk is discussed. Finally, we discuss future price volatility in the first part of the thesis. We performed analysis to acknowledge the effect of trading volume and days to maturity on futures price volatility.

The second part of this thesis employs an econometric approach to measure the futures price volatility of a sample of TURKDEX contracts. We first discuss the foundation and the specialties of TURKDEX, which is the first futures market of Turkey, recently established. Next, using an econometric approach, we measure the futures price volatility on TURKDEX contracts for a large sample. We found that

future price trend meets the theoretical trend. Our application also shows that the futures price volatility increases in line with the trading volume and days to maturity. Finally, we compared our results with the empirical literature and theoretical expectations in the second part of the thesis.

Previous analyses examining futures price volatility has shown that maturity effect and volume of trading are significant. In that respect, our results are consistent with the literature. Since some previous studies indicated that trading volume and maturity influences the volatility standalone, in this study it is examined in which way the two variables of trading volume and days to maturity have impact on the volatility. We concluded that days to maturity has positive and trading volume has negative effect on price volatility.

Keywords: Derivative markets, futures contracts, future price, volatility, TURKDEX

TÜREV PİYASALARI VE VADELİ SÖZLEŞME FİYAT VOLATİLİTESİ:

TÜRKDEX KONTRATLARINA BİR EKONOMETRİK UYGULAMA

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ÖZET

Bu çalışma, türev piyasalarını, bu piyasaları oluşturan etkenleri, vadeli sözleşme fiyat oynaklığını (volatilitesini) incelemektedir. Türev piyasalarının finansal piyasalar için önemi belirtilmekte ve türev piyasalarının gelişmekte olan ülkelerde kurulması ve kullanılmasının, yatırımcıların karşı karşıya kalabileceği piyasanın negatif etkilerinin nasıl en aza indirebilineceği tartışılmaktadır. Bu çalışmada, türev piyasalarının doğası ve ekonomi açısından önemi tartışılmıştır. Bir yatırımcının türev piyasalarında karşılaşabileceği spesifik konular ve teknik durumlar ilgili teoriler ve akademik çalışmalar ışığında incelenmiştir

Vadeli sözleşmeler, opsiyonlar gibi türev araçlarının doğası hakkında da bilgi verilmektedir. Fiyatlandırmanın nasıl yapıldığı, oynaklığın nedenleri açıklanmaktadır. Bu konular bünyesinde, türev piyasalarında risk kapsamı anlatılmakta ve bir yatırımcının riske karşı davranışları incelenmektedir. Vadeli İşlemler ve Opsiyon Borsası (VOB) hakkında kısa bir bilgi verilmekte ve örnek olarak seçilen ve VOB'da işlem gören sözleşmelerin fiyat oynaklığı üzerine, ilgili teoriler ışığında ekonometrik bir çalışma yapılmıştır. Bu çalışmada VOB da işlem gören sözleşmelerin ampirik çalışmalardakine uygun olarak, teorik fiyat eğrisi ile aynı yöndeki değişiklikleri izlediğini belirledik. Ekonometrik analizlerimizde, işlem hacmi ve sözleşme vade sonuna kadar kalan gün sayısının fiyat volatilitesini etkilediğini gözlenmedik. Daha önceki ampirik çalışmalar da benzer yönde saptamalarda bulunmuştur. Bu çalışmada hem işlem hacmi hem vade sonuna kadar kalan gün sayısı etkisi analizlere konu edilmiş ve bu iki faktörün fiyat volatilitesine etkisi şu şekilde saptanmıştır. Vade sonuna yaklaştıkça vade sonuna kadar kalan gün

sayısı azalırken, işlem hacminde artış gözükmektedir. Volatilite vade sonuna kadar kalan gün sayısı ile doğru ve işlem hacmi ile ters orantılıdır.

Anahtar Kelimeler: türev piyasaları, vadeli sözleşmeler, vadeli sözleşmeler değerlemesi, fiyat oynaklığı, VOB.

To My Family

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TABLE OF CONTENTS

LIST OF TABLES

TABLE

LIST OF FIGURES

FIGURE

FORMULAS

1) The forward prices on an investment asset; $F_0 = S_0 \cdot e^{rT}$

2) The known price on an investment asset; $F_0 = (S_0 - I) \cdot e^{rT}$

3) The known yield of a forward contract; $F_0 = S_0 \cdot e^{(r-q)T}$

4) The valuation of a forward contract; $F = (F_0 - K) \cdot e^{-rT}$

5) Arbitrage opportunity; $F(t,T) = R(t,T).p(t)$

6) The market equilibrium; $F(t,T)\{< or =\}(R(t,T) + c(t,T) - y(t,T)).p(t)$

7) Convenience yield; $Y = R + c - F(t,T) / p(t)$

8) The revaluation of a forward contract; $V(t,T,F^*) = (F(t,T) - F^*) / R(t,T)$

9) Normal backwardation theory; $F(t,T) \begin{matrix} < \\ > \end{matrix} \left\{ \begin{matrix} p(t) \Rightarrow \text{backwardation} \\ p(t) \Rightarrow \text{contango} \end{matrix} \right\}$

10) Price efficiency hypothesis; $S(f) = f + e$

11) Price / Earnings Ratio; $P/E = \dfrac{P}{E}$

12) Dividend Yield; $Y = \dfrac{CD}{P}$

13) Black-Scholes Pricing Model; $C_0 = S_0.N(d_1) \cdot X.e^{-rT}.N(d_2)$

14) Garman-Kohlhagen Pricing Model; $C_0 = E_d.N(d_1) \cdot X.e^{-rT}.N(d_2)$

15) The Lenand Pricing model; $C_0 = S.N(d_1) \cdot K.e^{-rT}.N(d_1.\sigma\sqrt{T})$

16) Theoretical price of share index contracts; $\mathrm{E(p)} = S_0 \cdot e^{(r-d)\cdot t/365}$

17) Theoretical price of FX future contracts; $\mathrm{E(p)} = S_0 \cdot e^{(rd-rf)\cdot t/365}$

18) Interest future contracts-bond price; $\mathrm{B} = \dfrac{100}{1 + \dfrac{r \cdot t}{365}}$

19) Value of the bond with n+365 days to maturity;

$A = 100/(1 + r_{n+365}(n + 365)/365)$

20) The theoretical price of an interest future contract; $E(p) = A.[1 + (r_n.n/365)]$

21) The theoretical price of commodity futures contracts; $E(p) = S_0 \cdot e^{(r-c)\cdot t/365}$

22) The sum of systematic and unsystematic risk; $\sigma_1^2 = ß_1^2.\sigma_m^2 + \sigma_e^2$

23) Value at Risk ; $VaR_a(X) = -\inf(xP(X \le x) \rhd \sigma)_2$

24) Expected Shortfall ; $ES_a(X) = E(-X - XVaR(X))$

25) Econometric modeling; $\log\sigma_t^2 = \omega + \alpha\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}^2}\right| + \beta\frac{\varepsilon_{t-1}}{\sigma_{t-1}^2} + \theta\log\sigma_{t-1}^2 + \delta dtm_t + \xi vlm_t$

1. INTRODUCTION

The derivative market is a financial market for a derivative. The derivative markets can be divided into two: exchange traded derivatives and over-the-counter derivatives. Derivative markets are very important for the economy as the trading actions of individuals or institutions can be directed in compliance with relevant expectations through the derivative instruments and market components. In international financial markets, derivative instruments have been in use for years.

Derivative markets have become indispensible components of liberal economic system. In free market economy, the investors perform transactions for profit and risk is an outcome of the high demand for return. Derivative instruments provide investors to hedge the transactions to minimize the risks. By the year 2007 the total transaction capacity value in derivative markets reached up to $2.200 billion. The number of contracts reached up to 15 billion in 2007. Free market economy requires a system that provides risk management thus, for the capital transfer among countries within globalization, the establishment of derivative markets is crucial.

The future price is the key factor to derive the actions of the traders, as a result the futures price volatility is the source of the speculative actions. The investor behaviors shape the price changes according to the demand. However, in derivative markets the trading volume and the days to maturity are crucial effects that narrow or expand the volatility. Through the end of the maturity of a futures contract, speculators perform more transactions since the range of price change is restricted due to the trend of the theoretical price. At the beginning of the futures contract, the positions that the

investors take creates a wider range of price volatility. The investor behaviors determine the volatility range afterwards. For accurate definitions of all the concepts determining the future price volatility, it is required to mention derivative markets, tools, terms, investor behaviors, speculative and hedging transactions and relevant empirical studies and theories developed in previous works.

The impact of the derivatives traded on the volatility for an underlying asset is an issue for the financial authorities and market regulators. Several empirical studies were done to define the variables that have impact on the volatility. We can claim that there are two major literature areas considering the impact of the trading on volatility. One of them has no certain outcomes and cannot identify the impact of the trading on the volatility. While other studies have obtained that there is a reduction in the volatility. For example; Conrad (1989), Damodaran and Lim (1991), Ma and Rao (1988) and Skinner (1989) obtained the reduction in volatility as the impact of the trading. The second literature is on the impact of the introduction of futures contracts. These studies investigated how the introduction of futures trading has affected the underlying asset and researchers such as Choi and Subrahmanyam (1994), Edwards (1988), Moriarty and Tosini (1985) indicated there is decrease or no change in volatility on the futures contract prices.

Many studies that used daily prices have shown that option prices provide accurate estimations compared to the historical information. In these studies, low-frequency data is involved and generally it is found that relevant information for volatility estimation is in option prices. For foreign exchange contracts, Jorion (1995) and Xu and Taylor (1995) performed this sort of studies and Figlewski (1997) and Poon and

Granger (2003) have survey papers for the mentioned issue. Recent researches have indicated that using additional historical information intraday prices in the analysis can provide higher accuracy for the results. The sum of intraday squared returns is defined as realized volatility and it provides a more accurate estimation comparison to the method that defines volatility as given by the daily squared returns (Andersen and Bollerslev, 1998).

The theoretical and empirical properties of realized volatility have become the subject of the studies of Andersen *et al*. (2001) for foreign exchange contracts. While considering the variables that have impact on the futures volatility, it shall be considered that previous studies, such as Anderson (1985) and Milonas (1986) found a maturity effect to be significant while Grammatikos and Saunders (1986) found the volume of trading to be more important than the maturity effect in explaining price variability.

It is known that financial return series demonstrate strong conditional time varying volatility, volatility clustering and volatility persistence. These characteristics of return volatility can be explained by Engle's (1982) autoregressive conditional heteroscedasticity (ARCH) model and its extension version, the generalized autoregressive conditional heteroscedasticity (GARCH) model of Bollerslev (1986).

In this thesis, the derivative market structure will be evaluated for developing an econometric approach to obtain the indicators that have positive effect on price volatility. The use and nature of the derivative instruments will be defined briefly. Since the aim of this work is analyzing the futures price volatility, the determination

of future price in derivative and secondary markets will be discussed first. Derivative instruments are used widespread not only for speculative purposes, but also hedging transaction. Hence, it is necessary to define the risks in financial markets and to determine the risk factors.

Even though the derivative markets have existed in international financial structures for several years, the derivative stock market has been established just recently in Turkey. The very first private exchange for derivative markets, Turkish Derivatives Exchange (TURKDEX) is established in 2001.[1] Since then the trading volume shows an increasing trend. TURKDEX provides the risk management opportunities in Turkey. Since individuals or companies are more sensible to global changes in economy, TURKDEX has become an important opportunity to hedge against risks. A deep financial market can be provided only through establishment of an efficient derivative market. This would create more options for arbitrageurs and speculators for investment. Also this can attract more investment to Turkey. Since limited number of speculators and arbitrageurs exist, the benefits will be provided by investors which will not affect economy positively. In line with the transaction capacity increase and the more investors act in derivative markets and the more positive aid the economy can incur.

In this thesis, we evaluated the derivative market structures and performed econometric analysis to define the impact of the trading volume and days to maturity

[1] The Turkish abbreviation for TURKDEX is VOB. Its establishment is compatible to 40th article of Capital Market Law number 2499. TURKDEX was established on Cabinet's resolution number 2001/3025 which has been announced with Official Gazette on October 29,2001, the State Ministry's resolution number 2381 on September 3, 2001 and Capital Markets Board of Turkey's approval statement number 9/1101 on August 17, 2001. On July4, 2001; the registration of TURKDEX by Registry of Commerce was announced on Official Gazette. More information about TURKDEX is available at www.vob.org.tr.

In this approach, we obtained the data from foreign exchange contracts of TURKDEX and we applied the models of Engle's (1982) autoregressive conditional heteroscedasticity (ARCH) model and its extended version, the generalized autoregressive conditional heteroscedasticity (GARCH) model of Bollerslev (1986). Since the exponential GARCH (E-GARCH) study of Nelson (1991) has more specialized features in comparison to the standard GARCH model, we performed the analysis based on this model.

2. DERIVATIVE MARKETS

2.1 Derivative Instruments

Derivative securities can be defined as an agreement in which two parties deal to exchange a standard asset at a determined price for a specified date in the future. The markets, in which these transactions are performed, are called derivative securities markets (Cornett and Saunders, 2004).

Derivative instrument is defined as a security that its value is derived from the price of an underlying financial asset, i.e. another security or asset (Scott, 1988). The most common derivatives are stock-index futures-options, currency futures-options-swaps, interest rate futures-options (Brown and Geist, 1983). Scott (1988) extended these common derivatives with more complex instruments such as caps, collars, reverse floating notes, look back option (Yıldırım, 1997). Derivatives are mainly two types: forward-type contracts and option-type contracts (Shoenfeld, 1994). Spot contract is called an agreement that involves immediate exchange of an asset. Forward contract is called an agreement that involves an exchange with settled price and quantity and which will occur in the future. Forward contracts are not standardized and issued only over-the-counter (OTC). OTC transactions incur out of any regulation in free market economy. Thus, futures markets only exist in line with regulatory environment. The traders do not have to perform immediate buying/ selling actions. Futures markets enable investing opportunities for traders on a defined period of time. The terms of these transactions have to be guaranteed by regulatory environment. Even if futures contracts are forward-type contracts, they are not issued

over the counter. Future contracts are standardized contracts issued in secondary markets just like options. In secondary markets previously issued futures and options are traded (Yıldırım, 1997).

Forward and futures contracts are on the same basis. Nonetheless, futures contracts can be identified as an agreement that involves an exchange with daily settled price and quantity and which will occur in the future. In other words, future contracts have daily prices which make them different than forward contracts. This fact allows the traders to change their position according to the daily settled prices. This concept is called marked to market. The future prices are adjusted daily according to the current conditions of the futures market (Cornett and Saunders, 2004).

For taking a position in futures markets a deposit that meets the terms of future contracts is required. This deposit is called initial margin. The deposit may be loosening due to the changes in the market. A certain amount of initial margin should be constantly provided to continue taking actions in the futures market. If the losses cause the deposit to fall below maintenance margin, the trader should pay additional amount of money that will make the deposit reach back to the initial margin (Cornett and Saunders, 2004). This amount is called maintenance margin.

Contract terms are determined before the contract takes place in the market. The terms that shall be determined can be summarized as follows (Cornett and Saunders, 2004):

- Trading Unit: Face value of the defined contract must be clear at the maturity date.
- Deliverable Grades: Delivery conditions, the time period of the delivery, the payment conditions must be clear for the calculation (e.g. par value, percentage of the yield, time duration etc.).
- Tick size: Every tick has a value to show the changes in the value of the contracts daily. Tick size must be determined (e.g. $30 per contract).
- Price quote: The terms of price shall be clear to inform the investors (e.g. in 1000s).
- Contract months: The months in which the contract can be used in transactions including the maturity date shall be clear.
- Last trading day: This day is through the maturity and shall be clearly pointed to the traders (e.g. seventh business day of the last month).
- Last delivery date: The time determination of the delivery must be determined (e.g. the last day of the delivery month).
- Delivery method: The way of the delivery shall be determined (e.g. federal reserve book-entry wire-transfer system).
- Trading hours: Trading hour's intervals shall be determined during the business days and at the last trading day of the contract.
- Ticker symbols: The symbols shall be clear (e.g. Open outcry-US or Electronic-ZB)
- Daily price limit: If a daily price limit is determined, it shall be indicated.

It is necessary to give the definition of the terms relevant to future markets. The trading process can be done in various ways. Open-outcry auction is one of them. In this trading method traders face each other and they offer to buy or sell futures contracts face to face on a determined price. The transactions can be done via floor brokers. Floor brokers are the term used for exchange members who perform trade transactions in the name of traders from public. Professional traders are the exchange members who perform trade transactions in their own account. Position traders are the investors who have an expectation for the price of an underlying asset and take position relevant to their expectation. If traders perform transactions and reevaluate their positions daily, these investors are called day traders. Scalpers are the exchange members who take very short positions. These short positions may even be consisted of minutes just to provide a benefit through sudden transactions (Cornett and Saunders, 2004).

In future markets typically a short position means the sale of a futures contract while a long position is the purchase of a futures contract. Unlike over the counter (OTC) markets, there is a guarantee in futures markets. “Clearing house” guarantees all the exchange transactions and delivery issue. All trades are performed by exchange traders under the guarantee of the clearing house. The total number for the all contracts including futures, put options (the buyer takes a short position offering the right, but not obligation) and call options (the buyer has the right, but not the obligation to buy) available at the beginning of a day in the market is called open interest (Cornett and Saunders 2004).

Some well-known future markets are Chicago Board of Trade, Chicago Mercantile Exchange, New York Mercantile Exchange, London Metal Exchange, International Petroleum Exchange and London International Financial Futures Exchange.

2.2 Futures Contracts and Forward Contracts

Forward contracts are a part of future markets. The traders with different needs take position through forward or futures contracts. There are three types of traders in forward markets. These are;

1) Arbitrageurs: These traders exploit the mis-differences in prices between the forward and spot prices. Market equilibrium exists when no arbitrage opportunity exist. If the market is out of equilibrium, arbitrageurs exploit the market in both directions (i.e., buy and sell).
2) Speculators: These traders speculate in the futures market through their expectations. Their purpose is providing profit through transactions but they carry the risk of loss.
3) Hedger: These traders have the purpose to reduce their risks through transactions in the market related to their production and merchandising operations. Especially in merchandising operations, the foreign exchange transactions in long-term contracts can be hedged by using proper futures contracts. (Bailey, 2007).

2.2.1 The differences between forward and futures contracts

Although forward and futures contracts are both derivative instruments that enable hedging and speculation on future prices, there are some differences between them:

1) Forward contracts are done between two identified parties. Futures contracts are being operated under the guarantee of clearing houses. The trader with short position must deliver the asset on the delivery date.
2) Future contracts are more standardized than the forward contracts. The terms and conditions are determined before the traders take their position. Quantity, grade, date and location of a contract are standardized. There is no obligation for forward contracts for standardization. The transactions occur over-the-counter.
3) Forward contracts are held until the end of the maturity while future contracts can be easily be traded from the initiation of the transaction to the end of the maturity.
4) Future contracts are marked to market daily unlike forward contracts. The investors can benefit from their transactions daily. If the market pushes the trader on reverse positions, the trader can remove the contract from its asset before the loss is growing.

Figure 1 below shows the difference between long position and short position in terms of payoff in the futures market.

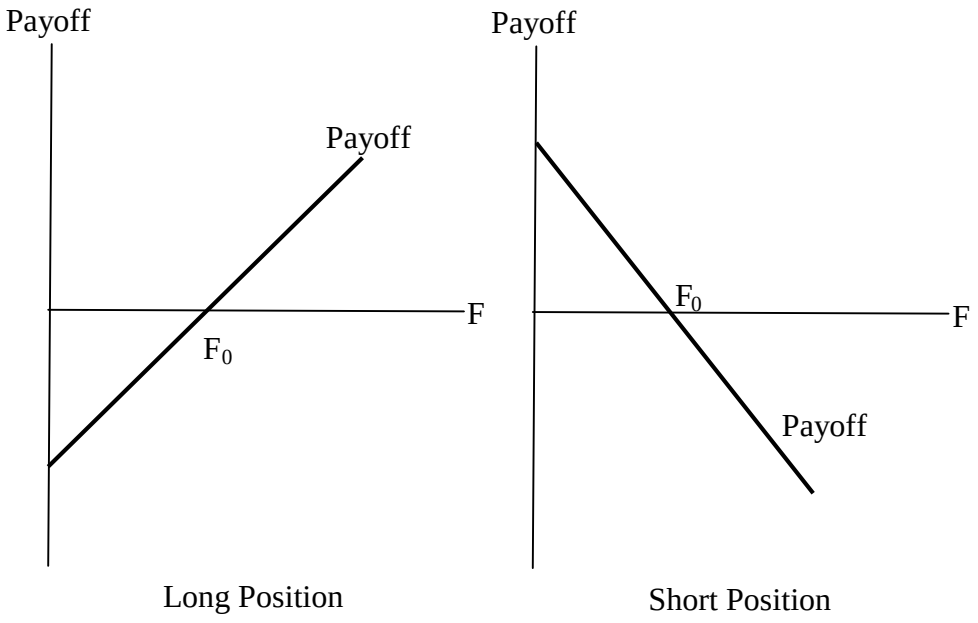

Figure 1 Short and long position in futures market (Bailey 2007)

Suppose that F_0 shows the contract price in the future market. For long position, if the offset (closing) price is higher than the price of the contract when the position is opened, F_0 , then the payoff is positive; so the action is profitable. In short position, on the contrary, the payoff is positive if the offset (closing) price is lower than the price of the contract when the position is opened, F_0 .

A long position investor and a short position investor can agree to perform the exchange before the maturity. This exchange and delivery must be done through the clearing house and the clearing house must be notified before the transactions occur. Forward contracts and futures contracts are issued for similar purposes. However the market of the contracts and the transaction regulations differ between them. In table 1, a comparison of forward and futures contracts is given (Bailey, 2007).

As the table indicates, there are 5 major dimensions that differ in application of forward contracts and futures contracts.

Table 1 Forward Contracts vs. Futures Contracts

Forward	**Futures**
1) Traded on over-the-counter market	1) Traded on an exchange
2) Not standardized	2) Standardized contract
3) Usually one specified delivery date	3) Range of delivery dates
4) Settled at end of contract	4) Settled daily
5) Delivery or final cash settlement usually takes place	5) Contract is usually closed out prior to maturity

Source: Hull (2003, 36)

In this chapter, we provided the major definitions and trading issues in derivative markets. The principles of future contracts are defined. The nature of futures is discussed indicating that they are the most common instrument of derivative markets since it provides easier application to the investors. In the next section, we will discuss how futures prices are determined.

3. FUTURE PRICE

3.1 Forward and Futures Prices and their Determination

The derivative markets set a price for forward and future contracts that have maturity at a future date. For the determination of forward and futures prices, it is necessary to get familiar with the measurement of interest rates. Futures and forward prices can be on an investment asset or consumption asset. Investment asset refers to the assets used by investors such as gold and silver. Consumption asset refer to the assets used for consumption purposes such as commodities (Hull, 2003). Investment assets by their nature are used to meet speculative needs of investors while consumption assets are for minimizing the risk of trading transactions and creating conservative profit.

While inquiring the concept of determination of forward and futures prices, some assumptions must be made for market participants (Hull, 2003):

1) The market participants are subject to no transactions costs when they trade.
2) The market participants are subject to the same tax rate on all net trading profits.
3) The market participants can borrow money at the same risk-free rate of interest as they can lend money
4) The market participants take advantage of arbitrage opportunities as they occur.

The theoretical price of a forward contract can be calculated through the spot price and the risk-free interest rate and time to maturity. To generalize the forward prices on an investment asset we can refer to the following formula where T denotes the time to maturity, r is the risk-free rate, S_0 is the spot price of the underlying asset and F_0 is the forward price (contract price). Risk free interest rate is assumed to be constant in the formula (Hull, 2003).

$$F_0 = S_0 \cdot e^{r \cdot T} \tag{1}$$

Equation (1) indicates that the value of a long forward contract at present must be some multiple of spot price, depending on the rate of interest and days to maturity.

The theoretical price of a forward contract on investment assets can be calculated through the spot price and the risk-free interest rate and time to maturity. Let $\tilde{T}$ represents lifetime of a contract, the period between the contract issued T_0 and the time it expired T_1: $\tilde{T} = T_1 - T_0$. To generalize the price on an investment asset we can refer to the following formula (Hull, 2003).

$$F_0 = (S_0 - I) \cdot e^{r \cdot \tilde{T}} \tag{2}$$

Equation (2) indicates that the value of a long forward contract today of an investment asset is determined by spot price minus the value of investment asset I multiplied by an exponential powered with interest rate times days to maturity which refers to the present value of discounted future price using interest rate. The

theoretical price of a forward contract including the known yield can be calculated through the spot price, average yield and the risk-free interest rate and time duration. The equation says that the price of a forward contract on investment good is a multiple of initial spot price minus the investment value.

The known yield of a forward contract can be formulized as follows, where q refers to the average yield per annum on an asset during the life of a forward contract.

$$F_0 = S_0 \cdot e^{(r-q)T} \tag{3}$$

Equation (3) shows that known yield of a future price is determined with a multiple of the spot price with the difference between interest rate on days to maturity and known yield.

If the price determination of a forward contract is desired to be obtained, the delivery price and the present value of the contract shall be included into the equation. The valuation of a forward contract in this case is given in equation (4), where K refers to the delivery price in the contract and F_0 refers to the value of a long forward contract today.

$$F = (S_0 - K) \cdot e^{-rT} \tag{4}$$

Equation (4) indicates that forward contract price is determined as a multiple of delivery price, spot price difference and interest rate on days to maturity.

The theoretical differences between forward prices and futures prices for short-term periods are typically insignificant. There are several factors that cause differences between futures and forward contract prices. These factors are taxes, transaction costs and the treatment of the margins. Futures are easily traded and more liquid compared to forward contracts. Generally it is reasonable to assume that forward and futures contract prices are equal. As the life of the contract increases, the difference between forward and futures contracts seem to be more significant. Then, it is not possible to assume forward contracts and futures can substitute each other (Hull, 2003).

3.2 Investor Behavior

In order to understand to trading actions in derivative markets, it is necessary to understand the investor behavior since derivative market transactions highly depended on the speculative expectations of the investors. The finance markets and the reaction of investors can be investigated in two ways: standard finance and behavioral finance. In standard finance people are assumed acting rational with regard to the changes in financial markets. In behavioral finance investors are considered typical that they try to maximize their profit as they reach their financial goals regardless to speculative actions. Behavioral finance is the psychological approach to finance (Pompian, 2006).

The definitions mentioned above led to a debate in comparing standard finance and behavioral finance. The debate is on especially rational markets and rational economic man. In rational markets, traders would act as rational economic man. This

refers that traders will be assuming; the market conditions of a future period will be in line with the expectations. In irrational markets, the traders would act as behaviorally biased man since the uncertainty of the futures markets creates individual acts for each investor. The terms mentioned above indicates that the expectation in the markets, the interest of individuals and the information received are three main dimensions to develop assumptions for a future period (Pompian, 2006).

In this section we briefly mentioned the investor behavior. For derivative markets, setting an example of transactions in derivative markets will clarify the investor behavior in certain circumstances. In table 2 and 3, trading example is set which defines how a hedger or a speculator would react to the mentioned market conditions. Risk averse or profit maximization purposes of traders would influence the transactions. In the example below, we set an example of how investors would act in derivative markets for futures contract trading.

Table 2 The trading path example of a future contract

Time	**Cash Trading**	**Futures Trading**
T=0	Underlying asset is needed in April. Expectation is an increase in price Current spot price: TL 100, 000.	The price of a 5-month futures contract price: TL 110, 000.
T=5	Buy the relevant underlying asset with a spot price of T=TL5 125,000	Sell futures contract with a current (T=5?) futures contract price: TL 130, 000.

In table 2, it is seen that if a trader does not aim to hedge himself, through cash trading TL25,000 of loss will incur. But if the trader does this transaction with

hedging; from buying and selling the relevant contract, TL30,000 of profit will incur. An overall profit of TL5,000 will be made via these transactions. The hedgers will avoid their losses and may even profit (Yıldırım, 1997).

During hedging the transactions through futures market, a profit may not occur frequently. But it is for sure that any hedging action will reduce the risk of making loss due to cash trading. In the table, the transactions shown as futures trading can be done just for investment. If a trader does not have any business obligation for the relevant market, he can make investments through future markets. In the example above, a profit amount of TL 30,000 may have been provided. In these cases, when traders perform action in futures markets just for investment, traders will have speculative point of view and develop expectation for the fluctuations may occur in the market (Yıldırım, 1997).

Table 3 below shows an example of hedging transaction that has to be done in case an increase in price is expected.

Table 3 The hedging procedures example for a futures contract

Time	**Cash Trading**	**Futures Trading**
December 2006	A decrease in underlying asset prices is expected. Current spot price is TL200.	Sell June futures contract of the relevant asset with a current contract price of TL210.
June 2007	Sell the asset with a spot price of TL190 in June 2007	Buy the relevant futures contract back at current contract price of TL195.

As it is seen in table 3 above, the trader will make a loss of TL10 through cash trading. If the trader takes action to hedge the transaction he will perform, he will

provide an opportunity for a profit amount of TL15. Overall profit of the trader will be TL5. In these two scenarios which are shown in tables 2 and 3, the appropriate behavior of a trader in case he/she desires to perform hedging for her/his transactions are shown (Yıldırım 1997).

3.2.1 Arbitrage – Hedging Concept

As mentioned before, the investors have the objective of acquiring profit or minimizing the loss. The actions for these purposes may refer to arbitrage-hedging concept. Regardless to the objectives of investors, futures can be applied in several types of assets. But shortly, the asset types of futures contracts can be summarized as follows[2]:

1) Commodity futures
2) FX futures
3) Finance futures
4) Index futures.

While pricing the futures, theoretical calculations are done. The pricing of futures contracts is based on a simple perception. The investors can use package contracts for specific requirements. Package contracts consist of multiple contracts issued by an investor. Two common packages exist: straddles and strips. Straddles involve both short and long positions with different delivery dates. Strips involve either short or long positions with different delivery dates.

[2] See Erol (1999).

Arbitrage concept which connects the spot price and the forward price can be explained with the relationship between borrowing and lending. Basically futures contracts are the deal of a buyer and a seller. Out of hedging and speculative strategies, arbitrage is done through borrowing money and investing it on an underlying asset to provide profit. Arbitrageurs include the interest cost of the borrowed money while calculating the arbitrage profit since they pay back the borrowed money at the end of the lifetime of a contract (Bailey, 2007).

For acknowledging the arbitrage concept in future markets, the compound interest concept shall be considered. An investor can borrow sufficient amount of money to buy a contract in future market at the spot price. The payoff will be collected at the delivery date which will enable the liquidity to repay the loan. The investor shall act in order to provide higher amount of payoff than the amount to be repaid. Basically arbitrage opportunity can be shown as[3]

$$F(t,T) = R(t,T) \cdot p(t) \tag{5}$$

In (5), $F(t,T)$ is the forward price, $R(t,T)$ is the amount of the loan, $p(t)$ is the amount of money borrowed, t is current period and T is time to maturity. This equation implies the profit range that incurs through the arbitrage opportunity.

The implicit assumptions that determine the relationship between the spot price and forward price are as follows:

[3] See Bailey (2007).

1) Frictionless markets: Where transactions costs assumed to be none and performance risk is ignored.
2) Storage (or carrying) costs: These costs can be neglected on the financial assets.
3) Convenience yield: Holding any asset will bring benefit through the fact of possession. These benefits are in the form of cash and cash equivalents. The benefit can also be described as liquidity premium.
4) Availability of stocks: Physical inventories may cause restrictions in the availability. If the stocks available for trade are limited, the arbitrage principle may not work within the equality.

Given that items 1 to 4 above hold, it can be shown that the market equilibrium will be

$$F(t,T)\{<or=\}(R(t,T)+c(t,T)-y(t,T)).p(t) \quad (6)$$

Where $y(t,T)$ is the convenience yield and $c(t,T)$ is the storage cost of \$1. This refers to the cost of storing inventory at an amount of 1\$. $p(t)$ is spot price. Equation (6) implies a condition where a market price is established through competition in which the amount of goods or services demanded by buyers is equal to the amount of goods or services produced by sellers.

In equation (6), there is convenience yield. Relevant to the equation above, the convenience yield formula can be shown as follows:

$$Y(t,T) = R(t,T) + c(t,T) - F(t,T)/\ p(t) \tag{7}$$

Equation (7) implies a pricing formula for forward prices in markets with trading constraints. Everyone who holds inventory has the choice for consumption or investment for the future. A rational investor will choose the best outcome. If the future price is expected to be higher, this will lead the trader to invest for the future. Otherwise, the investor would sell his stocks.

The forward and future prices may be equal or close to each other if the prices are small and the time interval is short, such as six to nine months. Hence, in relevant circumstances, future and forward price is interchangeable. If the circumstances do not meet the requirements mentioned above, this assumption cannot work. The revaluation of a forward contract to determine what will be the price of a contract on a future date can be calculated by the following formula:

$$V(t,T,F^*) = (F(t,T) - F^*) / R(t,T) \tag{8}$$

Where $V(t,T,F^*)$ is the value at date t of a forward contract that has a delivery date of T with an underlying asset price, $F(t,T)$ is the price of today, $R(t,T)$ is the amount of the loan, and F^* is the contract price. The equation indicates the revaluated expected price of a forward contract on a future determined date.

While explaining the arbitrage-hedging concept in this section, we also mentioned the relationship and relevant formulas between spot price and forward future price. In

derivative markets the future price is uncertain and traders with speculative purposes try to act accordingly in the market. Hedgers aim to minimize the risk and this condition contains conservative losses that are acceptable by hedgers. But speculators expect profit. One of the most essential theories of future markets is defined by Keynes- Hicks theory. This theory is known as normal backwardation. Normal backwardation indicates that the future price will be less than expected spot price at the end of maturity. According to this theory the markets can be defined as contango or backwardation markets referring to the situations shown below[4]

$$F(t,T) \begin{matrix} < \\ > \end{matrix} \left\{ \begin{matrix} p(t) \Rightarrow \text{backwardation} \\ p(t) \Rightarrow \text{contango} \end{matrix} \right\} \tag{9}$$

The points that Keynes- Hicks theory defines about future markets can be summarized in four dimensions:

1) Normally, future markets are controlled by short-hedger
2) Short-hedgers perform the sale of the relevant contracts and this action causes the future price decrease relative to the spot price. The arbitrage condition is relevant to the issue that mentioned the causes of convenience yield to be high or stocks of an asset to be limited.
3) Speculators aim to benefit from the differences between the futures price and the spot price.
4) When speculators buy the contracts that short-hedgers sell, these actions prevent the future price to be lower than the spot price.

[4] See Bailey (2007).

On the contrary several criticisms were raised against the four dimensions defined by Keynes-Hicks theory. These criticisms are as follows:

1) Empirical studies do not support the theory. The profit that speculators aim to provide is not observed accurately. Test of normal backwardation can be applied by establishing a link between the test applied and a model of prices.
2) It cannot be said that all future markets are under the domination of the short-hedgers. Domination of short-hedgers is only in specific cases; it cannot reflect overall structure of the markets. Even a speculator can turn to be a short-hedger to reduce the losses for a subsequent price fall.
3) The theory of Keynes- Hicks claims that future markets are isolated from other asset markets. The covariance, which is linked to Capital Asset Pricing Model and Arbitrage Pricing Theory, is ignored. The theory does not indicate whether these theories are applicable to the future markets.
4) Hendrik Houthakker who is a well-respected analyst said that "the most telling argument of the critics of normal backwardation is that, small speculators tend to lose money rather consistently."

Besides the items listed above for speculative actions, it is also necessary not to mix the terms of speculation and manipulation since the purpose and transaction natures of these concepts varies from each other.

Manipulation is another concept within the future markets. Manipulation is illegal and it is directing the market in personal interests. Most common manipulation type is cornering the market. For example, a manipulator may take long positions at a large quantity and with restricted delivery dates. Through the end of the maturity, investors with short positions will try to buy new contracts to offset their contracts.

But with narrowed delivery dates, and the restricted available contracts, manipulators will sell the contracts with higher prices that it is supposed to be (Bailey, 2007).

3.2.2 Spreads

Spread refers to the action that is defined as buying and selling a futures contract of the same or similar assets at the same time. If the asset is chosen to be the same, the action is called inter-market spread. If the two similar assets (commodities) are chosen, the action is called inter-commodity spread (Erol, 1999).

Spread in FX markets is based on the same concept. But in FX markets cross spread is the main issue. The buy and sell actions are taken in two different currencies. The parity of two currencies is obtained according to a pre-determined currency such as dollar. The ratio of two currencies on the parity of the pre-determined currency is calculated. This ratio becomes the major indicator for the spread and it is called cross spread (Erol, 1999).

Spread is a different concept than hedging. A hedger owns an asset and tries to minimize the price risk that may occur in the future and cause losses. However spread is used by speculators. Speculators take spread action in order to reduce the speculation risk. There are three main reasons to take spread action. These reasons are

1) Spread reduces the margin risk since a buy and a sell contract is held at the same time. So regardless to the increases and decreases in the price of the asset,

the speculator can avoid margin call since one contract is causing loss while the other provides profit.

2) Just like it is mentioned in the first reason, two contrary contracts also provide lower initiation margin.

3) If a speculator has a certain idea that the price of a futures contract will rise or fall, and if he finds it risky to take open positions due to the uncertainty in the price fluctuations, spread is the best option to be taken. Because in these situations, the speculator will provide profit in any way. The profits provided cannot be in the level of direct investors. This shows that when a spread position is taken, the direction of the spread is more important than the price fluctuations (Erol 1999, 119).

3.2.3. Price efficiency hypotheses

Price is very important for both hedgers and speculators. Price efficiency hypothesis is one of the methods for explaining price structure of the markets. This hypothesis can be formulized as follows:

$$S(f) = f + e \tag{10}$$

where $S(f)$ is the spot price that settles at the end of the maturity of a futures contract, f is the futures price at the beginning of the issued contract duration, and e is the normally distributed error term.

This hypothesis refers to the average expectation of the market for the settlement of the contract since futures price is determined on the basis of daily supply-demand balance and reflection of the traders' expectations. However it is not certain how efficient is the assumption for the settlement price of the contract. The hypothesis assumes that there is no systematic risk since it expects that only with coincidences the spot price can be different than the assumption (Erol, 1999).

In this section we discussed the futures price and explained different theoretical approaches for future price and set examples for investors' behaviors and actions regarding to the trading objectives in the futures market. We can conclude that price of a forward or futures contract at the settlement date is an uncertain variable. Just like in stock markets, market supply demand equilibrium, conservative and speculative transactions, the spot price at any date during the maturity of a contract are the factors that lead to the settlement price. Since there are several uncertainties, we will describe the market conditions and discuss the globally accepted models for minimizing the uncertainty (of variables) while estimating the future price in the next section.

4. PRICE DETERMINATION WITHIN FUTURES MARKETS

4.1. Economic roles of futures markets

Futures markets have an important role for investors since financial markets are full of uncertainties. Future markets provide hedging mechanism that minimizes risks and provide the optimal risk allocation. Future markets produce signals about the future movement of prices by reflecting the collective expectations and provides the price information in the underlying spot markets. Regarding to the issues mentioned above, it can be said that economic actors can use futures prices as reference (Yıldırım, 1997).

4.1.1 Imperfect market structures

According to the welfare economics, any Arrow-Debreu equilibrium allocation is Pareto optimal and some Pareto optimal allocations are competitive allocation. The first welfare theorem states that Walrasian equilibrium is weakly Pareto optimal. Such a theorem is true in a large and important class of general equilibrium models. The standard case is if every agent has a positive quantity of each good, and every agent has a utility function that is convex, continuous, and strictly increasing, then the First Welfare Theorem is applicable. The Second Welfare Theorem is that a Pareto efficient allocation can be provided by Walrasian equilibrium only if every agent has a positive quantity of every good, and preferences are convex, continuous, and strictly increasing. According to the Arrow-Debreu model, a market can be

complete only if a security exists or all securities (in the number of “n”) shall be an outcome of portfolio of traded assets (Yıldırım, 1997).

Arrow-Debreu model cannot show an analysis on insurance markets (Eatwell *et al*., 1987). Arrow-Debreu model assumes insurance markets working perfectly and costless. However there are high risks and high transaction costs in insurance markets. Informational asymmetries are essential for viewing the optimal allocation in the economy. However Arrow-Debreu model is not sufficient for asymmetric information. Many economists (e.g., Levhari and Rothscild (1983) and Friedman, Harrison and Salmon (1983)) indicated that completed markets justify the Arrow-Debreu model. Levhari-Rothscild (1983) argues that future markets make markets so complete that there may not be any opportunity of speculation. Theoretical and empirical researches indicate that futures trade improves allocation with technical efficiency and creates more product varieties within imperfect market structures (Yıldırım, 1997).

4.1.2 Anomaly

Anomaly is a tool for estimating the future price. Anomaly concept was defined by Thaler (1987) as a reality that is not in compliance with the theory. More simply, anomaly can be defined as the incident that occurs out of general perceptions and theories. Anomaly can be seen in political, economic and social environments as a paradox.

Anomaly analyses in financial markets can be performed with respect to;

1) days
2) months
3) holidays
4) companies

Anomaly analyses related to days are performed to notify whether some certain days of a week provides higher benefits. It was first studied by Fields (1931). Fields assumed that in a weekend, the prices will fall on Saturday. He assumed that the investors will make their portfolios empty at the end of a week regarding to the uncertainty occur for the weekend.

Anomaly analyses related to months are performed to notify whether some certain months of a year provides higher benefits. The most common concept of this perception is the “January Effect”. In January the highest profits are expected. Also “the turn of the month effect”, “the turn of the year effect” and “Intra-month effect” are other concepts of this perception.

Anomaly analyses related to holidays are performed to notify whether there is higher benefits before or after the holiday period. First study over this concept was also done by Fields (1934). As an example anomaly analyses related to holidays, the studies of Roll (1983) and Lakonishok and Smith (1984a) can be given. They observed that at the end of December and during the period before the Christmas holiday, the stock prices increase.

Anomaly analyses related to companies are performed to notify whether the size of the companies has any effect on the profit to be provided. “Small firm effect” and “size effect” are considered as two options in this perception. This concept was first studied by Banz (1981) and Reinganum (1981). They noticed that small size firms provide a higher average of profit comparison to the large size firms. The reason of this observation was defined that the financial assets’ valuation of small size firms are done and presumed through capital asset pricing model (CAPM) (Özmen, 1997).

4.2 Price Concept

A stock, a futures contract or an option establish hedging strategies through the expectations developed and generate benefit through financial markets. Futures and options have more complex structures compared to stock market. The question of how the price is determined for futures and options should also be asked (Little and Rhodes 1981).

There is an old saying on Wall Street, “a stock is only worth what someone is willing to pay”. Even though this saying seems to be to without vision, it is true in a way. The price of an asset cannot be higher than what someone is willing to pay for it. If a large demand occurs, the price will be higher. Sometimes the price is set low for attracting traders. In Wall Street, two major methods are used for price assumptions; “Price / Earnings Ratio” and “Dividend Yield” (Little and Rhodes, 1981).

4.2.1 Price / Earnings Ratio

This ratio defines the relationship between the stock price and the earnings per share. The formula of the ratio is as follows:

$$P/E = \frac{P}{E} \tag{11}$$

Where P is stock price and E is earnings per share. The P/E value shows the how valuable is a stock.

4.2.1.1 Dividend Yield

Dividend yield is also shortly called “yield”. Yield refers to the annual percentage of return that is provided by dividend. It is defined as

$$Y = \frac{CD}{P} \tag{12}$$

Where Y is dividend yield and CD is annual cash dividend per share. The Y value shows how much dividend amount is paid each year in accordance with its share price.

Lower P/E ratio and higher dividend yield Y is desirable for the market. However it is not possible to determine that relatively lower P/E ratio or higher dividend yield refer that the stock is priced appropriately for exchange. P/E and Y never remain

constant. When the price of a stock increases, P/E increases while Y decreases (Little & Rhodes, 1981).

After a stock is issued, the price of it will fluctuate due to changes in the market throughout the maturity duration. A stock's price can change for many reasons that can vary from demand and supply changes to politics. The price depends on the changes in the supply-demand balance. Since traders make transactions in stock markets for investment, speculation and trade, traders must develop expectations and take positions in compliance with the expected changes. Stock markets serve different purposes for traders having different investment purposes. Some has a purpose to hedge the asset positions and some wants profit maximization through it (Little & Rhodes, 1981)

4.3 The Pricing Models

The basic principles of pricing in futures markets are similar to other markets. For the pricing of option-type contracts, several theories have been developed. In this section we will discuss some of these theories.

4.3.1 Pricing of options

In this subsection, we will discuss pricing of options to get a better idea on pricing models since the assumptions and models developed are based on options. An option is a contract to buy or sell any particular asset or financial right with a determined price within a determined duration. There are two types of options: European options and American options. European type refers to the options that cannot be exercised at

any date except the expiration date. American type refers to the options that can be exercised throughout the time duration.

Pricing of options can also be applied on futures. A futures call option allows a trader to keep a long position in futures contracts while a futures put option allows a trader to keep a short position in futures contracts. In options on futures, the contracts are specified regarding to the underlying asset. The benefits of options on futures comparison to the options on cash instruments can be summarized as follows (Ritchken, 1987):

1) Cash markets are mostly over-the-counter, bid-and-offer markets that are dominated by major dealers. Thus, the transaction costs are highly important due to the fact that quotes on prices may be difficult to obtain. Price is uncertain and the relevant disclosures are continuous through the day.
2) Traders in options require underlying markets for liquidity. In accordance with this fact, supply of the futures contracts must not be restricted in numbers of contracts not to cause any problems.
3) Selling a commodity short is harder than selling a futures contract. However, if the underlying commodity is a futures contract, more options and strategies are available (Yıldırım, 1997).

4.3.1.1 Black-Scholes (B-S) Pricing Model

Fisher Black and Myron Scholes developed this model in 1973. The model was developed for stock options but the model is also applicable to other assets.

$$C_0 = S_0 \cdot N(d_1) \cdot X \cdot e^{-rT} \cdot N(d_2) \quad (13)$$

In equation (13), C_0 is the current call option value, S_0 is the spot exchange rate of currency, X is the exercise price, e is the natural logarithm, r is the risk-free interest rate and T is the time to maturity of option in years. $N(d)$ represents the probability of the option that expires in the maturity of the contract. If both $N(d_1)$ and $N(d_2)$ approaches to 1, the profitability that will be provided through the option will be higher (Kurtay, 1997). d_1 and d_2 are defined as follows:

$$d_1 = \ln (S_0 / X) + (r + \sigma^2 /2) T] / \sigma\sqrt{T}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

In the equations above, σ refers to the standard deviation of the annualized continuously compounded rate of return of the underlying currency. $N(d_1)$ and $N(d_2)$ refers to the probability of a standard normal distribution.

Even though B-S model is efficient and well-known and accepted in terms of accuracy in finance literature, volatility is the unknown variable in B-S model. Two different approaches are followed to estimate the volatility. These are historical and implied volatility. Historical volatility can be estimated through the past behavior of the relevant asset. Historical volatility can give uncertain results since it is not determined whether the relevant asset will show the same trend as the previous assets showed. Historical volatility may cause losses if the actual volatility does not have the behavior of estimated volatility. Implied volatility is estimated by solving the pricing equation backward. There is an implicit assumption that the option price can

be calculated correctly and that implied volatility is the current volatility. The market premium, which is the difference between the expected return on a market portfolio and the risk-free rate, is also added to the calculation for the estimation of the volatility. The implied volatility can change through the time since different time and maturities of the options exist. The higher implied volatility causes higher risk premium (Kurtay 1997).

Expectation of the volatility is very important for traders since it is possible to benefit through volatility differences. If the expected volatility is lower, short (selling the option) position can be taken. On the contrary, long position (buying the option) can be taken if the expected volatility is high (Kurtay 1997).

4.3.1.2 Garman-Kohlhagen Pricing Model

Black-Scholes model has been extended in several ways. Garman-Kohlhagen model (G-K) is one of them, which is based on the foreign currency options and developed in 1983.. The difference with B-S model is that instead of the exchange rate of underlying currency, foreign-interest rate-adjusted exchange rate is used in G-K model. The formula of the model is given as:

$$C_0 = E_d \cdot N(d_1) \cdot X \cdot e^{-rT} \cdot N(d_2) \qquad (14)$$

In (14), E_d refers to current call option value for foreign currency option. This equation has a similar reasoning as B-S model except that in this model E_0 is involved as the foreign-interest rate-adjusted exchange rate instead of the spot exchange rate of currency S_0 in BS model,. In (12) definition of d_1 is as follows:

$$d_1 = \ln (E_0 / \mathrm{X}) + (\mathrm{r} + 0{,}5.\sigma^2 /2)\ \mathrm{T}] / \sigma\sqrt{\mathrm{T}}$$

In this model since the interest rate differences occur among the currencies of different countries, the currency option shall be in compliance with it. If the foreign country's risk-free interest rate is higher than the domestic interest rate, the foreign currency will be defined as forward-discount according to the theorem. This means the domestic current spot exchange rate is higher then the current domestic futures spot rate. The relevant relation is called as the interest-rate parity theorem (see Cornell et al. (1989) and Kurtay (1997)).

4.3.1.3 Lenand Pricing Model

The Lenand Pricing model differs from B-S model in that account transaction costs are taken into account in the former. The model is developed in 1985 and by this model; it is possible to make a comparison on the basis of transaction costs, especially for re-hedging a position. Traders need to reconsider their hedged positions in case of a change in the exchange rates. The Lenand Pricing model can be formulized as:

$$C_0 = S \cdot N(d_1) \cdot K \cdot e^{-rT} \cdot N(d_1 \cdot \sigma\sqrt{T}) \qquad (15)$$

In (15), S indicates spot price of the exchange contract and K is the exercise rate of the currency option. This equation indicates the current price in which the transaction costs are involved. In (13), d_1 is defined as

$$d_1 = \ln (S_0 \,/\, \mathrm{K}e^{-rT}) \,/\, (\sqrt{\mathrm{T}} + \sigma\sqrt{\mathrm{T}}/2)$$

In the equation above, σ is defined as:

$$\sigma = [1 + \mathrm{K}\,(\sqrt{2}/\prod) \,/\, (\sigma\,(\sqrt{\Delta \mathrm{t}})^{1/2}$$

In the formula above, Δt is the revision interval and k is the proportional "round trip" transaction cost.

4.3.1.4 Accuracy of the Pricing Models

The major theorem for pricing is Black-Scholes Pricing Model. Other approaches to pricing are indeed extensions over the B-S model. Several simplifying assumptions are made in the B-S model. These assumptions are as follows:

1) The underlying currency's volatility is known and does not show any change through the life of the option.
2) The underlying currency's value is continuous in a way that it never makes sudden changes or moves.
3) The interest is known and it remains constant through the lifetime of the option.
4) Borrowing and lending are possible with a same short-term interest rate to buy an option.
5) Short selling is possible.
6) There are no transaction costs and taxes.
7) The option is assumed to be a European option (Kurtay, 1997).

There are many other models releasing one or more of the limiting assumptions of B-S model. For example, Hilliard *et al*. (1996) developed a model that includes noncontact interest rates in the B-S model. Tucker (1994) developed a model that accounts random jumps in exchange rates. Borensztein and Dooley (1987) developed a model that uses pure jump-diffusion process to avoid the pricing bias for out-of-money currency options (Kurtay, 1997).

Criticizes may show B-S model not valid on some certain issues but while criticizing the model, it cannot be denied that the model is simple and applicable. It is obvious that B-S model underprices the depth in the money call options and overprices the depth out-of –the-money call options. However when the transaction costs and bid-offer transactions are taken into account, the mispricing does not seem to create an arbitrage opportunity. Today many banks and dealers develop pricing models on the same logic with Black-Scholes Pricing Model (Kurtay, 1997).

In 1989, Black published an article called; “How to use the holes in Black-Scholes”. Black revised several parameters used in the B-S model and concluded that holes in the pricing formula reduced with the assumptions and simplifications developed for the model. However, today the model is not commonly applicable anymore. Only banks and some similar institutions are using the model due to the reason that there are several parameters cannot be calculated without the model, such as the volatility estimates (Kurtay, 1997).

In this section, we evaluated all major models developed for determination of futures price. However the volatility of a futures price is an unknown, which prevents one to determine a future price of a contract. The models and financial approaches mentioned above offers some estimations of volatility and hence futures prices. However, given that future price volatility is unknown, it is still possible to face unexpected futures price at the settlement date of any contract. In the next section, we will discuss the crucial factors that may affect futures price volatility.

5. FUTURES PRICE VOLATILITY

Expected future price is essential for trading options. John Maynard Keynes and John Hicks argued that if hedgers hold short positions and speculators hold long positions, the futures price of an asset will be below its expected future spot price. This issue will occur since speculators require compensation for the risk they bear. Speculators trade only for making money on average. Hedgers will lose some money on average; but it would be in an acceptable range since their losses and risks are minimized with hedging. Keynes and Hicks discussed that if speculators hold short positions and the hedgers hold long positions, then the future price will be above the expected future spot price. This would happen since the speculators would want to perform the sales transaction in a higher futures price and the hedgers would not act speculative (Hull, 2003).

Risk premium concept in future markets is firstly defined by Keynes. Keynes says in his theory that futures prices are biased according to the normal backwardation. The bias is the risk premium for the speculators. If the expected spot price exceeds the futures price by the premium, the risk premium is paid through the market. Typically, through the end of the maturity, the futures price and the spot price tend to converge. Thus the basis value that is approached must be zero. Supply and demand factors determine the cash commodity and the future contract prices at the date of the delivery.

The theories of Keynes on normal backwardation are not supported by some empirical studies. According to the Capital Asset Pricing Model (CAPM), the risk

premium is depended on beta coefficient and the systematic risk. The Beta Coefficient refers to an asset's risk as compared to the overall market. It measures how much the particular asset moves in relation to a broader index. Dusak (1973) applies CAPM for determining the risk premium demanded by the speculators. According to this perception, since the future price is not lower than the expected price, normal backwardation does not exist as the mean return and the systematic risk will be very close to zero. Williams (1990) supported the findings of Dusak (1973) and argued that normal backwardation theory cannot define the periods involving high carrying charges that occur in when the large stocks are in store.

Besides these theoretical debates, Stiglitz (1983) concluded whether the futures price will be over or below the expected price. Stiglitz (1983) defined that speculators cannot have any impact on the movement within the market and on the relationship between the expected price and futures price. Traders take speculative positions only when the difference between future price and expected price is different than zero (Yıldırım, 1997).

5.1 The quotations and the futures prices

In derivative markets; the long position and short position investors take an action for buying or selling a determined underlying asset on a determined price prior to the future maturity date of an issued contract. As in all stock exchanges, the transaction occurs when the orders of the different positions meet. When an investor wants to buy and another want to sell in the same moment, the action occurs. The delivery options and the available number of positions are always determined by the stock

exchanges. The only thing the market determines is the price of the futures contracts. It is for sure that the futures prices are not an assumption; it is determined on the basis of finance models regarding to the market environment.

5.1.1 Carrying Cost Model and Theoretical Price

In, carrying cost refers to the financial and operational expense relevant with an investment. Carrying cost depends on the equilibrium of supply and demand. The price of futures is determined with the spot price at the present time, the cost of holding the futures for a defined period of time and the expectation in the market. These parameters that influence futures price are subject to frequent changes; hence the futures price is volatile. Despite the changes we can define the futures price as the sum of selling price and carrying cost.

The determination of the carrying cost is important. The most important factor is the interest rate. Typically, keeping an asset will bring an interest income. If the pricing is done for inventory items, storage, insurance, freight must be considered during the calculation. If the pricing is done for share, the dividend income must be considered during the calculation. Naturally the expected price will be different than the actual price. This occurs due to the expectation of the investors. These expectations affect the price and they can be positive or negative. So the future price is equal to the sum of selling price, carrying cost and positive or negative expectations.

The future price is generally higher than the spot price. These markets are called normal markets. If the future price is lower than the spot price, these markets are

called reverse markets. These markets occur at the time of a financial/economic crises or regression. When there is limited good, keeping this good at the present time will be more expensive that keeping it for the future.

Future price determination is not a stabilization of a price on a future date. When a position is taken this does not mean that the price of the underlying asset on a defined future date will be the same as the date of transaction. The price of the underlying asset will change until the settlement price is obtained on the maturity. The investors stabilize the income or the cost which will occur during the transaction with an underlying asset.

The difference between the spot price and the futures price is called basis. Also the difference between same contracts with different maturities can be perceived as basis. The change ratio of this difference is called basis risk. Speculators may benefit from these basis fluctuations.

In derivative markets short positioned hedgers are defined as speculators who are going to sell an underlying asset that is owned by them or that will be owned in a future date. These speculators can hedge their investments by selling a futures contract. The long positioned hedgers are defined as speculators who will need an underlying asset. These speculators are able to stabilize the underlying asset price at the present time. Short hedgers expect the basis to decrease while long hedgers expect the basis to increase.

The interest rates used in the theoretical price calculations are taken from the slope of efficiency in the bond market of stock exchange. These interest rates are riskless. Slope of efficiency can be obtained by linear methods but also logarithmic methods such as Siegel & Nelson method (1987). They exploit the parsimony of the framework by forecasting three latent factors; level, slope and curvature of the yield curve. From the forecasts of these factors, the entire term structure at future points in time can be generated. A futures contract with "n" days to maturity can be theoretically calculated with the interest rates of "n" days. All contracts are calculated with compounded interest rates. Interest rate contracts are calculated with general discounting method to find out the theoretical price in compliance with the spot market conditions. In the formulas defined below, the theoretical price calculations are shown for share index contracts, foreign exchange contracts, interest future contracts and commodity future contracts.

Since we have the objective to measure the applicability of the theorems in TURKDEX, it is necessary to define the theoretical price calculations for the contracts issued in TURKDEX.

Share index contracts

Theoretical price in share index futures contracts can be calculated as the multiple of Spot ISE 30 Index value and logarithm of interest rate, dividend rate difference and days to maturity rate. This can be formulized as follows

$$\mathrm{E(p)} = S_0 \cdot e^{(r-d)\cdot t/365} \qquad (16)$$

Where expected price is $E(p)$, S_0 is the spot ISE index value, r is the interest rate, d is the dividend rate and t is the days to maturity.

FX future contracts

The theoretical price of foreign exchange contracts is calculated with the multiple of spot FX rate and logarithm of domestic and foreign interest rate difference and days to maturity:

$$E(p) = S_0 \cdot e^{(rd-rf)\cdot t/365} \tag{17}$$

In the equation, rd refers to the domestic interest rate and rf refers to the foreign interest rate.

Interest future contracts

The theoretical price of these contracts is calculated in line with the price calculation of bonds. Discount formula of a bond is as follows:

$$B = \frac{100}{1+\frac{r \cdot t}{365}} \tag{18}$$

In the equation B refers the bond price. When the days to maturity extends one year, then the value of the bond with n+365 days to maturity is calculated as follows:

$$A = 100/(1+r_{n+365}(n+365)/365) \tag{19}$$

The theoretical price of an interest future contract is found as follows

$$E(p) = A.[1 + (r_n .n / 365)] \quad (20)$$

Commodity future contracts

The theoretical price of commodity futures contracts is calculated with the multiple of current spot price of the commodity and the logarithm of interest rate, other expenses difference and days to maturity.

$$E(p) = S_0 \cdot e^{(r-c)\cdot t/365} \quad (21)$$

In the equation above c refers to the expenses of holding the commodity in other words carrying cost of commodity..

Besides the theoretical price calculations defined for derivative markets in Turkey, it is necessary to indicate that international markets are determined by supply and demand and they have significant depth due to higher volume of trading. It is seen that the market basis shows a trend that is approaching theoretical basis even after sudden speculative actions. This is an arbitrage factor. This issue is like the central bank reaction to markets after the high fluctuations in FX markets. Normally markets are run as normal-contango markets. Generally speculators take long positions while risk-averse players take short position for hedging purposes. If this general assumption was true, market price shall be lower than the future price (positive systematic risk). If the prices increase, the speculators will have a gain as much as

the risk they have carried. Risk-averse players are ready to accept small losses in return for reducing their risks.

However if we consider that basis risk is a part of these markets, we see that the markets are more favorable for the hedgers rather than speculators. Typically, if the basis difference is declining through the end of the maturity of futures, short hedgers make net relative profit while long hedgers make net relative loss (Altıngözlü, 2006).

In a normal-contango market, assuming that there is compliance in maturity and contract size, since the basis will be zero at the end of the maturity, if short hedgers hold their position until the end of contract maturity, they will provide the required hedging and relative profit. So the basis range is very important for an investor while taking a position with derivative tools. The actual futures price will show the same trend with the theoretical price calculated and thus speculators may perform transactions fitting investor interests during the time line of the contract. (Altıngözlü, 2006)

5.1.2 Risk determination in future price and the Equilibrium Pricing of Securities

Keynes and Hicks performed researches on the futures price and the expected future spot price. They claimed that speculators cannot trade if their expected outcome is beneficial. Also hedgers may accept a negative expected outcome since their purpose is to minimize the risk. The relationship between the futures price and the expected

future spot price is similar with the relationship between the risk and return. Higher risk brings higher rate of return (Hull 2005).

Risk refers to the unexpected and undesired incidents to incur. However, in financial markets, there is a major difference between the risk and uncertainty. Risk can be beneficial and depends on objective probability distribution. Uncertainty cannot be presumed by any historical data and it depends on subjective probability distribution (Yörük 2000).

Risk may have different qualifications regarding to the issues faced by the investors. Risk of a financial asset can be classified into two groups:

1) Systematic risk
2) Unsystematic risk

Total risk that is the sum of systematic and unsystematic risk can be defined as

$$\sigma_1^2 = ß_1^2 . \sigma_m^2 + \sigma_e^2 \qquad (22)$$

Equation (22), the formula indicates the total risk including systematic and unsystematic risk. In (22), σ_1^2 refers to the total risk of a financial asset, $ß_1^2 \cdot \sigma_m^2$ refers to the systematic risk, where $ß_1^2$ is the sensitivity of the asset against systematic risk, σ_m^2 is the market risk and σ_e^2 refers to the unsystematic risk.

Table 3 below shows the sources of financial risk under the segments of systematic and unsystematic risks.

Table 3 The sources of financial asset risk

Sources of Systematic Risk	Sources of Unsystematic Risk
1. Interest rate risk 2. Purchasing power risk 3. Market risk	1. Financial risk 2. Management risk 3. Operational risk 4. Sector risk

Systematic risk consists of the factors that affect the financial assets in the market and the fluctuations incur within the range of benefits provided through relevant financial assets. Financial assets are affected in different values but in the same direction from systematic risk. Systematic risk cannot be prevented by the investors.

Unsystematic risk consists of more micro issues compared to systematic risk. Unsystematic risk can be related to management issues or sector characteristics. Thus, it is possible to prevent unsystematic risk, unlike systematic risk (Yörük, 2000).

The future price of a security is the main source of the relevant risk. This is so because (i) the future price is uncertain, (ii) the utility of a trader can directly be affected. If the price of the security is high and we are invested in it, then we can consume more from the proceeds of selling that security, and thus our profit will be higher. Alternatively, if the price is low, we will consume less from the proceeds of selling the security and our utility will be lower (Baz & Chacko, 2004).

5.1.3 Measuring Price volatility

Several methods can be performed to measure the volatility. One of them, probably the simplest one, is to calculate the statistical variability of "absolute" prices, that is, standard deviation. But this method does not give the best result for comparing the size of deviations of different series. By converting a percentage variation approximation, the normalization of different levels of stock prices can be provided. Due to this reason, coefficient of variation is the most appropriate statistics while judging the volatilities of absolute price series.

Computing the standard deviation in a logarithmic form of absolute price observations is another method to measure the volatility. This method provides interpretation of the price date in percentage terms. Due to this reason, the method provides a standardized form for comparison. Measuring the volatility in terms of returns rather than absolute prices is an alternative way for comparative analysis. Return variable refers to the gross percentage change of prices. Stock volatility can also be calculated through logarithmic form that is interpreted as percent-per-period variation

Weiner (1984) calculated the volatilities of the Value Line Composite Index (VLCI), the NYSE Composite Index and the Dow Jones Industrial Average (DJIA). For all of these indexes, the logarithmic return form is applied for measuring the stock market volatility (Yıldırım, 1997)

According to some analysts, the volatility occurs due to the random arrival of information about the future returns from the stocks. According to some, volatility occurs from trading actions. When the cause of the volatility is tested empirically, the following two range determinations were involved to the researches;

1) The variance of stock price returns between the close of trading on one day and the close of trading on the next trading day when there are no intervening non-trading days.
2) The variance of the stock price returns between the close of trading on Fridays and the close of trading on Mondays (Hull 2003).

If the trading and non-trading days are assumed to be equal, the variance of the second case is three times greater than the variance in the first case. These results show that volatility is higher when the exchange is open. Random information may not be a major factor of volatility. For example commodities are generally consumption assets and their prices depend on information on weather, commodity goods, foreign exchange rates, stock market index etc. In the study it is also observed that the volatility in commodities is higher during trading rather than random information arrival. As a conclusion it is possible to say that the volatility occurs from trading itself (Hull, 2003).

5.1.3.1 Existence of the Hedging Need and Speculative Demand

The studies on the stock market volatility show that there is a high level of price variability. The studies indicate that derivatives follow the same path. Thus the range

of the price variability is restricted. It can be concluded that the high volatility of the stock market cannot be assumed as an obstacle since it provides a driving force for the establishment of derivative market in Turkey. Market feedback is required for this conclusion since active involvement of large numbers of market participants is critical for providing efficient derivative trading. In compliance with that fact, findings of market survey is significant (Yıldırım, 1997).

5.1.4. Value at Risk Method and Its Application

The method that measures the maximum loss risk level in a defined confidence interval is called value at risk (VaR). Value at risk (VaR) is the most common financial risk measurement in management. Value at Risk (VaR) is a widely used measurement for the risk of loss on a financial asset portfolio. The VaR risk measure is a popular for aggregating risk. Although it represents loss, VaR is a positive number. A negative VaR would indicate the portfolio has a high probability of making a profit. The simple and logical structure of the model is the factor that provides the common application of the model common. However many researches criticized the VaR model. For example, Artzner (1997) defined the weak points of VaR as follows: (Bozkuş, 2006)

1) VAR measures only a limited part of profit/loss distribution. If there is a tail risk existence; VAR neglects the effects of this tail risk.
2) If VAR is segmented in to sub levels, the application does not match in accordance with the segmentation. To prevent these problems, expected shortfall method shall be applied.

Expected shortfall (ES) is the assumption for the losses occurred out of VaR. ES shall be added to VAR as a method to minimize the theoretical problems. Indeed, VaR may misguide the investors who aim to maximize their profit. If the investors use only VaR, and if they find themselves in a position higher than the VaR level, higher losses than expected would occur. Due to this risk, ES is essential to be applied with VaR. The successful application of ES depends on the stability of the expectation developed and the right test methodology used. (Bozkuş, 2006)

5.1.4.1 Value at Risk (VaR)

Statistically, VaR is the portfolio loss distribution of a defined sample. (Bozkuş 2006) Artzner (1997) defined VaR in the confidence interval of (VaR_a (X)), 100 (1-α) % as follows:

$$VaR_a(X) = -\inf(xP(X \le x) \rhd \sigma) \qquad (23)$$

In equation (15), X refers to the sample variables. The profit-loss value for a portfolio is determined by where $\inf\{x; A\}$ refers to; X limit of an A event and $\inf\{xP[X \le x] \rhd a\}$ refers to the value of profit-loss at $100A$ limit. Since the losses are defined as negative, the calculated VaR value must be multiplied with (-).

VaR is calculated by three methods. These are parametric, Monte Carlo and historical data methods. Parametric method is used if there is a constant distribution, Monte Carlo method depends on the assumption that there is a certain model in

portfolio pricing and historical data is used regarding to the sample size. VaR is generally criticized on the non-coherent results obtained especially in the skewed tail distributions. We discussed the critiques of Artzner (1997) above. Researchers developed several feedbacks to prevent the non-coherent results in skewed tail distributions. For example, Huisman (1998) and Pant and Chang (2001) suggested to measure portfolio risk via t-distribution. t-distribution has skewed tail distribution. Thus, it can show market indicators more efficiently. Platen and Stahl (2003) tested this perception on the fixed asset gains on the market and concluded that portfolio return distribution is converging to the t-distribution.

5.1.4.2 Expected Shortfall (ES)

Expected shortfall (ES) method is developed by Artzner (1997) in order to reduce the weaknesses of the VaR. The first ES calculations are found in the studies of the Fishburn (1997). ES evaluates the value or risk of an investment conservatively; the approach focuses on the less profitable outcomes within the investment. .In compliance with the VAR equation given before, ES equation can be shown as follows: (Bozkuş, 2006).

$$ES_a(X) = E(-X - XVaR(X)) \qquad (24)$$

In equation (24) it shall be considered that $E[-X;\beta]$ refers that in B situation, the conditional expected value for –X.

Rockafeller and Uryasev (2000) found that ES method is functionally more successful than VaR in optimization of the portfolio. This conclusion is based on the fact that ES is convex with a linear combination with negative coefficients while VaR is not. Stability of the variables and indices are essential for the risk measurement in ES method. The application of the appropriate back testing method (with aid of computers, traders try to estimate how financial instruments performed in the past have a mechanical trading system been.) is also a key factor for finding more efficient results from ES method (Bozkuş 2006).

ES method is difficult to apply. Thus VaR method is used more common since it is easier to apply. Even if VaR has many defects, it is more common than ES due to its simplicity. Using only one method is risky while developing expectations for the future outcomes. Thus the risk management must be analyzed well if one method is being used. We can summarize the positive and negative aspects of VAR and ES as follows:

Strengths:

VaR: Directly related to the default issues of an institution, easy to perform back testing, common to measure risk, easy to apply with common software and system support.

ES: Deals with the losses out of VaR estimation, the low possibility of investors to be in reverse positions, it is sub-additive (property of a function that is evaluating the function for the sum of two elements), can be easily used in portfolio optimization (Bozkuş, 2006).

Weaknesses:

VaR: Incapable to measure the losses in skewed tail distributions, high possible of investors to be in reverse positions, it is not sub-additive, cannot be easily used in portfolio optimization.

ES: Not directly related to the default issues of an institution, not easy to perform back testing, it is not common to measure risk, cannot be applied easily with common software and system support. (Bozkuş, 2006)

There are several methods for measuring the market risk. The best method is the one that fits the special requirements and market conditions. If the market shows normal distribution, the fluctuations can be defined as volatility and correlation.

However, if the market does not show normal distribution, every expectation may generate its own probability and the high number of probabilities may cause uncertainty in the market. Thus measuring the possibility cannot be possible. This kind of markets can be observed with scenario analysis and stress tests (Bolgün and Çolaklı, 2007).

VaR method is easy to apply since it depends on past variables. In the theory, Monte Carlo simulation reduces technical difficulties compared to other methods. However for providing the system requirements of Monte Carlo application is highly complex and elegant that it cannot be held easily. Monte Carlo simulation requires more effort compared to VaR method.

As VaR method depends on previous data, it is independent from assumptions on the type of distribution. But the previous data must be reevaluated each day because the histogram, in which the VaR is estimated, consists of the actual price changes occurred in the relevant period. With Monte Carlo method, the observation and reevaluation of the data are not limited with the relevant observed period of time.

6. AN APPLICATION OF THE THEORIES FOR TURKISH DERIVATIVE MARKETS THROUGH TURKDEX

The spot price and the futures price show a slope in a trend approaching each other through the end of the maturity. In other words the basis must converge to zero at the end of the maturity. The settlement price at the end of the contract must be equal to the spot price. If the settlement price is different than the spot price, it will indicate an arbitrage opportunity for the speculators. Buying the same good on a lower price and selling it on a higher price shows that there is no equilibrium in the market. Thus, the settlement prices are directly taken from the spot price at the end of the contract maturities in this research.

The basis risk matters especially if the derivative instruments are used on purpose of hedging. The maturities of contracts are stabilized in TURKDEX. Thus the hedging period and the contract maturity may not meet each other on the basis of duration. Hedging may require buying or selling the contract before the maturity end. This will cause a difference between spot price and futures price. This difference is the essential variable to measure the efficiency of the hedging transactions. The theoretical price based on the carrying value is on the same principles. However, the calculation of the theory may depend on the theoretical prices of the contracts in TURKDEX. The calculations are just theoretical and it is highly possible that the prices at the end of the maturities may show difference.

Since the TURKDEX is established recently, derivative tools used through it can be problematic. Some of these problems are the arbitrage incapacity, the incompliance of the future prices with the markets, and the increase in the spread between the call and put prices. There are three types of prices in derivative markets. The actual price determined by the stock market, the theoretical price and expected spot price in the future. Theoretical price does not give accurate results. However, it can be a useful tool to shape the investment since it gives idea about the future prices that will occur. Since the foundation of TURKDEX, foreign exchange futures contracts are the most common derivative instrument used by the traders.

Turkish economy suffered several crises after 1990s. Even then, the Turkish securities market has been one of the most promising emerging markets in the relevant period. Due to the financial crises, high level of capital gains was reaped through high stock volatility. The issue to be discussed is whether high volatility in Turkey is an obstacle or an indicator of development for the futures-options market (Yıldırım, 1997).

In the examples below, 311 F-FX EUR and 301 F-FX USD contracts issued in TURKDEX is used to show the time pattern of spot and futures price.

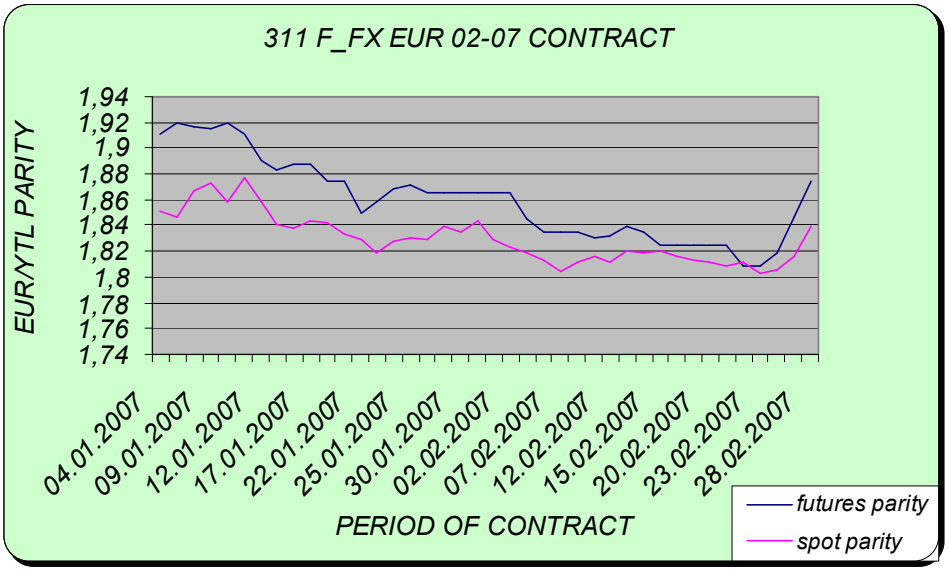

Figure 2. The spot price and future price of FX (Euro/ TL parity) issued in TURKDEX.

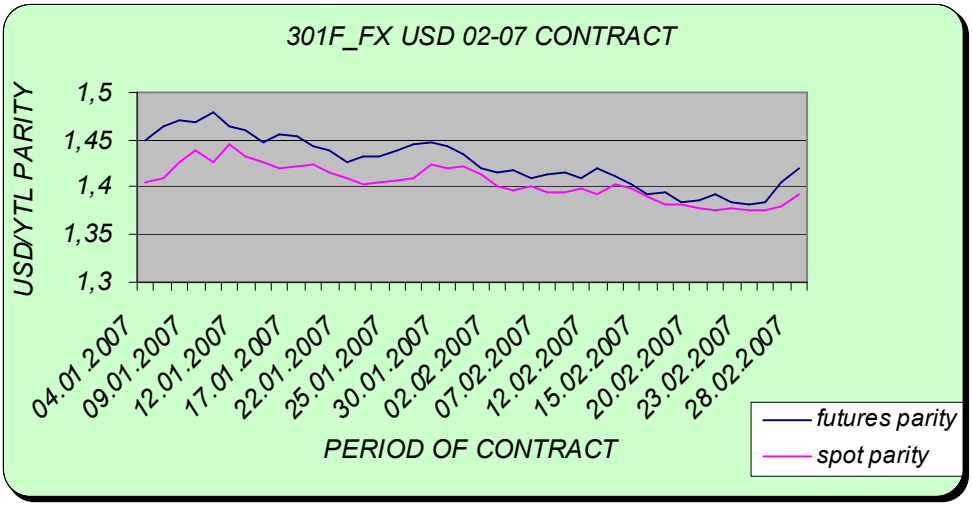

Figure 3. The spot price and future price of FX (Usd/ TL parity) issued in TURKDEX.

In the figures 2 and 3 above the movement of a EURO and USD FX contract is shown within the period of January-February 2008. The blue line indicates the futures price and the red line indicates spot price of the contract. The spot and futures prices do have the same value just once in the period. However, the two prices do follow a similar path as expected since it is known that spot price have impact on futures price and future price movement is in line with spot price changes that incur

daily. Note that futures prices have higher values compared to the spot prices. Furthermore, the fluctuations in USD and EUR contracts are similar.

In figure 4 below; the theoretical price of F-FX EUR contracts plotted in figure 2 above is plotted.

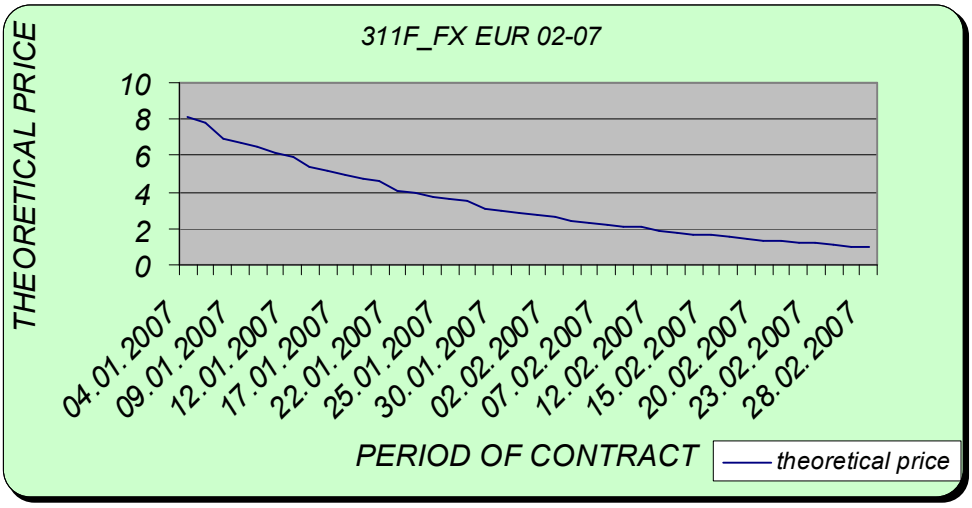

Figure 4. The theoretical price of the EURO contract.

In the figure above the theoretical price was calculated for the EUR contract plotted in figure 2. The theoretical price is calculated based on the formulas defined is section 5.1.1. As it is defined within the concept of theoretical price; the calculated value shows a descending trend.

Similarly, figure 5 below presents the theoretical price of F-FX USD contract given above in figure 3. The theoretical price of USD shows a declining path at theory.

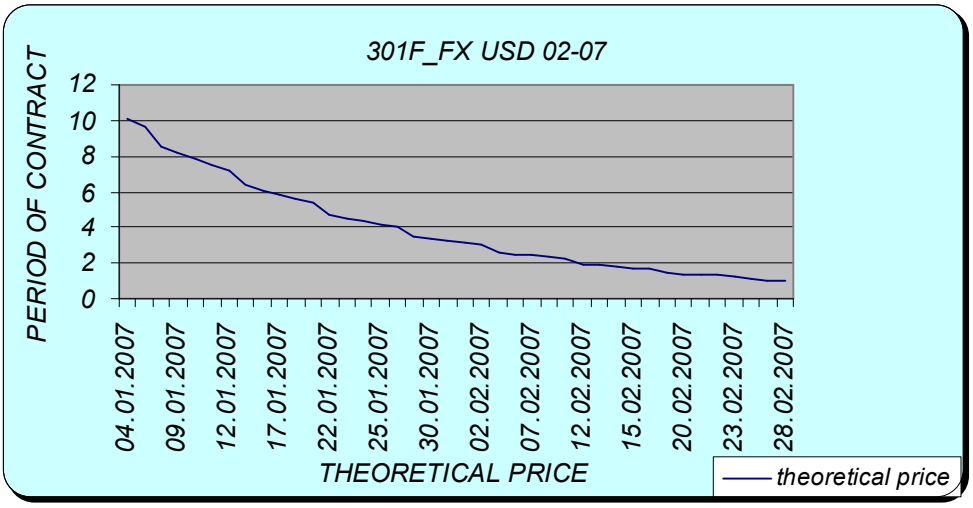

Figure 5. The theoretical price of USD contracts

Figures 2 and 3 consisted of the actual data provided from TURKDEX while figure 4 and 5 consisted of the theoretical prices for the sample contracts. The changing range of the price volatilities are in compliance with the theories spotted for the similar cases. The theoretical price change shows the shape of the trend of the actual futures and spot prices thus this led us to assume that Turkish Derivative Markets are in progress as in compliance with the international theories.

International markets, which are determined by the supply-demand and that are deeper with higher volume, in theoretical approach applied in prior studies it is observed that the market basis shows a trend to approach theoretical basis even after sudden speculative actions. This is an arbitrage factor. This issue is like the central bank reaction to markets after the high fluctuations in FX markets. Normally markets are run as normal-contango markets (Altıngözlü, 2006).

Samuelson (1965) theoretically indicated that future price change of a contract is significantly influenced by maturity. Future price volatility increases as the futures

contract market approaches end of the maturity period. Rutledge (1976) showed that the price changes in the prior period are directly influencing the current price changes. He also indicated that futures price volatility declines through the termination of a contract. Both the Samuelson and Rutledge models were based on the same assumptions; the futures price volatility is linked either to the price changes in the previous period or in the current period. Serletis (1991) indicated that the equations including both a maturity and trading volume are reasonable variables for measuring futures price volatility.

In this work the details of derivative markets, the investor and speculator behaviors that incur in shape of the hedging, speculating transactions in response to the nature of the market were explained. As we have indicated before, settlements are done majorly within the last days of maturity before the expiration of the contract. The highest and lowest daily price changes in accordance with the negotiations, the spot market prices and the transaction demand of the investors. These factors influence the buyer and seller expectations for the issued contracts.

6.1 Econometric Analysis for Measuring Price Volatility

6.1.1 Literature Review

Several studies have been done in order to determine the impact of the futures on the volatility. Lee and Ohk (1992) claimed in their studies that volatility differs from country to country due to different macroeconomic conditions. In this work, we examined the volatility on Turkish derivative markets. Bollerslev and Jubinski (1999) showed in their studies that volume and volatility have similar degree of fractional integration, and they argue that this evidence supports a long-run view of the mixture-of-distributions hypothesis.

Clark (1973) interprets that the daily price change is the total of a random number of within-day price changes. So the variation in daily price changes is random variables with a mean proportional to the mean number of daily transactions. Clark obtained that trading volume is related positively to the number of within-day transactions, thus the trading volume is related positively to the volatility of the price change. Studies of Epps and Epps (1976), Harris (1986), Morgan (1976), Rogalski (1978), and Smirlock and Starks (1985) claim there is a positive correlation between trading volume and the price change which refers to the volatility.

Recently Fleming and Kirby (2006) examined the trading volume and stock return volatility and obtained a strong correlation between them. In this study we examine the relationship between trading volume and futures volatility in foreign-exchange futures market. Differing from prior studies, we used the days to maturity variable

while determining the impact of trading volume on volatility. There are two well-known types of statistical models of return volatility. First one is the autoregressive conditional heteroskedasticity (ARCH) models developed by Engle (1982), and the second one is the stochastic volatility (SV) model of Taylor (1986).

It is a well-known fact that return series demonstrate strong conditional time varying volatility and volatility persistence. These issues of return volatility can be applied by Engle's (1982) autoregressive conditional heteroscedasticity (ARCH) model and the generalized autoregressive conditional heteroscedasticity (GARCH) model of Bollerslev (1986). While these models set up paths of time varying volatility in returns, further detection of the heteroscedasticity in stock returns can be helpful in explaining the volatility of returns.

While applying the models for identifying the impacts on volatility, it shall be considered that many studies obtained using daily prices favor the conclusion that option prices provide more accurate forecasts than historical information. The studies involving low-frequency data often result that all the relevant information for volatility assumption is in option prices. Jorion (1995) and Xu and Taylor (1995) used this assumption for foreign exchange futures contracts in their studies. Recent researches and studies have pointed that the historical information in intraday prices can be used to develop volatility forecasts with higher accuracy. Realized volatility that is defined as the sum of intraday squared returns, provides more accurate estimations than daily squared returns (Andersen and Bollerslev, 1998). The theoretical and empirical properties that are mentioned above are applied by Andersen (2001) for foreign exchange futures.

Harris and Raviv (1993) make an assumption for traders to receive common information that shape the investing activities. However, traders differ from each other regarding to the way in which they use the information, and each trader believes in the validity of their assumption. Information for futures contracts provide investors with new positions or allow them to hold existing positions at lower costs. In addition, futures contracts enable hedging. This condition is deriving that less reliance is required to be placed on spot hedging strategies. The transfer of the speculative transactions from the spot market to the futures market may show impact on spot market volatility. Relevant to this condition, Schwert (1990) claimed that intraday index futures volatility is around 40% higher than intraday equity market volatility.

Exploring the relationship between asset price variability and trading volume is performed by Clark (1973), Telser (1981), Tauchen and Pitts (1983), Grammatikos and Saunders (1986), Barro (1986), and Andersen (1996). All of the aforementioned studies obtained results for a positive relationship between price uncertainty and the overall volume of futures trading. In this study, we observed the daily prices for foreign exchange futures contracts and used days to maturity variable in modeling performed for the econometric analysis.

6.1.2 Data and Preliminary Analysis

For the analysis about to be examined, we chose to use the foreign-exchange futures contracts in TURKDEX. Since the depth of the derivative markets in Turkey does

not allow having sufficient data in commodity and stock index contracts, we preferred to use the daily data set of USD/TL parity foreign exchange contracts which has higher volume rates throughout the time line. With this purpose, we choose the year 2008 in which the trading volume in TURKDEX increased significantly and obtained the data daily for 6 different contracts: February 2008 (F301F_FXUSD0208), April 2008 (301F_FXUSD0408), June 2008 (301F_FXUSD0608), August 2008 (301F_FXUSD0808), October 2008 (301F_FXUSD1008) and December 2008 (301F_FXUSD1208). The data allocation enables to observe 760 samples in year 2008. For each day of each contract, we obtained the trading volume, daily settlement price and days to maturity variables to be added to the modeling of the analysis.

In Table 5; we statistically identified the variables. In the literature, there are three uses of trading volume data in the analysis: (i) raw trading volume data, (ii) the logarithm of the trading volume data, (iii) de-trended trading volume data. For matter of developing a proper approach, we included all three forms of trading volume data in the statistical analysis. In a parallel fashion, we used the same forms of data for days to maturity variable. If Q statistics for returns is positive, it indicates that there is autocorrelation in the series. Autocorrelation indicates the relationship between the observations. This led us a conclusion that contract return is linked to the historical returns and we can estimate the future prices using the historical data as well. Q statistics for square of the return indicates the variance. If the Q statistics for square of the return is positive, there is heteroscedasticity which indicates that regression cannot be applied since the standard deviations will not be minimized. Since there is heteroscedasticity GARCH models are appropriate for the modeling. Our statistical

analyses show that Q statistics for returns and Q statistics for square of the return have reliable positive results. This indicates that there is heteroscedasticity problem in the variance of variables. Out of our analysis on descriptive characteristics of data, we conclude that only GARCH modeling can be applied in our study and that OLS methods cannot be applied. Table 5 below presents the details of the descriptive characteristics of data.

Table 5. Descriptive statistics of sample return and volume series

Data	Mean	SD	Skewness	Kurtosis	JB
R^a	0.000	0.046	1.042	2.729	137.920*
dtm	115.826	88.126	0.974	3.309	121.291*
vlm	23977264	44656405	3.119	15.812	6337.095*
Logdtm	4.359	1.055	-1.206	4.858	289.371*
Logvlm	14.631	2.769	-0.171	1.968	36.921*
Detdtm	0.003	0.982	-1.429	5.551	458.047*
Detvlm	0.003	2.518	0.045	2.214	19.523*

Note: SD indicates standard deviation. Jarque-Bera normality test statistic has a chi-square distribution with 2 degrees of freedom.
* denotes significance at 1% level.
The end of sample period is 01.01.2008- 31.12.2008 for all the return series.
Detvlm is the detrended futures contract volume denoting the residuals of the equation: $\det vol_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \varepsilon_t$
Detdtm is the detrended day to maturity volume denoting the residuals of the equation: $\det dtm_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \varepsilon_t$
where Logvlm and Logdtm denote the logarithm of the trading volume of futures contract and the logarithm of day to maturity, respectively
[a] Ljung-Box statistic for returns and squared returns at 20 lags are 2815.9 and 2681.0, respectively

In table 6; we have applied unit root test to the allocated data from which we have stated the statistical results in table 5. We have applied ADF and KPSS methods during the analysis of unit root test. In the analysis we have obtained that detrended volume and days to maturity variables are more appropriate for modeling. In ADF method, null hypothesis refers that the series include unit root. We rejected this hypothesis since there is no unit root included in the series we have allocated. Despite ADF method, KPSS method refers that null hypothesis indicates stability in

the series. We accepted this hypothesis in line with KPSS method. Since ADF method hypothesis is rejected and unit root is not included in the series, we can assume that the series is stable and this provided us the information that the series is appropriate to be modeled.

Table 6 Unit root test results

		ADF Level	KPSS Level
R	η_μ	-5.951(19)*	0.241
	η_τ	-5.963(19)*	0.134
dtm	η_μ	0.393(18)	3.571*
	η_τ	-1.607(18)	0.171**
vlm	η_μ	-2.341(18)	0.830*
	η_τ	-2.679(19)	0.284*
Logdtm	η_μ	-0.406(14)	2.053*
	η_τ	-1.843(14)	0.344*
Logvlm	η_μ	-1.437(17)	2.316*
	η_τ	-3.045(15)	0.699*
Detdtm	η_μ	-3.188(14)**	0.155
	η_τ	-3. 950(14)**	0.131
Detvlm	η_μ	-3.818(15)*	0.304
	η_τ	-3.821(15)*	0.298*

Note: η_τ and η_μ refer to the test statistics with and without trend, respectively.

* and ** denote rejection of null hypothesis at 1% and 5%, respectively.
Numbers in parenthesis are optimum lags determined according to the Akaike Information Criteria (AIC)

6.1.3 Methodology

In the preliminary analysis we have shown that there is heteroscedasticity problem in the data. Therefore, GARCH models are appropriate for identifying the impact of trading volume and days to maturity variables on price volatility. For reflecting the characteristics of the data reasonably, the GARCH model developed by Engle (1982) and Bollerslev (1986). According to the GARCH model, there are two main parameters affecting the variance: past values of error terms (ARCH effect) and the conditional variances generated by information inflow into the market. For a GARCH (p, q) model, p and q refers to the lag length of conditional variances and past values of error terms, respectively.

There are several types of GARCH models such as E-GARCH, T-GARCH, IGARCH, etc. The exponential GARCH (E-GARCH) study of Nelson (1991) has more specialized features comparison to the standard GARCH model. Cumby (1993) explained two major advantages of the E-GARCH model in comparison to standard GARCH model. First, the limitations in ARCH and GARCH coefficients are reduced by exponential formulation. Second; EGARCH model is stronger on this case by modeling the standardized residual with moving average (MA) regressor in the variance equation. In line with the previous empirical studies, we have an expectation that the future return series used within our analysis will follow heteroskedastic path. The asymmetric structures of the relevant series have been demonstrated during the preliminary analysis of this study. On this basis, we developed models for GARCH, EGARCH, GJR-GARCH and T-GARCH methods.

However during the modeling, GJR-GARCH and T- GARCH models have convergence problem. Thus, we dropped them on this study and focused on GARCH and E-GARCH methods for identifying the impact of trading volume and days to maturity on price volatility. We have developed four models based on four types of data by using the E-GARCH method;

1. Volume and days to maturity are used in their raw form in the model (see Table 7 for detailed results).
2. Logarithm of volume and days to maturity are used in the model (see Table 8 and 10 for detailed results).
3. Detrended volume and detrended days to maturity are used in the model (see Table 9 for detailed results).
4. Detrended volume and days to maturity are used in the model (Table 11).

We focused in EGARCH method due to the fact that the GARCH method has several weaknesses. The major weakness is that the conditional variance depends on the magnitude of the disturbance term. GARCH fails to demonstrate the negative asymmetry in financial time series. On the other hand, the EGARCH model is stronger on this issue, as it models the standardized residual with moving average (MA) regressor in the variance equation. This prevents the magnitude effect as mentioned before. On this basis within EGARCH method we developed the model equation as follows;

$$\log\sigma_t^{\,2} = \omega + \alpha\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}^{\,2}}\right| + \beta\frac{\varepsilon_{t-1}}{\sigma_{t-1}^{\,2}} + \theta\log\sigma_{t-1}^{\,2} + \delta dtm_t + \xi vlm_t \qquad (25)$$

In equation (25) α measures magnitude effect that refers to the differences in means, β measures the asymmetry effect in the market, θ shows volatility persistency, δ measures the effect of day to maturity on volatility, and ξ measures the effect of trading volume on volatility.

Table 7. Estimation results of EGARCH model with volume and day-to-maturity

Mean equation	
μ	-0.012*
	(0.001)
R_{t-1}	-0.177*
	(0.023)
Variance equation	
ω	-6.552*
	(0.001)
α	0.270**
	(0.122)
β	-0.507*
	(0.091)
θ	0.217*
	(0.051)
δ	**0.010***
	(0.001)
ξ	**4.8E-010***
	(9.8E-010)
$\ln(L)$	1597.236
AIC	-4.249

Notes: QMLE standard errors are reported in the parentheses below corresponding parameter estimates. $\ln(L)$ is the value of the maximized Gaussian Likelihood, and AIC is the Akaike information criteria.
,** , and ***indicate significance levels at the 1%, 5%,

In table 7, we obtained that δ (refers to days to maturity) and ξ (refers to trading volume) have positive relationship with volatility. In this case if raw days to maturity

and trading volume data are included into the model we have developed, when both variables increase, volatility increases as well.

Table 8. Estimation results of EGARCH model with logarithms of volume and day-to- maturity

Mean equation	
μ	-0.024*
	(0.000)
R_{t-1}	-0.069*
	(0.008)
Variance equation	
ω	-11.910*
	(0.495)
α	-0.395*
	(0.056)
β	0.525*
	(0.051)
θ	-0.600*
	(0.017)
δ	**0.947***
	(0.034)
ξ	**-0.299***
	(0.024)
$\ln(L)$	1812.463
AIC	-4.824

Notes: QMLE standard errors are reported in the parentheses below corresponding parameter estimates. $\ln(L)$ is the value of the maximized Gaussian Likelihood, and AIC is the Akaike information criteria
* ,** , and ***indicate significance levels at the 1%, 5%, and 10%, respectively.

In table 8, we obtained that δ (refers to days to maturity) has positive and ξ (refers to trading volume) has negative relationship with volatility. In this case if logarithm of days to maturity and trading volume data are included into the model we have developed, when days to maturity variables increases and trading volume decreases, volatility increases as well.

Table 9. Estimation results of EGARCH model with detrended volume and RAW day-to-maturity

Mean equation	
μ	-0.025*
	(0.000)
R_{t-1}	-0.120*
	(0.007)
Variance equation	
ω	-12.776*
	(0.179)
α	-0.420*
	(0.063)
β	0.570*
	(0.061)
θ	-0.508*
	(0.018)
δ	**-0.541***
	(0.033)
ξ	**0.009***
	(0.001)
$\ln(L)$	1873.423
AIC	-4.987

Notes: QMLE standard errors are reported in the parentheses below corresponding parameter estimates. $\ln(L)$ is the value of the maximized Gaussian Likelihood, and AIC is the Akaike information criteria.
* ,** , and ***indicate significance levels at the 1%, 5%, and 10%, respectively.

In table 9, we obtained that δ (refers to days to maturity) has negative and ξ (refers to trading volume) has positive relationship with volatility. In this case if raw days to maturity and detrended trading volume data are included into the model we have developed, when days to maturity variables decreases and trading volume increases, volatility increases as well.

Table 10. Estimation results of EGARCH model with detrended volume and LOG day-to-maturity

Mean equation	
μ	-0.024*
	(0.000)
R_{t-1}	-0.071*
	(0.007)
Variance equation	
ω	-15.413*
	(0.186)
α	-0.265*
	(0.058)
β	0.468*
	(0.056)
θ	-0.483*
	(0.017)
δ	**-0.572***
	(0.028)
ξ	**0.850***
	(0.038)
$\ln(L)$	1908.593
AIC	-5.081

Notes: QMLE standard errors are reported in the parentheses below corresponding parameter estimates. $\ln(L)$ is the value of the maximized Gaussian Likelihood, and AIC is the Akaike information criteria.
* ,** , and ***indicate significance levels at the 1%, 5%, and 10%, respectively.

In table 10, we obtained that δ (refers to days to maturity) has negative and ξ (refers to trading volume) has positive relationship with volatility. In this case if logarithm of days to maturity and detrended trading volume data are included into the model we have developed, when days to maturity variables decreases and trading volume increases, volatility increases as well.

In tables 7, 8, 9 and 10 we have applied different types of data. During the review of prior studies, we have obtained that the trading volume data has strong trends. The strong trends may show impact on the indicators which may misguide the results of

the analysis. In several articles we obtained that detrended trading volume has led more accurate results for the analysis. Furthermore the raw version and logarithm of trading volume and days to maturity involve unit root which indicates that using these raw data in modeling cannot be appropriate. Detrended volume and days to maturity does not involve unit root thus it is more appropriate for modeling. Thus we used the detrended trading volume and raw days to maturity data in our data allocation and showed the results in table 11.

During the four type of modeling we have developed, all models yielded positive asymmetry. This refers to the fact that there is leverage effect on the futures market examined. The GARCH approach to modeling indicates that volatility change also refers to the testing of Black's (1976) leverage effect. Indeed, the E-GARCH class of models captures the tendency for negative shocks to be associated with increased volatility.

In table 11, we present the results of the econometric analysis that we have developed using E-GARCH method defined in equation (25). Since β parameter refers to the asymmetry, we concluded that symmetric GARCH model cannot be applied. As it is shown in table 11, the results marked with "*" indicate that the null hypothesis is rejected. In the modeling we have developed, all results for each indicator have statistical positive outcomes. Since we obtained that indicator δ is positive, ξ is negative, we can claim that days to maturity has positive and trading volume has negative relationship with the volatility.

Table 11. Estimation results of EGARCH model with detrended volume and day-to-maturity

Mean equation	
μ	-0.025*
	(0.000)
R_{t-1}	-0.074*
	(0.006)
Variance equation	
ω	-11.460*
	(0.165)
α	-0.159**
	(0.076)
β	0.458*
	(0.070)
θ	-0.409*
	(0.018)
δ	**1.143***
	(0.039)
ξ	**-0.532***
	(0.032)
$\ln(L)$	1971.965
AIC	-5.251

Notes: QMLE standard errors are reported in the parentheses below corresponding parameter estimates. $\ln(L)$ is the value of the maximized Gaussian Likelihood, and AIC is the Akaike information criteria.
* ,** , and ***indicate significance levels at the 1%, 5%, and 10%, respectively.

As indicated in table 11, we found that days to maturity has positive and trading volume has negative relationship with price volatility. If trading volume decreases and days to maturity increases, the volatility range increases as well. The results of our analysis are consistent with prior empirical studies. We can claim that Turkish derivative markets show the same characteristics as other futures markets show in terms of the impact of trading volume and days to maturity on return volatility.

The outcomes of our analysis may advise transaction patterns to the traders. Since the speculators and hedgers follow different strategies in line with their expectations,

risk taking and risk-averse positions shall be held considering the volume and days to maturity relationship with the volatility. Our study indicated that volatility range may expand during the initiation of a contract. Since in futures markets, daily transactions to be done, the prior periods of a contract provide higher volatility range. However in prior periods, the trading volume does not settle in higher levels either. This will lead the speculators to perform transactions more throughout the end of the maturity of a futures contract where stability increases. This condition will cause the trading volume to be higher through the maturity. Even though, days to maturity has positive and trading volume has negative relationship with volatility, due to the structure of the derivative markets, it can be claimed that trading volume is more crucial while performing transactions. Speculators may try to show impact of the prices before the contract matures. The nature of this may incur due to the high hedging potential in TURKDEX. In Turkish Derivative Market, traders generally perform transactions in order to minimize the losses especially in foreign-exchange contracts. Thus throughout the maturity of a contract, offsetting transactions generally applied rather than speculative actions. Since TL is a soft currency, especially foreign traders have the purpose to prevent potential losses that may incur due to fluctuations in USD/TL and EUR/TL parities.

7. CONCLUSION

Derivative markets are emerging in Turkey. The system is fresh and not all sort of contracts are issued within the stock exchange. Derivative markets in developed markets are even consisted of contracts linked to the weather expectations. This allows the speculators a wide offer of investment. In Turkey since the TL is a soft currency and arbitrage consists of a large space within the investing areas, FX contracts are promising. It is possible to say Turkish Derivative Markets have common movement with international markets however it shall be reminded that stock exchange & exchange rate trends can be traced to be opposite in Turkey. This occurs since TL is a soft currency to be effected by international incidents and Turkish Finance Market is not as deep as a developed country market. The arbitrageurs and speculators have a less deep market which causes unbalance in supply-demand equilibrium.

In this study, the concepts of derivative markets, the futures price, derivative instruments and the models relevant to them are discussed. Two sample FX contracts were chosen for the application of the theories in Turkish Derivative Markets. In TURKDEX; the FX contracts are majorly in use and applicable thus the examples were chosen as a USD and EUR contract issued in TURKDEX. In these examples, it is shown that theoretical price sets the trend that a contract is going to follow through the end of the maturity. The contracts we have applied fulfilled the theoretical requirements and we obtained that the futures price follows the same trend set by theoretical price as well as the spot price fluctuation.

In this study, we performed econometric analysis and it was found that trading volume caused variability in price changes. It is certain that days to maturity influences futures price volatility. Since the days to maturity decrease, the price change decreases. Thus, traders must consider trading volume changes through the expiration of a futures contract. Futures price is not a concept to be determined and settled. Only estimations and expectations can shape the settlement price of a contract. The investor behaviors indicate that through the end of the maturity, investors perform transactions more expecting that the volatility would be minimized. However the transaction demand may change the trading volume and the futures price can be higher than expected. Except hedging purposes, it is more beneficial for speculators to act regarding to the daily settlement prices of futures contracts.

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DATA A – RELATIVE TO FIGURE 2

Date	Futures (EUR/TL)	Spot (EUR/TL)
04.01.2007	1,911	1,8515
05.01.2007	1,919	1,847
08.01.2007	1,916	1,8676
09.01.2007	1,915	1,8725
10.01.2007	1,920	1,8586
11.01.2007	1,911	1,8771
12.01.2007	1,890	1,8577
15.01.2007	1,883	1,8404
16.01.2007	1,887	1,8383
17.01.2007	1,887	1,8434
18.01.2007	1,874	1,8418
19.01.2007	1,874	1,8332
22.01.2007	1,850	1,8288
23.01.2007	1,858	1,819
24.01.2007	1,869	1,8272
25.01.2007	1,872	1,8298
26.01.2007	1,866	1,8289
29.01.2007	1,866	1,8399
30.01.2007	1,866	1,8345
31.01.2007	1,866	1,8432
01.02.2007	1,866	1,8296
02.02.2007	1,866	1,8227
05.02.2007	1,845	1,8195
06.02.2007	1,835	1,8125
07.02.2007	1,835	1,8045
08.02.2007	1,835	1,8118
09.02.2007	1,830	1,8159
12.02.2007	1,832	1,8112
13.02.2007	1,840	1,8201
14.02.2007	1,835	1,8194
15.02.2007	1,825	1,8202
16.02.2007	1,825	1,8158
19.02.2007	1,825	1,8136
20.02.2007	1,825	1,8114
21.02.2007	1,825	1,8085
22.02.2007	1,808	1,8111
23.02.2007	1,808	1,8021
26.02.2007	1,819	1,8051
27.02.2007	1,847	1,8159
28.02.2007	1,874	1,8397

DATA B – RELATIVE TO FIGURE 3

Date	Futures (USD/TL)	Spot (USD/TL)
04.01.2007	1,450	1,4056
05.01.2007	1,465	1,4086
08.01.2007	1,470	1,4266
09.01.2007	1,469	1,4392
10.01.2007	1,480	1,4266
11.01.2007	1,464	1,4448
12.01.2007	1,459	1,4321
15.01.2007	1,448	1,4263
16.01.2007	1,455	1,4202
17.01.2007	1,453	1,4216
18.01.2007	1,443	1,4251
19.01.2007	1,438	1,4165
22.01.2007	1,426	1,4103
23.01.2007	1,432	1,4041
24.01.2007	1,432	1,405
25.01.2007	1,440	1,4073
26.01.2007	1,445	1,4087
29.01.2007	1,447	1,4252
30.01.2007	1,444	1,4201
31.01.2007	1,435	1,4221
01.02.2007	1,419	1,4135
02.02.2007	1,415	1,4001
05.02.2007	1,418	1,3971
06.02.2007	1,410	1,4007
07.02.2007	1,413	1,3944
08.02.2007	1,415	1,3949
09.02.2007	1,410	1,398
12.02.2007	1,419	1,3926
13.02.2007	1,412	1,4031
14.02.2007	1,403	1,3992
15.02.2007	1,393	1,3909
16.02.2007	1,394	1,3824
19.02.2007	1,385	1,3818
20.02.2007	1,387	1,3788
21.02.2007	1,392	1,3756
22.02.2007	1,385	1,3782
23.02.2007	1,383	1,3761
26.02.2007	1,384	1,376
27.02.2007	1,405	1,3793
28.02.2007	1,420	1,3922

DATA C – RELATIVE TO FIGURE 4

Date	e value	Days to maturity	theoretical price
04.01.2007	2,31	55	10,07
05.01.2007	2,27	54	9,66
08.01.2007	2,14	51	8,51
09.01.2007	2,10	50	8,16
10.01.2007	2,06	49	7,83
11.01.2007	2,02	48	7,51
12.01.2007	1,97	47	7,20
15.01.2007	1,85	44	6,35
16.01.2007	1,81	43	6,08
17.01.2007	1,76	42	5,83
18.01.2007	1,72	41	5,59
19.01.2007	1,68	40	5,36
22.01.2007	1,55	37	4,73
23.01.2007	1,51	36	4,53
24.01.2007	1,47	35	4,35
25.01.2007	1,43	34	4,17
26.01.2007	1,39	33	4,00
29.01.2007	1,26	30	3,52
30.01.2007	1,22	29	3,38
31.01.2007	1,18	28	3,24
01.02.2007	1,13	27	3,11
02.02.2007	1,09	26	2,98
05.02.2007	0,97	23	2,63
06.02.2007	0,92	22	2,52
07.02.2007	0,88	21	2,42
08.02.2007	0,84	20	2,32
09.02.2007	0,80	19	2,22
12.02.2007	0,67	16	1,96
13.02.2007	0,63	15	1,88
14.02.2007	0,59	14	1,80
15.02.2007	0,55	13	1,73
16.02.2007	0,50	12	1,66
19.02.2007	0,38	9	1,46
20.02.2007	0,34	8	1,40
21.02.2007	0,29	7	1,34
22.02.2007	0,25	6	1,29
23.02.2007	0,21	5	1,23
26.02.2007	0,08	2	1,09
27.02.2007	0,04	1	1,04
28.02.2007	0,00	0	1,00

DATA D – RELATIVE TO FIGURE 5

Date	e value	Days to maturity	theoretical price
04.01.2007	2,09	55	8,09
05.01.2007	2,05	54	7,79
08.01.2007	1,94	51	6,95
09.01.2007	1,90	50	6,69
10.01.2007	1,86	49	6,44
11.01.2007	1,82	48	6,20
12.01.2007	1,79	47	5,97
15.01.2007	1,67	44	5,33
16.01.2007	1,63	43	5,13
17.01.2007	1,60	42	4,94
18.01.2007	1,56	41	4,75
19.01.2007	1,52	40	4,57
22.01.2007	1,41	37	4,08
23.01.2007	1,37	36	3,93
24.01.2007	1,33	35	3,78
25.01.2007	1,29	34	3,64
26.01.2007	1,25	33	3,51
29.01.2007	1,14	30	3,13
30.01.2007	1,10	29	3,01
31.01.2007	1,06	28	2,90
01.02.2007	1,03	27	2,79
02.02.2007	0,99	26	2,69
05.02.2007	0,87	23	2,40
06.02.2007	0,84	22	2,31
07.02.2007	0,80	21	2,22
08.02.2007	0,76	20	2,14
09.02.2007	0,72	19	2,06
12.02.2007	0,61	16	1,84
13.02.2007	0,57	15	1,77
14.02.2007	0,53	14	1,70
15.02.2007	0,49	13	1,64
16.02.2007	0,46	12	1,58
19.02.2007	0,34	9	1,41
20.02.2007	0,30	8	1,36
21.02.2007	0,27	7	1,30
22.02.2007	0,23	6	1,26
23.02.2007	0,19	5	1,21
26.02.2007	0,08	2	1,08
27.02.2007	0,04	1	1,04
28.02.2007	0,00	0	1,00

DATA E – RELATIVE TO FIGURE 6

Contract Code	Maturity	Settlemet Pirce
Index		
111F_IX0300205	Feb 05	35,965
111F_IX0300405	Apr 05	30,375
111F_IX0300605	Jun 05	34,565
111F_IX0300805	Aug 05	39,240
111F_IX0301005	Oct 05	40,525
111F_IX0301205	Dec 05	50,625
111F_IX0300206	Feb 06	50,675
111F_IX0300406	Apr 06	50,675
111F_IX0300206	Feb 06	60,325
111F_IX0300406	Apr 06	55,250
111F_IX0300606	Jun 06	44,625
111F_IX0300806	Aug 06	47,125
111F_IX0301006	Oct 06	51,300
111F_IX0301206	Dec 06	48,550
111F_IX0300207	Feb 07	50,025
111F_IX0300407	Apr 07	50,925
111F_IX0300207	Şub.07	51,700
111F_IX0300407	Apr 07	56,300
111F_IX0300607	Jun 07	58,025
111F_IX0300807	Aug 07	63,100
111F_IX0301007	Oct 07	73,350
111F_IX0301207	Dec 07	70,475
111F_IX0300208	Feb 08	71,825
111F_IX0300408	Apr 08	72,800
301F_FXUSD0205	Feb 05	1,2845
301F_FXUSD0405	Apr 05	1,391
301F_FXUSD0605	Jun 05	1,34
301F_FXUSD0805	Aug 05	1,354
301F_FXUSD1005	Oct 05	1,348
301F_FXUSD1205	Dec 05	1,3485
301F_FXUSD0206	Feb 06	1,37
301F_FXUSD0406	Apr 06	1,39
301F_FXUSD0206	Feb 06	1,3125
301F_FXUSD0406	Apr 06	1,322
S301F_FXUSD0606	Jun 06	1,5775
301F_FXUSD0806	Aug 06	1,455
301F_FXUSD1006	Oct 06	1,461
301F_FXUSD1206	Dec 06	1,4125
301F_FXUSD0207	Feb 07	1,449
301F_FXUSD0407	Apr 07	1,4845
301F_FXUSD0207	Şub.07	1,42
301F_FXUSD0407	Apr 07	1,3675
301F_FXUSD0607	Jun 07	1,311
301F_FXUSD0807	Aug 07	1,2975
301F_FXUSD1007	Oct 07	1,1775
301F_FXUSD1207	Dec 07	1,165
301F_FXUSD0208	Feb 08	1,1945
301F_FXUSD0408	Apr 08	1,216

DATA F – RELATIVE TO TABLE 7, 8, 9, 10, 11

Day	Settlement Price	Quantity	Volume	Open position	Days to maturity
02.01.2008	1,3145	86	113.055	46	364
02.01.2008	1,2350	197	243.623	42	180
02.01.2008	1,2160	2.101	2.552.299	18.816	119
02.01.2008	1,1930	21.235	25.308.814	107.910	58
03.01.2008	1,3130	78	102.390	104	363
03.01.2008	1,2560	50	62.800	52	179
03.01.2008	1,2130	865	1.050.022	18.661	118
03.01.2008	1,1895	11.441	13.627.560	111.559	57
04.01.2008	1,2995	66	85.783	166	362
04.01.2008	1,2300	10	12.300	62	178
04.01.2008	1,2090	3.357	4.051.037	18.777	117
04.01.2008	1,1875	17.647	20.915.770	117.444	56
07.01.2008	1,3020	65	84.620	116	359
07.01.2008	1,2370	400	494.895	457	175
07.01.2008	1,2100	1.384	1.675.234	18.725	114
07.01.2008	1,1880	15.201	18.065.987	113.059	53
08.01.2008	1,2915	10	12.917	115	358
08.01.2008	1,2230	14	17.122	466	174
08.01.2008	1,2005	791	951.056	19.422	113
08.01.2008	1,1785	13.394	15.820.819	121.587	52
09.01.2008	1,2900	1	1.290	115	357
09.01.2008	1,2235	28	34.251	492	173
09.01.2008	1,2010	473	567.988	19.696	112
09.01.2008	1,1795	7.356	8.676.607	122.870	51
10.01.2008	1,2865	101	129.918	135	356
10.01.2008	1,2205	73	89.112	504	172
10.01.2008	1,1970	1.148	1.377.201	20.523	111
10.01.2008	1,1765	7.040	8.297.746	124.803	50
11.01.2008	1,2730	63	80.194	160	355
11.01.2008	1,2100	21	25.410	525	171
11.01.2008	1,1905	3.039	3.618.742	22.483	110
11.01.2008	1,1705	10.913	12.765.360	126.602	49
14.01.2008	1,2730	1	1.273	160	352
14.01.2008	1,2115	233	282.239	754	168
14.01.2008	1,1880	354	420.781	22.525	107
14.01.2008	1,1680	5.958	6.958.279	126.055	46
15.01.2008	1,2805	12	15.365	172	351
15.01.2008	1,2100	50	60.497	804	167
15.01.2008	1,1890	1.849	2.199.611	23.559	106
15.01.2008	1,1700	5.826	6.813.274	127.068	45
16.01.2008	1,3000	11	14.300	182	350
16.01.2008	1,2265	317	388.626	763	166
16.01.2008	1,2050	5.595	6.740.974	19.082	105
16.01.2008	1,1835	52.288	61.889.996	100.435	44
17.01.2008	1,3085	29	37.936	200	349
17.01.2008	1,2370	116	143.064	750	165
17.01.2008	1,2175	2.064	2.502.832	19.016	104
17.01.2008	1,1925	36.598	43.710.829	93.687	43
18.01.2008	1,3180	118	155.360	301	348
18.01.2008	1,2430	118	146.603	729	164
18.01.2008	1,2215	1.077	1.314.406	18.818	103
18.01.2008	1,1985	33.093	39.688.957	81.001	42
21.01.2008	1,3555	37	50.156	300	345

21.01.2008	1,2710	344	436.595	890	161
21.01.2008	1,2520	2.417	3.004.372	18.194	100
21.01.2008	1,2300	47.665	58.304.372	88.668	39
22.01.2008	1,3475	140	189.277	279	344
22.01.2008	1,2695	63	80.588	896	160
22.01.2008	1,2450	3.795	4.765.616	18.975	99
22.01.2008	1,2225	66.658	82.662.725	86.225	38
23.01.2008	1,3450	78	104.495	286	343
23.01.2008	1,2680	202	254.967	958	159
23.01.2008	1,2450	1.844	2.291.961	18.824	98
23.01.2008	1,2205	65.007	79.313.850	100.202	37
24.01.2008	1,3110	42	55.091	309	342
24.01.2008	1,2445	70	87.576	934	158
24.01.2008	1,2190	2.510	3.073.068	19.897	97
24.01.2008	1,1975	26.397	31.866.184	97.252	36
25.01.2008	1,3125	130	170.656	427	341
25.01.2008	1,2430	170	210.616	1.055	157
25.01.2008	1,2195	160	195.215	19.814	96
25.01.2008	1,1960	7.916	9.451.701	97.842	35
28.01.2008	1,3180	9	11.863	429	338
28.01.2008	1,2495	50	62.587	1.076	154
28.01.2008	1,2270	1.531	1.883.253	20.822	93
28.01.2008	1,2030	20.471	24.667.476	106.262	32
29.01.2008	1,3050	31	40.459	433	337
29.01.2008	1,2390	67	83.013	1.121	153
29.01.2008	1,2140	1.395	1.698.267	21.980	92
29.01.2008	1,1910	16.921	20.167.977	114.769	31
30.01.2008	1,3050	1	1.305	434	336
30.01.2008	1,2380	57	70.580	1.158	152
30.01.2008	1,2130	245	297.556	21.972	91
30.01.2008	1,1895	12.687	15.099.008	118.703	30
31.01.2008	1,2990	143	185.774	446	335
31.01.2008	1,2365	204	251.937	1.339	151
31.01.2008	1,2145	1.470	1.775.181	22.490	90
31.01.2008	1,1905	19.511	23.134.016	124.893	29
01.02.2008	1,3045	69	89.995	497	334
01.02.2008	1,2280	115	141.239	1.429	150
01.02.2008	1,2050	1.336	1.607.228	22.889	89
01.02.2008	1,1775	27.147	31.989.522	131.968	28
04.02.2008	1,3030	77	100.327	562	331
04.02.2008	1,2270	37	45.395	1.428	147
04.02.2008	1,2025	755	907.150	23.244	86
04.02.2008	1,1755	7.468	8.777.300	135.906	25
05.02.2008	1,3090	36	47.121	594	330
05.02.2008	1,2360	39	47.953	1.431	146
05.02.2008	1,2145	713	861.249	23.118	85
05.02.2008	1,1890	15.875	18.791.259	137.987	24
06.02.2008	1,3245	1.600	2.117.646	1.647	329
06.02.2008	1,2440	168	209.003	1.331	145
06.02.2008	1,2180	1.254	1.531.548	22.496	84
06.02.2008	1,1935	34.227	40.983.498	128.770	23
07.02.2008	1,3395	1.254	1.675.536	2.344	328
07.02.2008	1,2565	332	417.071	1.358	144
07.02.2008	1,2375	9.409	11.574.434	27.816	83
07.02.2008	1,2115	55.930	67.548.899	115.169	22
08.02.2008	1,3445	5	6.723	2.348	327
08.02.2008	1,2620	30	37.855	1.360	143

08.02.2008	1,2430	2.572	3.182.903	27.678	82
08.02.2008	1,2165	41.252	50.148.312	117.396	21
11.02.2008	1,3600	89	121.038	2.350	324
11.02.2008	1,2855	126	161.894	1.341	140
11.02.2008	1,2650	3.043	3.845.257	28.475	79
11.02.2008	1,2400	34.972	43.263.833	117.592	18
12.02.2008	1,3620	19	25.881	2.360	323
12.02.2008	1,2735	75	95.726	1.345	139
12.02.2008	1,2435	7.416	9.294.146	31.798	78
12.02.2008	1,2165	32.246	39.483.684	116.073	17
13.02.2008	1,3405	49	65.776	2.376	322
13.02.2008	1,2580	117	147.908	1.340	138
13.02.2008	1,2345	3.431	4.253.352	32.356	77
13.02.2008	1,2065	23.275	28.234.498	114.702	16
14.02.2008	1,3300	147	195.339	2.483	321
14.02.2008	1,2545	85	106.625	1.422	137
14.02.2008	1,2275	6.850	8.404.402	36.035	76
14.02.2008	1,2020	9.289	11.142.171	115.168	15
15.02.2008	1,3365	567	756.596	2.931	320
15.02.2008	1,2600	425	535.475	1.444	136
15.02.2008	1,2335	7.602	9.353.550	40.116	75
15.02.2008	1,2060	14.917	17.956.842	115.750	14
18.02.2008	1,3245	4	5.298	2.934	317
18.02.2008	1,2525	75	93.925	1.444	133
18.02.2008	1,2245	2.885	3.540.657	41.032	72
18.02.2008	1,1960	5.022	6.015.792	115.099	11
19.02.2008	1,3280	102	135.312	3.015	316
19.02.2008	1,2510	60	75.045	1.479	132
19.02.2008	1,2215	8.132	9.938.549	46.362	71
19.02.2008	1,1950	8.161	9.747.124	114.749	10
20.02.2008	1,3440	259	347.151	3.006	315
20.02.2008	1,2640	189	237.878	1.451	131
20.02.2008	1,2425	14.976	18.551.010	47.378	70
20.02.2008	1,2145	31.118	37.735.218	115.317	9
21.02.2008	1,3365	45	60.124	3.035	314
21.02.2008	1,2580	48	60.375	1.450	130
21.02.2008	1,2345	10.638	13.128.980	52.663	69
21.02.2008	1,2075	15.300	18.493.290	110.965	8
22.02.2008	1,3370	27	36.098	3.029	313
22.02.2008	1,2585	106	133.597	1.542	129
22.02.2008	1,2350	27.419	33.824.983	63.440	68
22.02.2008	1,2085	19.804	23.923.016	106.876	7
25.02.2008	1,3305	25	33.266	3.033	310
25.02.2008	1,2520	25	31.303	1.548	126
25.02.2008	1,2290	23.522	28.894.705	75.847	65
25.02.2008	1,2025	8.204	9.848.585	105.204	4
26.02.2008	1,3295	123	163.483	3.001	309
26.02.2008	1,2475	326	408.832	1.598	125
26.02.2008	1,2200	24.120	29.507.076	93.511	64
26.02.2008	1,1945	10.139	12.131.281	99.339	3
27.02.2008	1,3155	780	1.025.801	3.044	308
27.02.2008	1,2365	491	607.682	1.745	124
27.02.2008	1,2100	16.767	20.312.623	102.518	63
27.02.2008	1,1840	8.924	10.560.994	94.317	2
28.02.2008	1,3140	180	236.525	2.927	307
28.02.2008	1,2350	20	24.702	1.758	123
28.02.2008	1,2105	17.486	21.179.965	113.469	62

28.02.2008	1,1830	9.645	11.407.949	86.446	1
29.02.2008	1,3285	126	167.374	2.911	306
29.02.2008	1,2510	852	1.060.006	2.028	122
29.02.2008	1,2265	50.257	61.467.009	115.448	61
29.02.2008	1,1965	105.808	126.462.796	0	0
03.03.2008	1,3405	240	321.849	2.940	303
03.03.2008	1,2910	92	118.753	82	179
03.03.2008	1,2695	1.524	1.940.389	1.465	119
03.03.2008	1,2450	59.629	74.391.433	105.812	58
04.03.2008	1,3355	80	106.841	2.905	302
04.03.2008	1,2850	12	15.420	79	178
04.03.2008	1,2620	954	1.204.851	1.527	118
04.03.2008	1,2350	53.552	66.237.886	112.308	57
05.03.2008	1,3365	187	249.989	2.971	301
05.03.2008	1,2840	20	25.677	87	177
05.03.2008	1,2595	228	287.834	1.550	117
05.03.2008	1,2340	46.330	57.228.467	112.287	56
06.03.2008	1,3385	34	45.515	2.995	300
06.03.2008	1,2840	0	0	87	176
06.03.2008	1,2745	422	535.572	1.508	116
06.03.2008	1,2490	51.974	64.435.777	123.694	55
07.03.2008	1,3730	170	233.212	2.990	299
07.03.2008	1,3235	119	157.719	157	175
07.03.2008	1,2970	2.043	2.659.214	1.451	115
07.03.2008	1,2690	157.165	199.937.379	113.830	54
10.03.2008	1,3750	154	211.818	3.003	296
10.03.2008	1,3200	96	126.963	213	172
10.03.2008	1,2955	529	686.735	1.476	112
10.03.2008	1,2675	54.990	69.796.171	123.468	51
11.03.2008	1,3720	44	60.378	3.035	295
11.03.2008	1,3160	13	17.107	214	171
11.03.2008	1,2820	525	676.108	1.481	111
11.03.2008	1,2520	76.548	96.648.138	110.317	50
12.03.2008	1,3505	22	29.710	3.017	294
12.03.2008	1,3025	66	85.977	236	170
12.03.2008	1,2740	498	633.984	1.547	110
12.03.2008	1,2425	37.039	46.098.546	117.824	49
13.03.2008	1,3725	39	53.519	3.041	293
13.03.2008	1,3235	118	156.202	258	169
13.03.2008	1,2980	455	589.338	1.714	109
13.03.2008	1,2630	58.426	73.815.176	126.877	48
14.03.2008	1,3530	366	495.891	3.207	292
14.03.2008	1,2980	37	48.259	266	168
14.03.2008	1,2790	1.447	1.845.675	2.187	108
14.03.2008	1,2480	85.512	106.601.311	143.548	47
17.03.2008	1,3985	140	195.836	3.136	289
17.03.2008	1,3390	82	109.782	316	165
17.03.2008	1,3120	2.331	3.070.568	2.425	105
17.03.2008	1,2800	80.773	103.731.386	137.703	44
18.03.2008	1,3710	233	320.442	2.969	288
18.03.2008	1,3135	61	80.115	332	164
18.03.2008	1,2850	7.590	9.823.684	7.135	104
18.03.2008	1,2545	62.891	79.553.471	146.760	43
19.03.2008	1,3660	27	36.886	2.965	287
19.03.2008	1,3105	31	40.621	340	163
19.03.2008	1,2805	1.884	2.410.744	6.954	103
19.03.2008	1,2530	65.991	82.578.305	165.436	42

20.03.2008	1,3720	43	59.002	2.991	286
20.03.2008	1,3135	34	44.590	362	162
20.03.2008	1,2895	322	415.202	7.096	102
20.03.2008	1,2615	51.871	65.438.470	154.347	41
21.03.2008	1,3790	15	20.677	2.991	285
21.03.2008	1,3215	16	21.145	374	161
21.03.2008	1,2960	1.599	2.066.111	7.212	101
21.03.2008	1,2690	26.134	33.027.538	155.740	40
24.03.2008	1,3775	13	17.905	2.991	282
24.03.2008	1,3185	8	10.549	375	158
24.03.2008	1,2880	904	1.168.322	7.488	98
24.03.2008	1,2570	30.274	38.182.733	155.847	37
25.03.2008	1,3760	22	30.275	3.008	281
25.03.2008	1,3210	64	84.469	402	157
25.03.2008	1,2960	921	1.186.424	7.425	97
25.03.2008	1,2655	69.569	87.737.138	154.940	36
26.03.2008	1,3915	42	58.374	3.010	280
26.03.2008	1,3415	121	161.808	485	156
26.03.2008	1,3105	1.259	1.662.934	7.700	96
26.03.2008	1,2835	84.824	108.564.475	152.140	35
27.03.2008	1,3930	87	121.042	2.981	279
27.03.2008	1,3400	39	52.254	491	155
27.03.2008	1,3195	1.050	1.377.380	7.435	95
27.03.2008	1,2880	107.070	137.492.724	149.771	34
28.03.2008	1,4375	111	157.188	2.978	278
28.03.2008	1,3685	85	115.587	543	154
28.03.2008	1,3465	896	1.197.033	7.755	94
28.03.2008	1,3175	109.806	143.099.013	162.895	33
31.03.2008	1,4540	427	616.712	2.976	275
31.03.2008	1,3795	314	435.382	636	151
31.03.2008	1,3645	1.316	1.782.993	7.756	91
31.03.2008	1,3355	163.417	216.931.497	167.440	30
01.04.2008	1,4495	594	869.156	2.861	274
01.04.2008	1,3945	421	584.982	723	150
01.04.2008	1,3530	2.346	3.214.774	7.633	90
01.04.2008	1,3230	149.193	200.073.039	151.170	29
02.04.2008	1,4250	541	772.621	2.451	273
02.04.2008	1,3665	698	953.082	1.251	149
02.04.2008	1,3390	2.996	4.004.110	7.382	89
02.04.2008	1,3095	110.611	144.436.131	153.175	28
03.04.2008	1,4205	142	201.555	2.566	272
03.04.2008	1,3635	290	393.819	1.408	148
03.04.2008	1,3535	2.919	3.887.058	8.798	88
03.04.2008	1,3185	108.101	140.776.945	173.239	27
04.04.2008	1,4310	17	24.348	2.568	271
04.04.2008	1,3665	70	95.661	1.454	147
04.04.2008	1,3405	1.422	1.907.052	9.256	87
04.04.2008	1,3045	91.940	120.288.429	171.695	26
07.04.2008	1,4215	188	267.223	2.460	268
07.04.2008	1,3585	34	46.101	1.452	144
07.04.2008	1,3270	1.782	2.357.867	9.685	84
07.04.2008	1,2930	59.286	76.488.056	170.452	23
08.04.2008	1,4260	94	134.050	2.488	267
08.04.2008	1,3630	13	17.722	1.460	143
08.04.2008	1,3340	3.410	4.539.246	9.615	83
08.04.2008	1,3040	54.000	70.221.983	157.339	22
09.04.2008	1,4215	2	2.843	2.488	266

09.04.2008	1,3685	215	294.473	1.491	142
09.04.2008	1,3365	1.322	1.764.038	10.187	82
09.04.2008	1,3055	36.122	47.064.547	153.478	21
10.04.2008	1,4300	25	35.888	2.496	265
10.04.2008	1,3820	173	238.557	1.537	141
10.04.2008	1,3505	3.425	4.615.741	11.590	81
10.04.2008	1,3180	86.133	113.484.127	142.477	20
11.04.2008	1,4425	12	17.313	2.508	264
11.04.2008	1,3815	109	150.162	1.551	140
11.04.2008	1,3490	3.052	4.106.527	12.881	80
11.04.2008	1,3170	68.434	89.736.724	160.017	19
14.04.2008	1,4475	36	52.119	2.512	261
14.04.2008	1,3880	209	289.473	1.582	137
14.04.2008	1,3535	5.125	6.943.851	16.170	77
14.04.2008	1,3205	57.242	75.685.614	160.779	16
15.04.2008	1,4530	13	18.889	2.523	260
15.04.2008	1,3900	353	489.586	1.768	136
15.04.2008	1,3520	6.523	8.831.309	19.763	76
15.04.2008	1,3210	39.952	52.743.462	158.017	15
16.04.2008	1,4685	41	60.219	2.542	259
16.04.2008	1,4015	286	400.753	1.762	135
16.04.2008	1,3665	9.977	13.635.665	24.427	75
16.04.2008	1,3310	90.866	120.948.385	150.783	14
17.04.2008	1,4605	108	157.918	2.527	258
17.04.2008	1,3995	269	377.027	1.771	134
17.04.2008	1,3690	22.683	31.038.109	36.605	74
17.04.2008	1,3370	81.887	109.334.831	145.195	13
18.04.2008	1,4535	42	61.109	2.548	257
18.04.2008	1,3745	603	835.228	1.465	133
18.04.2008	1,3480	18.166	24.677.248	39.888	73
18.04.2008	1,3170	77.406	102.649.383	142.978	12
21.04.2008	1,4430	23	33.194	2.567	254
21.04.2008	1,3790	473	650.884	1.242	130
21.04.2008	1,3500	10.340	13.967.844	44.644	70
21.04.2008	1,3180	35.045	46.214.507	145.085	9
22.04.2008	1,4420	18	25.957	2.563	253
22.04.2008	1,3765	394	542.428	1.457	129
22.04.2008	1,3440	15.957	21.494.591	54.654	69
22.04.2008	1,3135	27.708	36.473.246	146.049	8
24.04.2008	1,4260	79	112.880	2.585	251
24.04.2008	1,3560	162	220.607	1.536	127
24.04.2008	1,3235	32.688	43.460.865	72.331	67
24.04.2008	1,2925	40.757	52.892.011	139.803	6
25.04.2008	1,4235	19	27.049	2.598	250
25.04.2008	1,3585	470	637.009	1.546	126
25.04.2008	1,3270	15.035	19.856.339	76.434	66
25.04.2008	1,2945	25.728	33.180.623	128.307	5
28.04.2008	1,4120	63	89.005	2.625	247
28.04.2008	1,3450	243	327.308	1.642	123
28.04.2008	1,3125	38.236	50.177.596	101.514	63
28.04.2008	1,2785	28.487	36.455.830	111.432	2
29.04.2008	1,4165	168	237.726	2.675	246
29.04.2008	1,3520	56	75.667	1.674	122
29.04.2008	1,3175	67.844	89.349.025	137.712	62
29.04.2008	1,2850	44.566	57.209.483	95.246	1
30.04.2008	1,4105	71	100.493	2.713	245
30.04.2008	1,3470	82	110.843	1.706	121

30.04.2008	1,3110	62.430	82.335.416	167.429	61
30.04.2008	1,2910	122.148	157.674.446	0	0
01.05.2008	1,4110	70	98.631	2.746	244
01.05.2008	1,3720	70	96.051	70	183
01.05.2008	1,3435	35	47.024	1.706	120
01.05.2008	1,3095	36.798	48.225.540	187.910	60
02.05.2008	1,3900	127	176.794	2.770	243
02.05.2008	1,3530	188	254.691	181	182
02.05.2008	1,3225	968	1.283.303	1.816	119
02.05.2008	1,2885	60.014	77.610.748	209.442	59
05.05.2008	1,3865	88	122.392	2.780	240
05.05.2008	1,3555	13	17.624	192	179
05.05.2008	1,3210	155	205.052	1.815	116
05.05.2008	1,2870	21.340	27.503.870	206.291	56
06.05.2008	1,3850	111	153.741	2.821	239
06.05.2008	1,3525	126	170.430	249	178
06.05.2008	1,3195	1.570	2.070.414	2.455	115
06.05.2008	1,2855	39.090	50.248.191	217.468	55
07.05.2008	1,3760	556	766.176	2.956	238
07.05.2008	1,3425	320	429.756	510	177
07.05.2008	1,3090	2.901	3.798.134	4.179	114
07.05.2008	1,2750	31.369	40.020.154	218.337	54
08.05.2008	1,3945	197	273.579	3.061	237
08.05.2008	1,3545	203	273.929	543	176
08.05.2008	1,3205	1.485	1.961.238	4.357	113
08.05.2008	1,2925	77.808	100.375.536	190.167	53
09.05.2008	1,3955	104	145.127	3.158	236
09.05.2008	1,3580	221	300.072	617	175
09.05.2008	1,3230	591	783.285	4.363	112
09.05.2008	1,2925	28.725	37.181.256	193.008	52
12.05.2008	1,3850	217	300.554	3.161	233
12.05.2008	1,3500	240	323.971	822	172
12.05.2008	1,3170	1.113	1.464.735	5.307	109
12.05.2008	1,2875	15.077	19.367.266	194.726	49
13.05.2008	1,3650	1.186	1.621.705	4.080	232
13.05.2008	1,3325	17.658	23.540.696	12.608	171
13.05.2008	1,3030	21.926	28.570.817	21.829	108
13.05.2008	1,2750	47.944	61.251.693	214.015	48
14.05.2008	1,3700	30	41.042	4.089	231
14.05.2008	1,3375	13	17.387	12.608	170
14.05.2008	1,3075	3.427	4.479.334	23.341	107
14.05.2008	1,2755	39.440	50.445.402	205.348	47
15.05.2008	1,3665	409	560.466	4.434	230
15.05.2008	1,3330	1.640	2.189.871	13.662	169
15.05.2008	1,2975	508	662.195	23.573	106
15.05.2008	1,2660	43.620	55.404.744	219.805	46
16.05.2008	1,3380	79	106.199	4.470	229
16.05.2008	1,3100	1.783	2.345.523	14.428	168
16.05.2008	1,2810	8.710	11.156.382	29.356	105
16.05.2008	1,2550	54.796	68.716.692	231.601	45
20.05.2008	1,3475	31	41.724	4.457	225
20.05.2008	1,3165	11	14.480	14.428	164
20.05.2008	1,2870	542	697.279	29.356	101
20.05.2008	1,2620	29.790	37.505.040	230.281	41
21.05.2008	1,3585	39	52.917	4.466	224
21.05.2008	1,3225	10	13.226	14.428	163
21.05.2008	1,2905	203	261.800	29.356	100

21.05.2008	1,2615	46.384	58.595.860	221.827	40
22.05.2008	1,3650	76	104.030	4.490	223
22.05.2008	1,3285	7	9.300	14.432	162
22.05.2008	1,2950	844	1.095.008	29.398	99
22.05.2008	1,2655	56.086	71.184.899	214.569	39
23.05.2008	1,3605	67	91.187	4.544	222
23.05.2008	1,3265	3	3.980	14.431	161
23.05.2008	1,2965	1.031	1.335.758	29.605	98
23.05.2008	1,2650	23.780	30.070.149	217.564	38
26.05.2008	1,3605	1.172	1.594.827	4.680	219
26.05.2008	1,3250	3	3.975	14.431	158
26.05.2008	1,2935	1.360	1.760.620	29.660	95
26.05.2008	1,2650	13.412	16.982.824	216.671	35
27.05.2008	1,3595	148	201.376	4.805	218
27.05.2008	1,3250	0	0	14.431	157
27.05.2008	1,2925	3.020	3.910.820	29.656	94
27.05.2008	1,2625	32.828	41.565.246	217.612	34
28.05.2008	1,3420	230	309.613	4.841	217
28.05.2008	1,3050	107	139.636	14.431	156
28.05.2008	1,2755	5.909	7.548.874	29.642	93
28.05.2008	1,2475	53.232	66.573.613	225.115	33
29.05.2008	1,3310	365	484.698	4.806	216
29.05.2008	1,2995	170	220.803	14.439	155
29.05.2008	1,2640	6.979	8.820.466	30.182	92
29.05.2008	1,2355	29.152	36.047.887	221.690	32
30.05.2008	1,3265	60	79.501	4.835	215
30.05.2008	1,2855	112	143.992	14.450	154
30.05.2008	1,2605	1.902	2.388.093	30.292	91
30.05.2008	1,2310	16.907	20.743.808	221.917	31
02.06.2008	1,3385	26	34.782	4.845	212
02.06.2008	1,2935	12	15.525	14.448	151
02.06.2008	1,2685	1.672	2.117.825	29.671	88
02.06.2008	1,2405	24.392	30.186.414	215.176	28
03.06.2008	1,3385	112	150.186	4.875	211
03.06.2008	1,3015	454	591.040	14.579	150
03.06.2008	1,2665	1.978	2.516.798	29.688	87
03.06.2008	1,2385	33.623	41.810.801	204.296	27
04.06.2008	1,3450	322	433.153	5.131	210
04.06.2008	1,3105	37	48.488	14.565	149
04.06.2008	1,2810	1.611	2.061.708	29.814	86
04.06.2008	1,2515	49.035	61.332.529	195.173	26
05.06.2008	1,3395	188	251.595	5.294	209
05.06.2008	1,3105	0	0	14.565	148
05.06.2008	1,2725	396	503.622	29.775	85
05.06.2008	1,2430	28.236	35.076.032	201.476	25
06.06.2008	1,3545	242	326.422	5.420	208
06.06.2008	1,3135	65	85.381	14.576	147
06.06.2008	1,2825	2.381	3.045.773	30.341	84
06.06.2008	1,2535	50.938	63.762.407	196.230	24
09.06.2008	1,3560	245	332.755	5.588	205
09.06.2008	1,3165	197	258.302	14.640	144
09.06.2008	1,2805	1.332	1.711.744	30.658	81
09.06.2008	1,2500	36.119	45.358.450	190.270	21
10.06.2008	1,3655	112	152.455	5.665	204
10.06.2008	1,3195	101	132.899	14.650	143
10.06.2008	1,2945	4.391	5.650.034	30.616	80
10.06.2008	1,2645	56.976	71.747.982	182.432	20

11.06.2008	1,3745	765	1.048.319	5.727	203
11.06.2008	1,3280	33	43.773	14.663	142
11.06.2008	1,3030	6.968	9.019.370	31.448	79
11.06.2008	1,2725	54.986	69.574.507	178.250	19
12.06.2008	1,3690	52	71.159	5.745	202
12.06.2008	1,3290	9	11.962	14.659	141
12.06.2008	1,2955	5.865	7.609.649	31.967	78
12.06.2008	1,2635	49.261	62.387.677	178.907	18
13.06.2008	1,3700	256	350.717	6.000	201
13.06.2008	1,3270	24	31.852	14.676	140
13.06.2008	1,2925	3.517	4.548.232	33.133	77
13.06.2008	1,2610	36.920	46.605.215	190.484	17
16.06.2008	1,3560	231	313.268	6.088	198
16.06.2008	1,3215	66	87.189	14.685	137
16.06.2008	1,2870	3.016	3.878.313	34.162	74
16.06.2008	1,2545	18.293	22.942.280	191.475	14
17.06.2008	1,3400	59	79.210	6.085	197
17.06.2008	1,3005	560	731.290	14.686	136
17.06.2008	1,2680	26.948	34.286.624	50.274	73
17.06.2008	1,2360	46.240	57.321.454	184.308	13
18.06.2008	1,3330	1.708	2.273.872	6.196	196
18.06.2008	1,2995	586	760.529	14.823	135
18.06.2008	1,2645	11.561	14.608.864	52.422	72
18.06.2008	1,2340	18.418	22.699.109	184.203	12
19.06.2008	1,3295	248	329.801	6.421	195
19.06.2008	1,2985	73	94.859	14.812	134
19.06.2008	1,2630	5.254	6.654.108	53.130	71
19.06.2008	1,2310	20.977	25.944.427	175.881	11
20.06.2008	1,3290	1.488	1.972.336	6.680	194
20.06.2008	1,2920	1.739	2.249.002	15.510	133
20.06.2008	1,2665	9.376	11.829.721	58.452	70
20.06.2008	1,2335	13.511	16.603.457	175.602	10
23.06.2008	1,3275	168	222.992	6.573	191
23.06.2008	1,2925	715	924.006	15.490	130
23.06.2008	1,2635	18.115	22.845.786	70.121	67
23.06.2008	1,2325	22.518	27.696.838	165.268	7
24.06.2008	1,3315	25	33.286	6.587	190
24.06.2008	1,2960	557	721.811	15.408	129
24.06.2008	1,2675	9.314	11.778.219	73.211	66
24.06.2008	1,2335	14.247	17.571.678	160.115	6
25.06.2008	1,3200	1.181	1.567.331	7.722	189
25.06.2008	1,2800	2.909	3.748.496	15.416	128
25.06.2008	1,2500	24.171	30.390.402	88.061	65
25.06.2008	1,2170	25.685	31.436.253	146.035	5
26.06.2008	1,3175	132	173.772	7.748	188
26.06.2008	1,2805	2.502	3.199.700	15.401	127
26.06.2008	1,2535	23.899	29.906.601	104.787	64
26.06.2008	1,2195	32.107	39.077.224	126.325	4
27.06.2008	1,3295	945	1.260.131	8.239	187
27.06.2008	1,2895	1.125	1.453.829	15.447	126
27.06.2008	1,2605	41.438	52.321.823	119.223	63
27.06.2008	1,2265	43.997	54.086.031	99.248	3
30.06.2008	1,3270	239	316.855	8.379	184
30.06.2008	1,2885	2.067	2.658.191	15.500	123
30.06.2008	1,2600	51.530	64.829.944	153.192	60
30.06.2008	1,2245	115.995	141.998.607	0	0
01.07.2008	1,3380	322	430.090	8.391	183

01.07.2008	1,2995	2.765	3.587.673	15.722	122
01.07.2008	1,2715	59.806	75.838.117	159.550	59
02.07.2008	1,3310	634	844.486	8.457	182
02.07.2008	1,2985	1.344	1.751.789	15.913	121
02.07.2008	1,2675	40.817	51.830.011	155.529	58
03.07.2008	1,3370	427	572.065	8.404	181
03.07.2008	1,3060	4.703	6.160.513	16.461	120
03.07.2008	1,2775	78.278	100.139.499	144.445	57
04.07.2008	1,3305	687	915.348	8.450	180
04.07.2008	1,2965	1.198	1.556.573	16.094	119
04.07.2008	1,2650	35.112	44.502.676	150.123	56
07.07.2008	1,3235	150	198.727	8.443	177
07.07.2008	1,2880	774	998.081	16.449	116
07.07.2008	1,2555	24.466	30.782.119	160.274	53
08.07.2008	1,3275	240	318.503	8.601	176
08.07.2008	1,2895	331	427.888	16.429	115
08.07.2008	1,2580	19.414	24.464.348	165.474	52
09.07.2008	1,3200	661	871.848	8.802	175
09.07.2008	1,2800	1.863	2.387.058	17.275	114
09.07.2008	1,2495	24.816	31.022.380	176.148	51
10.07.2008	1,3150	1.102	1.449.213	9.033	174
10.07.2008	1,2835	1.561	1.999.713	17.286	113
10.07.2008	1,2495	15.458	19.287.685	179.379	50
11.07.2008	1,3145	727	956.194	9.175	173
11.07.2008	1,2850	1.036	1.328.290	17.244	112
11.07.2008	1,2500	20.680	25.840.986	182.943	49
14.07.2008	1,3075	462	603.778	9.177	170
14.07.2008	1,2755	1.659	2.115.164	17.146	109
14.07.2008	1,2425	21.608	26.799.795	185.053	46
15.07.2008	1,3095	303	397.241	9.339	169
15.07.2008	1,2775	369	470.929	17.124	108
15.07.2008	1,2455	19.992	24.873.484	184.204	45
16.07.2008	1,3060	577	754.865	9.544	168
16.07.2008	1,2725	1.127	1.435.762	17.399	107
16.07.2008	1,2390	24.563	30.480.031	179.845	44
17.07.2008	1,2905	933	1.207.972	9.822	167
17.07.2008	1,2595	1.930	2.434.073	18.527	106
17.07.2008	1,2250	35.636	43.755.982	179.565	43
18.07.2008	1,2755	1.039	1.328.006	9.919	166
18.07.2008	1,2440	1.414	1.762.908	18.279	105
18.07.2008	1,2115	38.211	46.390.398	183.576	42
21.07.2008	1,2745	116	147.765	9.906	163
21.07.2008	1,2430	764	949.173	18.252	102
21.07.2008	1,2110	19.319	23.363.369	178.116	39
22.07.2008	1,2805	308	394.301	9.643	162
22.07.2008	1,2505	743	928.128	18.375	101
22.07.2008	1,2190	22.377	27.239.353	179.436	38
23.07.2008	1,2850	151	193.560	9.666	161
23.07.2008	1,2505	163	203.378	18.333	100
23.07.2008	1,2215	18.930	23.029.865	177.488	37
24.07.2008	1,2875	62	79.812	9.719	160
24.07.2008	1,2540	194	243.152	18.318	99
24.07.2008	1,2235	22.391	27.365.797	177.486	36
25.07.2008	1,2855	27	34.748	9.724	159
25.07.2008	1,2555	379	476.073	18.278	98
25.07.2008	1,2220	19.577	23.952.486	183.130	35
28.07.2008	1,2840	25	32.097	9.718	156

28.07.2008	1,2515	120	150.300	18.285	95
28.07.2008	1,2195	12.905	15.758.208	186.034	32
29.07.2008	1,2775	141	180.363	9.796	155
29.07.2008	1,2455	486	607.079	18.396	94
29.07.2008	1,2135	13.554	16.516.977	182.686	31
30.07.2008	1,2630	152	193.451	9.847	154
30.07.2008	1,2305	1.344	1.660.604	18.748	93
30.07.2008	1,1945	22.148	26.650.114	184.918	30
31.07.2008	1,2355	800	990.519	10.174	153
31.07.2008	1,2040	3.547	4.288.626	18.567	92
31.07.2008	1,1745	43.465	51.125.782	187.120	29
01.08.2008	1,2330	437	538.951	10.535	152
01.08.2008	1,2005	2.287	2.748.353	18.381	91
01.08.2008	1,1690	30.697	36.027.282	184.127	28
04.08.2008	1,2275	385	472.774	10.528	149
04.08.2008	1,1970	952	1.137.588	18.470	88
04.08.2008	1,1660	11.196	13.033.876	179.824	25
05.08.2008	1,2295	103	126.554	10.554	148
05.08.2008	1,1975	864	1.033.986	18.549	87
05.08.2008	1,1655	13.160	15.327.278	177.329	24
06.08.2008	1,2415	1.473	1.819.236	10.786	147
06.08.2008	1,2070	845	1.017.615	18.737	86
06.08.2008	1,1750	28.451	33.353.905	169.932	23
07.08.2008	1,2405	417	517.753	11.045	146
07.08.2008	1,2075	575	694.584	18.728	85
07.08.2008	1,1760	12.670	14.912.686	167.588	22
08.08.2008	1,2625	303	379.178	10.878	145
08.08.2008	1,2290	3.439	4.201.340	19.101	84
08.08.2008	1,2000	45.291	54.026.312	169.871	21
11.08.2008	1,2535	70	87.943	10.904	142
11.08.2008	1,2215	551	673.169	19.262	81
11.08.2008	1,1915	22.088	26.315.559	166.584	18
12.08.2008	1,2490	242	302.529	11.016	141
12.08.2008	1,2155	923	1.125.387	19.258	80
12.08.2008	1,1865	24.558	29.239.525	158.840	17
13.08.2008	1,2510	219	273.661	11.124	140
13.08.2008	1,2205	715	870.355	19.413	79
13.08.2008	1,1905	18.826	22.347.674	153.200	16
14.08.2008	1,2510	90	112.634	11.194	139
14.08.2008	1,2195	1.245	1.518.721	19.713	78
14.08.2008	1,1890	14.323	17.038.234	147.235	15
15.08.2008	1,2495	547	684.863	11.499	138
15.08.2008	1,2190	980	1.196.287	19.894	77
15.08.2008	1,1900	9.850	11.726.960	142.578	14
18.08.2008	1,2465	200	249.316	11.509	135
18.08.2008	1,2155	501	609.244	19.936	74
18.08.2008	1,1845	5.453	6.462.580	140.757	11
19.08.2008	1,2595	312	392.214	11.493	134
19.08.2008	1,2300	6.532	8.004.345	23.255	73
19.08.2008	1,1990	26.408	31.556.140	130.338	10
20.08.2008	1,2555	209	262.479	11.586	133
20.08.2008	1,2275	1.107	1.356.748	23.195	72
20.08.2008	1,1965	5.258	6.282.547	128.791	9
21.08.2008	1,2585	105	132.134	11.590	132
21.08.2008	1,2260	2.145	2.630.412	24.704	71
21.08.2008	1,1950	6.406	7.660.667	126.385	8
22.08.2008	1,2515	115	143.894	11.627	131

22.08.2008	1,2210	1.213	1.479.966	24.714	70
22.08.2008	1,1890	12.479	14.829.002	120.311	7
25.08.2008	1,2505	206	257.761	11.734	128
25.08.2008	1,2185	3.551	4.331.094	24.448	67
25.08.2008	1,1885	7.531	8.947.456	114.884	4
26.08.2008	1,2580	147	184.564	11.752	127
26.08.2008	1,2255	13.328	16.292.886	27.751	66
26.08.2008	1,1940	25.545	30.464.653	104.445	3
27.08.2008	1,2515	580	726.375	11.941	126
27.08.2008	1,2220	7.300	8.910.676	32.110	65
27.08.2008	1,1910	11.625	13.837.480	96.532	2
28.08.2008	1,2480	105	131.168	12.021	125
28.08.2008	1,2175	18.578	22.653.766	42.860	64
28.08.2008	1,1845	11.940	14.176.823	90.783	1
29.08.2008	1,2455	214	266.446	12.126	124
29.08.2008	1,2140	23.943	29.025.753	63.136	63
29.08.2008	1,1805	108.744	128.363.689	0	0
01.09.2008	1,2465	592	738.234	12.399	121
01.09.2008	1,2135	13.014	15.806.725	71.105	60
02.09.2008	1,2500	227	283.665	12.347	120
02.09.2008	1,2180	14.621	17.806.449	66.786	59
03.09.2008	1,2665	1.125	1.424.153	12.330	119
03.09.2008	1,2350	40.973	50.624.380	68.983	58
04.09.2008	1,2855	1.911	2.445.319	12.847	118
04.09.2008	1,2545	31.293	39.091.391	71.098	57
05.09.2008	1,2935	3.985	5.170.342	12.477	117
05.09.2008	1,2645	37.860	48.009.790	69.394	56
08.09.2008	1,2800	2.680	3.422.852	12.714	114
08.09.2008	1,2515	29.718	37.051.426	67.405	53
09.09.2008	1,2860	302	386.998	12.820	113
09.09.2008	1,2530	22.769	28.483.886	69.265	52
10.09.2008	1,2900	816	1.054.270	12.801	112
10.09.2008	1,2585	30.292	38.210.338	70.503	51
11.09.2008	1,3230	2.809	3.698.522	12.536	111
11.09.2008	1,2930	67.461	86.661.398	74.931	50
12.09.2008	1,3040	1.743	2.269.862	13.286	110
12.09.2008	1,2705	55.138	70.107.427	71.268	49
15.09.2008	1,3195	548	721.586	13.282	107
15.09.2008	1,2870	46.091	59.241.870	73.730	46
16.09.2008	1,3305	2.726	3.628.022	13.020	106
16.09.2008	1,2995	56.787	73.836.080	71.610	45
17.09.2008	1,3285	1.024	1.349.365	13.161	105
17.09.2008	1,2975	47.513	61.321.622	71.580	44
18.09.2008	1,3255	716	955.115	13.194	104
18.09.2008	1,2950	63.456	82.916.475	81.648	43
19.09.2008	1,2985	2.424	3.164.761	12.335	103
19.09.2008	1,2695	41.889	53.325.173	69.898	42
22.09.2008	1,2895	758	978.722	12.539	100
22.09.2008	1,2585	25.265	31.838.577	71.455	39
23.09.2008	1,2850	2.769	3.572.499	13.939	99
23.09.2008	1,2560	22.605	28.478.117	76.668	38
24.09.2008	1,2900	9.898	12.758.643	21.873	98
24.09.2008	1,2605	20.727	26.095.047	73.476	37
25.09.2008	1,2750	9.539	12.238.621	28.672	97
25.09.2008	1,2460	14.019	17.564.887	74.227	36
26.09.2008	1,2835	847	1.087.240	28.672	96
26.09.2008	1,2525	15.374	19.271.462	76.450	35

29.09.2008	1,3020	964	1.247.157	28.815	93
29.09.2008	1,2725	19.461	24.647.493	78.568	32
03.10.2008	1,3380	2.985	4.015.041	29.113	89
03.10.2008	1,3095	55.686	73.330.017	71.952	28
06.10.2008	1,4110	3.211	4.468.369	29.487	86
06.10.2008	1,3835	67.982	92.403.339	78.505	25
07.10.2008	1,4010	4.742	6.661.154	30.954	85
07.10.2008	1,3765	64.976	89.316.172	81.554	24
08.10.2008	1,4445	16.004	23.206.678	30.743	84
08.10.2008	1,4135	162.279	230.497.920	79.708	23
09.10.2008	1,4195	8.090	11.504.342	30.080	83
09.10.2008	1,3910	70.094	97.715.301	72.212	22
10.10.2008	1,4600	7.381	10.837.345	30.661	82
10.10.2008	1,4300	114.492	164.886.739	74.004	21
13.10.2008	1,4375	5.013	7.166.959	31.771	79
13.10.2008	1,4065	55.937	78.602.708	75.297	18
14.10.2008	1,4145	3.808	5.373.013	31.288	78
14.10.2008	1,3865	59.288	81.994.857	76.958	17
15.10.2008	1,4560	3.251	4.662.117	31.690	77
15.10.2008	1,4265	59.163	83.173.112	80.203	16
16.10.2008	1,5230	8.347	12.656.354	32.756	76
16.10.2008	1,4960	120.315	178.894.301	88.940	15
17.10.2008	1,5495	9.203	14.168.181	34.783	75
17.10.2008	1,5205	110.263	166.844.402	77.674	14
20.10.2008	1,5520	18.347	28.282.740	30.030	72
20.10.2008	1,5135	58.916	88.552.460	70.882	11
21.10.2008	1,6030	21.482	33.958.696	29.383	71
21.10.2008	1,5665	77.363	119.772.988	71.397	10
22.10.2008	1,6995	35.295	59.380.246	36.153	70
22.10.2008	1,6590	111.155	182.765.573	64.539	9
23.10.2008	1,7425	31.431	54.813.813	42.837	69
23.10.2008	1,6945	152.521	259.660.346	66.835	8
24.10.2008	1,7375	32.708	57.193.185	51.088	68
24.10.2008	1,6935	139.384	237.472.755	60.925	7
27.10.2008	1,7040	47.081	81.859.997	67.539	65
27.10.2008	1,6570	78.059	132.148.024	53.696	4
28.10.2008	1,6335	24.111	39.786.761	66.474	64
28.10.2008	1,5865	37.289	59.774.494	40.868	3
30.10.2008	1,5785	83.434	128.829.669	65.430	62
30.10.2008	1,5375	48.475	72.630.466	33.461	1
31.10.2008	1,5860	92.494	148.124.459	77.010	61
31.10.2008	1,5680	59.131	92.701.738	0	0
03.11.2008	1,5845	74.874	117.478.870	86.579	58
04.11.2008	1,5410	85.716	133.816.322	80.918	57
05.11.2008	1,5415	102.880	158.550.666	86.968	56
06.11.2008	1,5660	75.678	118.595.403	88.784	55
07.11.2008	1,5755	80.240	126.704.943	98.130	54
10.11.2008	1,5720	43.813	68.361.769	98.487	51
11.11.2008	1,6400	154.458	250.378.385	115.416	50
12.11.2008	1,6715	228.381	380.950.142	116.179	49
13.11.2008	1,6715	173.133	291.016.922	102.022	48
14.11.2008	1,6450	82.258	136.736.444	93.277	47
17.11.2008	1,6635	86.678	143.770.235	103.098	44
19.11.2008	1,7040	135.115	230.693.908	116.407	42
20.11.2008	1,7475	149.529	260.520.030	119.904	41
21.11.2008	1,7050	118.791	203.147.066	104.855	40
24.11.2008	1,6140	109.127	178.459.686	101.387	37

25.11.2008	1,5930	81.928	131.014.419	104.625	36
26.11.2008	1,6165	74.375	119.786.229	103.307	35
27.11.2008	1,5955	51.779	82.605.487	119.455	34
28.11.2008	1,5950	60.938	97.022.658	126.071	33
01.12.2008	1,6185	66.713	107.410.136	130.348	30
02.12.2008	1,6105	82.802	134.546.057	125.053	29
03.12.2008	1,5905	58.922	94.176.933	123.829	28
04.12.2008	1,5800	50.939	80.954.462	118.924	27
05.12.2008	1,6040	63.663	101.374.574	117.862	26
12.12.2008	1,5670	44.921	70.703.453	111.306	19
15.12.2008	1,5750	43.111	67.863.417	107.702	16
16.12.2008	1,5715	28.140	44.371.356	103.724	15
17.12.2008	1,5455	36.392	56.523.065	102.581	14
18.12.2008	1,5095	69.634	105.958.750	97.952	13
19.12.2008	1,5340	47.461	72.335.220	89.358	12
22.12.2008	1,5310	32.030	48.896.079	84.167	9
23.12.2008	1,5225	28.278	43.140.708	78.364	8
24.12.2008	1,5240	21.082	32.115.895	74.778	7
25.12.2008	1,5130	10.833	16.430.183	73.225	6
26.12.2008	1,5070	23.320	35.107.353	67.810	5
29.12.2008	1,5150	27.687	41.905.888	61.075	2
30.12.2008	1,5220	31.429	47.889.020	54.302	1
31.12.2008	1,5290	67.119	102.563.873	0	0