CORPORATE STRATEGIES FOR CURRENCY RISK MANAGEMENT

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ABSTRACT

CORPORATE STRATEGIES FOR CURRENCY RISK MANAGEMENT

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For many years, forecasting the sales has been thought as a significant fundamental for the companies that operate in fast moving consumer goods (FMCG) sector. Companies that are successful in predicting their sales, also have the strength to manage company's financials. Also, companies have the chance to react to tough situations that they might face. In the academic literature, there exist many studies about forecasting the future of sales. However, there are limited studies about how the companies forecast their gross to net spending apart from gross sales. This thesis aims to present a model constituted from several steps of sales process and aims to contribute the academic literature with that model. It also analyzes the process of performing a sales organization in Turkey. The performance of this organization is affected by many materials such as goods' costs, margins, foreign currency rates, strategy calls and order breakdown. These materials are studied in the light of the historical data which are hypothetical but related with FMCG sector. The impact of foreign exchange (FX) rate on the goods and its fluctuations are discussed alongside the gross to net forecasting for different type of orders. In forecasting, Geometric Brownian Motion and ARIMA models are used. Excess amount of gross to net spending is calculated by using Monte Carlo simulation, how the organization decides to pass over the excess amount is explained. Finally, different derivatives are suggested to help the organization to hedge its position.

Keywords: GTN Forecasting, ARIMA Model, Geometric Brownian Motion, Monte Carlo Simulation, Hedging

ÖZ

DÖVİZ KURU RİSK YÖNETİMİ İÇİN ŞİRKET STRATEJİLERİ

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Hızlı tüketim sektöründeki şirketler, gelecek dönem satışlarını tahmin etmelerinin oldukça önemli bir yapı taşı olduğunun yıllardır farkındadırlar. Bu tahminleri etkili bir şekilde uygulayan şirketler, tüm operasyonlarının finansal yapısını kontrol etmekte ve gelecek kararların verilmesini kolaylaştırmaktadırlar. Bunun yanında bu şirketler, oluşabilecek herhangi bir duruma karşı hızlıca reaksiyon gösterebilmektedirler. Akademik literatürde, gelecek dönem satışlarının tahmin edilmesi ile ilgili bir çok makale yer almaktadır. Fakat, şirketlerin net satış için yaptıkları harcamalar ve onların tahminlerine dair çalışmalara yer verilmemiştir. Bu tezde satış sürecinin çeşitli adımlarına ve net satış için yapılan harcamaların tahmin modellerine yer verilerek, akademik literatüre katkıda bulunulmaya çalışılacaktır. Bu teze konu olan şirketin Türkiye organizasyonlarına yönelik operasyonları incelenmektedir. Organizasyonun performansı, portföyünde yer alan ürünlerin maliyetlerine, marjlarına, sipariş ağırlıklarına, döviz kur değerlerine ve stratejik hamlelere bağlıdır. Bu kriterler, şirketin geçmiş verileri dikkate alınarak çalışılmıştır. Döviz kuru oranının etkisi ve dalgalanması ile birlikte net satış için yapılan harcamalar gelecek dönemler için tahmin edilmektedir. Bu tahminler Geometrik Brownian Hareketi ve ARIMA modeli kullanılarak yapılmaktadır. Bu tahminler doğrultusunda Monte Carlo simülasyonu kullanılarak, şirketin gelecekteki durumuyla ilgili fikir sahibi olunmaktadır. Simülasyonların sonucunda ise olası bir bütçe aşımı durumunda şirketin, nasıl aksiyon alması gerektiği ve ne gibi finansal türevler kullanabileceği tartışılmaktadır.

Anahtar Kelimeler: Net Satış Tahminlemesi, ARIMA Modeli, Geometrik Brownian Hareketi, Monte Carlo Simülasyonu, Riskten Korunma

To My Family

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I would like to wish to express my deepest gratitude to my supervisor Prof. Dr. A. Sevtap Selçuk Kestel and co-supervisor Assoc. Prof. Dr. Özge Sezgin Alp for their guidance, advice, criticism, encouragements and insight throughout the research. I would also like to thank my family for their support and continuous encouragements.

The findings in this thesis does not impose the state of any company or firm related to the products listed in the data set which is hypothetically created based on the inputs of a real firm.

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LIST OF ABBREVIATIONS

ARIMA	Autoregressive Integrated Moving Average
ARMA	Autoregressive Moving Average
MM	Monetary Model
CM	Conjunctural Model
ANN	Artificial Neural Network
EST	Exponential Smoothing Technique
PA	Probabilistic Approach
MAD	Median Absolute Deviations
ACF	Auto Correlation Function
PACF	Partial Auto Correlation Function
CBRT	Central Bank of the Republic of Turkey
SDE	Stochastic Differential Equation
GBM	Geometric Brownian Motion
ISE	International Securities Exchange
OTC	Over The Counter
FMCG	Fast Moving Consumer Goods
KPI	Key Performance Indicator
RM	Retail Marketing
PWP	Purchase With Purchase
BOGOF	Buy One Get One Free
GTN	Gross To Net
US	The United States
FX	Foreign Exchange
USD	US Dollar
TRY	Turkish Lira
JPY	Japanese Yen
DM	Deutsche Mark
GBP	British Pound

CHF	Swiss Franc
AUD	Australian Dollar
RON	Romanian Leu
CNY	Chinese Yuan
RUB	Russian Ruble
NGN	Nigerian Naira

CHAPTER 1

INTRODUCTION

One of the significant components of the Turkish economy is the fast moving consumer goods (FMCG) sector; these goods are packaged products (such as tooth paste, soap, etc.) that are sold everyday at supermarkets, shops etc.. The sector serves the whole population of the country and accounts for millions of dollars in sales every year. Many companies in this sector are subsidiaries of their global parent companies. The goal of the present thesis is a profit analysis of such a subsidiary FMCG company in a fixed time period corresponding to one of its sales cycles. Being a subsidiary of a global company naturally brings with it a foreign exchange rate risk: transcations with the parent company is made in US Dollars whereas sales within Turkey takes place in Turkish Liras. Therefore, the profit of such a company is mainly determined by two factors: its gross/net sales and foreign exhange rate fluctuations. The goal of the present thesis is to propose simple models for these three processes (gross sales, gross to net (GTN) spending and USDTRY FX rate) and forecast the profit of an FMCG subsidiary, which we will refer to as "STA Turkey," over a sales cycle using these models. To deal with FX-risk the company can use futures and options; we also comment on the use of these financial tools.

Gross to net spending (GTN) is the amount that an FMCG company spends to improve its sales volume. This concept along with the whole sales operation in an FMCG subsidiary is reviewed below in Section 1.1. Our approach to profit analysis is as follows: we forecast the amount of external funding STA Turkey will need at the end of a sales cycle, when it pays back its global parent company. Forecasting is assumed to take place at the beginning of a sales cycle when STA Turkey receives

goods to be sold from the parent company, goods are priced in US Dollars and the amount will be paid at the end of the sales cycle; further details are given in Section 1.1 below and in Chapter 3. The first step is to forecast the usdtry exchange rate at the end of cycle when the proceeds from sales will be converted in to US Dollars. This task is undertaken in Chapter 2, using an autoregressive model on the daily changes in the USDTRY exchange rate. Our forecasting result is given in Table 2.4; further details about the reliability of this forecast and our forecasting technique is given in Chapter 2. The result of this forecast is taken as the exchange rate for the end of the sales cycle. Chapter 3 proposes a Geometric Brownian Motion as a model for both sales and GTN spending. To compute the paths of GTN spending and sales we simulate 1000 samples of these processes through the length of sales cycle consisting of 90 days; the simulation simulates these processes with daily increments. The first order is calculated by using list prices of the products in the portfolio and their estimated weights, which are empirical weights (average tonnages sold) computed from historical data. After first order calculation, gross sales and GTN for future days of the sales cylce are simulated with the assumption that they follow a Geometric Brownian Motion (GBM) whose drift and volatility are also estimated from data. The simulated paths are in Turkish Liras, they are finally converted to US Dollars using the forecasted exchange rate; the details of this procedure is given in Chapter 3. Our main result is given in Figure 3.4, which is the histogram of the external funding needed to payback the parent company at the end of sales cycle. It is clearly seen that most of the simulations are clustered between 0 and $1,000,000. However, there are some samples that results more budget exceeds than company assumes. In this type of cases, there must be an action plan to avoid from high exposures as much as possible.

We note that for the simple GBM model we adopt in the present thesis, simulation is not necessary; nonetheless we preferred a simulation approach because for more realistic models, which can be considered in future work, simulation is often one of the few alternative to compute distributions.

Let us briefly comment on the hedging aspect of the problem. Global companies usually use forward contracts to avoid from the FX rate exposures and unexpected market moves. STA Turkey already use forward contracts by purchasing $1,050,000

to guarantee the foreign currency payments. However, derivative tools with fixed amount are not enough for healthy decisions. 17.9% of the simulations show that excess amount of GTN spending is more than $1,050,000. So, company can use an additional derivative tool, call options and protects itself from the instant rise of USDTRY rate. The rest, 82.1% of the simulations show that excess amount of GTN spending is lower than $1,050,000. So, company holds extra USD in it's accounts and can use put options by selling USD with the agreed rate and protects itself from the instant fall of USDTRY rate. Options are easy to use since their costs are not much expensive for the company when compare company's sales volume. So, these type of companies might use option instruments in addition to current derivative contracts and create a financial back door in case of unfavourable outcomes. We comment on the hedging problem further in in Chapter 3; further comments on our results and study are given in the Conclusion. In the rest of this introduction we explain briefly the processes that effect the profitability of an FMCG subsidiary, namely: the sales, GTN spending and FX exposure and how a typical company manages these.

1.1 Running a Sales Organization in Turkey

In Turkey, most of the companies in FMCG sector have similar characteristics. For example, all of them are responsible for running the sales organization in Turkey and have many Key Performance Indicators (KPIs) such as growing the market share profitability, engaging the customers to grow sustainably and growing margins smarter and faster. Companies' performances are controlled by their global associates. In order to successfully perform these KPIs, they must set some strategies by taking into consideration the customer and consumer needs. While setting strategies, the companies need to spend some of their budget for in-store activities to keep being competitive in the market and to be a desired brand for the consumers. To successfully perform the strategies in the market, companies have to be sure that there is no excess amount of GTN spending after sales processes. The excess amount of GTN might be caused by different factors such as foreign exchange (FX) market risk, deficient forecasting strategies, and wrong usage of financial instruments.

Considering the FMCG sector in Turkey, most of the well-known companies are sub-

sidiaries of their global associates and they are controlled by them both financially and operationally. In this thesis, a hypothetical company is studied based on conjectural history of data. This company is called STA Turkey for the rest of the study.

In today's business world, number of global companies that operate in Turkey is increasing. The foreign exchange risk exposure becomes a crucial part of company's finance departments. It is because most of the companies that operate in Turkey, get their finished goods or raw materials (to produce the goods in Turkey) from out of the country with foreign currency (usually in USD). However, since they run their sales operations in Turkey, their income is in domestic currency, TRY. Between the time that companies get the products and repay their invoices back at the maturity date, they might get exposed to the foreign exchange risk.

STA Turkey gets the finished goods from the plants that located from all around the world. The corporate policy allows Turkey operations to spend 3% of the cost of purchased goods for the market activities in Turkey. The rest (97%) must be paid at the quarter end which is 90 days after from the purchase process also called as maturity date. After the buying process is completed, STA Turkey runs sales operations with different types of customers in Turkey such as perfumery, local & global market chains and wholesalers. Customer development team is responsible for the applications of the activities in the market. Team operates with 144 different finished goods which take part in the portfolio. The prices of the goods and their weights vary in the customer orders.

Considering recent changes in Turkey's social-economic situations such as increasing inflation, low wage raises etc., people prefer to low-cost shopping. These changes obligate the team to apply different type of activities in the market such as special offers for the products, category discounts, purchase with purchase (PWP), or buy one get one free (BOGOF) activities etc. The company spends a lot of money to run these activities. After the goods are purchased from abroad, the team sets off their activity grid, shares with customers and creates their orders into the system every day during the entire quarter. Apart from 3% of the purchased good's costs that global policy allows Turkey operation to use, instant changes in the market and tough circumstances of the economic situations might cause the company to use more

budget than allowed. However at the maturity date, STA Turkey is faced with the amount needs to be paid to the vendors.

There is always a risk that company carries with the foreign exchange exposure, because the amount to be paid changes due to USDTRY foreign exchange rate and all the collections is in TRY. If STA Turkey forecasts the risks and prepares an action plan to prevent them before they happen, then the company has an advantage in case of exposure.

1.2 FX Modelling and Hedging with Derivatives

The risks that companies face while running their sales operations can be divided into two main categories: financial and non-financial risks. Non-financial risks can be categorized into service deficiencies, organizational flaws, employee efficiencies and competition environment. Problems that occur while producing or transporting, technology usage and competitor activities might be some examples for non-financial risks. These risks vary and can be surpassed by accurate management decisions. On the other hand, causes of financial risks are certain. The ways to surpass or prevent the financial risks are the same no matter what company is. The companies can forecast the risks and amounts before they are occurred. So, financial risks are tangible and that is why they are more harmful than non-financials.

Financial risks can be categorized into two groups: caused by financial structure of the company and "the outside world" that the company definitely has no impact on it. This outside world can be named financial markets. While the companies running their businesses, they also need to control and manage financial risks to be successful in the market and finally to make profit. Due to the FX rate structure and hitches in the financial market, FX rate fluctuations affect the companies' financial statements. Especially the companies that report in foreign currency, are in an uncertainty position all the time. Because of those fluctuations, companies face with a macroeconomic uncertainty and have difficulties in cash flow management. In this thesis, STA Turkey's financial risks are defined and studied in terms of the current and future foreign exchange rates. Hedging proposals by using financial derivative instruments are

discussed to prevent the risks that are faced before they are occurred.

To make a proper estimation of the excess amount of GTN spending after forecasting, STA Turkey needs to calculate the future rate of USDTRY and make a financial statement for the quarter end. It is hard to estimate what is the future rate of USDTRY at a specific time. Time series models are applied to specify future rate of USDTRY. According to the academic literature, financial derivative instruments (Swaps, Options, Futures and Forwards) are the most efficient hedging tools against foreign exchange rate exposures. In section 3.9, there is a suggestion part about how the companies use those instruments to avoid from such an exchange rate exposure.

1.3 Gross To Net Forecasting

In FMCG sector, companies always have many difficulties when trying to reach to the consumers. These difficulties might be caused by several reasons such as not satisfying consumer or customer needs for quality concerns & financially, competitors' prices and activities in the market, and loss of market capacity due to financial crisis.

In this environment, STA Turkey has to be competitive in the market and satisfy customer needs financially. One of the main KPIs for STA Turkey is to maintain the market leadership in the categories they operates. So, the company's products must be irresistible for the consumers and brands must be the brand on consumers' mind when they shop in the market. There are several ways to do that. STA Turkey often applies special offers for the products and categories.

Moreover, the customer development team prepares PWP and BOGOF activities for each quarter to gain market share in the related categories. These activities are applied with a deep discount to draw attention of the consumers. According to financial statements of the company, the difference between gross sales amount and net sales amount is named GTN. It is the amount that the company spends for the activities mentioned. To maintain company's financials in the global limits, STA Turkey must control their GTN budget for each quarter which can be done by forecasting.

GTN forecasting gives a future estimation of the GTN spending based on historical

market activity prices and volume distributions of the company. In this thesis, there exist a simulation study by using the products of STA Turkey's portfolio. This study is generated by the GBM from the previous quarters' sales orders and normally distributed data for the distribution of the product weights in every order.

1.4 STA Turkey Initiatives

Most of the companies operate in Turkey for many years. Therefore, their finance departments have already realized the financial risks and try to avoid them by using different type of derivative instruments. STA Turkey for instance, makes forward contracts every month with three different maturity dates in the following quarter. To avoid the fluctuations in USDTRY rate, they divide into 3 different dates i.e. 30, 60 and 90 days after from the purchase process. Forward contracts are made by purchasing $1,050,000 to take guarantee the foreign currency payments at the end of the quarter.

According to the results of forward contract (Figure 1.1), the total gain is TL 294,060 at the end of the transactions since 2015.

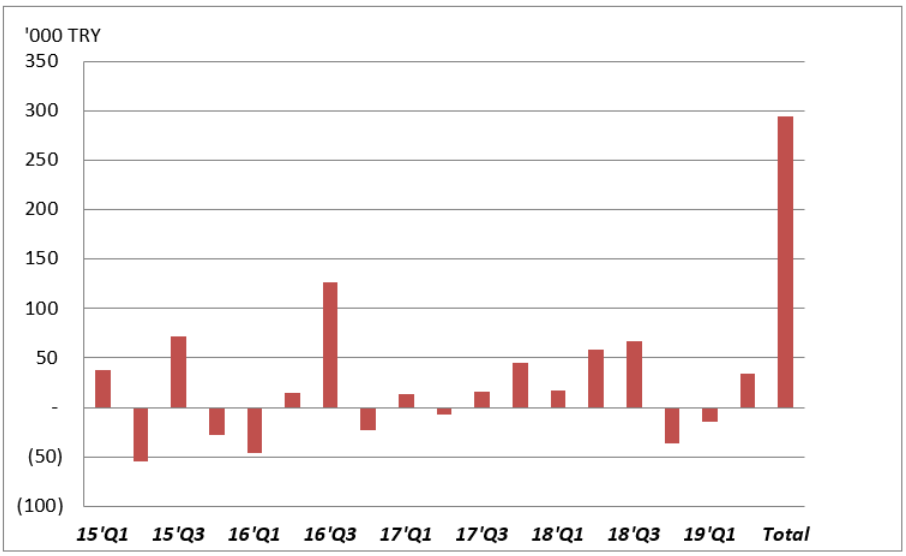

Figure 1.1: Forward Contract Report of STA Turkey

After examining these transactions, it is observed that amount and maturity dates are fixed and not changed under any circumstances in Turkey. However, according to the academic literature, fixed transactions don't bring beneficial results all the time and it

is a risky situation for the companies. So, STA Turkey must have a flexible strategy when they use financial derivatives depending on the amount and timeline.

CHAPTER 2

MODELING EXCHANGE RATES

Foreign exchange (FX) is the conversion of one country's currency into another one. It is a well-known concept by the governments and companies since all international transactions are made by taking FX into account. It also plays a significant role in corporate agreements between multi-national companies. Future rate of FX might be changed due to any events that affect the parties. The gains and losses might be changed for the companies as well. Moreover, since companies improve dramatically in the global world, their businesses are vulnerable by the future rate of FX pairs (domestic currency and strongest currencies) in the market.

There are several discussions about accuracy of the ARIMA model when predicting the future values of foreign exchange rates. Box and Jenkins (1970), defines the time series forecasting model autoregressive integrated moving average (ARIMA) that contains model checking, identification and parameter forecasts as one of the best methods [9]. On the contrary, accordingly to Zhang's (2003) & Pai and Lin's (2005) studies, there are some constraints of the model such as pre assumed linear form of the model [10, 12]. Zhang (2003) states that for the nonlinear data set, this model might not work [10]. Which means forecasting might be inaccurate when the model is applied for highly volatile series. According to Babu and Reddy's (2015) studies, the model still has an important role when examining the exchange rates [11]. Altough there are different point of views in the literature, it can be concluded that time series models are one of the most popular methods while forecasting the future rate of FX.

2.1 How does it affect STA Turkey?

STA Turkey processes their sales operation in Turkey. However, the finished goods and raw materials are purchased with foreign currency, USD. Also, STA Turkey's purchased product payments are made in USD and financial statements are prepared in USD as well. Since the operation incomes in TRY and all the payments and reports are prepared in USD, the fluctuation of USDTRY rate affects the company in every aspect. Therefore, STA Turkey faces with a macroeconomic uncertainty and have difficulties in profit and loss reports.

As mentioned before, it is known that STA Turkey has a payment process between the purchased date and maturity date, which is 90 days. So, the company is affected by foreign exchange rate fluctuations in 90 day time period.

In this chapter, STA Turkey's financial risks are defined in terms of future foreign exchange rates (at the maturity date). It is hard to forecast the future rate of USDTRY at a specific time. In this structure, the forecasting of USDTRY is made by using the ARIMA model. The period that takes into account is between 1 January 2017 and 17 January 2019 (which is the last day of the finished goods are purchased by STA Turkey). 747 daily observations are used for the model.

The future rate of FX is forecasted for STA Turkey when the model is applied. GTN spending estimations and excess amount simulations are made in Chapter 3 in the light of this estimated rate.

2.2 Literature Review

There are several studies related to forecasting USDTRY rate by using ARIMA so far. Bircan and Karagoz (2003) observe the rates for 132 months between January 1991 and December 2002 and examine monthly average USDTRY rate. They apply an ARIMA (2,1,1) model and decide that the model is appropriate for the USDTRY exchange rate forecasting [13].

Kadilar et al. (2009) observe the rates for 160 weeks between 3 January 2005 and

28 January 2008 and decide that the most appropriate model is ARIMA (0,0,1) [14]. Vergil and Özkan (2007) observe monthly USDTRY rates between January 1980 and July 2001 and compare the successes of ARIMA and monetary model (MM). They conclude that ARIMA (3,1,2) is more effective in forecasting of the USDTRY rate than MM models [15].

Kaynar and Taştan (2009) observe both daily and monthly USDTRY rates between January 2000 and June 2008 and decide that the most appropriate model is ARIMA (2,1,0) [16]. Özkan (2011) observes the rates for 338 months between the years 1986 and 2010 and compares the successes of ARIMA, artificial neural network (ANN) and conjunctural model (CM). She concludes that ANN is the most appropriate model. However, she does not state the specification of generated ARIMA model [17]. Yıldıran and Fettahoglu (2017) observe the rates for 3069 days between January 2005 and 8 March 2017 and decide that the most appropriate model for short term is ARIMA (2,1,0) and for long term is ARIMA (0,1,1) [21].

Yao and Tan (2000), observe the USDJPY, USDDM, USDGBP, USDCHF and USDAUD rates for 510 weeks between 18 May 1984 and 7 of July 1995 and decide that the most appropriate model is ANN while FX trading. They also compare the successes of ARIMA and ANN models and conclude that ANN is better than ARIMA [18].

Zhang (2003) observes the USDGBP rate for 731 weeks between 1980 and 1993 and decides that hybrid model is more appropriate than both ARIMA and ANN [10]. Maniatis (2012) observes EURUSD rate for 3,202 days between 4 January 1999 and 1 July 2011 and compares the successes of ARIMA method, exponential smoothing technique (EST) and probabilistic approach (PA). He concludes that PA performs better than the others [19].

Maria and Eva (2011), observe the rates EURRON, GBPRON, USDRON, JPYRON, CNYRON and RUBRON between 3 January 2011 and 22 April 2011 and compare the successes of ARIMA and EST models. They conclude that the most appropriate model is ARIMA (1,0,0) for EURRON, ARIMA (1,1,1) for GBPRON, ARIMA (1,0,0) for USDRON, ARIMA (4,0,6) for JPYRON, ARIMA (1,0,0) for CNYRON, ARIMA (1,1,3) for RUBRON. However, they also conclude that EST is more appro-

priate than ARIMA [20].

Nwankwo (2014) observes the rate NGNUSD for 30 years (average values) between 1982 and 2011 and decide that the most appropriate model is ARIMA (1,0,0) [35]. Babu and Reddy (2015) observes the rates USDINR, GBPINR, EURINR and JPY-INR for 1,284 days between January 2010 and April 2015. They compare the successes of ARIMA, ANN and fuzzy systems and decide that ARIMA is the most appropriate model [11].

2.3 Data and Descriptive Statistics

The data is taken from the web site of Central Bank of Turkey (CBRT) [33] and it is used for forecasting the USDTRY rate.

The data includes 747 daily observations of USDTRY rate between 1 January 2017 and 17 January 2019 which is the date that the finished goods are purchased by STA Turkey.

To perform the model ARIMA properly, the descriptive statistics of USDTRY rates are studied first.

Table 2.1: The Descriptive Statistics of USDTRY Rates

$\mathbf{P_t}$	
Minimum	3.4026
1st Quarter	3.5853
Median	3.8219
Mean	4.2711
3rd Quarter	4.8263
Maximum	6.8922

Table 2.1 shows the descriptive statistic of USDTRY daily rate between the dates 1 January 2017 and 17 January 2019. P_t denotes the price of USDTRY.

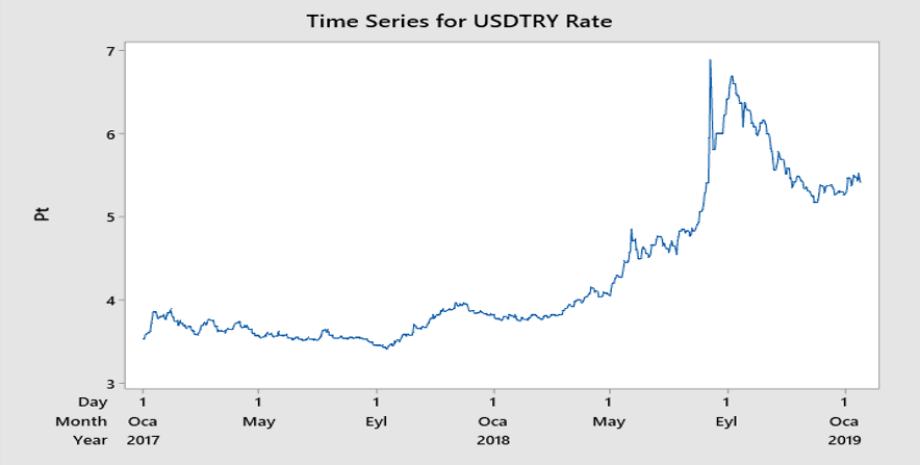

Figure 2.1: The Price of USDTRY Between 1 Jan 2017 and 17 Jan 2019

Figure 2.1 shows that there is a rising trend especially started from 1 May 2018. After 1 September 2018, it is deduced that the data is slightly decreasing and takes less volatile position. The log transformation on the rates, illustrated in Figure 2.2 shows the same pattern. lnP_t denotes the natural logarithm of P_t.

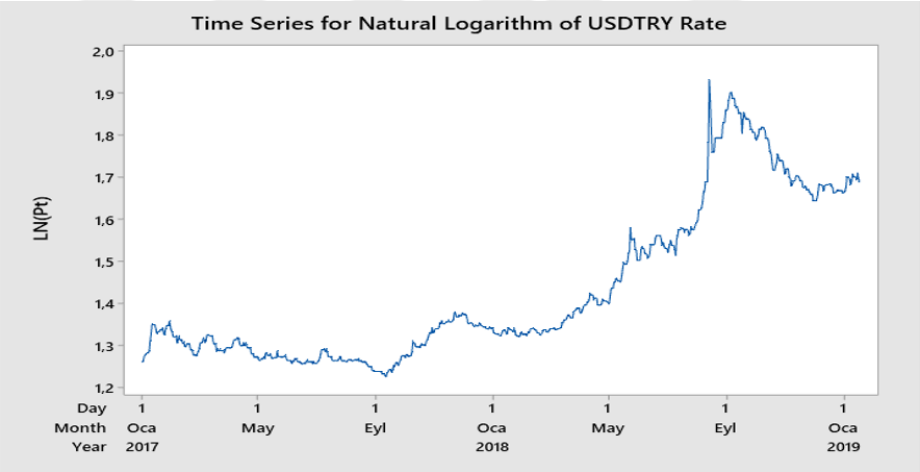

Figure 2.2: The Natural Log of USDTRY Between 1 Jan 2017 and 17 Jan 2019

After the logarithm of the price of USDTRY is taken, it is observed that the range between the first and the last value is getting smaller. Due to the similarity in pattern, the natural logarithm return r_t can be calculated by the equation 2.1:

$$r_t = lnP_t - lnP_{t-1} \tag{2.1}$$

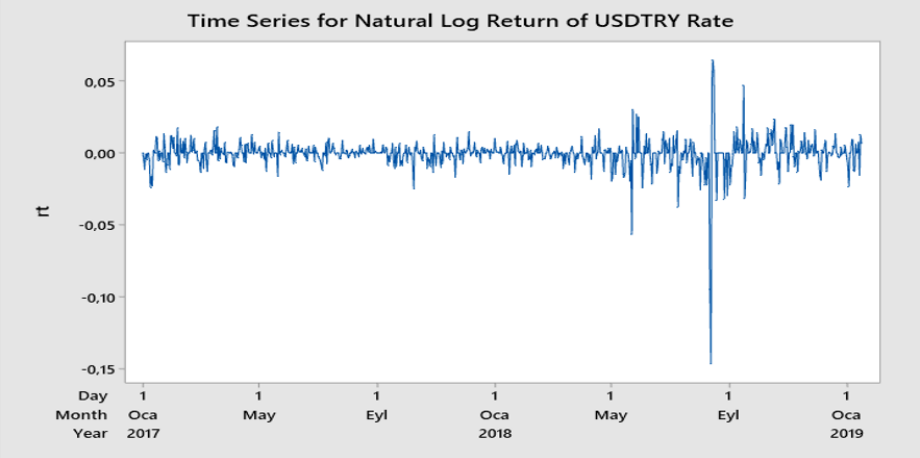

Figure 2.3: The Natural Log Return of USDTRY Between 1 Jan 2017 and 17 Jan 2019

Figure 2.3 shows that r_t has a random behavior since volatility. Considering whole interval, it has a higher volatility between May 2018 and October 2018.

To examine stationarity, augmented Dickey–Fuller (ADF) [39] test is performed for the time series of USDTRY rate. Because P_t and lnP_t series show a clear uptrend, trend parameter is added to ADF equation 2.2, however, test of ADF for r_t series executed with unit root model by equation 2.3.

$$\nabla y_t = \delta y_{t-1} + a_0 + a_1 t + u_t \tag{2.2}$$

$$\nabla y_t = \delta y_{t-1} + u_t \tag{2.3}$$

Hypotheses are created as follows: "H_0 = The series is stationary" and the alternative, "H_1 = The series is not stationary", considering Table 2.2. As for P_t and lnP_t, because a_1 values of the models greater than the "DF test statistics", null hypothesis is rejected. While, because δ values of r_t is bigger than "DF test statistics" in absolute values null hypothesis is not rejected that implies r_t is stationary. After stationarity is ensured for lnP_t at its first difference as r_t series, modelling is performed.

Table 2.2: ADF test for USDTRY series

	a_1	δ	DF Test Statistics
P_t	4.2690	x	1.3388
lnP_t	1.4328	x	1.0862
r_t	x	2.9476	0.6676

2.4 ARIMA Model

In the academic literature, there are several applications in order to choose the right model for the given data. However, most of those applications are subjective. For example, for a single data set many model applications are used so far.

Considering all of these, STA Turkey calculates different ARIMA models and compares them. ARIMA (0,1,1), ARIMA (1,1,0), ARIMA (1,1,1), ARIMA (0,1,2), ARIMA (1,1,2), ARIMA (2,1,0), ARIMA (2,1,1), and ARIMA (2,1,2) are used for 747 daily observations of USDTRY rate between 1 January 2017 and 17 January 2019 to make a decent decision about choosing the right model of ARIMA,

Mean absolute deviations (MAD) are calculated for each model to find the best performing model [21]:

$$MAD = Average \mid P_t - Avg(P_t) \mid \tag{2.4}$$

In Table 2.3, STA Turkey observes that ARIMA (1,1,0) has the smallest mean absolute deviation which means it is the best model for the forecasting the price of USDTRY rates after 17 January 2019.

Table 2.3: The MAD Calculations of ARIMA Models

ARIMA Model	**Mean Absolute Deviations**
ARIMA (0 1 1)	0.8166
ARIMA (1 1 0)	**0.8157**
ARIMA (1 1 1)	0.8172
ARIMA (0 1 2)	0.8182
ARIMA (1 1 2)	0.8195
ARIMA (2 1 0)	0.8190
ARIMA (2 1 1)	0.8193
ARIMA (2 1 2)	0.8191

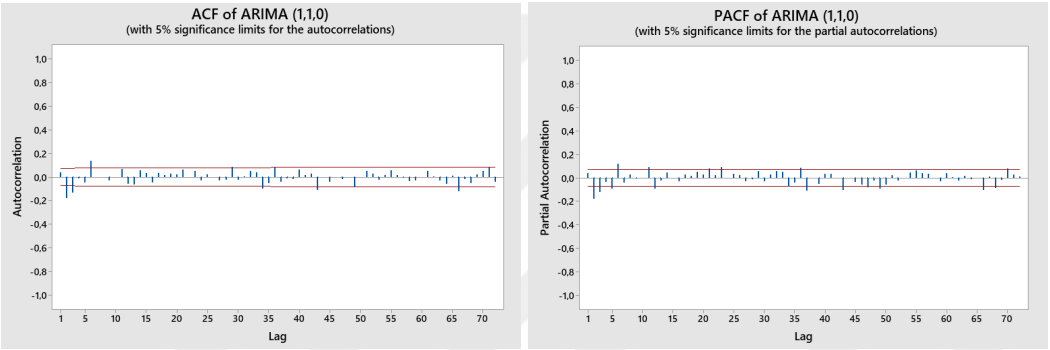

Figure 2.4: The ACF and PACF of ARIMA (1,1,0)

ACF finds the correlation of the residuals of present lags. However, partial auto correlation functions (PACF) finds the correlation of the residuals with the next lag. If there is any missed information in the residuals then they are formulized with the next lag. In Figure 2.4, it is observed that ACF results of the ARIMA (1,1,0) works very well and the model is suitable for forecasting. Just like ACF, PACF also works very well and shows that ARIMA (1,1,0) is suitable for forecasting as well.

Since ARIMA (1,1,0) model has performed better than any other ARIMA models, it is used for daily forecasting of USDTRY rate after the given time period, 1 January 2017 and 17 January 2019. In Chapter 1, it is explained that STA Turkey needs to forecast USDTRY rate 90 days after from the purchase process. Therefore, forecasting with ARIMA model is applied with 90 day period with the 95% confidence interval.

2.5 Forecasting with ARIMA (1, 1, 0)

The model is used to forecast the USDTRY rate 90 days after from the purchase process and it helps STA Turkey to forecast GTN spending (in USD) in Chapter 3. Figure 2.5 shows that there is 95% confidence interval and STA Turkey needs to work within this interval.

The red line in the middle shows the actual forecast value between 1 and 90 days after purchasing the goods. The upper red line shows the highest forecast values in the given time period and the lower red line shows the lowest forecast values in the same time period.

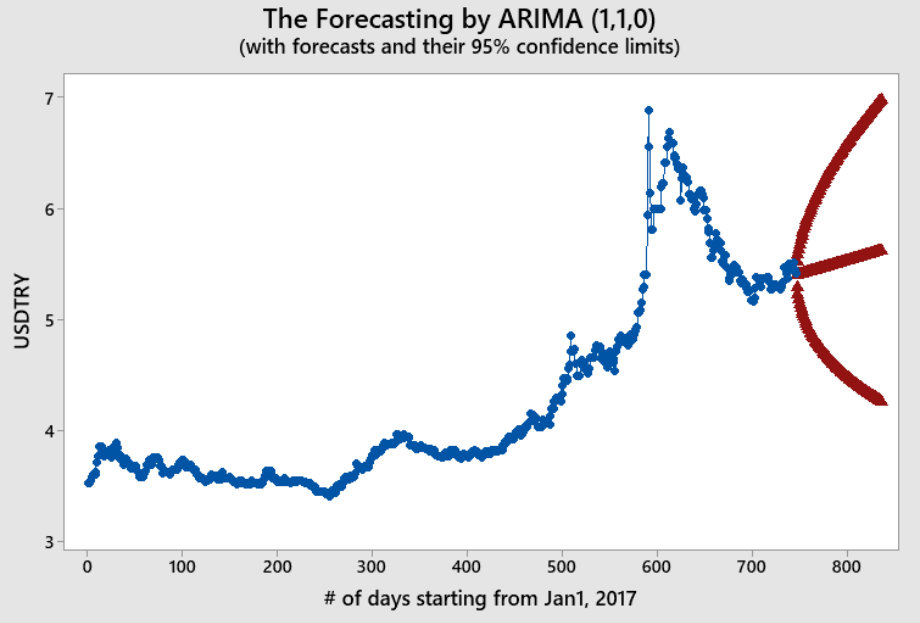

Figure 2.5: The Forecasting of USDTRY by ARIMA (1,1,0)

90 days after from the purchase process (17 April 2019), the lowest, highest and the optimum forecast values of USDTRY are shown in Table 2.4. In Chapter 3, GTN forecasting simulations are made based on these USDTRY forecast rates.

Table 2.4: Forecasted USDTRY Rates

USDTRY rate at 17 April 2019	
Forecast	5.6372
Lower	4.2646
Upper	7.0098

CHAPTER 3

GTN FORECASTING AND HEDGING

3.1 GTN Forecasting in the Literature

In today's business world, many companies work with third parties to commodify their products and services. They work with different agencies and distributors to achieve a healthy business and distribute their products all around the world. These agencies and distributors gain two different fees: on invoice discounts for the list price of the products and rewards at the end of the year upon achievements of key point indicators. The sum of these discounts and acquisitions are called GTN spending which is the difference between gross and net sales.

For a manufacturer, GTN provides the motivation for the sales universe to deliver the products to distributors and retail markets, and finally to consumers which are the real targets by the companies. It also helps distributors to publicize the finished goods by promotional activities to sub-distributors, wholesalers, retailers and consumers.

According to Soelton (2017), when companies look at GTN management from a strategic point of view, they see that GTN information is observed accurately and timely, also results to make more accurate decisions in order to adjust in volatile sales market [31]. In addition to its basic and accounting functions, a GTN model is useful in making decisions and forming strategies. That is why companies' approaches to GTN models must include pricing, the history of the data, market analysis and must allow to each department for having a look at the model details for their future decisions.

As a part of the model, companies also need to support the model with the correct data set and analytic tools. They need to compare all outcomes from a wide range of scenarios. Companies with different sizes also must have different type of models and capabilities.

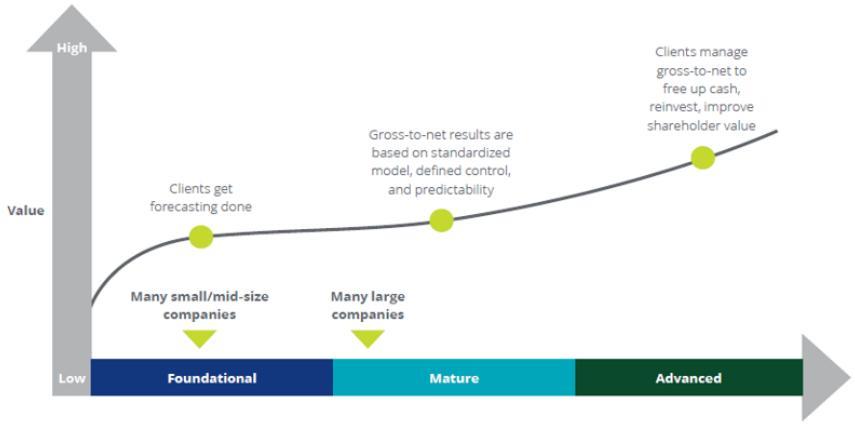

Figure 3.1: Company Types and Their Approach to GTN Models, Building a GTN Strategy in a Fast Changing Market, Deloitte, 2018

The companies at advanced level (Figure 3.1) create an automated GTN model which results continuous progress in algorithms and modelling. GTN strategies are proactive at company decisions & operation spending, and also help to increase the control of the financials.

According to Matsuk (2011), the excellence in GTN operation allows companies to forecast their discount liabilities more accurately and to understand the possible outcomes of contract decisions on their operations [34].

In the academic literature, there are not any study made on the subject of GTN forecasting. So far, companies and consulting firms have worked based on the historical data structure without doing any mathematical computation.

In this thesis, STA Turkey forecasts the company's GTN spending by applying a mathematical technique called Geometric Brownian Motion. One of the main key indicators for STA Turkey is not to excess GTN spending and with this method, they can easily forecast GTN percentages and decide about their strategies in the light of the forecasted results. Moreover, using such a method helps STA Turkey to build

their financial statements more accurately.

3.2 STA Turkey Sales Processes

STA Turkey is a subsidiary of STA global and responsible for running a business in Turkey. The company has some KPIs which are examined by STA global. Some of these KPIs are growing the market share profitability, engaging the customers to grow sustainably and growing margins smarter and faster. Therefore, the company has to prepare action plans to accomplish these KPIs. The company also needs to consider the market needs both consumers and customers. These actions plans consist in-store activities such as BOGOF, PWP, category discounts and special offers.

The company's sales organization gains strenght with cooperation of many departments. For example, the strategies are decided by retail marketing (RM) team and the approval of the strategies are given by finance team. Finance team needs to check the financial of activities whether they are applicable or not considering profit and loss statements. Both departments have to be sure that the GTN spending and margin calculations are not put company into a difficult situation. After the decisions are made, the customer development team apply these strategies considering the market needs.

STA Turkey's sales process has different steps between the time of purchasing or producing the products and the time shelving them in the market.

3.2.1 Purchasing or Producing the Products

STA Turkey has a plant in Turkey. They produce some of the products here by taking their raw materials from all around the world. However most of the products are imported directly from other STA plants which are located all around the world. The invoices for the imported products have the maturity date to be paid 90 days after from the purchase process.

Before the purchasing of products process has started, RM team has to study the products' cost and set the targeted margins.

At time $t = 0$ (17 Jan 2019) which is the purchasing date for the imported products into the local plant, products are purchased in USD. FX rate of USDTRY is 5.41 according to CBRT.

After purchasing, all the products' values are calculated with this rate. It is an obligation for STA Turkey to repay them 90 days after from the purchase process.

Table 3.1: FX Rate for USDTRY When Products are Purchased by STA Turkey, CBRT, 2019

Currency Code	**Unit**	**Currency**	**FX Buying**
USDTRY	1	US Dollar	5.41

3.2.2 RM Strategies and Portfolio Analysis

STA Turkey has 144 different products in the portfolio from different categories. All of these products have different costs and margins but their list prices are fixed with the desired margin structure. They are calculated after the cost analysis.

Table 3.2 shows an example of the cost analysis of some products in the portfolio. The calculations are made for all 144 products in the portfolio. However since all cannot be given in a single table, 5 of them are selected from different categories as a sample.

Table 3.2: A Brief Example of STA Turkey's Portfolio

Category	**Product Name**	**Cost($)**	**Margin (51%)**	**List Price ($)**
Oral Care	STA TOOTHPASTE WHITENING 75 ML	4.08	51%	6.17
Personal Care	STA MOISTURIZING CREAM 50 ML	2.60	51%	3.92
Personal Care	STA SHOWER GEL MEN 500 ML	1.73	51%	2.61
Home Care	STA DETERGENT 500 ML	1.15	51%	1.73
Home Care	STA SURFACE CLEANING 1 L	0.83	51%	1.25

Costs depend on the products' materials such as packaging, plastics, oils, chemicals, scents etc. Also plant expenditures and depreciation costs are reflected on the product costs. RM team keeps the entire products margin to 51% and defines the list prices according to it.

After the list prices are announced to STA Turkey, customer development team contacts with customers for planning the quarter sales operations. Each day in the entire quarter period, teams upload their orders into the system with different products volume and distributions.

3.2.3 STA Turkey Product Portfolio

After making the cost analysis for the products in the portfolio, STA Turkey is ready to announce the list prices to their customers in the market. By using the FX rate at $t = 0$, the list prices for STA Turkey's products are updated in terms of domestic currency, TRY.

Table 3.3 shows a sample of the portfolio about the list prices of the products both in USD and in TRY. The list prices are fixed for the entire quarter which is Q1 of 2019 in our case.

Table 3.3: A Brief Example of STA Turkey's Portfolio in TRY

Category	**Product Name**	**List Price ($)**	**FX Rate**	**List Price (TRY)**
Oral Care	STA TOOTHPASTE WHITENING 75 ML	6.17	5.41	33.37
Personal Care	STA MOISTURIZING CREAM 50 ML	3.92	5.41	21.22
Personal Care	STA SHOWER GEL MEN 500 ML	2.61	5.41	14.11
Home Care	STA DETERGENT 500 ML	1.73	5.41	9.38
Home Care	STA SURFACE CLEANING 1 L	1.25	5.41	6.74

All products take part in different type of categories depending on their benefits.

Since the aim of this thesis is to forecast possible outcomes of gross & net sales and to prevent any negativity such as excess amount of GTN spending, an order simulation must be studied before GTN calculations.

3.2.4 First Order Estimation

The team simulates the first order based on the 144 products in the portfolio, distributed with different weights. According to the historical sales data of STA Turkey, relative frequencies (weights) for every product have calculated considering the average tonnages sold for the same period in last year.

From the historical sales data, their weights are calculated:

$$P(X_j) = \frac{X_j}{\sum_{j=1}^{144} X_j} \tag{3.1}$$

where X_j is average tonnages sold of the products in the portfolio for the same time period in last year and $P(X_j)$ denotes their weights.

By using equation 3.1, STA Turkey calculates the weights of all the products in the portfolio. Since it is hard to show each products' weights, a sample is randomly selected from the portfolio. Table 3.4 shows a sample of the portfolio and gives an idea about how STA Turkey calculates the products' weights in the first order.

Table 3.4: A Sample of Product List Prices and Weights in the First Order of STA Turkey

Category	**Product Name**	**List Price (TRY)**	**Average Tonnages Sold (X_j)**	**Weight $P(X_j)$**
Oral Care	STA TOOTHPASTE WHITENING 75 ML	33.37	0.31	0.48%
Personal Care	STA MOISTURIZING CREAM 50 ML	21.22	0.92	1.33%
Personal Care	STA SHOWER GEL MEN 500 ML	14.11	0.59	0.53%
Home Care	STA DETERGENT 500 ML	9.38	0.75	1.04%
Home Care	STA SURFACE CLEANING 1 L	6.74	0.91	1.28%

After applying weight equations for each product, STA Turkey gets Figure 3.2 which indicates the weights of each product in the given portfolio.

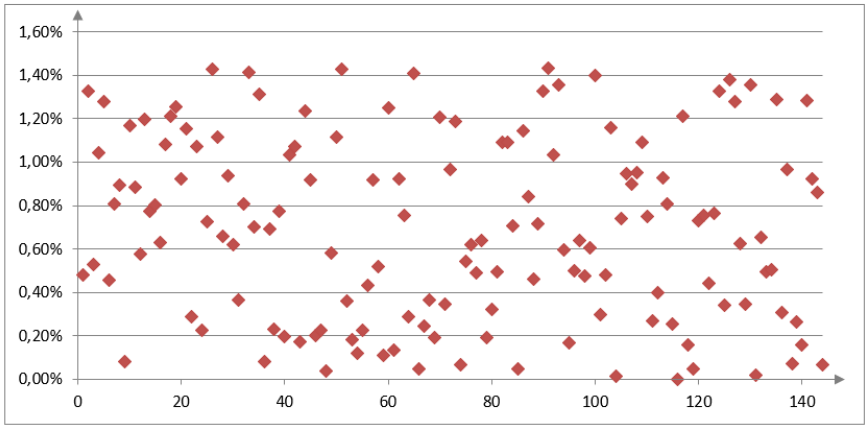

Figure 3.2: Weight Distribution of All Products in the Portfolio

In Figure 3.2, X axis is the number identification of the products in the portfolio and Y axis is their weights in the first order. It is seen that the products' weights are distributed almost uniformly on the interval between 0.00% and 1.50%.

After the products' weights in the portfolio are calculated, the contribution amount of

every products for the first order can be easily estimated by equation 3.2:

$$C_i = L_i \times P(X_i) \times 100,000 \tag{3.2}$$

where C_i denotes the contribution of a single product and gives how much a single product contribute to the entire order. L_i expresses the list price (TRY) of a single product which are calculated before. $P(X_i)$ denotes the relative frequency (weight of a single product) which gives the weight percentages of each product in the portfolio, they are calculated in equation 3.1.

The reason to multiply with 100,000 is to give the correct tonnage of the products based on the historical average tonnages sold for STA Turkey.

In Table 3.5, a sample of the portfolio for the product contribution is given and relative frequency P(X_j) is called weight of the products in the order.

Table 3.5: A Brief Example of Product Contributions in the First Order of STA Turkey

Category	**Product Name**	**List Price (TRY)**	**Weight**	**Contribution**
Oral Care	STA TOOTHPASTE WHITENING 75 ML	33.37	0.48%	16,075.54
Personal Care	STA MOISTURIZING CREAM 50 ML	21.22	1.33%	28,140.32
Personal Care	STA SHOWER GEL MEN 500 ML	14.11	0.53%	7,485.33
Home Care	STA DETERGENT 500 ML	9.38	1.04%	9,802.18
Home Care	STA SURFACE CLEANING 1 L	6.74	1.28%	8,612.27

STA Turkey operates with 144 products in its portfolio for market activities. From the equation mentioned above, all of these 144 products' weights (relative frequencies) and their contributions to the first order are calculated. After the calculations, the

projected first order can be expressed as follows:

$$S_1 = \sum_{i=1}^{144} C_i \tag{3.3}$$

where S_1 denotes the first order amount in TRY

Calculations are made and the first order of STA Turkey in Q1 of 2019 is estimated as TRY 1,583,278.

3.3 Geometric Brownian Motion

Any financial market particularly stock markets use Brownian Motion when they decide to build forecasting scenarios. In this thesis, this method is used to forecast STA Turkey's Gross sales and GTN spending. Before working on the data and application of the method, a brief definition of the method is explained.

Any stochastic process that follows the equation below is called as Geometric Brownian Motion (GBM):

$$dS_t = \mu S_t dt + \sigma S_t W_t \tag{3.4}$$

where S_t is a stochastic process and W_t is a wiener process, the drift μ & the volatility σ are constant variables, μS_t is the trend of the Brownian Motion and $\sigma S_t W_t$ is the random noise that affects Brownian Motion.

The solution S_t can be found by the application of Ito's Lemma to the stochastic differential equation (SDE). The equation 3.4 is a SDE and it can be solved by dividing both sides with St.

$$\frac{dS_t}{S_t} = \mu dt + \sigma dW_t \tag{3.5}$$

Notice that the left hand side of this equation looks similar to the derivative of $logS_t$.

Applying Ito's Lemma to $logS_t$ gives:

$$dlogS_t = (logS_t)'\mu S_t dt + (logS_t)'\sigma S_t dW_t + \frac{1}{2}(logS_t)''\sigma^2 S_t^2 dt \tag{3.6}$$

This becomes:

$$dlogS_t = \mu dt + \sigma dW_t - \frac{1}{2}\sigma^2 dt = (\mu - \frac{\sigma^2}{2})dt + \sigma W_t \tag{3.7}$$

This is an Ito drift-diffusion process. It is a standard Brownian motion with a drift term. Since the above formula is simply shorthand for an integral formula, we can write this as:

$$logS_t - logS_0 = (\mu - \frac{\sigma^2}{2})t + \sigma W_t \tag{3.8}$$

Finally, taking the exponential of this equation gives:

$$S_t = S_0 exp((\mu - \frac{\sigma^2}{2})t + \sigma W_t) \tag{3.9}$$

With the constant μ & σ and given time interval, a Geometric Brownian Motion solution can be viewed as follows:

$$S(t) = S_0 e^{x(t)} \tag{3.10}$$

$$X(t) = (\mu - \frac{\sigma^2}{2})t + \sigma W_t \tag{3.11}$$

With the given drift μ and volatility σ, the moment generating function can be expressed as follows:

$$M_{X(t)}(s) = E(e^{sX(t)}) = e^{uts + \frac{\sigma^2 t s^2}{2}} \tag{3.12}$$

And expectation and variance of GBM are given below:

$$E(S(t)) = E(S_0 e^{X(t)}) = S_0 M_{X(t)}(1) = S_0 e^{(\mu + \frac{\sigma^2}{2})t} \tag{3.13}$$

$$Var(S(t)) = E(S^2(t)) - E(S(t))^2 = S_0^2 e^{2\mu t + \sigma^2 t}(e^{\sigma^2 t} - 1) \tag{3.14}$$

3.4 Using Geometric Brownian Motion for STA Turkey Organization

The drift $\hat{\mu}$ and volatility $\hat{\sigma}$ is estimated by using the historical sales data for STA Turkey. This data includes the gross sales and GTN spending for each day in the Q1 and Q2 of 2018 which denotes the time period between 18 Jan 2018 and 17 Jul 2018

Drift $\hat{\mu}$ and volatility $\hat{\sigma}$ are estimated from the log normal distributions of the historical sales data [38]. The observations $\{r_1, r_2,..,r_n\}$ in equation 3.15 are assumed to be independent. Interested readers can see the values of r_i in appendix C.

$$r_i = log\left(\frac{S(t_i)}{S(t_{i-1})}\right) \tag{3.15}$$

Observations $\{r_1, r_2,..,r_n\}$ are examined by using S(t_i) which denotes the historical data of gross sales and GTN amount separately. Calculations are made for both gross sales and GTN. They are used to find the estimated drift $\hat{\mu}$ and volatility $\hat{\sigma}$.

The sample variance S_μ^2 is given in equation 3.16 and estimate of variance σ is given in equation 3.17:

$$S_\mu^2 = \frac{1}{n-1}\sum_{i=1}^{n}(r_i - \hat{\mu})^2 \tag{3.16}$$

$$\hat{\sigma} = \frac{S_\mu^2}{\Delta t} \tag{3.17}$$

The estimate of drift μ is given in equation 3.18:

$$\hat{\mu} = \frac{1}{n} \sum_{i=1}^{n} r_i \tag{3.18}$$

Estimated drift $\hat{\mu}$ and volatility $\hat{\sigma}$ of Gross Sales and GTN for STA Turkey are given in Table 3.6 & Table 3.7:

Table 3.6: Drift $\hat{\mu}$ and Volatility $\hat{\sigma}$ of STA Turkey's Gross Sales

Gross Sales	
Sample Variance	155.61%
Variance	124.74%
Drift (Mean)	-3.01%

Table 3.7: Drift $\hat{\mu}$ and Volatility $\hat{\sigma}$ of STA Turkey's GTN

GTN	
Sample Variance	186.60%
Variance	136.60%
Drift (Mean)	-2.17%

Since FMCG market is very volatile and sales data can be changed due to any incident such as holidays, maturity date of the payments, meeting periods with customers etc., the percentage volatility for both gross sales and GTN can be really high. After the computation of those variables, STA Turkey estimates the rest of the orders in Q1 of 2019 based on the constants $\hat{\mu}$ & $\hat{\sigma}$ and the first order they forecasted. Since there are 90 days in Q1 of 2019, forecasting is also made for 90 orders.

Q1 of 2019: is the time period between 18 Jan 2019 and 17 Apr 2019

Table 3.8: The Sample of the Forecasting for the First 10 Days

Geometric Brownian Motion for Gross Sales				**Geometric Brownian Motion for GTN**			
Variance		124.74%		Variance		136.60%	
Drift (Mean)		-3.01%		Drift (Mean)		-2.17%	
N(0,1)	Log Return	1st day	1,583,278	N(0,1)	Log Return	1st day	190,017
0.39	45.41%	2nd day	2,493,364	-1.18	163.70%	2nd day	36,969
-1.31	-166.19%	3rd day	300,457	-2.51	-345.04%	3rd day	6,030
-0.91	-117.04%	4th day	491,191	0.34	44.92%	4th day	297,775
0.51	60.35%	5th day	2,894,955	-0.49	-69.64%	5th day	94,703
-0.94	-120.80%	6th day	473,061	-1.16	-160.28%	6th day	38,256
-0.69	-88.66%	7th day	652,371	-0.29	-41.22%	7th day	125,823
0.83	100.86%	8th day	4,340,823	-0.71	-99.75%	8th day	70,077
2.04	251.15%	9th day	19,510,503	-1.70	-234.31%	9th day	18,248
-0.70	-89.76%	10th day	645,258	0.46	60.45%	10th day	347,793

STA Turkey forecasts 90 days orders (in Q1 of 2019) with the Geometric Brownian Motion and gets different simulations with the normally distributed random variables. In Figure 3.3, a small simulation of the Gross sales and GTN for STA Turkey is given:

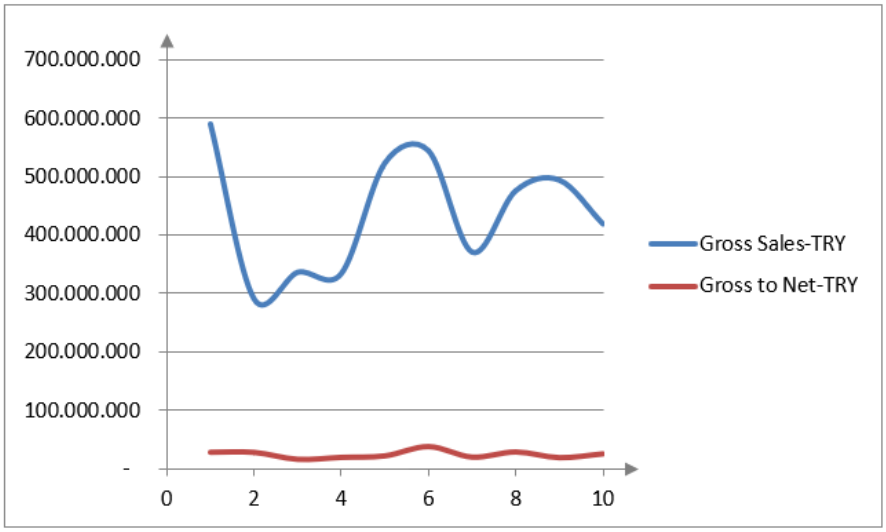

Figure 3.3: Geometric Brownian Motion Simulations for Gross Sales and GTN

3.5 The First Simulation of the Geometric Brownian Motion

After giving the solution of Geometric Brownian Motion for the gross sales and GTN spending of STA Turkey (for Q1 of 2019), the company able to simulate the order.

Gross Sales and GTN are calculated from the Geometric Brownian Motion and Net Revenues can be calculated with the below formula:

$$NetRevenues = GrossSales - GTN \tag{3.19}$$

Table 3.9: The Financial Results After First Simulation is Created According to FX Rate at t = 0

Gross Sales - TRY	589,842,779
FX Rate of USDTRY at t=0	5.41
Gross Sales - USD	109,028,240
GTN - TRY	28,101,429
GTN - USD	5,194,349
Net Revenue - TRY	561,741,350
Net Revenue - USD	103,833,891

After the calculation of the financials, it is easy to find the GTN% which also means how much the spending used by STA Turkey team.

$$GTN\% = \frac{GTN}{GrossSales} \tag{3.20}$$

According to equation 3.20, GTN% of the first simulation (in USD) is 4.76%

When STA Turkey calculates the company's financials with foreign currency (USD), the company uses FX rate at $t = 0$ as a base.

However it is misleading since the payment terms & amounts are fixed at the maturity date which are calculated with the FX rate at $t = T$.

These calculations show how much money borrowed from STA Global. According to the results obtained in Chapter 2, at the maturity date ($t = T$, 90 days after from the purchase process) STA Turkey needs to pay 97% of the amount of products bought with the FX rate 5.6372.

In Table 3.10, STA Turkey's financial position is explained:

Table 3.10: Financials of STA Turkey at $t = T$

Gross Sales at t = 0 (USD)	109,028,240
Repaid Amount (USD)	105,757,393
USDTRY Rate at t = T	5.6372
Gross Sales at t = T (USD)	104,633,999
Required Budget (USD)	1,123,394

where Gross Sales at $t = 0$ (USD) defines the amount of the products purchased at $t = 0$ and Repaid Amount (USD) defines the amount that is paid at $t = T$ (maturity date) by STA Turkey

$$RepaidAmount = GrossSales \times 97\% \tag{3.21}$$

USDTRY Rate at $t = T$ is found in Chapter 2,

Gross Sales at $t = T$ (USD): The revalued amount of the purchased product

$$GrossSales(t = T) = \frac{GrossSales(t = 0) \times FXRate(t = 0)}{FXRate(t = T)} \tag{3.22}$$

Required Budget (USD): The excess amount of the GTN spending for STA Turkey

$$RequiredBudget(USD) = RepaidAmount(USD) - GrossSales(USD) \tag{3.23}$$

With a single simulation, STA Turkey has faced with an excess amount of $1,123,394. However it is not enough to use a single simulation to decide about the company

financials. To have a consistent idea about the excess amount and to take an action on it, STA Turkey needs to simulate these calculations for more than once.

3.6 Monte Carlo Simulations

Monte Carlo simulations are employed for the forecasting of how much excess amount of GTN spending revealed for STA Turkey.

Gross sales and GTN spendings are calculated for the first simulation by the Geometric Brownian Motion. Based on the same algorithms, 1000 trials are calculated by using Monte Carlo simulation. USDTRY rate on 17 April 2019 which is 90 days after from the purchase process, is forecasted as 5.6372 in Chapter 2 by using ARIMA (1,1,0) model. STA Turkey studies all calculations by using this rate.

The simulation results are shown in Figure 3.4 and it is seen that the external sources required for some of the trials.

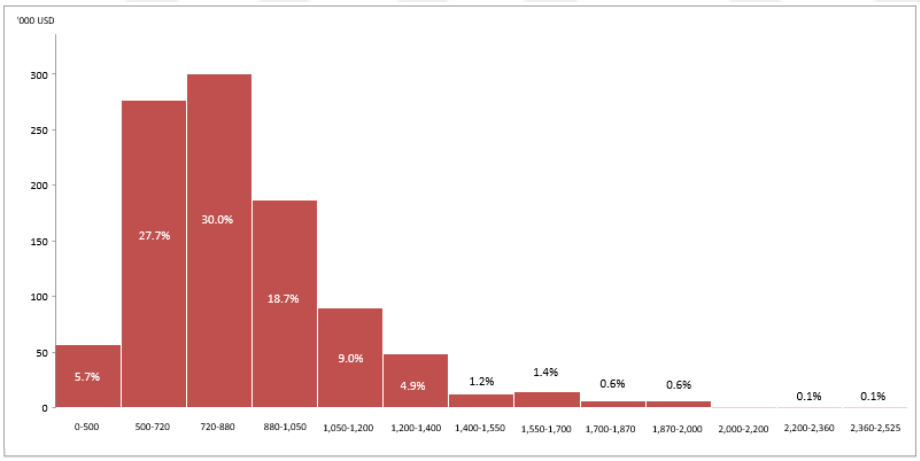

Figure 3.4: Required USD for STA Turkey from Monte Carlo Simulations

Y axis denotes the number of the simulations that result the amounts in X axis. From these simulations, it is seen that almost 82% of the simulations result lower than the current future contract amount of STA Turkey. In the light of these results, the summary Table 3.11 is taken into consideration by STA Turkey and future plans are made according to it.

The subjects are calculated as follows:

$$GrossAmountUSD(Borrowed) = \frac{GrossAmountTRY(Borrowed)}{USDTRYrate(t=0)} \tag{3.24}$$

$$RepaidAmountUSD = GrossAmountUSD(Borrowed) \times 97\% \tag{3.25}$$

$$GrossAmountUSD(Gained) = \frac{GrossAmountTRY(Borrowed)}{USDTRYrate(t=T)} \tag{3.26}$$

$$RequiredExternalUSD = RepaidAmountUSD - GrossAmountUSD(Gained) \tag{3.27}$$

Table 3.11: The Summary Table of Financial Results After Monte Carlo Simulations are Created for STA Turkey

Gross Amount - USD (Borrowed)	$83,461,297
Repaid Amount - USD	$80,957,458
USDTRY Forecasted Rate at t=T	5.6372
Gross Amount - USD (Gained)	$80,097,498
Required External - USD	$859,959

To sum up, STA Turkey needs to decide their corporate strategies in case of any excess amount of GTN spending. And after all the calculations are made in Chapter 2 and Chapter 3, company forecasts the average required external excess amout of GTN spending which is approximately $860,000 and needs to set the action plans and aims to pass over the exposure. The action plans are explained in section 3.9 considering many different derivative models that can help organization to hedge their positions.

3.7 Financial Derivatives and Hedging

The financial risks that are faced can be categorized into foreign exchange, interest rate, commodity and equity exposures. Figure 3.5 shows the types of financial risk

exposures that are hedged by companies in different studies all around the world [37]. It can be concluded that the equity and commodity risk exposures hedged by nonfinancial companies are lower than the interest rate and foreign exchange risk exposures.

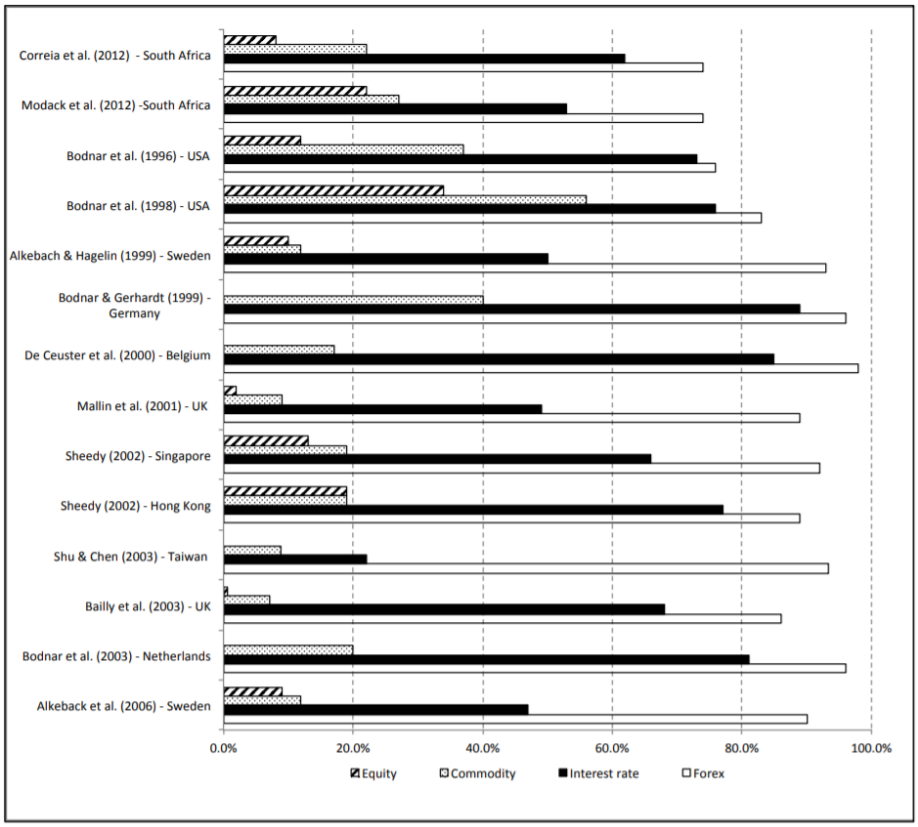

Figure 3.5: Types of Risk Exposures Hedged by Companies, Holman et al., 2013

Multinational companies that operate in Turkey, usually have different structure of foreign exchange risk management. However in the academic literature, a centralized currency management approach is recommended by Dhanani (2003) for all the companies [25]. It is since centralization brings some time to time opportunities for cash flow netting. In today's world, no matter how the companies want, they cannot fully hedge their foreign currency exposure. According to Bodnar et al. (1998), "most of the companies hedge less than half of their perceived currency exposures, with a majority of them also preferring short term financial market hedges with maturities less than 3 months to long term hedges" [24]. This research's outcome is also true for STA Turkey. Loderer and Pichler (2002) states in their study; "risk management objectives of multinational companies found that most of them are risk averse and orientate their

currency risk management policies solely towards hedging" [26]. However, some of the companies seek to make profit manage their actions for speculative purposes.

3.8 Why do Companies Hedge?

To understand why companies hedge, we need to figure out what companies gain from hedging. Figure 3.6 indicates that when a company hedges its risk, there are more chances to get a higher expected value. It can be concluded that hedging narrows the cash flow distribution [22] and reduces the risk.

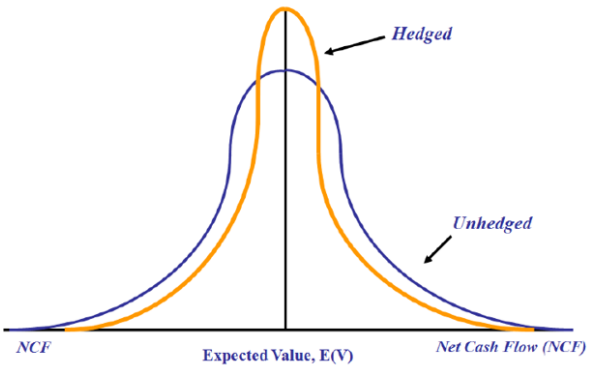

Figure 3.6: Hedged Curve vs. Unhedged Curve, Fundamentals of Multinational Finance, Stonehill et al. 2007

According to Holman et al. (2013), a substantial percentage of the companies use derivative tools to hedge their different type of risks especially FX [37], this is shown in Table 3.12.

Table 3.12: Percentage of Companies Reporting the Use of Derivatives, Holman et al., 2013

Phillips (1995)	USA	63.2%
Jalilvand (1999)	Canada	75.0%
Pramborg (2003)	Sweden	81.0%
Bodnar and Gebhardt (1999)	Germany	77.8%
Bodnar et al. (2003)	Netherlands	60.0%
De Ceuster et al. (2000)	Belgium	65.8%
Sprcic (2007)	Slovenia	65.9%
Sprcic (2007)	Crotia	43.0%
Selvi and Türel (2010)	Turkey	35.0%
El-Masry (2006)	UK	67.0%
Prevost et al. (2000)	New Zeland	67.1%
El-Masry (2006)	UK	67.0%
Berkman et al. (2002)	Australia	52.8%
Sheedy (2006)	Hong Kong	81.0%
Sheedy (2006)	Singapore	75.0%
Pramborg (2003)	Korea	51.0%
Correia, Holman and Jahreskog (2012)	South Africa	90.0%

In the literature, many studies defend the idea that companies cannot guess the market and shareholders have more chance to diversify risk than company's hedging actions. However, despite these arguments, it is clearly seen that many companies still hedge their foreign currency exposure.

Table 3.13: The Usage of Financial Derivatives in Turkey, Derivatives Usage in Risk Management by Turkish Non-Financial Firms and Banks: A Comparative Study, Selvi and Türel, 2010

		2009	2010	2011	2012	2013	2014	All Years
Users	Number	33	36	40	40	33	40	222
Users	Percentage	32%	34%	37%	37%	30%	37%	35%
Nonusers	Number	69	71	68	69	76	68	421
Nonusers	Percentage	68%	66%	63%	63%	70%	63%	65%
Total Number of Firms		102	107	108	109	109	108	643

In Turkey, the findings based on footnote disclosures (Table 3.13 by Selvi and Türel, 2010) show that 35% of the non-financial companies listed in ISE-100 indices use derivative instruments [30]. It shows that companies in Turkey do not use derivatives as much as the companies all around the world.

Hedging helps companies to plan properly, and therefore companies have a chance to predict their cash flow certainly. Stonehill et al. (2007) states that "this also help to decrease the likelihood that the company's cash reserves fall below the minimum cash level point and make them illiquid [22].

Hedging gives an idea about which project made done without any difficulty. By using hedging tools, companies are more secure to implement the projects; otherwise they might reject them due to risks.

Lastly, from the psychological point of view, hedging reduces stress levels and improves decision-making.

3.9 Hedging Decision

The current forward contracts are made by purchasing $1,050,000 to guarantee the foreign currency payments at the end of the quarter. These contract values are decided by STA global and can not be changed by STA Turkey. Considering the excess amount of GTN spending in Chapter 3 and according to the financial derivative definitions, it is seen that the excess amount of GTN spending varies from a simulation to the other.

Therefore, to protect the company from FX fluctuations, STA Turkey should make additional contracts and the most proper derivative to use is options. Because, having a right to cancel the additional contract might be really useful for the company.

According to Figure 3.4, the required external USD is very volatile. For example 17.9% of the simulations' excess amount of GTN spending is more than $1,050,000. So, if call options for USDTRY is smaller than spot rate then company can use the right and protects itself from the instant rise of USDTRY rate. In the same figure, 82.1% of the simulations show that excess amount of GTN spending is lower than

$1,050,000. For these type of simulations, if put options for USDTRY is bigger than spot rate then company can use the right and sell USD with the agreed rate and protects itself from the instant fall of USDTRY rate. Options are easy to use since their costs are not much expensive for the company when compare STA Turkey's sales volume. Hedging decision for the company is out of the scope of the thesis and can be studied further by companies.

CHAPTER 4

CONCLUSION

The performance of STA Turkey is affected by many factors such as goods' costs and margins depending on the foreign currency rates, strategy calls and GTN spending during market activities. STA Turkey has financial risk exposures since they operate in Turkey and it has a volatile financial situation most of the time. Company tries to manage and averse this risk exposures by using simple forward contracts with fixed amounts and maturity dates. However, there is not any analytic work behind those strategies.

In this thesis, the impact of the FX rate on the goods and its fluctuations are discussed by using ARIMA series and finally the forecast rate of USDTRY is calculated. The GTN forecasting also studied for different type of orders by using Geometric Brownian Motion model in the light of forecasted USDTRY rate. Moreover, the simulations are made by using Monte Carlo Simulation and excess amount of gross to net spendings are calculated. Finally, it is seen that hedging this type of financial risk might be viewed in a different aspect.

In the beginning of the study, it is aimed to find out if companies assure their risk exposure and carry out the strategies to get through with it. When forecasting of the USDTRY rate and calculation of the GTN simulations are examined, it is seen that STA Turkey can actually set their financials based on analytic calculations instead of instruments with fixed amounts. Fixed transactions do not bring beneficial results all the time and it is a risky situation for the companies. So, STA Turkey must have a changeable strategy depending on the amounts and timeline when the company uses financial derivatives. It is realised that the risk exposures of STA Turkey or any similar

company that conducts it's business in FMCG sector, might be affected by FX market risk, deficient forecasting strategies, and wrong usage of financial instruments. After the calculations of the forecasted rate of FX in Chapter 2 and the excess amount of the GTN spending in Chapter 3, it is found that companies might use multiple financial instruments in order to prevent risk exposures. The simulations in Chapter 3 shows that the outcomes are really fluctuant and derivative instruments with fixed amount are not enough for healthy decisions. So, these type of companies might use option instruments in addition to current derivative contracts since it gives to companies a chance to decide about buy or sell the asset at the maturity time and contract charge for them is really small when comparing with their business volumes. It creates a financial back door in case of unfavourable outcomes.

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APPENDIX A

PRELIMINARIES

A.1 The Definition of the Time Series

According to Brockwell and Davis (2002), a set of observations x_t indexed in time order t is called as time series $\{X_t\}$. If those are equally spaced observations than the time series are called discrete time series [8].

A.1.1 Stationary

Some of the data in time series might be not changing over time. In this type of time series, data is assumed as stationary. A time series {Xt} is called stationary if the joint distribution of the data does not change over time.

A more common stationary type is weaker version of it which is defined as follows:

Definition 2.1. A time series is called as to be weakly stationary if

- E[X_t] = μ
- Cov(X_t,X_{t-1}) =γ

where μ is a constant and γ only depends on the lag length l.

Therefore, if a time series is defined as stationary than it is formulized as I(0) and if the first difference is needed to fulfill the requirements for the time series than it is formulized as I(1).

A.1.2 ARIMA Model

If the given time series does not contain the properties of the definition of stationary, then there is a change of the data generated to become with the desired properties.

If the given set of data requires the differencing to contain the properties of stationary, then ARIMA can be used.

It is the generated version of autoregressive moving average models (ARMA) and defined as follows:

ARIMA (p,1,q):

$$\Delta X_t = \phi_1 \Delta X_{t-1} + \phi_2 \Delta X_{t-2} + ... + \phi_p \Delta X_{t-p} + e_t - \theta_1 e_{t-1} - \theta_2 e_{t-2} - ... - \theta_q e_{t-q} \quad \text{(A.1)}$$

APPENDIX B

PORTFOLIO DATA

Since the data for all 144 products in the portfolio could not be indicated in Chapter 3, the cost distributions of the portfolio are given in Figures B.1 & B.2

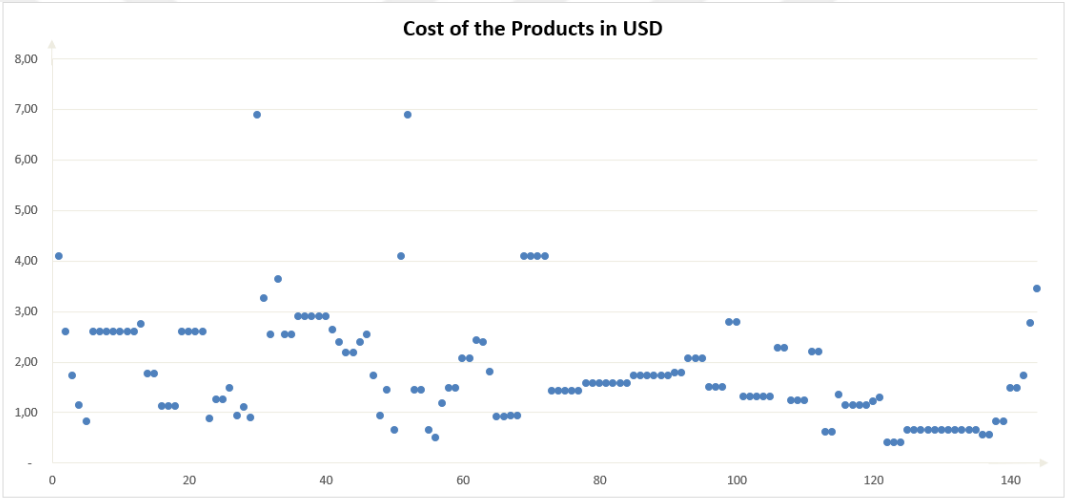

Figure B.1: The Cost of the Products in the Portfolio (USD)

Where X axis denotes id number of the products in the portfolio and Y axis denotes the cost of the products in the portfolio in USD.

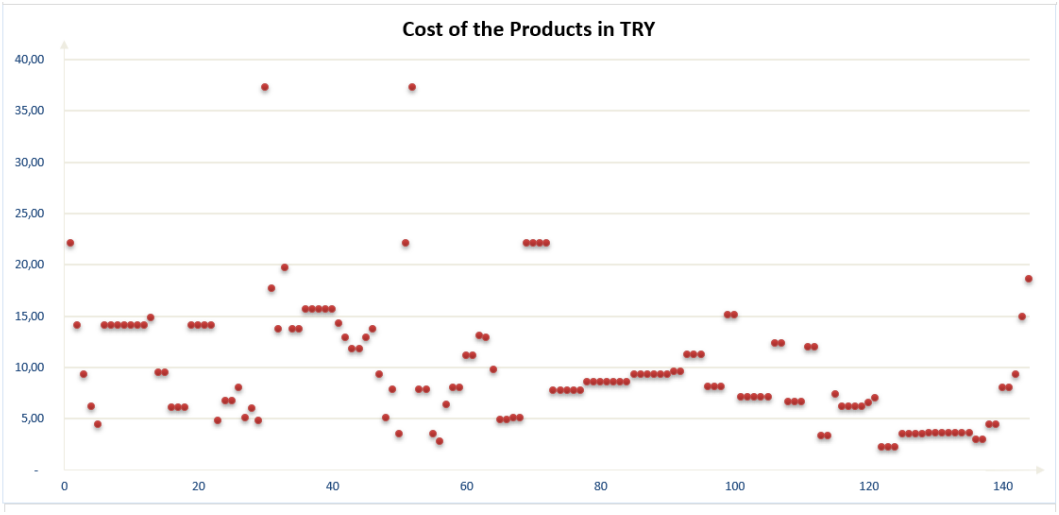

Figure B.2: The Cost of the Products in the Portfolio (TRY)

Where X axis denotes id number of the products in the portfolio and Y axis denotes the cost of the products in the portfolio in TRY.

From the equation 3.2, the contribution of all products are calculated and given in Figure B.3. Their summation gives the 1st estimated order for the study.

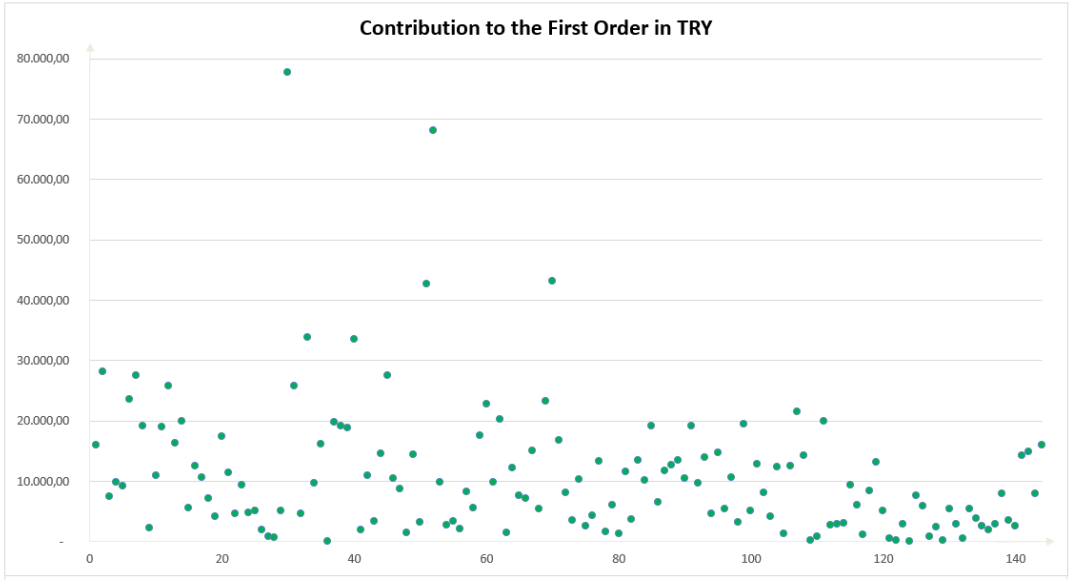

Figure B.3: The Contribution of the Products for the First Order (TRY)

Where X axis denotes id number of the products in the portfolio and Y axis denotes the contribution of the products to the first order in TRY.

APPENDIX C

ESTIMATING DRIFT AND VOLATILITY

The subjected data includes the gross sales and GTN spending for each day in Q1 and Q2 of 2018 and it is used for estimated drift $\hat{\mu}$ and volatility $\hat{\sigma}$.

Drift $\hat{\mu}$ and volatility $\hat{\sigma}$ are estimated from the log normal distributions of the historical sales data. The observations $\{r_1, r_2,..,r_n\}$ in equation 3.15 are assumed to be independent and showed in Figures C.1 and C.2.

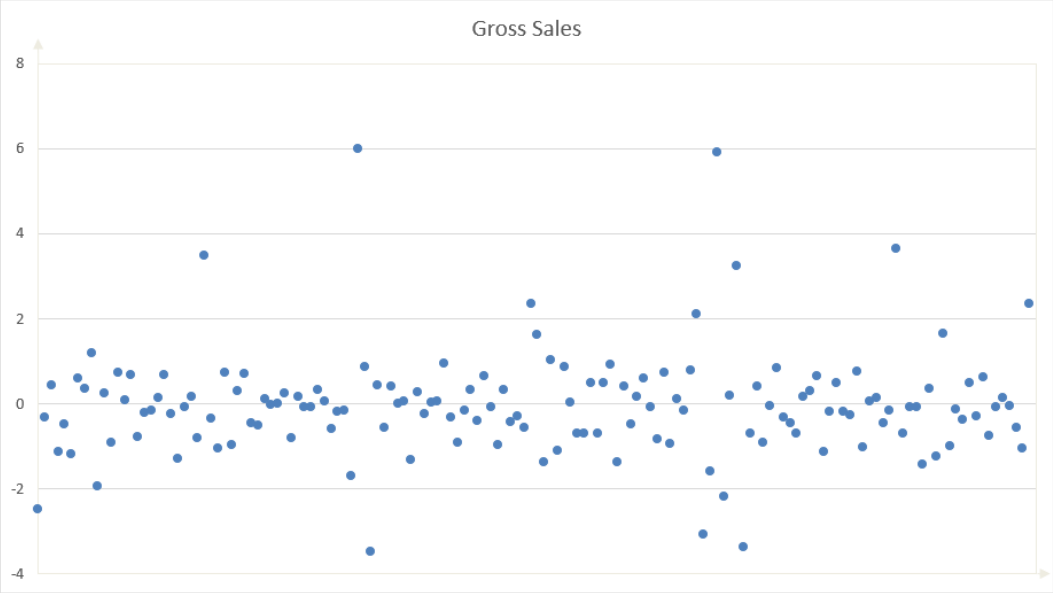

Figure C.1: Independent Observations r_i of Historical Gross Sales Data

Where X axis denotes number of observations and Y axis denotes r_i results of gross sales according to equation 3.15.

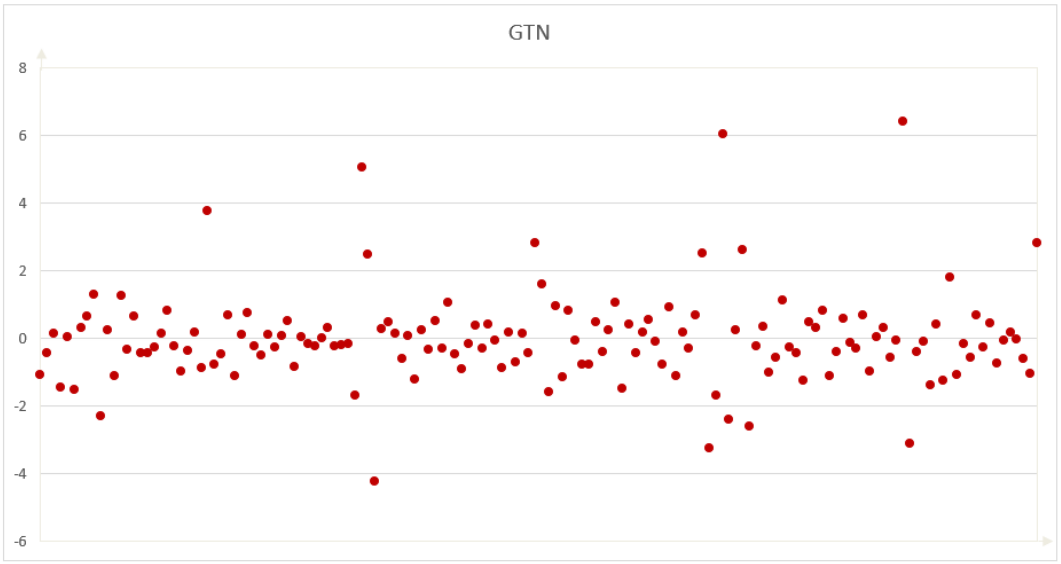

Figure C.2: Independent Observations r_i of Historical GTN Data

Where X axis denotes number of observations and Y axis denotes r_i results of GTN according to equation 3.15.