IMPROVING FORECAST ACCURACY BY USING TIME SERIES METHODS IN FMCG INDUSTRIAL

SORAWIT SANGPOTIRAT

A INDEPENDENT STUDY REPORT SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT
INTERNATIONAL COLLEGE
KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG
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INDENPENDENT STUDY TITLE	IMPROVING FORECAST ACCURACY BY USING TIME SERIES METHODS IN FMCG INDUSTRY
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ABSTRACT

Nowadays, people cannot deny that fast moving consumer goods or FMCG industry has very high demand and also high competition in the market, because of the fast movement of the production from supplier to customer. Thus, every company has to focus on every process and every role. In-order to satisfy the customer, planners have to take the important role to forecast on supply and demand in both long-term and short-term which aim to avoid a shortage situation and a surplus situation to occur in the company and the market. In both ways, they are the opportunity loss for the company and also affect the company's income. Thus, forecasting is the backbone of the company. Planners have to provide a very good forecasting on the production line and satisfying the market. This research examined the tools that provide the planner with a good forecast in the company situation. This result also provides the job guideline in the company to improve the supply chain process in the production line.

ACKNOWLEDGEMENT

Without the contribution of many people, this research would not have been existed. It owes the existence to the supports and inspirations from a lot of people.

To my advisor Dr.Vithaya suharitdamrong of International College at King Mongkut's Institute of Technology Ladkrabang, I would like to express my deepest gratitude for the encouragement and supervision through all obstacles and challenges since the beginning until the end of my study.

I also want to express my gratitude to all lecturers for your support and guidance to me for the whole two years. Also, I would like to thank all my friends who always be there to support and motivate me as always. Moreover, I also would love to express my gratitude to all respondents who contribute their information and time of this study. And I do believe the study could not be done without their input.

Finally, I must express my very greatest gratitude to my parents and all relatives for providing me with unfailing support and continuous motivation throughout my years of study. This accomplishment would not have been possible without them.

Sorawit Sangpotirat

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LIST OF SYMBOLS

M	Moving average at time t, which is the forecast value at time t+1
Y_t	Observation at time t
e_t	Forecast error
F_{t+1}	Forecast value for period t+1 made at time t
Y_t	Actual value in period t
F_t	Forecast value for period t made by t-1

LIST OF DEFINITIONS

FMCG	Fast Moving Consumer Goods
SFA	Sale Forecast Accuracy

CHAPTER 1

INTRODUCTION

1.1 Introduction

Fast Moving Consumer Goods (FMCG) business is challenging now a day. Those products that always sold out rapidly. Thus, the demands of this market always shift up and down as well. Many companies have to manage their stock very well in-order to satisfy their customer in the market.

The FMCG industry is volume driven and characterized by low margins. The products are branded and backed by marketing, heavy advertising, slick packaging and strong distribution networks. The FMCG segment can be classified under the premium segment and popular segment (McDonald, De Chernatony, & Harris, 2001). The premium segment caters mostly to the higher/upper middle class which is not as price sensitive apart from being brand conscious. The price sensitive popular or mass segment consists of consumers belonging mainly to the semi-urban or rural areas who are not particularly brand conscious. Products sold in the popular segment have considerably lower prices than their premium counterparts.

Fast Moving Consumer Goods (FMCG) typically include short-shelf life and perishable products such as fruit, vegetables, dairy product (milk, cheese, yogurt), baked goods (bread and cake), beer, soft drinks, newspapers, that sell high volume and often low margin (Nijssen, 1999). It may also include electronic products such as low-end (low cost, potentially disposable) mobile phones and digital cameras. FMCG are distinguished from durable goods and major appliances (refrigerators, freezers, range tops) with higher purchase cost and long usage life. At the outset, there are several challenges in forecasting FMCG products. Seasonality is a factor. Whiskey

sales are higher on Fridays and Saturdays in Bangkok to support weekend entertainment. They are also higher during summer months or long weekend such as Songkarn festival, New Year period, Christmas, etc. Fruits are only available at certain growing times of the year, unless imported from another hemisphere, and generally at premium prices. Some fruit, such as apples, is available year-round from cold storage, but at a higher price. This study indicates demand forecasting in FMCG business with using the statistic method.

1.2 Statement of the Problem

This study is chosen one of the alcohol industry, namely "FMCG". This is because alcohol industry has very high actual sell and demand in every month, especially weekends and holiday period. Therefore, forecasting has to be as accurate as possible in-order to satisfy our customers in the market. Thus, the company can know the accurate volume to be sold and can produce the products accordingly. This study creates a tool to calculate long term forecasting which aims to run the planning job smoothly.

1.3 Objective of the Study

The main objective is to be more accurate as much as possible in forecasting, in order to avoid a shortage situation when our forecast is lower than our actual sell or surplus situation when our forecast is more than our actual sell. Because in both ways, the company must pay the money (storage charge or opportunity, loss etc.) and that will affect their net income in the future.

1.4 Scope of the Study

This research focus on statistic formula that can calculate demand forecasting as accurate as possible. Planner tries to use three methods that company selected and applied to real FMCG supply and planning situation to provide them the better forecasting, which planners are going to compare every method with the old company's forecasting method. And department will come up with the result that which one can provide most accuracy performances.

Forecasting is a method or a technique for estimating future aspects of a business or the operation (Box, Jenkins, Reinsel, & Ljung, 2015). It is a method for translating past data or experience into estimates of the future. It is a tool, which helps the management in its attempts to cope with the uncertainty of the future. Forecasts are important for short-term and long-term decisions. Businesses may use forecast in several areas: technological forecast, economic forecast, demand forecast. There two broad categories of forecasting techniques: quantitative methods (objective approach) and qualitative methods (subjective approach). Quantitative forecasting methods are based on analysis of historical data and assume that past patterns in data can be used to forecast future data points. Qualitative forecasting techniques employ the judgment of experts in specified field to generate forecasts. They are based on educated guesses or opinions of experts in that area (Batyrshin & Sheremetov, 2007).

Time series modelling is a dynamic research area which has attracted attention of researcher community over last few decades. The main aim of time series modelling is to carefully collect and rigorously study the past observations of a time series to develop an appropriate model which describes the inherent structure of the series (Chatfield, 2016). This model is used to generate future values for the series, i.e. to make forecasts. Time series forecasting can be termed as the act of predicting

the future by understanding the past. Due to the indispensable importance of time series forecasting in numerous practical fields such as business, economics, finance, science and engineering, etc., proper care should be taken to fit an adequate model to the underlying time series. It is obvious that a successful time series forecasting depends on an appropriate model fitting. A lot of efforts have been done by researchers over many years for the development of efficient models to improve the forecasting accuracy. As a result, various important time series forecasting models have been evolved.

CHAPTER 2

LITERATURE REVIEW

2.1 A Time series

Time-series methods make forecasts based solely on historical patterns in the data. Time-series methods use time as independent variables to produce demand (Montgomery, Johnson, & Gardiner, 1990). In a time series, measurements are taken at successive points or over successive periods. The measurements may be taken every hour, day, week, month, or year, or at any other regular (or irregular) interval. A first step in using time-series approach is to gather historical data. The historical data is representative of the conditions expected in the future. Time-series models are adequate forecasting tools if demand has shown a consistent pattern in the past that is expected to recur in the future. Time series models are characterized of four components: trend component, cyclical component, seasonal component, and irregular component (Wei, 2006). The trend is important characteristics of time series models. Although time series may display trend, there might be data points lying above or below trend line. Any recurring sequence of points above and below the trend line that last for more than a year is considered to constitute the cyclical component of the time series, these observations in the time series deviate from the trend due to fluctuations (Franses & Van Dijk, 2000). The component of the time series that captures the variability in the data due to seasonal fluctuations is called the seasonal component (Lam, 1990). The seasonal component is similar to the cyclical component in that they both refer to some regular fluctuations in a time series. Seasonal components capture the regular pattern of variability in the time series

within one-year periods. Seasonal commodities are the best examples for seasonal components (Zhang, 2003). Random variations in time series are represented by the irregular component. The irregular component of the time series cannot be predicted in advance. The random variations in the time series are caused by short-term, unanticipated and nonrecurring factors that affect the time series (Nelson & Plosser, 1982).

Basic Concepts of Time Series Modelling is a sequential set of data points, measured typically over successive times (Montgomery et al., 1990). The measurements taken during an event in a time series are arranged in a proper chronological order. A time series containing records of a single variable is termed as univariate. But if records of more than one variable are considered, it is termed as multivariate. A time series can be continuous or discrete. In a continuous time series observations are measured at every instance of time, whereas a discrete time series contains observations measured at discrete points of time (Box et al., 2015). For example, actual sell in the future, demand in the future can be recorded as a continuous time series. On the other hand, population of a particular city, production of a company, exchange rates between two different currencies may represent discrete time series. Usually in a discrete time series the consecutive observations are recorded at equally spaced time intervals such as hourly, daily, weekly, monthly or yearly time separations. The variable being observed in a discrete time series is assumed to be measured as a continuous variable using the real number scale. Furthermore, a continuous time series can be easily transformed to a discrete one by merging data together over a specified time interval (Fuller, 2009).

2.2 Components of Time series

A time series in general is supposed to be affected by four main components, which can be separated from the observed data (Wei, 2006). These components are: Trend, Cyclical, Seasonal and Irregular components. A brief description of these four components is given here. The general tendency of a time series to increase, decrease or stagnate over a long period of time is termed as Secular Trend or simply Trend. Thus, it can be said that trend is a long-term movement in a time series (Brockwell & Davis, 2013). For example, series relating to demand growth, number of customers in the market etc. shows an upward trend, whereas downward trend can be observed in series relating to mortality rates, epidemics, etc. seasonal variations in a time series are fluctuations within a year during the season. The important factors causing seasonal variations are climate and weather conditions, customs, traditional habits, etc. For example, sales of alcoholic beverage increase in Songkarn festival, Chinese New Year, Christmas etc. Seasonal variation is an important factor for businessmen, shopkeeper and producers for making proper future plans (Zhang & Qi, 2005). The cyclical variation in a time series describes the medium-term changes in the series, caused by circumstances, which repeat in cycles. The duration of a cycle extends over a longer period of time, usually two or more years (Barsky & Miron, 1989). Most of the economic and financial time series show some kind of cyclical variation. These variations are caused by incidences such as war, strike, earthquake, flood, revolution, etc. There is no defined statistical technique for measuring random fluctuations in a time series (Demetriades & Hussein, 1996).

This study considered and selected three methods in a time series such as: Moving Averages, Forecasting using exponential smoothing and Regression. These three methods used to calculate the forecasting demand in the future.

2.3 Moving Average Overview

Moving averages are developed based on an average of weighted observations, which tends to smooth out short-term irregularity in the data series. They are useful if the data series remains steady over time (Holt, 2004).

Notations

$M \equiv \hat{Y}_{T+1}$ = Moving average at time t, which is the forecast value at time t+1

Y_t = Observation at time t

$e_t = Y_t - \hat{Y}_t$ = Forecast error

A moving average is obtained by calculating the mean for a specified set of values and then using it to forecast the next period. That is,

$$M_t = (Y_t + Y_{t-1} + \cdots + Y_{t-n+1})/n$$

$$M_{t-1} = (Y_{t-1} + Y_{t-2} + \cdots + Y_{t-n})/n$$

Subtracting Equation from Equation,

$$M_t = M_{t-1} + (Y_t + Y_{t-n})/n$$

Equation allows us to update the data, making the forecasting process much easier. This equation states that the moving average can be updated by using a previous moving average plus the average changes in the actual value from time t to t-n (Nahmias & Cheng, 2009).

2.4 Exponential Smoothing Overview

Exponential smoothing is a familiar feature of forecasting modules in business, economic and finance. While the broad heading of exponential smoothing covers a range of methods including some recent developments, the long-established approaches of single exponential smoothing and Holt's linear methods still occupy

central positions within this area of analysis (Chen, Ryan, & Simchi- Levi, 2000). In this case study it is argued that given the algebraic nature of these approaches, their demonstration via application to relevant series is vital to engage students and allow the development of a mastery of these methods. Consequently, topical applications are presented herein to allow the nature, structure and relevance of the methods to be demonstrated.

To illustrate the various important issues associated with the smoothing methods considered (the structure of the relevant component equations, the selection of smoothing parameter values initialization of the methods, the generation of forecasts),

Simple exponential smoothing takes the form of:

$$F_{t+1} = \alpha Y_1 + (1-\alpha)F_t$$

$$\widehat{Y}_{T+1} = \alpha Y_1 + (1-\alpha)\widehat{Y}_T$$

Notation

F_{t+1} = Forecast value for period t+1 made at time t

Y_t = Actual value in period t

F_t = Forecast value for period t made by t-1

α = Smoothing constant (0< α<1)

There are two points need to define before determined to make the forecasts. First, the planner needs to decide the initial value Y. A convenient way to accomplish this is to utilize the value of the initial data point or the average value of the first few observations of the data series. Second, the planner must determine the value of α (best used in forecasting is 0.6).

2.5 Regression Overview

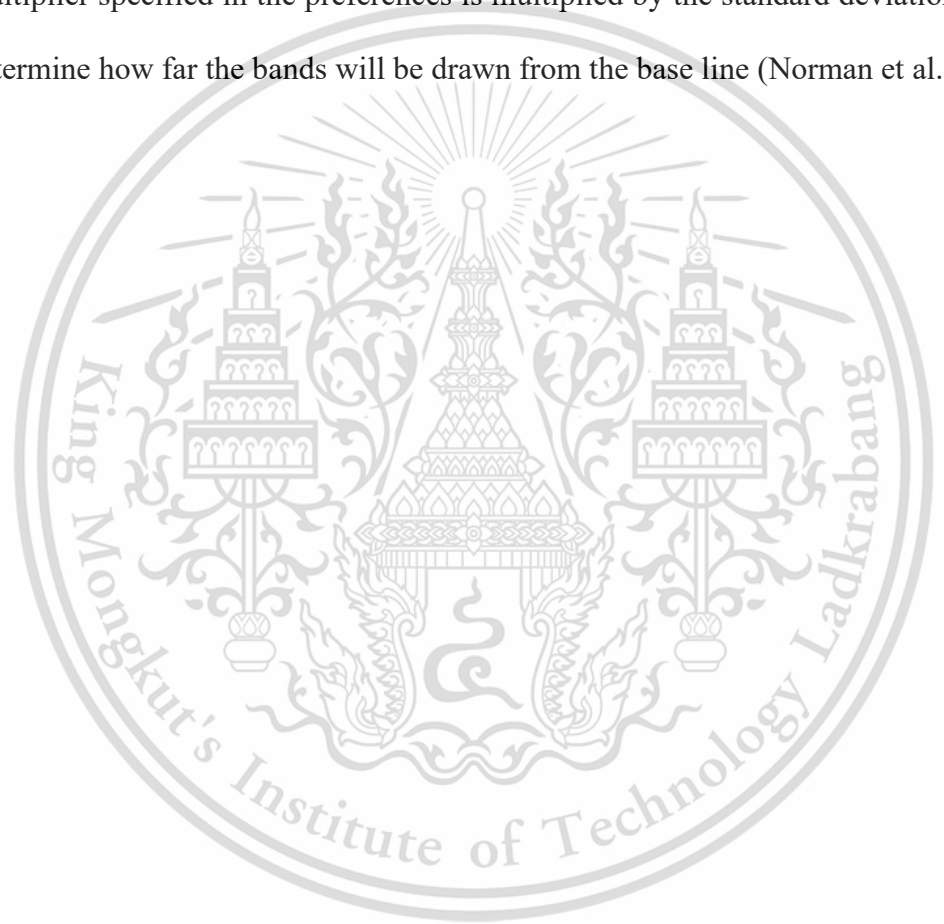
Regression is used for forecasting by establishing a mathematical relationship between two or more variables. This study interested in identifying relationships between variables and demand. If the models shows that something has caused demand to behave in a certain way in the past, planner can identify that relationship so if the same thing happens again in the future, planner can predict what the demand will be (Harrell, 2001).

The Linear Regression Forecast indicator performs regression analysis on optionally smoothed price data, forecasts the regression lines if desired, and creates standard deviation bands above and below the regression line (Ng, Skitmore, & Wong, 2008). First, the data based on the price is smoothing using the moving average period and type. If you prefer no smoothing, choose a period of 1. The resulting data is used to form regression lines ending at each bar, using the regression period specified. The values at each bar can optionally be forecasted values, determined by projecting the regression lines X bars into the future, X is the forecast period. If X=0, then no forecasting will occur. Standard deviation bands can be drawn above and below the regression line, based on a number of standard deviations (standard deviation multiple) specified, and a standard deviation value computed using data in the regression period range (Norman et al., 2003).

The name of this indicator understates its capabilities. In its most basic form, with no smoothing (period of 1) and no forecasting (forecast period of 0), LRF simply gives the ending point of linear regression lines ending at each bar using the regression period provided. These settings produce a moving average identical to the *Least Squares* moving average type available in investor (Wong et al., 2008).

A smoothing period causes the data to be pre-smoothed prior to performing regression analysis or forecasting (Fu, 2008). A forecast period takes the linear regression line ending at each point, and projects it forward X number of bars, X being the forecast period. This projected value is used as the LRF value for that bar.

The bands that are drawn, use a standard deviation that changes over time. The standard deviations are computed for the Linear Regression. The standard deviation multiplier specified in the preferences is multiplied by the standard deviation value to determine how far the bands will be drawn from the base line (Norman et al., 2003).



CHAPTER 3

METHODOLOGY

In this chapter planner team used three statistic methods (moving average, exponential smoothing and regression) to calculate the future forecast of each SKU (about 100 SKUs) and they selected top 10 SKU that have the highest actual sell each month to calculate the forecast accuracy for that month. Thus, team can see which methods have higher forecast accuracy (Holt, 2004).

According to **Figure 3.1** demonstrate forecasting report that company uses in FMCG (alcohol business).

APO Code	Description	Actual' 17 5	Actual' 17 6	Actual' 17 7	Actual' 17 8	Actual' 17 9	forecast' 17 10	forecast' 17 11	forecast' 17 12	CY 17
1066571	Moet & Chandon Impri MN 24X01 200	27	33	27	15	30	32	34	35	343
1057482	Moet & Chandon Brut Impri 12X01 375	12	4	10	2	2	9	8	8	90
1057410	Moet & Chandon Brut Impri 06X01 750	21	62	84	96	166	78	89	100	1,189
1057364	Moet & Chandon Brut ImpriNB 06X01 750	70	46	58	50	47	72	73	74	813
1063554	Moet & Chandon Ice Imperi 06X01 750	5	6	2	9	15	4	5	5	75
1059115	Moet & Chandon Brut Impri 03X01 1.5 NV	14	2	6	7	14	8	8	9	123
1041394	Moet & Chandon Brut Rose GB 06x01 750 NV	3	2	8	2	2	5	6	6	61
1041393	Moet & Chandon Brut Rose TD 06x01 750 NV	11	17	19	23	23	26	26	26	313
1065128	Dom Perignon GB 06X01 750 06	5	6	3	9	16	1	3	5	90
1026523	Krug Cuvee Champagne NA 06x01 750 NV	3	1	2	1	1	2	2	2	19
1037296	Veuve Clicquot Champagne NA 12x01 375 NV	3	7	7	2	2	4	4	4	44
1042468	Veuve Clicquot Champagne Gl 06x01 750 NV	1	2	5	2	2	5	6	6	48
1029131	Veuve Clicquot Champagne NB 06X01 750	28	18	40	36	41	5	12	18	384
1038786	Veuve Clicquot Champagne NA 03x01 1.5 NV	4	1	1	2	9	3	4	4	39
1042498	Veuve Clicquot Rose WB 06X01 750	8	4	4	6	5	7	7	7	71
1072805	Terrazas Rsrv Cab Sauv 06X01 750 14	1	7	14	19	8	9	9	9	159
1074594	Terrazas Rsrv Malbec 06X01 750 15	17	14	11	18	20	27	27	27	323
1068396	Terrazas Alto Malbec 06X01 750 14	21	24	89	29	25	18	19	20	301
1070866	Terrazas Alto Chard 06X01 750 15	76	74	79	82	68	39	41	42	868
1068397	Terrazas Alto Cab Sauv 06X01 750 14	120	150	157	145	155	74	83	92	1,673
NZ	Cloudy Bay Chardonnay 12X01 750 13	3	2	6	3	5	4	4	4	71
NZ	Cloudy Bay Sauvignon Blnc 12X01 750 15	7	7	14	14	23	20	20	20	252
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	53	52	64	79	88	97	96	95	1,041
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	120	119	115	124	130	92	92	92	1,463
AUS	Georgiana Sauvignon Blan 06X01 750 16	17	7	2	5	4	15	17	18	171
AUS	Marmaduke Shiraz 06X01 750 15	9	6	7	6	28	10	12	14	136
AUS	Chandon Brut ND 06X01 750 15	170	217	559	475	509	337	365	392	5,062
1075797	Chandon Brut SM 06X01 750 17	120	134	144	127	138	229	224	219	2,093
AUS	Chandon Brut Rose ND 06X01 750 15	105	110	226	149	142	142	152	161	1,942
AUS	Domaine Chandon Shiraz 06X01 750 14	12	10	9	17	20	28	28	27	265

Figure 3.1: Forecasting report for every SKU's alcoholic beverage

According to **Figure 3.1:** Forecasting report for every SKU's alcoholic beverage, this is the report that shows and records actual sell and forecast in for the whole year. And shows for all of the SKUs that demand planner have been handled in the company. But in this research, the report showed some band (wine, sparkling wine, etc.), which are only 53 SKUs. There are green zone and white zone. Green

zone is the actual sell for previous month, so planner can keep record and forecast depend on the history of actual sell. White zone is forecasting that planner input for 12 months period.

C	S	T	U	V	W	X	Y
	Actual' 17	Actual' 17	Actual' 17	Actual' 17	Actual' 17	Actual' 17	Actual' 17
Description	3	4	5	6	7	8	9
Moet & Chandon Imprl MN 24X01 200	26	23	27	33	27	15	30
Moet & Chandon Brut Imprl 12X01 375	6	8	12	4	10	2	2
Moet & Chandon Brut Imprl 06X01 750	125	174	21	62	84	96	166
Moet & Chandon Brut ImprlNB 06X01 750	96	68	70	46	58	50	47
Moet & Chandon Ice Imperi 06X01 750	7	8	5	6	2	9	15
Moet & Chandon Brut Imprl 03X01 1.5 NV	10	18	14	2	6	7	14
Moet & Chandon Brut Rose GB 06x01 750 NV	6	4	3	2	8	2	2
Moet & Chandon Brut Rose TD 06x01 750 NV	33	26	11	17	19	23	23
Dom Perignon GB 06X01 750 06	19	2	5	6	3	9	16
Krug Cuvee Champagne NA 06x01 750 NV	1	3	3	1	2	1	1
Veuve Clicquot Champagne NA 12x01 375 NV	3	6	3	7	7	2	2
Veuve Clicquot Champagne GI 06x01 750 NV	2	5	1	2	5	2	2
Veuve Clicquot Champagne NB 06X01 750	50	49	28	18	40	36	41
Veuve Clicquot Champagne NA 03x01 1.5 NV	2	4	4	1	1	2	9
Veuve Clicquot Rose WB 06X01 750	5	7	8	4	4	6	5

Figure 3.2: Actual sale for each month

This figure shows the example of actual sell for wine group. Planner collected every month's actual sell previously. Therefore, planner can use this information to determine the forecast for this month. They can see the trend in the past.

		forecast' 17	forecast' 17	forecast' 17		Forecast' 18	Forecast' 18	Forecast' 18	Forecast' 18	
APO Code	Description	10	11	12	CY 17	1	2	3	4	CY 18
1066571	Moet & Chandon Imprl MN 24X01 200	19	21	22	304	19	21	22	23	85
1057482	Moet & Chandon Brut Imprl 12X01 375	9	8	8	90	9	8	8	8	33
1057410	Moet & Chandon Brut Imprl 06X01 750	78	89	100	1,189	78	89	100	111	378
1057364	Moet & Chandon Brut ImprlNB 06X01 750	72	73	74	813	72	73	74	75	294
1063554	Moet & Chandon Ice Imperi 06X01 750	4	5	5	75	4	5	5	5	19
1059115	Moet & Chandon Brut Imprl 03X01 1.5 NV	8	8	9	123	8	8	9	9	34
1041394	Moet & Chandon Brut Rose GB 06x01 750 NV	5	6	6	61	5	6	6	7	24
1041393	Moet & Chandon Brut Rose TD 06x01 750 NV	26	26	26	313	26	26	26	27	105
1065128	Dom Perignon GB 06X01 750 06	1	3	5	90	1	3	5	7	16
1026523	Krug Cuvee Champagne NA 06x01 750 NV	2	2	2	19	2	2	2	2	8
1037296	Veuve Clicquot Champagne NA 12x01 375 NV	4	4	4	44	4	4	4	4	16
1042468	Veuve Clicquot Champagne GI 06x01 750 NV	5	6	6	48	5	6	6	6	23
1029131	Veuve Clicquot Champagne NB 06X01 750	5	12	18	384	5	12	18	24	59
1038786	Veuve Clicquot Champagne NA 03x01 1.5 NV	3	4	4	39	3	4	4	5	16
1042498	Veuve Clicquot Rose WB 06X01 750	7	7	7	71	7	7	7	7	28
1072805	Terrazas Rsrv Cab Sauv 06X01 750 14	9	9	9	159	9	9	9	8	35
1074594	Terrazas Rsrv Malbec 06X01 750 15	27	27	27	323	27	27	27	27	108
1068396	Terrazas Alto Malbec 06X01 750 14	18	19	20	301	18	19	20	22	79
1070866	Terrazas Alto Chard 06X01 750 15	39	41	42	868	39	41	42	44	166
1068397	Terrazas Alto Cab Sauv 06X01 750 14	74	83	92	1,673	74	83	92	100	349
NZ	Cloudy Bay Chardonnay 12X01 750 13	4	4	4	71	4	4	4	4	16

Figure 3.3: Forecasting for each month

Every month planner had the meeting with sale team and marketing team to discuss about the situation and future promotion. Therefore, planner used the history actual sell and those factors to fill in the forecast in the white zone. Once the planner gets the final number that will plan to start the product line accordingly.

Planner used this report to fill in forecasting in 12 months periods. After planner got actual sell for the previous month, they will replace the forecast in that month. Thus, the team can keep recording the actual sell and can determine the forecast accuracy in that month. For this research planner used those methods to calculate forecast from October 2017 to April 2018 and keep track the forecast accuracy for each month (which this research is shown how to measure the forecast accuracy on the next chapter).

				forecast' 17	forecast' 17	forecast' 17		Forecast' 18	Forecast' 18	Forecast' 18	Forecast' 18	
	Brand	APO Code	Description	10	11	12	CY 17	1	2	3	4	CY 18
3	Moet & Chandon	1066571	Moet & Chandon Imprl MN 24X01 200	19	21	22	304	19	21	22	23	85
4	Moet & Chandon	1057482	Moet & Chandon Brut Imprl 12X01 375	9	8	8	90	9	8	8	8	33
5	Moet & Chandon	1057410	Moet & Chandon Brut Imprl 06X01 750	78	89	100	1,189	78	89	100	111	378
6	Moet & Chandon	1057364	Moet & Chandon Brut ImprlNB 06X01 750	72	73	74	813	72	73	74	75	294
7	Moet & Chandon	1063554	Moet & Chandon Ice Imperi 06X01 750	4	5	5	75	4	5	5	5	19
8	Moet & Chandon	1059115	Moet & Chandon Brut Imprl 03X01 1.5 NV	8	8	9	123	8	8	9	9	34
9	Moet & Chandon	1041394	Moet & Chandon Brut Rose GB 06x01 750 NV	5	6	6	61	5	6	6	7	24
10	Moet & Chandon	1041393	Moet & Chandon Brut Rose TD 06x01 750 NV	26	26	26	313	26	26	26	27	105
11	Dom Perignon	1065128	Dom Perignon GB 06X01 750 06	1	3	5	90	1	3	5	7	16
12	Krug	1026523	Krug Cuvee Champagne NA 06x01 750 NV	2	2	2	19	2	2	2	2	8
13	Veuve Clicquot	1037296	Veuve Clicquot Champagne NA 12x01 375 NV	4	4	4	44	4	4	4	4	16
14	Veuve Clicquot	1042468	Veuve Clicquot Champagne GI 06x01 750 NV	5	6	6	48	5	6	6	6	23
15	Veuve Clicquot	1029131	Veuve Clicquot Champagne NB 06X01 750	5	12	18	384	5	12	18	24	59
16	Veuve Clicquot	1038786	Veuve Clicquot Champagne NA 03x01 1.5 NV	3	4	4	39	3	4	4	5	16
17	Veuve Clicquot	1042498	Veuve Clicquot Rose WB 06X01 750	7	7	7	71	7	7	7	7	28
18	Terrazas	1072805	Terrazas Rsrv Cab Sauv 06X01 750 14	9	9	9	159	9	9	9	8	35
19	Terrazas	1074594	Terrazas Rsrv Malbec 06X01 750 15	27	27	27	323	27	27	27	27	108
20	Terrazas	1068396	Terrazas Alto Malbec 06X01 750 14	18	19	20	301	18	19	20	22	79
21	Terrazas	1070866	Terrazas Alto Chard 06X01 750 15	39	41	42	868	39	41	42	44	166
22	Terrazas	1068397	Terrazas Alto Cab Sauv 06X01 750 14	74	83	92	1,673	74	83	92	100	349
23	Cloudy Bay	NZ	Cloudy Bay Chardonnay 12X01 750 13	4	4	4	71	4	4	4	4	16
24	Cloudy Bay	NZ	Cloudy Bay Sauvignon Blnc 12X01 750 15	20	20	20	252	20	20	20	21	81
25	Cape Mentelle	AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	97	96	95	1,041	97	96	95	93	381
26	Cape Mentelle	AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	92	92	92	1,463	92	92	92	92	368
27	Cape Mentelle	AUS	Georgiana Sauvignon Blan 06X01 750 16	15	17	18	171	15	17	18	20	70
28	Cape Mentelle	AUS	Marmaduke Shiraz 06X01 750 15	10	12	14	136	10	12	14	15	51
29	Chandon	AUS	Chandon Brut ND 06X01 750 15	337	365	392	5,062	337	365	392	420	1,514
30	Chandon	1075797	Chandon Brut SM 06X01 750 17	229	224	219	2,093	229	224	219	214	886
31	Chandon	AUS	Chandon Brut Rose ND 06X01 750 15	142	152	161	1,942	142	152	161	170	625
32	Green Point	AUS	Domaine Chandon Shiraz 06X01 750 14	28	28	27	265	28	28	27	27	110
33	Green Point	AUS	Domaine Chandon Chard 06X01 750 14	29	29	29	350	29	29	29	29	116
34	Green Point	AUS	Domaine Chandon Pinot Noi 06X01 750	19	19	19	199	19	19	19	18	75
35	Hennessy VS	1062248	Hennessy Vs 20cl 24X01	27	24	22	214	27	24	22	20	93
36	Hennessy VS	1060349	Hennessy Vs 70cl 06X01 GB	117	133	149	2,124	117	133	149	166	565
37	Hennessy VS	1067962	Hennessy Vs 70cl 06X01 Naked	222	222	222	2,873	222	222	222	222	888
38	Hennessy VSOP	1057023	Hennessy Vsop 20cl 24X01 NEW2012	20	20	19	216	20	20	19	18	77
39	Hennessy VSOP	1055628	Hennessy Vsop 70cl 12X01 NEW 2012	275	302	329	4,319	275	302	329	356	1,262
40	Hennessy VSOP	1055628	Hennessy Vsop 70cl 06X01 F12 P6	27	28	30	270	27	28	30	31	116
41	Hennessy XO	1055259	Hennessy Xo 70cl 12X01 F12	20	22	24	304	20	22	24	26	92
42	Beveldere	1052556	Belvedere Vodka 20cl 12X01 W/CAP	6	6	6	83	6	6	6	6	24
43	Beveldere	1059710	Belvedere Vodka 70cl 06X01 F13	80	85	90	1,646	80	85	90	95	350
44	Beveldere	1062924	Belvedere Vodka 1.75L 06X01	33	34	34	578	33	34	34	34	135
45	Beveldere	1052734	Belvedere Vodka 3L 01X01	9	9	9	153	9	9	9	9	36
46	Beveldere	1065108	Belvedere Vodka 6L 01X01 ILUMPOU	24	23	23	197	24	23	23	22	92
47	Beveldere	1030174	Belvedere Vodka 75cl 06X01	25	27	29	423	25	27	29	31	112
48	Glenmorngie	1071061	Glnmorngie 70cl 06X01 NEWLABEL	46	43	41	518	46	43	41	39	169
49	Glenmorngie	1061913	Glnmorngie Lasa 70cl 06X01 LASANTA	3	3	4	62	3	3	4	4	14
50	Glenmorngie	1061904	Glnmorngie QuRn 70cl 06X01 QNRUBAN	3	3	3	44	3	3	3	4	13
51	Glenmorngie	1061903	Glnmorngie 70cl 06X01 NECTAR	1	1	2	25	1	1	2	2	6
52	Glenmorngie	1042783	Glnmorngie 70cl 18Y 06X01 F14	1	1	1	15	1	1	1	1	4
53	Ardbeg	1040626	Ardbeg 10Yo 70cl 06X01 New	2	2	3	48	2	2	3	3	10

Figure 3.4: Forecasting for every SKU shows in each month

3.1 Moving Average Forecasting

Second, the research will start with a moving average.

A moving average of order k, MA(k) is the value of k consecutive observations.

$$M_t = (Y_t + Y_{t-1} + \cdots + Y_{t-n+1})/n$$

N is the number of terms in the moving average.

The moving average model does not handle trend or seasonality, very well, although it can do better than the total mean.

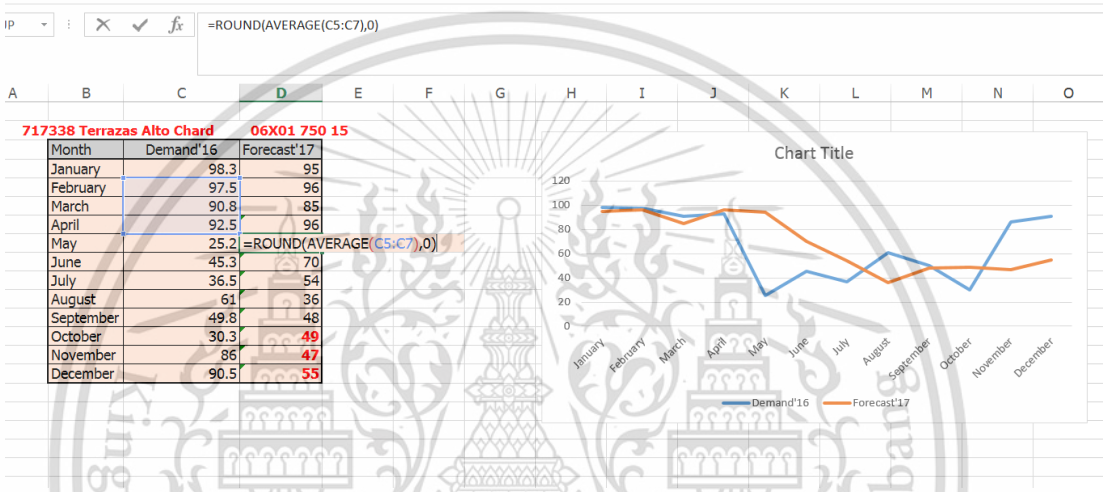
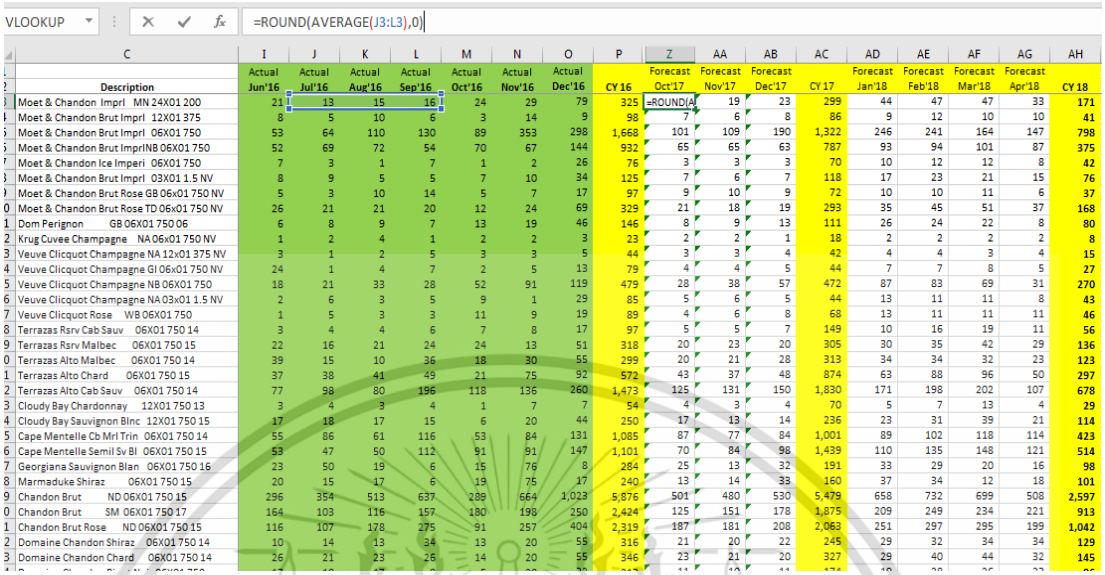


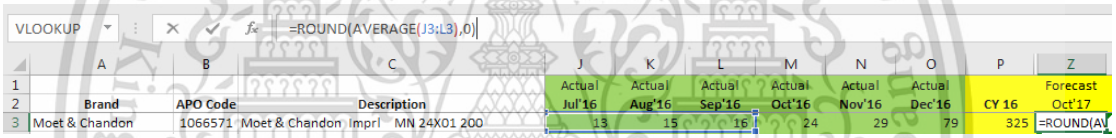
Figure 3.5: Example for one SKU applied by moving average formula

And then planner will apply this moving average's formula to every SKU that they handle. Thus, planner can get the forecasting for all of SKU from October 2017 to April 2018 by using this method.



Description	Actual Jun'16	Actual Jul'16	Actual Aug'16	Actual Sep'16	Actual Oct'16	Actual Nov'16	Actual Dec'16	CY 16	Forecast Oct'17	Forecast Nov'17	Forecast Dec'17	CY 17	Forecast Jan'18	Forecast Feb'18	Forecast Mar'18	Forecast Apr'18	CY 18
Moet & Chandon Imprl MN 24X01 200	21	13	15	16	24	29	79	325	=ROUND(A	19	23	299	44	47	47	33	171
Moet & Chandon Brut Imprl 12X01 375	8	5	10	6	3	14	9	98	7	6	8	86	9	12	10	10	41
Moet & Chandon Brut Imprl 06X01 750	53	64	110	130	89	353	298	1,668	101	109	190	1,322	246	241	164	147	798
Moet & Chandon Brut ImprlNB 06X01 750	52	69	72	54	70	67	144	932	65	65	63	787	93	94	101	87	375
Moet & Chandon Ice Imperi 06X01 750	7	3	1	7	1	2	26	76	3	3	3	70	10	12	12	8	42
Moet & Chandon Brut Imprl 03X01 1.5 NV	8	9	5	5	7	10	34	125	7	6	7	118	17	23	21	15	76
Moet & Chandon Brut Rose GB 06x01 750 NV	5	3	10	14	5	7	17	97	9	10	9	72	10	10	11	6	37
Moet & Chandon Brut Rose TD 06x01 750 NV	26	21	21	20	12	24	69	329	21	18	19	293	35	45	51	37	168
Dom Perignon GB 06X01 750 06	6	8	9	7	13	19	46	146	8	9	13	111	26	24	22	8	80
Krug Cuvee Champagne NA 06x01 750 NV	1	2	4	1	2	2	3	23	2	2	1	18	2	2	2	2	8
Veuve Clicquot Champagne NA 12x01 375 NV	3	1	2	5	3	3	5	44	3	3	4	42	4	4	3	4	15
Veuve Clicquot Champagne GI 06x01 750 NV	24	1	4	7	2	5	13	79	4	4	5	44	7	7	8	5	27
Veuve Clicquot Champagne NB 06X01 750	18	21	33	28	52	91	119	479	28	38	57	472	87	83	69	31	270
Veuve Clicquot Champagne NA 03x01 1.5 NV	2	6	3	5	9	1	29	85	5	6	5	44	13	11	11	8	43
Veuve Clicquot Rose WB 06X01 750	1	5	3	3	11	9	19	89	4	6	8	68	13	11	11	11	46
Terrazas Rsrv Cab Sauv 06X01 750 14	3	4	4	6	7	8	17	97	5	5	7	149	10	16	19	11	56
Terrazas Rsrv Malbec 06X01 750 15	22	16	21	24	24	13	51	318	20	23	20	305	30	35	42	29	136
Terrazas Alto Malbec 06X01 750 14	39	15	10	36	18	30	55	299	20	21	28	313	34	34	32	23	123
Terrazas Alto Chard 06X01 750 15	37	38	41	49	21	75	92	572	43	37	48	874	63	88	96	50	297
Terrazas Alto Cab Sauv 06X01 750 14	77	98	80	196	118	136	260	1,473	125	131	150	1,830	171	198	202	107	678
Cloudy Bay Chardonnay 12X01 750 13	3	4	3	4	1	7	7	54	4	3	4	70	5	7	13	4	29
Cloudy Bay Sauvignon Blnc 12X01 750 15	17	18	17	15	6	20	44	250	17	13	14	236	23	31	39	21	114
Cape Mentelle Cb Mrl Trin 06X01 750 14	55	86	61	116	53	84	131	1,085	87	77	84	1,001	89	102	118	114	423
Cape Mentelle Semil Sv Bl 06X01 750 15	53	47	50	112	91	91	147	1,101	70	84	98	1,439	110	135	148	121	514
Georgiana Sauvignon Blan 06X01 750 16	23	50	19	6	15	76	8	284	25	13	32	191	33	29	20	16	98
Marmaduke Shiraz 06X01 750 15	20	15	17	6	19	75	17	240	13	14	33	160	37	34	12	18	101
Chandon Brut ND 06X01 750 15	296	354	513	637	289	664	1,023	5,876	501	480	530	5,479	658	732	699	508	2,597
Chandon Brut SM 06X01 750 17	164	103	116	157	180	198	250	2,424	125	151	178	1,875	209	249	234	221	913
Chandon Brut Rose ND 06X01 750 15	116	107	178	275	91	257	404	2,319	187	181	208	2,063	251	297	295	199	1,042
Domaine Chandon Shiraz 06X01 750 14	10	14	13	34	13	20	55	316	21	20	22	245	29	32	34	34	129
Domaine Chandon Chard 06X01 750 14	26	21	23	26	14	20	55	346	23	21	20	327	29	40	44	32	145

Figure 3.6: Example for moving average applied to every SKU



Brand	APO Code	Description	Actual Jul'16	Actual Aug'16	Actual Sep'16	Actual Oct'16	Actual Nov'16	Actual Dec'16	CY 16	Forecast Oct'17
Moet & Chandon	1066571	Moet & Chandon Imprl MN 24X01 200	13	15	16	24	29	79	325	=ROUND(AV

Figure 3.7: Apply moving average function in excel

According to **Figure 3.6**: Example for Moving Average applied to every SKUs. By using a moving average function in excel, planner selected three months (N=3) previously from historical data. According to the **Figure 3.7**, planner uses data from July 2016 - September 2016 to calculate forecast of October 2017.

	Description	Forecast Oct'17	Forecast Nov'17	Forecast Dec'17	CY 17	Forecast Jan'18	Forecast Feb'18	Forecast Mar'18	Forecast Apr'18	CY 18
3	Moet & Chandon Imprl MN 24X01 200	15	19	23	299	44	47	47	33	171
4	Moet & Chandon Brut Imprl 12X01 375	7	6	8	86	9	12	10	10	41
5	Moet & Chandon Brut Imprl 06X01 750	101	109	190	1,322	246	241	164	147	798
6	Moet & Chandon Brut ImprINB 06X01 750	65	65	63	787	93	94	101	87	375
7	Moet & Chandon Ice Imperi 06X01 750	3	3	3	70	10	12	12	8	42
8	Moet & Chandon Brut Imprl 03X01 1.5 NV	7	6	7	118	17	23	21	15	76
9	Moet & Chandon Brut Rose GB 06x01 750 NV	9	10	9	72	10	10	11	6	37
10	Moet & Chandon Brut Rose TD 06x01 750 NV	21	18	19	293	35	45	51	37	168
11	Dom Perignon GB 06X01 750 06	8	9	13	111	26	24	22	8	80
12	Krug Cuvee Champagne NA 06x01 750 NV	2	2	1	18	2	2	2	2	8
13	Veuve Clicquot Champagne NA 12x01 375 NV	3	3	4	42	4	4	3	4	15
14	Veuve Clicquot Champagne GI 06x01 750 NV	4	4	5	44	7	7	8	5	27
15	Veuve Clicquot Champagne NB 06X01 750	28	38	57	472	87	83	69	31	270
16	Veuve Clicquot Champagne NA 03x01 1.5 NV	5	6	5	44	13	11	11	8	43
17	Veuve Clicquot Rose WB 06X01 750	4	6	8	68	13	11	11	11	46
18	Terrazas Rsrv Cab Sauv 06X01 750 14	5	5	7	149	10	16	19	11	56
19	Terrazas Rsrv Malbec 06X01 750 15	20	23	20	305	30	35	42	29	136
20	Terrazas Alto Malbec 06X01 750 14	20	21	28	313	34	34	32	23	123
21	Terrazas Alto Chard 06X01 750 15	43	37	48	874	63	88	96	50	297
22	Terrazas Alto Cab Sauv 06X01 750 14	125	131	150	1,830	171	198	202	107	678
23	Cloudy Bay Chardonnay 12X01 750 13	4	3	4	70	5	7	13	4	29
24	Cloudy Bay Sauvignon Blnc 12X01 750 15	17	13	14	236	23	31	39	21	114
25	Cape Mentelle Cb Mrl Trin 06X01 750 14	87	77	84	1,001	89	102	118	114	423
26	Cape Mentelle Semil Sv Bl 06X01 750 15	70	84	98	1,439	110	135	148	121	514
27	Georgiana Sauvignon Blan 06X01 750 16	25	13	32	191	33	29	20	16	98
28	Marmaduke Shiraz 06X01 750 15	13	14	33	160	37	34	12	18	101
29	Chandon Brut ND 06X01 750 15	501	480	530	5,479	658	732	699	508	2,597
30	Chandon Brut SM 06X01 750 17	125	151	178	1,875	209	249	234	221	913
31	Chandon Brut Rose ND 06X01 750 15	187	181	208	2,063	251	297	295	199	1,042
32	Domaine Chandon Shiraz 06X01 750 14	21	20	22	245	29	32	34	34	129
33	Domaine Chandon Chard 06X01 750 14	23	21	20	327	29	40	44	32	145
34	Domaine Chandon Pinot Noi 06X01 750	11	10	11	174	19	28	26	23	96
35	Hennessy Vs 20cl 24X01	3	4	5	153	7	9	9	17	42
36	Hennessy Vs 70cl 06X01 GB	139	176	172	2,212	321	354	308	140	1,123
37	Hennessy Vs 70cl 06X01 Naked	255	292	198	3,252	185	319	342	211	1,057
38	Hennessy Vsop 20cl 24X01 NEW2012	12	14	12	195	17	19	26	25	87
39	Hennessy Vsop 70cl 12X01 NEW 2012	331	586	569	4,899	648	543	497	324	2,012
40	Hennessy Vsop 70cl 06X01 F12 P6	25	31	35	276	49	57	45	35	186
41	Hennessy Xo 70cl 12X01 F12	23	41	40	342	50	51	46	22	169
42	Belvedere Vodka 20cl 12X01 W/CAP	5	5	5	80	6	7	7	8	28
43	Belvedere Vodka 70cl 06X01 F13	102	95	87	1,675	133	226	230	101	690
44	Belvedere Vodka 1.75L 06X01	11	8	12	508	57	91	87	63	298
45	Belvedere Vodka 3L 01X01	4	4	5	139	12	25	26	13	76
46	Belvedere Vodka 6L 01X01 ILUMPOU	12	10	12	161	25	29	30	40	124
47	Belvedere Vodka 75cl 06X01	31	34	39	446	49	47	46	30	172
48	Glnmorngie 70cl 06X01 NEWLABEL	40	39	29	496	17	20	26	37	100
49	Glnmorngie Lasa 70cl 06X01 LASANTA	5	4	5	66	7	8	8	4	27
50	Glnmorngie QuRn 70cl 06X01 QNRUBAN	5	3	5	48	7	7	4	3	21
51	Glnmorngie 70cl 06X01 NECTAR	3	3	3	30	5	5	5	1	16
52	Glnmorngie 70cl 18Y 06X01 F14	2	1	1	16	1	2	1	1	5
53	Ardbeg 10Yo 70cl 06X01 New	4	4	6	55	8	8	6	3	25

Figure 3.8: Example of moving average applied to every SKU

3.2 Exponential Smoothing Forecasting

The exponential smoothing equation is

$$F_{t+1} = \alpha Y_1 + (1-\alpha)F_t$$

$$\hat{Y}_{T+1} = \alpha Y_1 + (1-\alpha)\hat{Y}_T$$

Notation

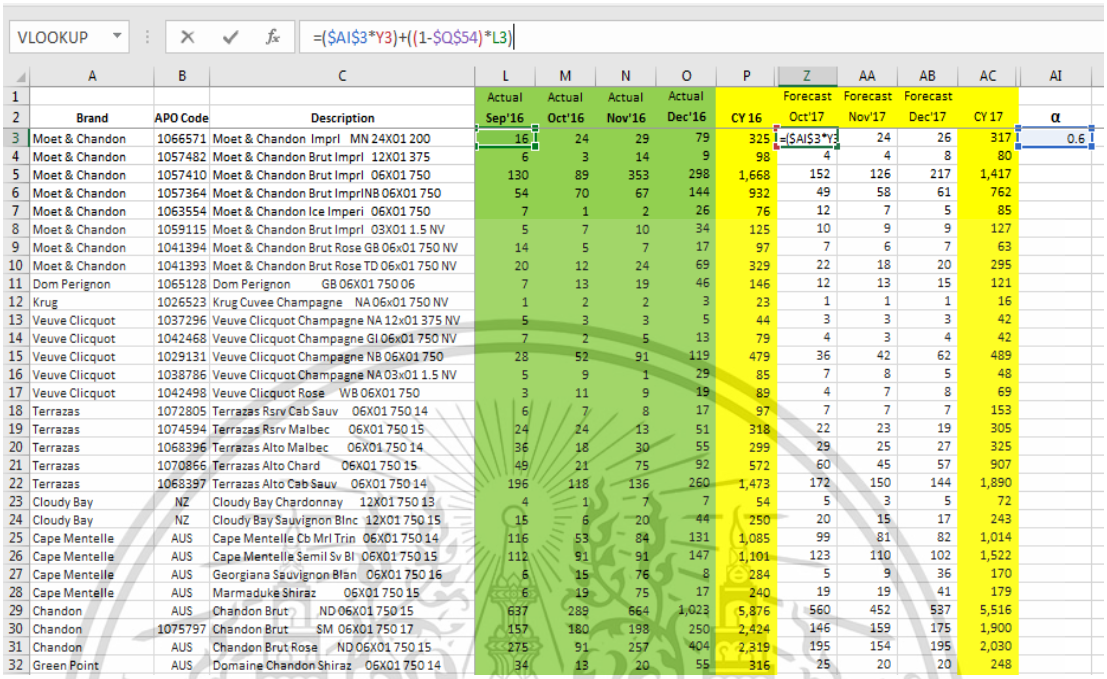
F_{t+1} = Forecast value for period t+1 made at time t

Y_t = Actual value in period t

F_t = Forecast value for period t made by t-1

α = Smoothing constant (0< α<1)

The forecast F_{t+1} is based on the most weighting recent observation. (Weighting the most recent forecast F_t with a weight of 1- α).



VLOOKUP | =(AI3*Y3)+((1-Q54)*L3)

	A	B	C	L	M	N	O	P	Z	AA	AB	AC	AI
1				Actual	Actual	Actual	Actual		Forecast	Forecast	Forecast		
2	Brand	APO Code	Description	Sep'16	Oct'16	Nov'16	Dec'16	CY 16	Oct'17	Nov'17	Dec'17	CY 17	α
3	Moet & Chandon	1066571	Moet & Chandon Imprl MN 24X01 200	16	24	29	79	325	=(AI3*Y3	24	26	317	0.6
4	Moet & Chandon	1057482	Moet & Chandon Brut Imprl 12X01 375	6	3	14	9	98	4	4	8	80	
5	Moet & Chandon	1057410	Moet & Chandon Brut Imprl 06X01 750	130	89	353	298	1,668	152	126	217	1,417	
6	Moet & Chandon	1057364	Moet & Chandon Brut ImprlNB 06X01 750	54	70	67	144	932	49	58	61	762	
7	Moet & Chandon	1063554	Moet & Chandon Ice Imperi 06X01 750	7	1	2	26	76	12	7	5	85	
8	Moet & Chandon	1059115	Moet & Chandon Brut Imprl 03X01 1.5 NV	5	7	10	34	125	10	9	9	127	
9	Moet & Chandon	1041394	Moet & Chandon Brut Rose GB 06x01 750 NV	14	5	7	17	97	7	6	7	63	
10	Moet & Chandon	1041393	Moet & Chandon Brut Rose TD 06x01 750 NV	20	12	24	69	329	22	18	20	295	
11	Dom Perignon	1065128	Dom Perignon GB 06X01 750 06	7	13	19	46	146	12	13	15	121	
12	Krug	1026523	Krug Cuvee Champagne NA 06x01 750 NV	1	2	2	3	23	1	1	1	16	
13	Veuve Clicquot	1037296	Veuve Clicquot Champagne NA 12x01 375 NV	5	3	3	5	44	3	3	3	42	
14	Veuve Clicquot	1042468	Veuve Clicquot Champagne GI 06x01 750 NV	7	2	5	13	79	4	3	4	42	
15	Veuve Clicquot	1029131	Veuve Clicquot Champagne NB 06X01 750	28	52	91	119	479	36	42	62	489	
16	Veuve Clicquot	1038786	Veuve Clicquot Champagne NA 03x01 1.5 NV	5	9	1	29	85	7	8	5	48	
17	Veuve Clicquot	1042498	Veuve Clicquot Rose WB 06X01 750	3	11	9	19	89	4	7	8	69	
18	Terrazas	1072805	Terrazas Rsrv Cab Sauv 06X01 750 14	6	7	8	17	97	7	7	7	153	
19	Terrazas	1074594	Terrazas Rsrv Malbec 06X01 750 15	24	24	13	51	318	22	23	19	305	
20	Terrazas	1068396	Terrazas Alto Malbec 06X01 750 14	36	18	30	55	299	29	25	27	325	
21	Terrazas	1070866	Terrazas Alto Chard 06X01 750 15	49	21	75	92	572	60	45	57	907	
22	Terrazas	1068397	Terrazas Alto Cab Sauv 06X01 750 14	196	118	136	260	1,473	172	150	144	1,890	
23	Cloudy Bay	NZ	Cloudy Bay Chardonnay 12X01 750 13	4	1	7	7	54	5	3	5	72	
24	Cloudy Bay	NZ	Cloudy Bay Sauvignon Blnc 12X01 750 15	15	6	20	44	250	20	15	17	243	
25	Cape Mentelle	AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	116	53	84	131	1,085	99	81	82	1,014	
26	Cape Mentelle	AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	112	91	91	147	1,101	123	110	102	1,522	
27	Cape Mentelle	AUS	Georgiana Sauvignon Blan 06X01 750 16	6	15	76	8	284	5	9	36	170	
28	Cape Mentelle	AUS	Marmaduke Shiraz 06X01 750 15	6	19	75	17	240	19	19	41	179	
29	Chandon	AUS	Chandon Brut ND 06X01 750 15	637	289	664	1,023	5,876	560	452	537	5,516	
30	Chandon	1075797	Chandon Brut SM 06X01 750 17	157	180	198	250	2,424	146	159	175	1,900	
31	Chandon	AUS	Chandon Brut Rose ND 06X01 750 15	275	91	257	404	2,319	195	154	195	2,030	
32	Green Point	AUS	Domaine Chandon Shiraz 06X01 750 14	34	13	20	55	316	25	20	20	248	

Figure 3.9: Example for exponential smoothing applied to every SKU

	A	B	C	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1				Forecast	Forecast	Forecast		Forecast	Forecast	Forecast	Forecast		
2	Brand	APO Code	Description	Oct'17	Nov'17	Dec'17	CY 17	Jan'18	Feb'18	Mar'18	Apr'18	CY 18	α
3	Moet & Chandon	1066571	Moet & Chandon Imprl MN 24X01 200	24	24	26	317	47	42	36	32	157	0.6
4	Moet & Chandon	1057482	Moet & Chandon Brut Imprl 12X01 375	4	4	8	80	8	10	9	8	35	
5	Moet & Chandon	1057410	Moet & Chandon Brut Imprl 06X01 750	152	126	217	1,417	249	179	156	143	727	
6	Moet & Chandon	1057364	Moet & Chandon Brut ImprlNB 06X01 750	49	58	61	762	94	85	86	90	355	
7	Moet & Chandon	1063554	Moet & Chandon Ice Imperi 06X01 750	12	7	5	85	14	11	8	8	40	
8	Moet & Chandon	1059115	Moet & Chandon Brut Imprl 03X01 1.5 NV	10	9	9	127	19	21	14	12	67	
9	Moet & Chandon	1041394	Moet & Chandon Brut Rose GB 06x01 750 NV	7	6	7	63	11	8	10	8	38	
10	Moet & Chandon	1041393	Moet & Chandon Brut Rose TD 06x01 750 NV	22	18	20	295	40	41	41	38	160	
11	Dom Perignon	1065128	Dom Perignon GB 06X01 750 06	12	13	15	121	28	19	17	18	81	
12	Krug	1026523	Krug Cuvee Champagne NA 06x01 750 NV	1	1	1	16	2	2	2	1	7	
13	Veuve Clicquot	1037296	Veuve Clicquot Champagne NA 12x01 375 NV	3	3	3	42	4	3	3	3	13	
14	Veuve Clicquot	1042468	Veuve Clicquot Champagne GI 06x01 750 NV	4	3	4	42	8	6	7	5	26	
15	Veuve Clicquot	1029131	Veuve Clicquot Champagne NB 06X01 750	36	42	62	489	85	67	59	55	265	
16	Veuve Clicquot	1038786	Veuve Clicquot Champagne NA 03x01 1.5 NV	7	8	5	48	15	10	7	5	36	
17	Veuve Clicquot	1042498	Veuve Clicquot Rose WB 06X01 750	4	7	8	69	12	9	9	7	37	
18	Terrazas	1072805	Terrazas Rsrv Cab Sauv 06X01 750 14	7	7	7	153	11	16	16	17	60	
19	Terrazas	1074594	Terrazas Rsrv Malbec 06X01 750 15	22	23	19	305	32	35	35	47	149	
20	Terrazas	1068396	Terrazas Alto Malbec 06X01 750 14	29	25	27	325	38	30	27	25	120	
21	Terrazas	1070866	Terrazas Alto Chard 06X01 750 15	60	45	57	907	71	82	88	89	330	
22	Terrazas	1068397	Terrazas Alto Cab Sauv 06X01 750 14	172	150	144	1,890	191	193	176	170	729	
23	Cloudy Bay	NZ	Cloudy Bay Chardonnay 12X01 750 13	5	3	5	72	6	7	13	10	35	
24	Cloudy Bay	NZ	Cloudy Bay Sauvignon Blnc 12X01 750 15	20	15	17	243	28	28	34	28	119	
25	Cape Mentelle	AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	99	81	82	1,014	102	98	111	94	404	
26	Cape Mentelle	AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	123	110	102	1,522	120	139	135	134	529	
27	Cape Mentelle	AUS	Georgiana Sauvignon Blan 06X01 750 16	5	9	36	170	25	16	29	27	97	
28	Cape Mentelle	AUS	Marmaduke Shiraz 06X01 750 15	19	19	41	179	31	23	18	17	89	
29	Chandon	AUS	Chandon Brut ND 06X01 750 15	560	452	537	5,516	731	643	611	558	2,543	
30	Chandon	1075797	Chandon Brut SM 06X01 750 17	146	159	175	1,900	205	243	207	189	843	
31	Chandon	AUS	Chandon Brut Rose ND 06X01 750 15	195	154	195	2,030	279	259	256	189	983	
32	Green Point	AUS	Domaine Chandon Shiraz 06X01 750 14	25	20	20	248	34	30	28	27	118	
33	Green Point	AUS	Domaine Chandon Chard 06X01 750 14	33	26	23	345	36	39	37	41	153	
34	Green Point	AUS	Domaine Chandon Pinot Noi 06X01 750	13	10	14	179	21	26	20	22	90	
35	Hennessy VS	1062248	Hennessy Vs 20cl 24X01	27	18	13	200	13	11	9	10	44	
36	Hennessy VS	1060349	Hennessy Vs 70cl 06X01 GB	114	176	172	2,187	315	335	213	251	1,114	
37	Hennessy VS	1067962	Hennessy Vs 70cl 06X01 Naked	280	284	192	3,262	199	397	287	324	1,207	
38	Hennessy VSOP	1057023	Hennessy Vsop 20cl 24X01 NEW2012	13	14	13	197	18	19	24	26	87	
39	Hennessy VSOP	1055628	Hennessy Vsop 70cl 12X01 NEW 2012	357	593	512	4,876	550	583	451	517	2,101	
40	Hennessy VSOP	1055628	Hennessy Vsop 70cl 06X01 F12 P6	20	30	34	269	45	54	35	27	161	
41	Hennessy XO	1055259	Hennessy Xo 70cl 12X01 F12	28	46	36	348	44	57	37	32	169	
42	Beveldere	1052556	Belvedere Vodka 20cl 12X01 W/CAP	8	7	7	87	7	8	6	9	30	
43	Beveldere	1059710	Belvedere Vodka 70cl 06X01 F13	134	108	94	1,726	160	234	174	198	767	
44	Beveldere	1062924	Belvedere Vodka 1.75L 06X01	36	25	25	563	70	86	56	80	293	
45	Beveldere	1052734	Belvedere Vodka 3L 01X01	8	7	6	147	14	25	20	16	75	
46	Beveldere	1065108	Belvedere Vodka 6L 01X01 ILUMPOU	12	9	13	161	29	24	22	25	100	
47	Beveldere	1030174	Belvedere Vodka 75cl 06X01	37	37	41	457	50	42	43	42	177	
48	Glenmorngie	1071061	Glnmorngie 70cl 06X01 NEWLABEL	48	41	33	509	20	27	33	45	124	
49	Glenmorngie	1061913	Glnmorngie Lasa 70cl 06X01 LASANTA	6	4	6	68	8	6	7	7	29	
50	Glenmorngie	1061904	Glnmorngie QuRn 70cl 06X01 QNRUBAN	4	3	6	48	7	5	4	5	20	
51	Glenmorngie	1061903	Glnmorngie 70cl 06X01 NECTAR	3	3	3	29	5	5	4	4	17	
52	Glenmorngie	1042783	Glnmorngie 70cl 18Y 06X01 F14	1	1	1	16	1	2	1	1	5	
53	Ardbeg	1040626	Ardbeg 10Yo 70cl 06X01 New	5	4	6	58	8	6	6	6	26	

Figure 3.10: Example for exponential smoothing applied to every SKUs

VLOOKUP =(AI3*Y3)+((1-AJ3)*L3)

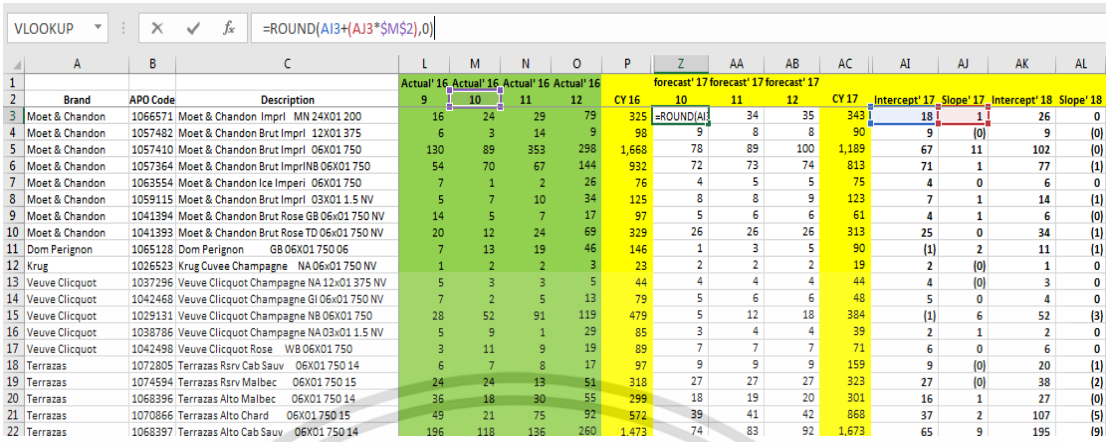
	A	B	C	L	M	N	O	P	Y	Z	AI	AJ
1				Actual	Actual	Actual	Actual		Actual	Forecast		
2	Brand	APO Code	Description	Sep'16	Oct'16	Nov'16	Dec'16	CY 16	Sep'17	Oct'17	α	α
3	Moet & Chandon	1066571	Moet & Chandon Imprl MN 24X01 200	16	24	29	79	325	30	=(AI3*Y3	0.6	0.6

Figure 3.11: Apply exponential smoothing function in excel

In this case, planner used α=0.6. Then, applied the exponential smoothing formula as **Figure 3.10**: Apply Exponential smoothing function in excel.

Planner applied this exponential smoothing's formula to every SKU that department is handled. Thus, planner team can get the forecasting for all of SKU from October 2017 to April 2018 by using this method.

3.3 Regression Forecasting



VLOOKUP | =ROUND(AI3+(AJ3*M2),0)

	A	B	C	L	M	N	O	P	Z	AA	AB	AC	AI	AJ	AK	AL
1				Actual' 16	Actual' 16	Actual' 16	Actual' 16		forecast' 17	forecast' 17	forecast' 17					
2	Brand	APO Code	Description	9	10	11	12	CY 16	10	11	12	CY 17	Intercept' 17	Slope' 17	Intercept' 18	Slope' 18
3	Moet & Chandon	1066571	Moet & Chandon Imprl MN 24X01 200	16	24	29	79	325	=ROUND(AI3	34	35	343	18	1	26	0
4	Moet & Chandon	1057482	Moet & Chandon Brut Imprl 12X01 375	6	3	14	9	98	9	8	8	90	9	(0)	9	(0)
5	Moet & Chandon	1057410	Moet & Chandon Brut Imprl 06X01 750	130	89	353	298	1,668	78	89	100	1,189	67	11	102	(0)
6	Moet & Chandon	1057364	Moet & Chandon Brut ImprlNB 06X01 750	54	70	67	144	932	72	73	74	813	71	1	77	(1)
7	Moet & Chandon	1063554	Moet & Chandon Ice Imperi 06X01 750	7	1	2	26	76	4	5	5	75	4	0	6	0
8	Moet & Chandon	1059115	Moet & Chandon Brut Imprl 03X01 1.5 NV	5	7	10	34	125	8	8	9	123	7	1	14	(1)
9	Moet & Chandon	1041394	Moet & Chandon Brut Rose GB 06x01 750 NV	14	5	7	17	97	5	6	6	61	4	1	6	(0)
10	Moet & Chandon	1041393	Moet & Chandon Brut Rose TD 06x01 750 NV	20	12	24	69	329	26	26	26	313	25	0	34	(1)
11	Dom Perignon	1065128	Dom Perignon GB 06X01 750 06	7	13	19	46	146	1	3	5	90	(1)	2	11	(1)
12	Krug	1026523	Krug Cuvee Champagne NA 06x01 750 NV	1	2	2	3	23	2	2	2	19	2	(0)	1	0
13	Veuve Clicquot	1037296	Veuve Clicquot Champagne NA 12x01 375 NV	5	3	3	5	44	4	4	4	44	4	(0)	3	0
14	Veuve Clicquot	1042468	Veuve Clicquot Champagne Gl 06x01 750 NV	7	2	5	13	79	5	6	6	48	5	0	4	0
15	Veuve Clicquot	1029131	Veuve Clicquot Champagne NB 06X01 750	28	52	91	119	479	5	12	18	384	(1)	6	52	(3)
16	Veuve Clicquot	1038786	Veuve Clicquot Champagne NA 03x01 1.5 NV	5	9	1	29	85	3	4	4	39	2	1	2	0
17	Veuve Clicquot	1042498	Veuve Clicquot Rose WB 06X01 750	3	11	9	19	89	7	7	7	71	6	0	6	0
18	Terrazas	1072805	Terrazas Rsrv Cab Sauv 06X01 750 14	6	7	8	17	97	9	9	9	159	9	(0)	20	(1)
19	Terrazas	1074594	Terrazas Rsrv Malbec 06X01 750 15	24	24	13	51	318	27	27	27	323	27	(0)	38	(2)
20	Terrazas	1068396	Terrazas Alto Malbec 06X01 750 14	36	18	30	55	299	18	19	20	301	16	1	27	(0)
21	Terrazas	1070866	Terrazas Alto Chard 06X01 750 15	49	21	75	92	572	39	41	42	868	37	2	107	(5)
22	Terrazas	1068397	Terrazas Alto Cab Sauv 06X01 750 14	196	118	136	260	1,473	74	83	92	1,673	65	9	195	(9)

Figure 3.12: Example for regression applied to every SKU

Brand	APO Code	Description	CY 16	forecast' 17 10	forecast' 17 11	forecast' 17 12	CY 17	Intercept' 17	Slope' 17	Intercept' 18	Slope' 18
Moet & Chandon	1066571	Moet & Chandon Imprl MN 24X01 200	325	32	34	35	343	18	1	26	0
Moet & Chandon	1057482	Moet & Chandon Brut Imprl 12X01 375	98	9	8	8	90	9	(0)	9	(0)
Moet & Chandon	1057410	Moet & Chandon Brut Imprl 06X01 750	1,668	78	89	100	1,189	67	11	102	(0)
Moet & Chandon	1057364	Moet & Chandon Brut ImprlNB 06X01 750	932	72	73	74	813	71	1	77	(1)
Moet & Chandon	1063554	Moet & Chandon Ice Imperi 06X01 750	76	4	5	5	75	4	0	6	0
Moet & Chandon	1059115	Moet & Chandon Brut Imprl 03X01 1.5 NV	125	8	8	9	123	7	1	14	(1)
Moet & Chandon	1041394	Moet & Chandon Brut Rose GB 06x01 750 NV	97	5	6	6	61	4	1	6	(0)
Moet & Chandon	1041393	Moet & Chandon Brut Rose TD 06x01 750 NV	329	26	26	26	313	25	0	34	(1)
Dom Perignon	1065128	Dom Perignon GB 06X01 750 06	146	1	3	5	90	(1)	2	11	(1)
Krug	1026523	Krug Cuvee Champagne NA 06x01 750 NV	23	2	2	2	19	2	(0)	1	0
Veuve Clicquot	1037296	Veuve Clicquot Champagne NA 12x01 375 NV	44	4	4	4	44	4	(0)	3	0
Veuve Clicquot	1042468	Veuve Clicquot Champagne Gl 06x01 750 NV	79	5	6	6	48	5	0	4	0
Veuve Clicquot	1029131	Veuve Clicquot Champagne NB 06X01 750	479	5	12	18	384	(1)	6	52	(3)
Veuve Clicquot	1038786	Veuve Clicquot Champagne NA 03x01 1.5 NV	85	3	4	4	39	2	1	2	0
Veuve Clicquot	1042498	Veuve Clicquot Rose WB 06X01 750	89	7	7	7	71	6	0	6	0
Terrazas	1072805	Terrazas Rsrv Cab Sauv 06X01 750 14	97	9	9	9	159	9	(0)	20	(1)
Terrazas	1074594	Terrazas Rsrv Malbec 06X01 750 15	318	27	27	27	323	27	(0)	38	(2)
Terrazas	1068396	Terrazas Alto Malbec 06X01 750 14	299	18	19	20	301	16	1	27	(0)
Terrazas	1070866	Terrazas Alto Chard 06X01 750 15	572	39	41	42	868	37	2	107	(5)
Terrazas	1068397	Terrazas Alto Cab Sauv 06X01 750 14	1,473	74	83	92	1,673	65	9	195	(9)
Cloudy Bay	NZ	Cloudy Bay Chardonnay 12X01 750 13	54	4	4	4	71	4	0	11	(1)
Cloudy Bay	NZ	Cloudy Bay Sauvignon Blnc 12X01 750 15	250	20	20	20	252	20	0	29	(1)
Cape Mentelle	AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	1,085	97	96	95	1,041	98	(1)	91	(1)
Cape Mentelle	AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	1,101	92	92	92	1,463	92	(0)	157	(5)
Cape Mentelle	AUS	Georgiana Sauvignon Blan 06X01 750 16	284	15	17	18	171	13	2	20	(1)
Cape Mentelle	AUS	Marmaduke Shiraz 06X01 750 15	240	10	12	14	136	8	2	9	0
Chandon	AUS	Chandon Brut ND 06X01 750 15	5,876	337	365	392	5,062	309	28	483	(9)
Chandon	1075797	Chandon Brut SM 06X01 750 17	2,424	229	224	219	2,093	234	(5)	169	1
Chandon	AUS	Chandon Brut Rose ND 06X01 750 15	2,319	142	152	161	1,942	133	9	190	(4)
Green Point	AUS	Domaine Chandon Shiraz 06X01 750 14	316	28	28	27	265	28	(0)	22	(0)
Green Point	AUS	Domaine Chandon Chard 06X01 750 14	346	29	29	29	350	29	0	36	(1)
Green Point	AUS	Domaine Chandon Pinot Noi 06X01 750	213	19	19	19	199	20	(0)	21	(1)
Hennessy VS	1062248	Hennessy Vs 20cl 24X01	182	27	24	22	214	29	(2)	5	2
Hennessy VS	1060349	Hennessy Vs 70cl 06X01 GB	2,474	117	133	149	2,124	101	16	231	(8)
Hennessy VS	1067962	Hennessy Vs 70cl 06X01 Naked	2,653	222	222	222	3,173	222	(0)	357	(14)
Hennessy VSOP	1057023	Hennessy Vsop 20cl 24X01 NEW2012	199	20	20	19	216	21	(1)	21	(1)
Hennessy VSOP	1055628	Hennessy Vsop 70cl 12X01 NEW 2012	5,077	275	302	329	4,319	248	27	456	(15)
Hennessy VSOP	1055628	Hennessy Vsop 70cl 06X01 F12 P6	399	27	28	30	270	26	1	24	(0)
Hennessy XO	1055259	Hennessy Xo 70cl 12X01 F12	376	20	22	24	304	18	2	34	(1)
Beveldere	1052556	Belvedere Vodka 20cl 12X01 W/CAP	65	6	6	6	83	6	(0)	8	(0)
Beveldere	1059710	Belvedere Vodka 70cl 06X01 F13	1,275	80	85	90	1,646	76	5	222	(13)
Beveldere	1062924	Belvedere Vodka 1.75L 06X01	424	33	34	34	578	33	0	74	(4)
Beveldere	1052734	Belvedere Vodka 3L 01X01	107	9	9	9	153	9	(0)	22	(1)
Beveldere	1065108	Belvedere Vodka 6L 01X01 ILUMPOU	244	24	23	23	197	25	(1)	15	0
Beveldere	1030174	Belvedere Vodka 75cl 06X01	429	25	27	29	423	23	2	40	(1)

Figure 3.13: Example for regression applied to every SKU

For this method, planner must determine the intercept and slope first by using the actual sale for the previous year and the period of months and then apply the

regression formula to all of SKUs as figure 10-11: Example for Regression applied to every SKUs.

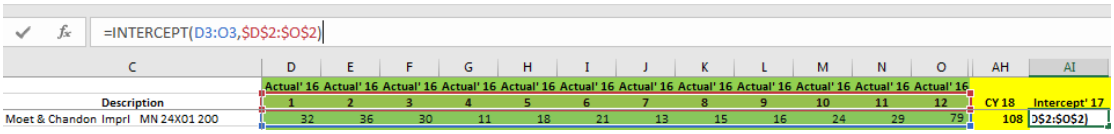


Figure 3.14: Apply regression function in excel

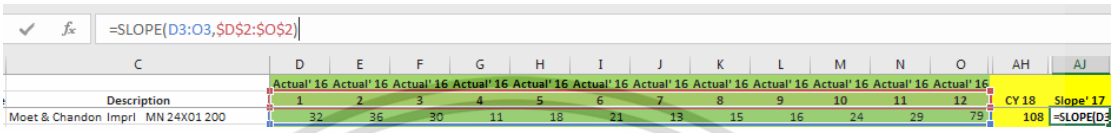


Figure 3.15: Apply regression function in excel

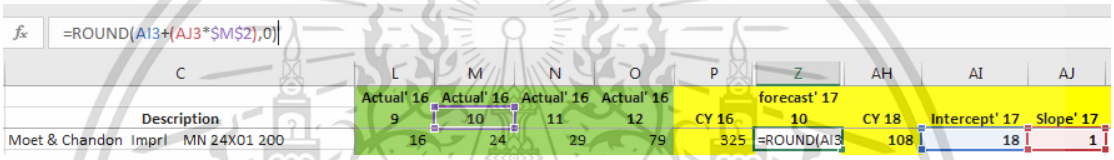


Figure 3.16: Apply regression function in excel

According to **Figure 3.16**: Apply Regression function in excel, these figures showed the intercept and slope function in excel. And calculate forecasting in October 2017.

3.4 Forecast Accuracy

Currently planner uses this report to compare and calculate forecast accuracy for each method. Planner was compared and calculated only top 15 SKUs that has the highest actual sale (Hyndman & Koehler, 2006). Thus, they can see and compare the results from each method and also comparing to the previous year as well. Here is the format of the report that planner team use in the company to see the forecast accuracy. And planner must fill in the comments for those products that have huge variance and also comment how to avoid that situation.

Product	Final Fcst. SFA M-2	Final Fcst. M-2	Actual Sales (SC)	Difference (%)	Abs difference	Actual Sales Rolling 12 months	MHAP Comments
1055628 - HY-VSOPP40-0,7L-WB-C12-THA DP-M12	0.00%	322	272	-641%	50	4,626	
1067962 - HY-VS40-0,7L--C6-THA DP	0.00%	693	293	-173%	400	2,373	The Demand for this sku dropped in January mainly came from moderntrade channel as right now they order the EOY version for the festive. But this will be back in normal by March
1060349 - HY-VS40-0,7L-WB-C6-THA DP M13	0.00%	366	266	-365%	100	2,079	
1076524 - BV BELVPURE V2 40% 700ML C6 TH	0.00%	411	107	-135%	304	1,653	We oversold on the pervious month and also low demand than we expected
1057410 - MC MI B 75CL C6 GP TPTH	0.00%	100	111	-909%	11	1,650	
1057364 - MC MI B 75CL C6 TPTH	0.00%	80	70	-800%	10	793	
1075869 - TZ ADP Cab Sauv 2016 75cl CS6 THAI	0.00%	200	73	-157%	127	664	Low demand from southern part. One of our customer stopped purchasing the product. Right now we are offering them a new contact.
1029131 - CP BRUT 75CL C6 SIGN TPTH	0.00%	52	69	-306%	17	606	
1062924 - BV BELVPURE V1 40% 1750ML C6 INT IL	0.00%	3	47	-7%	44	529	
1078357 - GN OGNL 40% 70CL C6 CTN TH	0.00%	37	37	-36900%	0	512	
1030174 - BV BELVPURE 40% 750ML C6 US W/CAP	0.00%	29	48	-154%	19	466	
1072728 - MC MI B 20CL C24 GP MINI TPTH	0.00%	30	24	-500%	6	383	
1055259 - HY-XO40-0,7L-WB-C12-THA DP-M12	0.00%	70	27	-163%	43	344	
1041393 - MC ROSIMP 75CL C6 TPTH	0.00%	42	45	-1400%	3	342	
1075867 - TZ ADP Malbec 2016 75cl CS6 THAI 1077962 TZ ADP Malbec 2017 75cl CS6 THAI	0.00%	42	0	-100%	42	275	
	0.00%	**2,478**	**0**		**1,177**	**17,295**	

Market		TOP 15 Forecast Accuracy
CTH	THAILAND	52.49%

Figure 3.17: Example for top 15 SKUs forecast accuracy report

This report is too complicated, planner team has decided to create the new one for this research as below **Figure 3.18**: Example for revised Top 15 SKUs forecast accuracy report.

SKU	Description	Forecast	Actual Sale	Difference
1057410	Moet & Chandon Brut Impri 06X01 750	101	186	85
1057364	Moet & Chandon Brut ImprlNB 06X01 750	65	65	0
1029131	Veuve Clicquot Champagne NB 06X01 750	28	59	31
1070866	Terrazas Alto Chard 06X01 750 15	43	87	44
1068397	Terrazas Alto Cab Sauv 06X01 750 14	125	215	90
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	87	145	58
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	70	93	23
AUS	Chandon Brut ND 06X01 750 15	501	493	8
1075797	Chandon Brut SM 06X01 750 17	125	105	20
AUS	Chandon Brut Rose ND 06X01 750 15	187	162	25
1060349	Hennessy Vs 70cl 06X01 GB	139	85	54
1067962	Hennessy Vs 70cl 06X01 Naked	255	244	11
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	331	275	56
1059710	Belvedere Vodka 70cl 06X01 F13	102	97	5
1030174	Belvedere Vodka 75cl 06X01	31	52	21
Total		**2190**		**531**

Market		TOP 15 Forecast Accuracy
CTH	THAILAND	75.75%

Figure 3.18: Example for revised top 15 SKUs forecast accuracy report

Here is the example of forecast accuracy for each method, there are SKU and description column. Number of forecast that planner fill in that month compares with

actual sale for that month and planner already applied the formula to calculate the variance in percentage. In below example, are forecast accuracy of November.

Moving Average

SKU	Description	Forecast	Actual Sale	Difference
1057410	Moet & Chandon Brut Imprl 06X01 750	109	132	23
1057364	Moet & Chandon Brut ImprlNB 06X01 750	65	41	24
1029131	Veuve Clicquot Champagne NB 06X01 750	38	22	16
1070866	Terrazas Alto Chard 06X01 750 15	37	25	12
1068397	Terrazas Alto Cab Sauv 06X01 750 14	131	104	27
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	77	67	10
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	84	73	11
AUS	Chandon Brut ND 06X01 750 15	480	384	96
1075797	Chandon Brut SM 06X01 750 17	151	124	27
AUS	Chandon Brut Rose ND 06X01 750 15	181	116	65
1060349	Hennessy Vs 70cl 06X01 GB	176	142	34
1067962	Hennessy Vs 70cl 06X01 Naked	292	211	81
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	586	524	62
1059710	Belvedere Vodka 70cl 06X01 F13	95	54	41
1030174	Belvedere Vodka 75cl 06X01	34	11	23
Total		2536		552

Nov		TOP 15 Forecast Accuracy
CTH	THAILAND	78.23%

Figure 3.19: Example for top 15 SKUs forecast accuracy using moving sverage

Exponential Smoothing

SKU	Description	Forecast	Actual Sale	Difference
1057410	Moet & Chandon Brut Imprl 06X01 750	126	132	6
1057364	Moet & Chandon Brut ImprlNB 06X01 750	58	41	17
1029131	Veuve Clicquot Champagne NB 06X01 750	42	22	20
1070866	Terrazas Alto Chard 06X01 750 15	45	25	20
1068397	Terrazas Alto Cab Sauv 06X01 750 14	150	104	46
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	81	67	14
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	110	73	37
AUS	Chandon Brut ND 06X01 750 15	452	384	68
1075797	Chandon Brut SM 06X01 750 17	159	124	35
AUS	Chandon Brut Rose ND 06X01 750 15	154	116	38
1060349	Hennessy Vs 70cl 06X01 GB	176	142	34
1067962	Hennessy Vs 70cl 06X01 Naked	284	211	73
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	593	524	69
1059710	Belvedere Vodka 70cl 06X01 F13	108	54	54
1030174	Belvedere Vodka 75cl 06X01	37	11	26
Total		2574		555

Nov		TOP 15 Forecast Accuracy
CTH	THAILAND	78.44%

Figure 3.20: Example for top 15 SKUs forecast accuracy using exponential smoothing

Regression

SKU	Description	Forecast	Actual Sale	Difference
1057410	Moet & Chandon Brut Imprl 06X01 750	89	132	43
1057364	Moet & Chandon Brut ImprlNB 06X01 750	73	41	32
1029131	Veuve Clicquot Champagne NB 06X01 750	12	22	10
1070866	Terrazas Alto Chard 06X01 750 15	41	25	16
1068397	Terrazas Alto Cab Sauv 06X01 750 14	83	104	21
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	96	67	29
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	92	73	19
AUS	Chandon Brut ND 06X01 750 15	365	384	19
1075797	Chandon Brut SM 06X01 750 17	224	124	100
AUS	Chandon Brut Rose ND 06X01 750 15	152	116	36
1060349	Hennessy Vs 70cl 06X01 GB	133	142	9
1067962	Hennessy Vs 70cl 06X01 Naked	222	211	11
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	302	524	222
1059710	Belvedere Vodka 70cl 06X01 F13	85	54	31
1030174	Belvedere Vodka 75cl 06X01	27	11	16
Total		1996		614

Nov		TOP 15 Forecast Accuracy
CTH	THAILAND	69.24%

Figure 3.21: Example for top 15 SKUs forecast accuracy using regression

Normal forecasting

SKU	Description	Forecast	Actual Sale	Difference
1057410	Moet & Chandon Brut Imprl 06X01 750	101	132	31
1057364	Moet & Chandon Brut ImprlNB 06X01 750	70	41	29
1029131	Veuve Clicquot Champagne NB 06X01 750	50	22	28
1070866	Terrazas Alto Chard 06X01 750 15	80	25	55
1068397	Terrazas Alto Cab Sauv 06X01 750 14	144	104	40
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	105	67	38
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	112	73	39
AUS	Chandon Brut ND 06X01 750 15	345	384	39
1075797	Chandon Brut SM 06X01 750 17	138	124	14
AUS	Chandon Brut Rose ND 06X01 750 15	105	116	11
1060349	Hennessy Vs 70cl 06X01 GB	240	142	98
1067962	Hennessy Vs 70cl 06X01 Naked	250	211	39
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	405	524	119
1059710	Belvedere Vodka 70cl 06X01 F13	92	54	38
1030174	Belvedere Vodka 75cl 06X01	33	11	22
Total		2270		640

Nov		TOP 15 Forecast Accuracy
CTH	THAILAND	71.79%

Figure 3.22: Example for Top 15 SKUs forecast accuracy using normal method

CHAPTER 4

RESULTS AND DISCUSSIONS

These are the results for normal method that planner team used in the alcohol business that they must set up the meeting and discuss with sales team, marketing team and planning team.

				forecast' 17	forecast' 17	forecast' 17		Forecast' 18	Forecast' 18	Forecast' 18	Forecast' 18	
	Brand	APO Code	Description	10	11	12	CY 17	1	2	3	4	CY 18
3	Moet & Chandon	1066571	Moet & Chandon Imprl MN 24X01 200	19	21	22	304	19	21	22	23	85
4	Moet & Chandon	1057482	Moet & Chandon Brut Imprl 12X01 375	9	8	8	90	9	8	8	8	33
5	Moet & Chandon	1057410	Moet & Chandon Brut Imprl 06X01 750	78	89	100	1,189	78	89	100	111	378
6	Moet & Chandon	1057364	Moet & Chandon Brut ImprlNB 06X01 750	72	73	74	813	72	73	74	75	294
7	Moet & Chandon	1063554	Moet & Chandon Ice Imperi 06X01 750	4	5	5	75	4	5	5	5	19
8	Moet & Chandon	1059115	Moet & Chandon Brut Imprl 03X01 1.5 NV	8	8	9	123	8	8	9	9	34
9	Moet & Chandon	1041394	Moet & Chandon Brut Rose GB 06x01 750 NV	5	6	6	61	5	6	6	7	24
10	Moet & Chandon	1041393	Moet & Chandon Brut Rose TD 06x01 750 NV	26	26	26	313	26	26	26	27	105
11	Dom Perignon	1065128	Dom Perignon GB 06X01 750 06	1	3	5	90	1	3	5	7	16
12	Krug	1026523	Krug Cuvee Champagne NA 06x01 750 NV	2	2	2	19	2	2	2	2	8
13	Veuve Clicquot	1037296	Veuve Clicquot Champagne NA 12x01 375 NV	4	4	4	44	4	4	4	4	16
14	Veuve Clicquot	1042468	Veuve Clicquot Champagne GI 06x01 750 NV	5	6	6	48	5	6	6	6	23
15	Veuve Clicquot	1029131	Veuve Clicquot Champagne NB 06X01 750	5	12	18	384	5	12	18	24	59
16	Veuve Clicquot	1038786	Veuve Clicquot Champagne NA 03x01 1.5 NV	3	4	4	39	3	4	4	5	16
17	Veuve Clicquot	1042498	Veuve Clicquot Rose WB 06X01 750	7	7	7	71	7	7	7	7	28
18	Terrazas	1072805	Terrazas Rsrv Cab Sauv 06X01 750 14	9	9	9	159	9	9	9	8	35
19	Terrazas	1074594	Terrazas Rsrv Malbec 06X01 750 15	27	27	27	323	27	27	27	27	108
20	Terrazas	1068396	Terrazas Alto Malbec 06X01 750 14	18	19	20	301	18	19	20	22	79
21	Terrazas	1070866	Terrazas Alto Chard 06X01 750 15	39	41	42	868	39	41	42	44	166
22	Terrazas	1068397	Terrazas Alto Cab Sauv 06X01 750 14	74	83	92	1,673	74	83	92	100	349
23	Cloudy Bay	NZ	Cloudy Bay Chardonnay 12X01 750 13	4	4	4	71	4	4	4	4	16
24	Cloudy Bay	NZ	Cloudy Bay Sauvignon Blnc 12X01 750 15	20	20	20	252	20	20	20	21	81
25	Cape Mentelle	AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	97	96	95	1,041	97	96	95	93	381
26	Cape Mentelle	AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	92	92	92	1,463	92	92	92	92	368
27	Cape Mentelle	AUS	Georgiana Sauvignon Blan 06X01 750 16	15	17	18	171	15	17	18	20	70
28	Cape Mentelle	AUS	Marmaduke Shiraz 06X01 750 15	10	12	14	136	10	12	14	15	51
29	Chandon	AUS	Chandon Brut ND 06X01 750 15	337	365	392	5,062	337	365	392	420	1,514
30	Chandon	1075797	Chandon Brut SM 06X01 750 17	229	224	219	2,093	229	224	219	214	886
31	Chandon	AUS	Chandon Brut Rose ND 06X01 750 15	142	152	161	1,942	142	152	161	170	625
32	Green Point	AUS	Domaine Chandon Shiraz 06X01 750 14	28	28	27	265	28	28	27	27	110
33	Green Point	AUS	Domaine Chandon Chard 06X01 750 14	29	29	29	350	29	29	29	29	116
34	Green Point	AUS	Domaine Chandon Pinot Noi 06X01 750	19	19	19	199	19	19	19	18	75
35	Hennessy VS	1062248	Hennessy Vs 20cl 24X01	27	24	22	214	27	24	22	20	93
36	Hennessy VS	1060349	Hennessy Vs 70cl 06X01 GB	117	133	149	2,124	117	133	149	166	565
37	Hennessy VS	1067962	Hennessy Vs 70cl 06X01 Naked	222	222	222	2,873	222	222	222	222	888
38	Hennessy VSOP	1057023	Hennessy Vsop 20cl 24X01 NEW2012	20	20	19	216	20	20	19	18	77
39	Hennessy VSOP	1055628	Hennessy Vsop 70cl 12X01 NEW 2012	275	302	329	4,319	275	302	329	356	1,262
40	Hennessy VSOP	1055628	Hennessy Vsop 70cl 06X01 F12 P6	27	28	30	270	27	28	30	31	116
41	Hennessy XO	1055259	Hennessy Xo 70cl 12X01 F12	20	22	24	304	20	22	24	26	92
42	Beveldere	1052556	Belvedere Vodka 20cl 12X01 W/CAP	6	6	6	83	6	6	6	6	24
43	Beveldere	1059710	Belvedere Vodka 70cl 06X01 F13	80	85	90	1,646	80	85	90	95	350
44	Beveldere	1062924	Belvedere Vodka 1.75L 06X01	33	34	34	578	33	34	34	34	135
45	Beveldere	1052734	Belvedere Vodka 3L 01X01	9	9	9	153	9	9	9	9	36
46	Beveldere	1065108	Belvedere Vodka 6L 01X01 ILUMPOU	24	23	23	197	24	23	23	22	92
47	Beveldere	1030174	Belvedere Vodka 75cl 06X01	25	27	29	423	25	27	29	31	112
48	Glenmorngie	1071061	Glnmorngie 70cl 06X01 NEWLABEL	46	43	41	518	46	43	41	39	169
49	Glenmorngie	1061913	Glnmorngie Lasa 70cl 06X01 LASANTA	3	3	4	62	3	3	4	4	14
50	Glenmorngie	1061904	Glnmorngie QuRn 70cl 06X01 QNRUBAN	3	3	3	44	3	3	3	4	13
51	Glenmorngie	1061903	Glnmorngie 70cl 06X01 NECTAR	1	1	2	25	1	1	2	2	6
52	Glenmorngie	1042783	Glnmorngie 70cl 18Y 06X01 F14	1	1	1	15	1	1	1	1	4
53	Ardbeg	1040626	Ardbeg 10Yo 70cl 06X01 New	2	2	3	48	2	2	3	3	10

Figure 4.1: The results of forecasting using by normal method

Normally the company forecasted depend on their experiences and the situation at that time. Thus, the company does not have any exact method to calculate the forecast. As in the **Figure 4.1**: The Results of forecasting using by normal method the forecast always high during the month that have a long weekend. For example, on

January for New year period or April that Thailand has Songkran festival or Christmas and Chinese New Year as well. The reasons are people has a lot of days off and can spend their time and money for celebrating their long break and a part of that, sell team and marketing team always launch new promotion and new product during that period as well. Therefore, that is the reason company have to set up a meeting with them and company forecasted depend upon these kinds of events and situations.

SKU	Description	Forecast	Actual Sale	Difference	Oct		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	124	186	62	CTH	THAILAND	74.02%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	44	65	21			
1029131	Veuve Clicquot Champagne NB 06X01 750	80	59	21			
1070866	Terrazas Alto Chard 06X01 750 15	102	87	15			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	174	215	41			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	114	145	31			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	61	93	32			
AUS	Chandon Brut ND 06X01 750 15	527	493	34			
1075797	Chandon Brut SM 06X01 750 17	84	105	21			
AUS	Chandon Brut Rose ND 06X01 750 15	201	162	39			
1060349	Hennessy Vs 70cl 06X01 GB	154	85	69			
1067962	Hennessy Vs 70cl 06X01 Naked	336	244	92			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	214	275	61			
1059710	Belvedere Vodka 70cl 06X01 F13	56	97	41			
1030174	Belvedere Vodka 75cl 06X01	33	52	19			
Total		2304		599			

Figure 4.2: The results of forecasting using by normal method (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Nov		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	101	132	31	CTH	THAILAND	71.79%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	70	41	29			
1029131	Veuve Clicquot Champagne NB 06X01 750	50	22	28			
1070866	Terrazas Alto Chard 06X01 750 15	80	25	55			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	144	104	40			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	105	67	38			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	112	73	39			
AUS	Chandon Brut ND 06X01 750 15	345	384	39			
1075797	Chandon Brut SM 06X01 750 17	138	124	14			
AUS	Chandon Brut Rose ND 06X01 750 15	105	116	11			
1060349	Hennessy Vs 70cl 06X01 GB	240	142	98			
1067962	Hennessy Vs 70cl 06X01 Naked	250	211	39			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	405	524	119			
1059710	Belvedere Vodka 70cl 06X01 F13	92	54	38			
1030174	Belvedere Vodka 75cl 06X01	33	11	22			
Total		2270		640			

Figure 4.3: The results of forecasting using by normal method (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Dec		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	247	311	64	CTH	THAILAND	72.54%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	67	81	14			
1029131	Veuve Clicquot Champagne NB 06X01 750	54	78	24			
1070866	Terrazas Alto Chard 06X01 750 15	76	88	12			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	157	170	13			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	126	116	10			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	91	127	36			
AUS	Chandon Brut ND 06X01 750 15	634	597	37			
1075797	Chandon Brut SM 06X01 750 17	257	193	64			
AUS	Chandon Brut Rose ND 06X01 750 15	110	237	127			
1060349	Hennessy Vs 70cl 06X01 GB	308	207	101			
1067962	Hennessy Vs 70cl 06X01 Naked	290	227	63			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	425	597	172			
1059710	Belvedere Vodka 70cl 06X01 F13	78	45	33			
1030174	Belvedere Vodka 75cl 06X01	45	89	44			
Total		2964		814			

Figure 4.4: The results of forecasting using by normal method (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Jan		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	254	325	71	CTH	THAILAND	73.29%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	50	74	24			
1029131	Veuve Clicquot Champagne NB 06X01 750	60	72	12			
1070866	Terrazas Alto Chard 06X01 750 15	102	82	20			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	254	164	90			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	92	107	15			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	98	111	13			
AUS	Chandon Brut ND 06X01 750 15	541	654	113			
1075797	Chandon Brut SM 06X01 750 17	124	171	47			
AUS	Chandon Brut Rose ND 06X01 750 15	257	215	42			
1060349	Hennessy Vs 70cl 06X01 GB	374	244	130			
1067962	Hennessy Vs 70cl 06X01 Naked	187	254	67			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	532	611	79			
1059710	Belvedere Vodka 70cl 06X01 F13	54	80	26			
1030174	Belvedere Vodka 75cl 06X01	274	154	120			
Total		3253		869			

Figure 4.5: The results of forecasting using by normal method (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Feb		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	195	294	99	CTH	THAILAND	72.04%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	37	40	3			
1029131	Veuve Clicquot Champagne NB 06X01 750	187	136	51			
1070866	Terrazas Alto Chard 06X01 750 15	197	122	75			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	78	123	45			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	98	134	36			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	157	103	54			
AUS	Chandon Brut ND 06X01 750 15	495	604	109			
1075797	Chandon Brut SM 06X01 750 17	104	163	59			
AUS	Chandon Brut Rose ND 06X01 750 15	151	204	53			
1060349	Hennessy Vs 70cl 06X01 GB	354	280	74			
1067962	Hennessy Vs 70cl 06X01 Naked	214	287	73			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	570	647	77			
1059710	Belvedere Vodka 70cl 06X01 F13	124	154	30			
1030174	Belvedere Vodka 75cl 06X01	158	124	34			
Total		3119		872			

Figure 4.6: The results of forecasting using by normal method (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Mar		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	174	211	37	CTH	THAILAND	72.08%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	32	49	17			
1029131	Veuve Clicquot Champagne NB 06X01 750	92	121	29			
1070866	Terrazas Alto Chard 06X01 750 15	197	155	42			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	107	134	27			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	110	145	35			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	187	98	89			
AUS	Chandon Brut ND 06X01 750 15	421	548	127			
1075797	Chandon Brut SM 06X01 750 17	248	145	103			
AUS	Chandon Brut Rose ND 06X01 750 15	274	178	96			
1060349	Hennessy Vs 70cl 06X01 GB	187	258	71			
1067962	Hennessy Vs 70cl 06X01 Naked	456	385	71			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	503	597	94			
1059710	Belvedere Vodka 70cl 06X01 F13	195	134	61			
1030174	Belvedere Vodka 75cl 06X01	187	145	42			
Total		3370		941			

Figure 4.7: The results of forecasting using by normal method (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Apr		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	297	201	96	CTH	THAILAND	75.24%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	87	53	34			
1029131	Veuve Clicquot Champagne NB 06X01 750	187	136	51			
1070866	Terrazas Alto Chard 06X01 750 15	225	124	101			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	185	125	60			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	221	162	59			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	187	110	77			
AUS	Chandon Brut ND 06X01 750 15	564	457	107			
1075797	Chandon Brut SM 06X01 750 17	197	154	43			
AUS	Chandon Brut Rose ND 06X01 750 15	241	142	99			
1060349	Hennessy Vs 70cl 06X01 GB	395	315	80			
1067962	Hennessy Vs 70cl 06X01 Naked	507	435	72			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	710	614	96			
1059710	Belvedere Vodka 70cl 06X01 F13	154	112	42			
1030174	Belvedere Vodka 75cl 06X01	185	127	58			
Total		4342		1075			

Figure 4.8: The results of forecasting using by normal method (Oct 17-Apr 18)

According to the above figures, that shown all of forecast accuracy from October 2017 to April 2018. Those forecasts accuracies come from the normal method that planner has been doing in that company. Thus, planner team can compare this method to other tools in this research.

4.1 Moving Average Results

SKU	Description	Forecast	Actual Sale	Difference	Oct		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	101	186	85	CTH	THAILAND	75.75%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	65	65	0			
1029131	Veuve Clicquot Champagne NB 06X01 750	28	59	31			
1070866	Terrazas Alto Chard 06X01 750 15	43	87	44			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	125	215	90			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	87	145	58			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	70	93	23			
AUS	Chandon Brut ND 06X01 750 15	501	493	8			
1075797	Chandon Brut SM 06X01 750 17	125	105	20			
AUS	Chandon Brut Rose ND 06X01 750 15	187	162	25			
1060349	Hennessy Vs 70cl 06X01 GB	139	85	54			
1067962	Hennessy Vs 70cl 06X01 Naked	255	244	11			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	331	275	56			
1059710	Belvedere Vodka 70cl 06X01 F13	102	97	5			
1030174	Belvedere Vodka 75cl 06X01	31	52	21			
Total		2190		531			

Figure 4.9: The results of forecasting using by moving average (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Nov		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	109	132	23	CTH	THAILAND	78.23%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	65	41	24			
1029131	Veuve Clicquot Champagne NB 06X01 750	38	22	16			
1070866	Terrazas Alto Chard 06X01 750 15	37	25	12			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	131	104	27			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	77	67	10			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	84	73	11			
AUS	Chandon Brut ND 06X01 750 15	480	384	96			
1075797	Chandon Brut SM 06X01 750 17	151	124	27			
AUS	Chandon Brut Rose ND 06X01 750 15	181	116	65			
1060349	Hennessy Vs 70cl 06X01 GB	176	142	34			
1067962	Hennessy Vs 70cl 06X01 Naked	292	211	81			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	586	524	62			
1059710	Belvedere Vodka 70cl 06X01 F13	95	54	41			
1030174	Belvedere Vodka 75cl 06X01	34	11	23			
Total		2536		552			

Figure 4.10: The results of forecasting using by moving average (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Dec		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	190	311	121	CTH	THAILAND	78.44%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	63	81	18			
1029131	Veuve Clicquot Champagne NB 06X01 750	57	78	21			
1070866	Terrazas Alto Chard 06X01 750 15	48	88	40			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	150	170	20			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	84	116	32			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	98	127	29			
AUS	Chandon Brut ND 06X01 750 15	530	597	67			
1075797	Chandon Brut SM 06X01 750 17	178	193	15			
AUS	Chandon Brut Rose ND 06X01 750 15	208	237	29			
1060349	Hennessy Vs 70cl 06X01 GB	172	207	35			
1067962	Hennessy Vs 70cl 06X01 Naked	198	227	29			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	569	597	28			
1059710	Belvedere Vodka 70cl 06X01 F13	87	45	42			
1030174	Belvedere Vodka 75cl 06X01	39	89	50			
Total		2671		576			

Figure 4.11: The results of forecasting using by moving average (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Jan		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	246	325	79	CTH	THAILAND	82.58%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	93	74	19			
1029131	Veuve Clicquot Champagne NB 06X01 750	87	72	15			
1070866	Terrazas Alto Chard 06X01 750 15	63	82	19			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	171	164	7			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	89	107	18			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	110	111	1			
AUS	Chandon Brut ND 06X01 750 15	658	654	4			
1075797	Chandon Brut SM 06X01 750 17	209	171	38			
AUS	Chandon Brut Rose ND 06X01 750 15	251	215	36			
1060349	Hennessy Vs 70cl 06X01 GB	321	244	77			
1067962	Hennessy Vs 70cl 06X01 Naked	185	254	69			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	648	611	37			
1059710	Belvedere Vodka 70cl 06X01 F13	133	80	53			
1030174	Belvedere Vodka 75cl 06X01	49	154	105			
Total		3313		577			

Figure 4.12: The results of forecasting using by moving average (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Feb		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	241	294	53	CTH	THAILAND	73.06%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	94	40	54			
1029131	Veuve Clicquot Champagne NB 06X01 750	83	136	53			
1070866	Terrazas Alto Chard 06X01 750 15	88	122	34			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	198	123	75			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	102	134	32			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	135	103	32			
AUS	Chandon Brut ND 06X01 750 15	732	604	128			
1075797	Chandon Brut SM 06X01 750 17	249	163	86			
AUS	Chandon Brut Rose ND 06X01 750 15	297	204	93			
1060349	Hennessy Vs 70cl 06X01 GB	354	280	74			
1067962	Hennessy Vs 70cl 06X01 Naked	319	287	32			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	543	647	104			
1059710	Belvedere Vodka 70cl 06X01 F13	226	154	72			
1030174	Belvedere Vodka 75cl 06X01	47	124	77			
Total		3708		999			

Figure 4.13: The results of forecasting using by moving average (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Mar		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	164	201	37	CTH	THAILAND	65.34%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	101	53	48			
1029131	Veuve Clicquot Champagne NB 06X01 750	69	136	67			
1070866	Terrazas Alto Chard 06X01 750 15	96	124	28			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	202	125	77			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	118	162	44			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	148	110	38			
AUS	Chandon Brut ND 06X01 750 15	699	457	242			
1075797	Chandon Brut SM 06X01 750 17	234	154	80			
AUS	Chandon Brut Rose ND 06X01 750 15	295	142	153			
1060349	Hennessy Vs 70cl 06X01 GB	308	315	7			
1067962	Hennessy Vs 70cl 06X01 Naked	342	435	93			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	497	614	117			
1059710	Belvedere Vodka 70cl 06X01 F13	230	112	118			
1030174	Belvedere Vodka 75cl 06X01	46	127	81			
Total		3549		1230			

Figure 4.14: The results of forecasting using by moving average (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Apr		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	147	201	54	CTH	THAILAND	44.96%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	87	53	34			
1029131	Veuve Clicquot Champagne NB 06X01 750	31	136	105			
1070866	Terrazas Alto Chard 06X01 750 15	50	124	74			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	107	125	18			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	114	162	48			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	121	110	11			
AUS	Chandon Brut ND 06X01 750 15	508	457	51			
1075797	Chandon Brut SM 06X01 750 17	221	154	67			
AUS	Chandon Brut Rose ND 06X01 750 15	199	142	57			
1060349	Hennessy Vs 70cl 06X01 GB	140	315	175			
1067962	Hennessy Vs 70cl 06X01 Naked	211	435	224			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	324	614	290			
1059710	Belvedere Vodka 70cl 06X01 F13	101	112	11			
1030174	Belvedere Vodka 75cl 06X01	30	127	97			
Total		2391		1316			

Figure 4.15: The results of forecasting using by moving average (Oct 17-Apr 18)

Unfortunately, moving averages are not perfect tools for establishing trends and moving average presents many subtle but significant risks to forecasting. Moreover, moving averages do not apply to all types of companies and industries.

Moving averages draw trends from past information. Moving average does not consider changes that may affect a security's future performance, such as new

competitors, higher or lower demand for products in the industry and changes in the managerial structure of the company.

Ideally, a moving average shows a consistent change in the price of a security, over time. Unfortunately, moving averages don't work for all companies, especially for those in very volatile industries or those that are heavily influenced by current events. This is especially true for the FMCG industry, oil industry and highly speculative industries, in general.

Moving averages can be spread out over any time period. However, this can be problematic because the general trend can change significantly depending on the time period used. Shorter time frames have more volatility, whereas longer time frames have less volatility, but do not account for new changes in the market. Investors must be careful which time frame they choose to make sure the trend is clear and relevant.

An ongoing debate is more emphasis should be placed on the most recent days in the time period. Many feel that recent data better reflect the direction the security is moving, while others feel that giving some days more weight than others, incorrectly biases the trend. A company that uses different methods for calculating averages may draw completely different trends.

4.2 Exponential Smoothing Results

SKU	Description	Forecast	Actual Sale	Difference	Oct		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	152	186	34	CTH	THAILAND	83.08%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	49	65	16			
1029131	Veuve Clicquot Champagne NB 06X01 750	36	59	23			
1070866	Terrazas Alto Chard 06X01 750 15	60	87	27			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	172	215	43			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	99	145	46			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	123	93	30			
AUS	Chandon Brut ND 06X01 750 15	560	493	67			
1075797	Chandon Brut SM 06X01 750 17	146	105	41			
AUS	Chandon Brut Rose ND 06X01 750 15	195	162	33			
1060349	Hennessy Vs 70cl 06X01 GB	114	85	29			
1067962	Hennessy Vs 70cl 06X01 Naked	280	244	36			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	357	275	82			
1059710	Belvedere Vodka 70cl 06X01 F13	134	97	37			
1030174	Belvedere Vodka 75cl 06X01	37	52	15			
Total		2514		560			

Figure 4.16: The results of forecasting using by exponential (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Nov		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	126	132	6	CTH	THAILAND	78.44%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	58	41	17			
1029131	Veuve Clicquot Champagne NB 06X01 750	42	22	20			
1070866	Terrazas Alto Chard 06X01 750 15	45	25	20			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	150	104	46			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	81	67	14			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	110	73	37			
AUS	Chandon Brut ND 06X01 750 15	452	384	68			
1075797	Chandon Brut SM 06X01 750 17	159	124	35			
AUS	Chandon Brut Rose ND 06X01 750 15	154	116	38			
1060349	Hennessy Vs 70cl 06X01 GB	176	142	34			
1067962	Hennessy Vs 70cl 06X01 Naked	284	211	73			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	593	524	69			
1059710	Belvedere Vodka 70cl 06X01 F13	108	54	54			
1030174	Belvedere Vodka 75cl 06X01	37	11	26			
Total		2574		555			

Figure 4.17: The results of forecasting using by exponential (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Dec		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	217	311	94	CTH	THAILAND	76.59%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	61	81	20			
1029131	Veuve Clicquot Champagne NB 06X01 750	62	78	16			
1070866	Terrazas Alto Chard 06X01 750 15	57	88	31			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	144	170	26			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	82	116	34			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	102	127	25			
AUS	Chandon Brut ND 06X01 750 15	537	597	60			
1075797	Chandon Brut SM 06X01 750 17	175	193	18			
AUS	Chandon Brut Rose ND 06X01 750 15	195	237	42			
1060349	Hennessy Vs 70cl 06X01 GB	172	207	35			
1067962	Hennessy Vs 70cl 06X01 Naked	192	227	35			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	512	597	85			
1059710	Belvedere Vodka 70cl 06X01 F13	94	45	49			
1030174	Belvedere Vodka 75cl 06X01	41	89	48			
Total		2642		618			

Figure 4.18: The results of forecasting using by exponential (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Jan		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	249	325	76	CTH	THAILAND	79.23%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	94	74	20			
1029131	Veuve Clicquot Champagne NB 06X01 750	85	72	13			
1070866	Terrazas Alto Chard 06X01 750 15	71	82	11			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	191	164	27			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	102	107	5			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	120	111	9			
AUS	Chandon Brut ND 06X01 750 15	731	654	77			
1075797	Chandon Brut SM 06X01 750 17	205	171	34			
AUS	Chandon Brut Rose ND 06X01 750 15	279	215	64			
1060349	Hennessy Vs 70cl 06X01 GB	315	244	71			
1067962	Hennessy Vs 70cl 06X01 Naked	199	254	55			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	550	611	61			
1059710	Belvedere Vodka 70cl 06X01 F13	160	80	80			
1030174	Belvedere Vodka 75cl 06X01	50	154	104			
Total		3400		706			

Figure 4.19: The results of forecasting using by exponential (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Feb		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	179	294	115	CTH	THAILAND	72.68%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	85	40	45			
1029131	Veuve Clicquot Champagne NB 06X01 750	67	136	69			
1070866	Terrazas Alto Chard 06X01 750 15	82	122	40			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	193	123	70			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	98	134	36			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	139	103	36			
AUS	Chandon Brut ND 06X01 750 15	643	604	39			
1075797	Chandon Brut SM 06X01 750 17	243	163	80			
AUS	Chandon Brut Rose ND 06X01 750 15	259	204	55			
1060349	Hennessy Vs 70cl 06X01 GB	335	280	55			
1067962	Hennessy Vs 70cl 06X01 Naked	397	287	110			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	583	647	64			
1059710	Belvedere Vodka 70cl 06X01 F13	234	154	80			
1030174	Belvedere Vodka 75cl 06X01	42	124	82			
Total		3578		977			

Figure 4.20: The results of forecasting using by exponential (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Mar		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	156	211	55	CTH	THAILAND	68.26%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	86	49	37			
1029131	Veuve Clicquot Champagne NB 06X01 750	59	121	62			
1070866	Terrazas Alto Chard 06X01 750 15	88	155	67			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	176	134	42			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	111	145	34			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	135	98	37			
AUS	Chandon Brut ND 06X01 750 15	611	548	63			
1075797	Chandon Brut SM 06X01 750 17	207	145	62			
AUS	Chandon Brut Rose ND 06X01 750 15	256	178	78			
1060349	Hennessy Vs 70cl 06X01 GB	213	258	45			
1067962	Hennessy Vs 70cl 06X01 Naked	287	385	98			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	451	597	146			
1059710	Belvedere Vodka 70cl 06X01 F13	174	134	40			
1030174	Belvedere Vodka 75cl 06X01	43	145	102			
Total		3053		969			

Figure 4.21: The results of forecasting using by exponential (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Apr		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	143	201	58	CTH	THAILAND	68.05%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	90	53	37			
1029131	Veuve Clicquot Champagne NB 06X01 750	55	136	81			
1070866	Terrazas Alto Chard 06X01 750 15	89	124	35			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	170	125	45			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	94	162	68			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	134	110	24			
AUS	Chandon Brut ND 06X01 750 15	558	457	101			
1075797	Chandon Brut SM 06X01 750 17	189	154	35			
AUS	Chandon Brut Rose ND 06X01 750 15	189	142	47			
1060349	Hennessy Vs 70cl 06X01 GB	251	315	64			
1067962	Hennessy Vs 70cl 06X01 Naked	324	435	111			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	517	614	97			
1059710	Belvedere Vodka 70cl 06X01 F13	198	112	86			
1030174	Belvedere Vodka 75cl 06X01	42	127	85			
Total		3044		973			

Figure 4.22: The results of forecasting using by exponential (Oct 17-Apr 18)

Only three pieces of data are required for exponential smoothing methods. One, it needs the forecast for the most recent time period. Two, it needs the actual value for that time period. And three, it needs the value of the smoothing constant, a weighting factor that reflects the weight given to the most recent data values.

An exponential smoothing method produces a forecast for one period ahead. Using the trend projection technique, forecasts for more periods ahead can then be generated. The forecast is considered accurate as it accounts for the difference between actual projections and what actually occurred.

Observed data is the sum of two or more components, one being the random error which is the difference between the observed value and the true value. In a smoothing technique, the random variation is neglected. As such, it's much easier to see the underlying phenomenon.

The lag is a side effect of the smoothing process. Because it neglects the ups and downs associated with random variation. But ignoring the random variation also

allows companies to see the underlying phenomenon, which helps when presenting data and making a forecast of future values.

Exponential smoothing is best used for forecasts that are long-term and in the absence of seasonal or cyclical variations. As a result, forecasts aren't accurate when data with cyclical or seasonal variations are present. As such, this kind of averaging won't work well if there is a trend in the series.

This method is only accurate when a reasonable amount of continuity can between the past and future can be assumed. As such, it's best suited for long-term forecasting as it assumes future patterns and trends will look like current patterns and trends. While this kind of assumption may sound reasonable in the short term, it creates problems the further the forecast goal.

In summary, there are variations of exponential smoothing that can handle trend patterns. This method can calculate strong trend patterns while the rest method can cover in a strong trend and seasonal pattern variations.

4.3 Regression Results

SKU	Description	Forecast	Actual Sale	Difference	Oct		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	78	186	108	CTH	THAILAND	57.27%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	72	65	7			
1029131	Veuve Clicquot Champagne NB 06X01 750	5	59	54			
1070866	Terrazas Alto Chard 06X01 750 15	39	87	48			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	74	215	141			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	97	145	48			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	92	93	1			
AUS	Chandon Brut ND 06X01 750 15	337	493	156			
1075797	Chandon Brut SM 06X01 750 17	229	105	124			
AUS	Chandon Brut Rose ND 06X01 750 15	142	162	20			
1060349	Hennessy Vs 70cl 06X01 GB	117	85	32			
1067962	Hennessy Vs 70cl 06X01 Naked	222	244	22			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	275	275	0			
1059710	Belvedere Vodka 70cl 06X01 F13	80	97	17			
1030174	Belvedere Vodka 75cl 06X01	25	52	27			
Total		1884		805			

Figure 4.23: The results of forecasting using by regression (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Nov		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	89	132	43	CTH	THAILAND	69.24%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	73	41	32			
1029131	Veuve Clicquot Champagne NB 06X01 750	12	22	10			
1070866	Terrazas Alto Chard 06X01 750 15	41	25	16			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	83	104	21			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	96	67	29			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	92	73	19			
AUS	Chandon Brut ND 06X01 750 15	365	384	19			
1075797	Chandon Brut SM 06X01 750 17	224	124	100			
AUS	Chandon Brut Rose ND 06X01 750 15	152	116	36			
1060349	Hennessy Vs 70cl 06X01 GB	133	142	9			
1067962	Hennessy Vs 70cl 06X01 Naked	222	211	11			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	302	524	222			
1059710	Belvedere Vodka 70cl 06X01 F13	85	54	31			
1030174	Belvedere Vodka 75cl 06X01	27	11	16			
Total		1996		614			

Figure 4.24: The results of forecasting using by regression (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Dec		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	100	311	211	CTH	THAILAND	42.92%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	74	81	7			
1029131	Veuve Clicquot Champagne NB 06X01 750	18	78	60			
1070866	Terrazas Alto Chard 06X01 750 15	42	88	46			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	92	170	78			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	95	116	21			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	92	127	35			
AUS	Chandon Brut ND 06X01 750 15	392	597	205			
1075797	Chandon Brut SM 06X01 750 17	219	193	26			
AUS	Chandon Brut Rose ND 06X01 750 15	161	237	76			
1060349	Hennessy Vs 70cl 06X01 GB	149	207	58			
1067962	Hennessy Vs 70cl 06X01 Naked	222	227	5			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	329	597	268			
1059710	Belvedere Vodka 70cl 06X01 F13	90	45	45			
1030174	Belvedere Vodka 75cl 06X01	29	89	60			
Total		2104		1201			

Figure 4.25: The results of forecasting using by regression (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Jan		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	101	325	224	CTH	THAILAND	61.91%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	76	74	2			
1029131	Veuve Clicquot Champagne NB 06X01 750	49	72	23			
1070866	Terrazas Alto Chard 06X01 750 15	102	82	20			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	187	164	23			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	90	107	17			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	152	111	41			
AUS	Chandon Brut ND 06X01 750 15	474	654	180			
1075797	Chandon Brut SM 06X01 750 17	170	171	1			
AUS	Chandon Brut Rose ND 06X01 750 15	186	215	29			
1060349	Hennessy Vs 70cl 06X01 GB	223	244	21			
1067962	Hennessy Vs 70cl 06X01 Naked	343	254	89			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	441	611	170			
1059710	Belvedere Vodka 70cl 06X01 F13	209	80	129			
1030174	Belvedere Vodka 75cl 06X01	40	154	114			
Total		2843		1083			

Figure 4.26: The results of forecasting using by regression (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Feb		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	101	294	193	CTH	THAILAND	59.58%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	74	40	34			
1029131	Veuve Clicquot Champagne NB 06X01 750	46	136	90			
1070866	Terrazas Alto Chard 06X01 750 15	96	122	26			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	178	123	55			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	90	134	44			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	146	103	43			
AUS	Chandon Brut ND 06X01 750 15	464	604	140			
1075797	Chandon Brut SM 06X01 750 17	171	163	8			
AUS	Chandon Brut Rose ND 06X01 750 15	181	204	23			
1060349	Hennessy Vs 70cl 06X01 GB	214	280	66			
1067962	Hennessy Vs 70cl 06X01 Naked	329	287	42			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	426	647	221			
1059710	Belvedere Vodka 70cl 06X01 F13	196	154	42			
1030174	Belvedere Vodka 75cl 06X01	39	124	85			
Total		2751		1112			

Figure 4.27: The results of forecasting using by regression (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Mar		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	101	211	110	CTH	THAILAND	62.65%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	73	49	24			
1029131	Veuve Clicquot Champagne NB 06X01 750	43	121	78			
1070866	Terrazas Alto Chard 06X01 750 15	91	155	64			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	169	134	35			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	89	145	56			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	141	98	43			
AUS	Chandon Brut ND 06X01 750 15	455	548	93			
1075797	Chandon Brut SM 06X01 750 17	172	145	27			
AUS	Chandon Brut Rose ND 06X01 750 15	177	178	1			
1060349	Hennessy Vs 70cl 06X01 GB	206	258	52			
1067962	Hennessy Vs 70cl 06X01 Naked	314	385	71			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	412	597	185			
1059710	Belvedere Vodka 70cl 06X01 F13	183	134	49			
1030174	Belvedere Vodka 75cl 06X01	38	145	107			
Total		2664		995			

Figure 4.28: The results of forecasting using by regression (Oct 17-Apr 18)

SKU	Description	Forecast	Actual Sale	Difference	Apr		TOP 15 Forecast Accuracy
1057410	Moet & Chandon Brut Imprl 06X01 750	100	201	101	CTH	THAILAND	58.62%
1057364	Moet & Chandon Brut ImprlNB 06X01 750	71	53	18			
1029131	Veuve Clicquot Champagne NB 06X01 750	40	136	96			
1070866	Terrazas Alto Chard 06X01 750 15	86	124	38			
1068397	Terrazas Alto Cab Sauv 06X01 750 14	161	125	36			
AUS	Cape Mentelle Cb Mrl Trin 06X01 750 14	88	162	74			
AUS	Cape Mentelle Semil Sv Bl 06X01 750 15	135	110	25			
AUS	Chandon Brut ND 06X01 750 15	446	457	11			
1075797	Chandon Brut SM 06X01 750 17	172	154	18			
AUS	Chandon Brut Rose ND 06X01 750 15	173	142	31			
1060349	Hennessy Vs 70cl 06X01 GB	198	315	117			
1067962	Hennessy Vs 70cl 06X01 Naked	300	435	135			
1055628	Hennessy Vsop 70cl 12X01 NEW 2012	397	614	217			
1059710	Belvedere Vodka 70cl 06X01 F13	170	112	58			
1030174	Belvedere Vodka 75cl 06X01	37	127	90			
Total		2574		1065			

Figure 4.29: The results of forecasting using by regression (Oct 17-Apr 18)

Regression analysis allows planners to establish objective measures of relationships between the independent and the dependent variables, rather than purely using personal judgment. This generally results in accurate information that is more reliable for decision-making, and other parties can empirically test the results using the same or separate data without resorting to personal opinions.

When the demand planner obtains the results of the regression models electronically, most of the computers they have software packages that provide a few statistics, such as the R-square and the student t-value statistics. Or even in the excel normally has the function to calculate the slope and intercept. The two statistics help companies to determine the accuracy of the predictions, and thus the level of reliability of the results that they have obtained using the regression equations.

The multiple regression analysis models allow demand planners to test for several independent variables that may explain different things about the dependent variable. Though complex, the planners can test for all the factors that they think it has an effect on a given depended variable. This is unlike other inferior models that

allow for only one independent variable. With the use of several variables, the accuracy of prediction is also improved.

Regression analysis provides input for activity-based costing and management techniques. These techniques are based on knowing what activities or transactions cause the acquisition and use of resources. The theory of constraints encourages managers to look at throughput per scarce resource as part of dealing with a dynamic environment of changing constraints. Regression analysis allows help planners to establish objective.

4.4 Forecast Accuracy Comparison

Normal	TOP 15 Forecast Accuracy	Oct	Nov	Dec	Jan	Feb	Mar	Apr
CTH	THAILAND	74.02%	71.79%	72.54%	73.29%	72.04%	72.08%	75.24%

Figure 4.30: The results of forecast accuracy using by normal method

Moving Average	TOP 15 Forecast Accuracy	oct	nov	dec	jan	feb	mar	apr
CTH	THAILAND	75.75%	78.23%	78.44%	82.58%	73.06%	65.34%	44.96%

Figure 4.31: The results of forecast accuracy using by moving average

Smoothing	TOP 15 Forecast Accuracy	Oct	Nov	Dec	Jan	Feb	Mar	Apr
CTH	THAILAND	77.72%	78.44%	76.59%	79.23%	72.68%	68.26%	68.05%

Figure 4.32: The results of forecast accuracy using by smoothing Average

Regression	TOP 15 Forecast Accuracy	Oct	Nov	Dec	Jan	Feb	Mar	Apr
CTH	THAILAND	57.27%	69.24%	42.92%	61.91%	59.58%	62.65%	58.62%

Figure 4.33: The results of forecast accuracy using by regression

In summary, according to the results for forecast accuracy from each method. A company can see that the normal method (human experience) still has the better forecasting comparing to the other. However, Exponential smoothing planner get the accurate forecasting. Even though there also has a gap in this method, but planner can consider the exponential smoothing as the good tool as well. Thus, in order to reduce the lead time for forecasting, which planner has to set up the meeting, making the presentation. The sales team has to come to the office every month. The company can also use the exponential smoothing tool to help them forecast in the future. Moreover, this research shows that exponential smoothing is the best useful method in short term forecast (5-6 months). However, this research will suggest that this method can help the planner to perform a good forecasting and also for the new planner that has less experience as well. Everyone can use this tool to forecast and moreover company can reduce the extra jobs.

Figure 4.33 indicates the results of forecast accuracy using by regression, it can be recognized that the company can increase the forecast accuracy by 2% in each year.

USA	Russia	Germany	Thailand	China
Volume	Volume	Volume	Volume	Volume
EU47.4m	EU44.4m	EU32.2m	EU21.1m	EU97.1m
Reported: ↑1%	Reported: ↑1%	Reported: ↑3%	Reported: ↑2%	Reported: ↓6%
Organic: ↑2%	Organic: ↑3%	Organic: ↑3%	Organic: ↑2%	Organic: ↓1%
Net sales[i]	Net sales[i]	Net sales[i]	Net sales[i]	Net sales[i]
£4,161m	£2,824m	£1,556m	£1,044m	£2,419m
Reported: ↑17%	Reported: ↑11%	Reported: ↑11%	Reported: ↑21%	Reported: ↑17%
Organic: ↑3%	Organic: ↑5%	Organic: ↑5%	Organic: ↑9%	Organic: ↑3%
Operating profit[ii]	Operating profit[ii]	Operating profit[ii]	Operating profit[ii]	Operating profit[ii]
£1,899m	£936m	£218m	£250m	£487m
Reported: ↑22%	Reported: ↑17%	Reported: ↑3%	Reported: ↑26%	Reported: ↑23%
Organic: ↑4%	Organic: ↑8%	Organic: ↑10%	Organic: ↑15%	Organic: ↑4%
Read more p28 & 29	Read more p30 & 31	Read more p32 & 33	Read more p34 & 35	Read more p36 & 37

(i) Does not include corporate net sales of £46 million (2016 – £36 million). (ii) Excluding exceptional operating charges of £42 million (2016 – £167 million) and net corporate operating costs of £189 million (2016 – £150 million).

Figure 4.34: Company's revenue

If planner team can keep this results for the whole year (12 months), it means that company can save the revenue £250 million each year or equal to 214.6 million Thai baht per year.

CHAPTER 5

CONCLUSION

According to the results of forecast accuracy comparison. The planner can see that exponential smoothing method has the best result comparing to the moving average and regression. But the results do not make a huge variance from normal forecasting that company have been using in the company right now. However, this method has the potential and liable for planner to use as well. Company can reduce the working hour for the meeting and planner team will have some tool that everyone in that company or team can use it to make a good forecasting. Instead of setting up the meeting and use someone's experience to predict the forecasting.

According to the result from **Figure 4.34**: Company's revenue, the results represent that company can increase their revenue almost 215 million baht for the forecast accuracy that increased 2 percent. This research shows the importance of forecast accuracy and how forecast affects the company. Thus, planer team is the most important job to perform their forecasting. Equivalent as backbone of the company, planner team is the first stage to run the production line depends on the forecasting.

It is important to evaluate forecast accuracy, using genuine forecasts. The accuracy of forecasts can only be determined by considering how well a model performs on new data that were not used when fitting the model. When choosing models, it is common to use a portion of the available data for testing, and use the rest of the data for fitting the model. Then the test data can be used to measure how well the model is likely to forecast on new data.

Sales forecasts was related to FMCG business. A forecast of demand for business actual products will help company for planning ordering or manufacturing. It also allows for coordination of marketing efforts to let customers know business is in a position to satisfy demand. In addition, accurate sales forecasts can help a company plan for cash expenditures and revenues. With these forecasts, sales forecasts allow for preparation.

However, this research started from October 2017 to April 2018, which planner can consider as a short-term period of time in forecasting. Thus, planner team should keep monitoring and keep updating this method to their team every month. Thus, a company can know whether this tool is preformed the good performance in the long-term forecasting or not. But as planners see from the results, in the short-term forecasting (October 2017 – April 2018), this tool can give them a good result as well.

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APPENDIX A

Table A Actual sale for champagne group 2016

		Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Brand	**APO Code**	**Jan'16**	**Feb'16**	**Mar'16**	**Apr'16**	**May'16**	**Jun'16**	**Jul'16**	**Aug'16**	**Sep'16**	**Oct'16**	**Nov'16**	**Dec'16**
Moet & Chandon	1066571	32	36	30	11	18	21	13	15	16	24	29	79
Moet & Chandon	1057482	11	10	9	4	10	8	5	10	6	3	14	9
Moet & Chandon	1057410	250	137	56	60	70	53	64	110	130	89	353	298
Moet & Chandon	1057364	86	68	107	73	73	52	69	72	54	70	67	144
Moet & Chandon	1063554	5	11	8	1	5	7	3	1	7	1	2	26
Moet & Chandon	1059115	4	30	10	3	1	8	9	5	5	7	10	34
Moet & Chandon	1041394	5	5	8	14	4	5	3	10	14	5	7	17
Moet & Chandon	1041393	40	46	26	15	9	26	21	21	20	12	24	69

Table B Actual sale for sparkling champagne group 2016

		Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Brand	**APO Code**	**Jan'16**	**Feb'16**	**Mar'16**	**Apr'16**	**May'16**	**Jun'16**	**Jul'16**	**Aug'16**	**Sep'16**	**Oct'16**	**Nov'16**	**Dec'16**
Dom Perignon	1065128	2	6	17	9	5	6	8	9	7	13	19	46
Krug	1026523	4	2	1	1	1	1	2	4	1	2	2	3
Veuve Clicquot	1037296	7	3	3	6	2	3	1	2	5	3	3	5
Veuve Clicquot	1042468	3	6	7	7	1	24	1	4	7	2	5	13
Veuve Clicquot	1029131	27	44	23	14	8	18	21	33	28	52	91	119
Veuve Clicquot	1038786	5	4	15	2	5	2	6	3	5	9	1	29
Veuve Clicquot	1042498	17	9	7	3	3	1	5	3	3	11	9	19

Table C Actual sale for white wine group 2016

		Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Brand	**APO Code**	**Jan'16**	**Feb'16**	**Mar'16**	**Apr'16**	**May'16**	**Jun'16**	**Jul'16**	**Aug'16**	**Sep'16**	**Oct'16**	**Nov'16**	**Dec'16**
Terrazas	1072805	20	6	7	7	9	3	4	4	6	7	8	17
Terrazas	1074594	35	26	27	26	33	22	16	21	24	24	13	51
Terrazas	1068396	40	20	10	14	13	39	15	10	36	18	30	55
Terrazas	1070866	80	50	20	36	35	37	38	41	49	21	75	92
Terrazas	1068397	102	92	129	98	88	77	98	80	196	118	136	260

Table D Actual sale for red wine group 2016

		Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Brand	**APO Code**	**Jan'16**	**Feb'16**	**Mar'16**	**Apr'16**	**May'16**	**Jun'16**	**Jul'16**	**Aug'16**	**Sep'16**	**Oct'16**	**Nov'16**	**Dec'16**
Cloudy Bay	NZ	4	5	3	9	5	3	4	3	4	1	7	7
Cloudy Bay	NZ	24	23	17	32	17	17	18	17	15	6	20	44
Cape Mentelle	AUS	124	100	118	71	87	55	86	61	116	53	84	131
Cape Mentelle	AUS	141	78	143	53	94	53	47	50	112	91	91	147
Cape Mentelle	AUS	10	15	22	10	30	23	50	19	6	15	76	8
Cape Mentelle	AUS	12	19	23	10	8	20	15	17	6	19	75	17

Table E Actual sale for sparkling wine group 2016

		Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Brand	**APO Code**	**Jan'16**	**Feb'16**	**Mar'16**	**Apr'16**	**May'16**	**Jun'16**	**Jul'16**	**Aug'16**	**Sep'16**	**Oct'16**	**Nov'16**	**Dec'16**
Chandon	AUS	434	574	517	401	175	296	354	513	637	289	664	1,023
Chandon	1075797	254	190	220	232	359	164	103	116	157	180	198	250
Chandon	AUS	179	248	169	190	105	116	107	178	275	91	257	404
Green Point	AUS	47	30	25	22	33	10	14	13	34	13	20	55
Green Point	AUS	28	23	45	19	46	26	21	23	26	14	20	55
Green Point	AUS	19	17	32	17	19	17	10	17	8	5	20	32

Table F Actual sale for cognac group 2016

Brand	APO Code	Actual Jan'16	Actual Feb'16	Actual Mar'16	Actual Apr'16	Actual May'16	Actual Jun'16	Actual Jul'16	Actual Aug'16	Actual Sep'16	Actual Oct'16	Actual Nov'16	Actual Dec'16
Hennessy VS	1062248	25	17	8	52	24	23	2	4	5	5	6	12
Hennessy VS	1060349	90	183	146	286	88	303	157	177	83	267	167	529
Hennessy VS	1067962	73	265	296	248	184	267	181	336	250	290	54	211
Hennessy VSOP	1057023	25	23	26	16	11	11	8	18	9	16	10	26
Hennessy VSOP	1055628	261	380	331	553	239	377	183	439	371	**948**	**389**	**607**
Hennessy VSOP	1055628	48	23	35	36	24	14	26	29	19	45	41	60
Hennessy XO	1055259	24	22	21	44	27	21	18	27	25	72	22	55

Table G Actual sale for vodka group 2016

		Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Brand	**APO Code**	**Jan'16**	**Feb'16**	**Mar'16**	**Apr'16**	**May'16**	**Jun'16**	**Jul'16**	**Aug'16**	**Sep'16**	**Oct'16**	**Nov'16**	**Dec'16**
Beveldere	1052556	6	13	4	3	3	3	5	6	4	5	7	6
Beveldere	1059710	89	152	63	107	76	81	90	97	121	68	72	260
Beveldere	1062924	28	118	42	12	16	1	18	13	3	9	26	138
Beveldere	1052734	12	16	12	8	5	6	5	2	3	5	6	26
Beveldere	1065108	16	81	22	2	3	10	10	11	13	4	18	53
Beveldere	1030174	31	30	30	30	37	29	30	30	34	37	48	64
Glenmorngie	1071061	43	41	29	49	31	38	32	50	37	30	20	1
Glenmorngie	1061913	3	6	3	5	4	4	4	8	5	1	9	12
Glenmorngie	1061904	3	5	2	2	5	6	6	5	3	2	10	8
Glenmorngie	1061903	1	2	1	1	5	1	3	2	3	3	3	8
Glenmorngie	1042783	1	1	2	1	2	2	2	2	1	1	2	1

Table H Forecasting for champagne group October 2017 – April 2018

		Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Brand	**APO Code**	Oct'17	Nov'17	Dec'17	Jan'18	Feb'18	Mar'18	Apr'18
Moet & Chandon	1066571	24	24	26	47	42	36	32
Moet & Chandon	1057482	4	4	8	8	10	9	8
Moet & Chandon	1057410	152	126	217	249	179	156	143
Moet & Chandon	1057364	49	58	61	94	85	86	90
Moet & Chandon	1063554	12	7	5	14	11	8	8
Moet & Chandon	1059115	10	9	9	19	21	14	12
Moet & Chandon	1041394	7	6	7	11	8	10	8
Moet & Chandon	1041393	22	18	20	40	41	41	38

Table I Forecasting for sparkling champagne group October 2017 – April 2018

Brand	APO Code	Forecast Oct'17	Forecast Nov'17	Forecast Dec'17	Forecast Jan'18	Forecast Feb'18	Forecast Mar'18	Forecast Apr'18
Dom Perignon	1065128	12	13	15	28	19	17	18
Krug	1026523	1	1	1	2	2	2	1
Veuve Clicquot	1037296	3	3	3	4	3	3	3
Veuve Clicquot	1042468	4	3	4	8	6	7	5
Veuve Clicquot	1029131	36	42	62	85	67	59	55
Veuve Clicquot	1038786	7	8	5	15	10	7	5
Veuve Clicquot	1042498	4	7	8	12	9	9	7

Table J Forecasting for white wine group October 2017 – April 2018

		Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Brand	**APO Code**	Oct'17	Nov'17	Dec'17	Jan'18	Feb'18	Mar'18	Apr'18
Terrazas	1072805	7	7	7	11	16	16	17
Terrazas	1074594	22	23	19	32	35	35	47
Terrazas	1068396	29	25	27	38	30	27	25
Terrazas	1070866	60	45	57	71	82	88	89
Terrazas	1068397	172	150	144	191	193	176	170

Table K Forecasting for red wine group October 2017 – April 2018

		Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Brand	**APO Code**	Oct'17	Nov'17	Dec'17	Jan'18	Feb'18	Mar'18	Apr'18
Cloudy Bay	NZ	5	3	5	6	7	13	10
Cloudy Bay	NZ	20	15	17	28	28	34	28
Cape Mentelle	AUS	99	81	82	102	98	111	94
Cape Mentelle	AUS	123	110	102	120	139	135	134
Cape Mentelle	AUS	5	9	36	25	16	29	27
Cape Mentelle	AUS	19	19	41	31	23	18	17

Table L Forecasting for sparkling wine group October 2017 – April 2018

		Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Brand	**APO Code**	Oct'17	Nov'17	Dec'17	Jan'18	Feb'18	Mar'18	Apr'18
Chandon	AUS	560	452	537	731	643	611	558
Chandon	1075797	146	159	175	205	243	207	189
Chandon	AUS	195	154	195	279	259	256	189
Green Point	AUS	25	20	20	34	30	28	27
Green Point	AUS	33	26	23	36	39	37	41
Green Point	AUS	13	10	14	21	26	20	22

Table M Forecasting for cognac group October 2017 – April 2018

		Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Brand	**APO Code**	Oct'17	Nov'17	Dec'17	Jan'18	Feb'18	Mar'18	Apr'18
Hennessy VS	1062248	27	18	13	13	11	9	10
Hennessy VS	1060349	114	176	172	315	335	213	251
Hennessy VS	1067962	280	284	192	199	397	287	324
Hennessy VSOP	1057023	13	14	13	18	19	24	26
Hennessy VSOP	1055628	357	593	512	550	583	451	517
Hennessy VSOP	1055628	20	30	34	45	54	35	27
Hennessy XO	1055259	28	46	36	44	57	37	32

Table N Forecasting for vodka group October 2017 – April 2018

Brand	APO Code	Forecast Oct'17	Forecast Nov'17	Forecast Dec'17	Forecast Jan'18	Forecast Feb'18	Forecast Mar'18	Forecast Apr'18
Beveldere	1052556	8	7	7	7	8	6	9
Beveldere	1059710	134	108	94	160	234	174	198
Beveldere	1062924	36	25	25	70	86	56	80
Beveldere	1052734	8	7	6	14	25	20	16
Beveldere	1065108	12	9	13	29	24	22	25
Beveldere	1030174	37	37	41	50	42	43	42
Glenmorngie	1071061	48	41	33	20	27	33	45
Glenmorngie	1061913	6	4	6	8	6	7	7
Glenmorngie	1061904	4	3	6	7	5	4	5
Glenmorngie	1061903	3	3	3	5	5	4	4
Glenmorngie	1042783	1	1	1	1	2	1	1

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