DOKUZ EYLÜL UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

IMPROVEMENT FOR EXPONENTIAL SMOOTHING

by
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October, 2009
İZMİR

IMPROVEMENT FOR EXPONENTIAL SMOOTHING

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Ph.D. THESIS EXAMINATION RESULT FORM

We have read the thesis entitled **"IMPROVEMENT FOR EXPONENTIAL SMOOTHING"** completed by **SEDAT ÇAPAR** under supervision of **ASSOC. PROF. DR. GÜÇKAN YAPAR** and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Doctor of Philosophy.

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IMPROVEMENT FOR EXPONENTIAL SMOOTHING

ABSTRACT

Exponential smoothing methods have been employed since 1950s and they are most popular and used methods in business and industry for forecasting. However there are two main problems about choosing the smoothing constant and starting value. In this thesis a new method is introduced for smoothing constant and starting value. Modified method gives even more weights than the classical method to most recent observations. A software tool developed to compare the modified method with the original. And real time series from M-competition are used to compare the methods empirically.

Keywords : Forecast, Exponential Smoothing, Smoothing Constant, Starting Value

ÜSTEL DÜZELTME İÇİN KATKILAR

ÖZ

İlk 1950'li yıllarda ortaya çıkan üstel düzeltme yöntemleri bugün iş ve endüstri dünyasında en çok bilinen ve kullanılan zaman serisi tahmin yöntemleri arasında yer almaktadır. Ancak üstel düzeltme yöntemlerinin düzeltme terimi ve başlangıç değerinin belirlenmesi gibi iki önemli problemi bulunmaktadır. Bu tezde düzeltme terimi ve başlangıç değeri için yeni bir yöntem geliştirilmiştir. Yeni yöntemde son gözlemlere verilen ağırlık klasik yöntemde verilen ağırlıklardan daha da fazladır. Yeni yöntemin teorik olarak klasik yöntemin temel özelliklerine sahip olduğu ispat edilmiş, metotların karşılaştırılması için geliştirilen yazılımla M-Competition olarak bilinen çalışmalara ait zaman serileri kullanılarak deneysel karşılaştırmalar yapılmıştır.

Anahtar sözcükler : Zaman Serileri, Tahminleme, Üstel Düzeltme, Düzeltme Terimi, Başlangıç Değeri

CONTENTS

CHAPTER ONE

TIME SERIES

1.1 Introduction

A time series is a collection of data values measured at regular intervals of time. In fact it consists of two variables: the measurement and the time at which the measurement was taken. So, a time series is usually stored as a pair of two data sets. First data set represents the time while the second data set represents the observations. However, it is also possible to form a time series as only one data set of observations ordered by time.

Formally, a time series is defined as a set of random variables indexed in time, $\{ X_1, X_2, \ldots, X_T \}$ and an observed time series is denoted by $\{ x_1, x_2, \ldots, x_T \}$.

There are two types of time series called as continuous and discrete time series. Time component determines the type of a time series it is not important that the measured variable may be continuous or discrete. If the measurements are observed at every instant of time then it is called continuous time series, e.g. electro diagrams. If the measurements are observed at regularly spaced intervals then it is called discrete time series. Usually a continuous time series is also analyzed like a discrete time series by sampling the continuous series at equal intervals of time to obtain a discrete time series.

Time series analysis is a statistical method or model which is trying to find a pattern inherent in a time series. There are two main goals of a time series analysis: identifying a pattern and forecasting. Time series analysis is based on the premise that by knowing the past, the future can be forecast. Therefore, the primary assumption of a time series analysis is that the near future will depend on the past and that any past patterns will continue in the future.

1.2 Displaying Time Series Data

A line graph is the most used type of graph to display a time series. The measurement is plotted on the vertical (y) axis and time is plotted on the horizontal (x) axis. Line graph may easily illustrate the pattern of a time series. It will give a visual representation of the data over time.

For example, the following table includes the number of marriages that took place each quarter between 2001 and 2003 in England and Wales (Marriage, 2008).

Table 1.1 Marriages that took place each quarter between 2001 and 2003

Year	Quarter	Marriages
2001	1	28,836
	2	70,876
	3	105,331
	4	44,184
2002	1	31,893
	2	71,124
	3	105,671
	4	46,908
2003	1	34,025
	2	75,152
	3	111,869
	4	49,063

Figure 1.1 shows the above time series as a time chart. The horizontal axis represents the quarters between 2001 and 2003 and the vertical axis represents the number of marriages that varies over time. The time chart displays the time series such that the pattern of the data is immediately apparent.

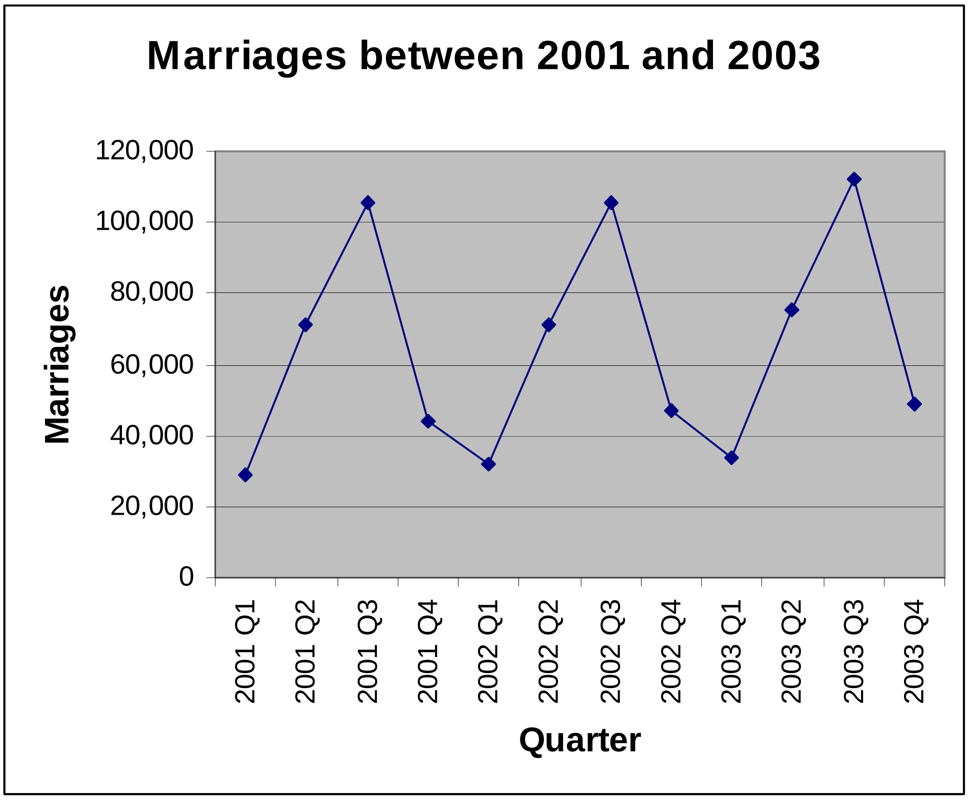


Figure 1.1 Time chart for marriages that took place each quarter between 2001 and 2003

1.3 Forecasting Time Series

As originally described by Brown (1964) and George (George, Gwilym and Gregory, 1994), forecasts are usually needed over a period of time known as lead time, which varies with each problem. The observations available up to a time t are used to forecast its value at some future time $t+l$ where l is the lead time (or sometime it is also called forecast horizon).

In generating forecasts of events that will occur in the future, a forecaster must rely on information concerning events that occurred in the past (Bruce and Richard, 1979). Therefore, the forecaster must analyze the observed data and must base the forecast on the result of this analysis. First, the data is analyzed to identify a pattern then this pattern can be used in the future to make a forecast. We must agree with the assumption that the pattern that has been identified will continue in the future to use the forecast obtained from the identified pattern. It is also mentioned by (Bruce and Richard, 1979), a forecasting technique cannot be expected to give good predictions unless this assumption is valid. If the data pattern that has been identified does not persist in the future, the forecasting technique being used will likely produce inaccurate predictions.

1.4 Components of a Time Series

A time series is a combination of four components; Trend, Cycle, Seasonal and Irregular (error) components. These components do not always have to occur alone. They can occur in any combination therefore there is no single best forecasting technique exists. So, the most important thing is to select most appropriate forecasting technique to the pattern of the time series data.

1.4.1 Trend Component

Trend refers to a long-term movement in the time series. It is the result of influences such as population growth, technological progress or general economic changes. Trend may be upward or downward. Thus, trend reflects the long-run growth or decline in the time series. For most time series it evolves smoothly and gradually.

It is possible to detect a trend in a time series simply by taking averages of it over a certain time period. If these averages are changing with time then it is possible to say that there is a trend in this time series. A visual representation will also be helpful to determine the trend component of a time series. Figure 1.2 displays an example of trend component.

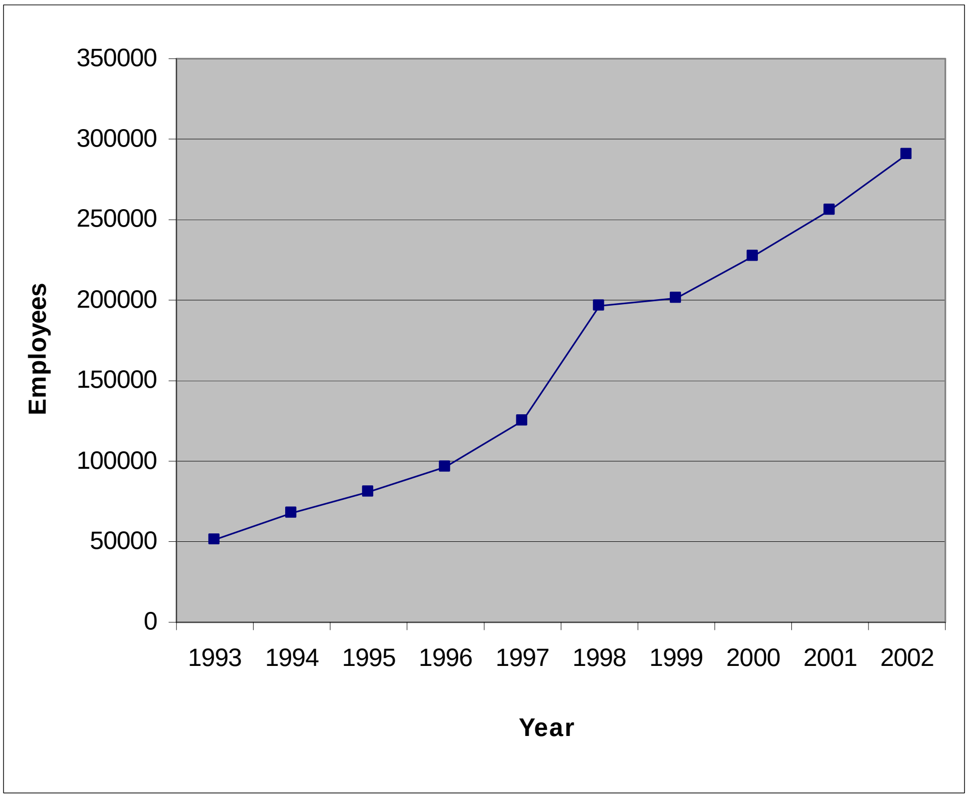


Figure 1.2 Trend component of a time series

1.4.2 Cycle Component

Cycle refers to regular or periodic up and down movements around the trend. There is a repeating pattern with some regularity but the fluctuations in the series are longer than 1 year. Sometimes the cycle and the trend are estimated jointly because most time series are too short for the identification of a trend.

A cycle consists of an expansion phase followed by a recession phase. This sequence is recurrent but not strictly periodic. Figure 1.3 displays an example of cycle component.

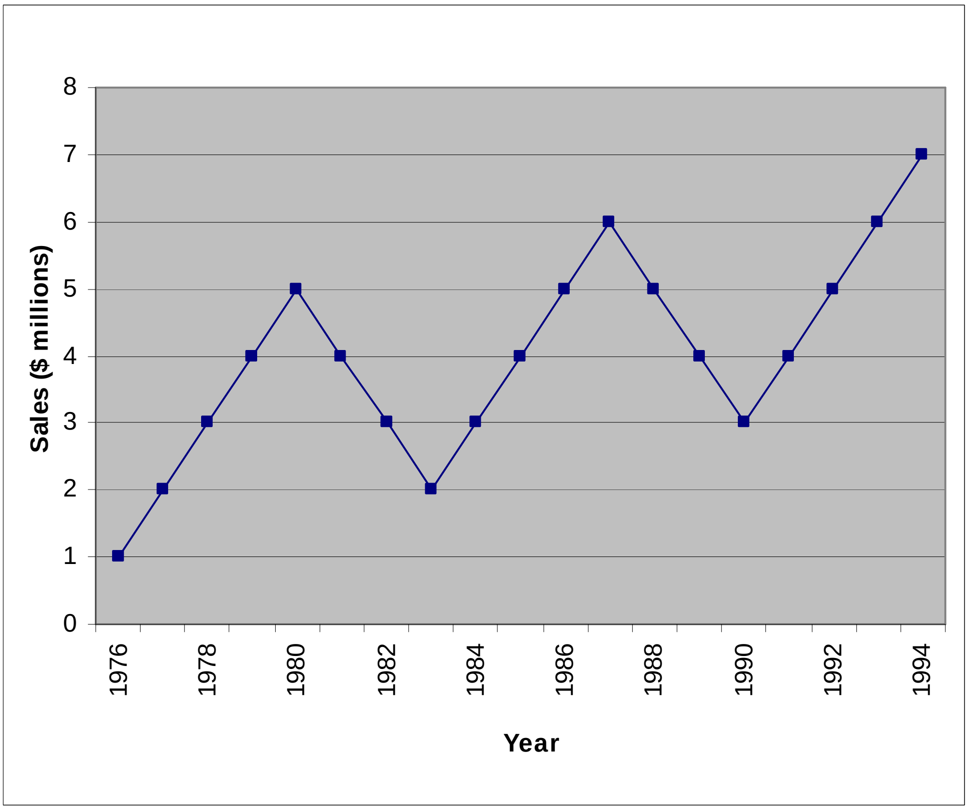


Figure 1.3 Cycle component of a time series

1.4.3 Seasonal Component

Seasonal component is a periodic change in the time series that occurs in a short term. There are periodic fluctuations and these periods occur within one year (e.g., 12 moths per year, or 7 days per week). The seasonal cycle is the period of time that elapses before the periodic pattern repeats itself. Figure 1.4 displays an example of seasonal component.

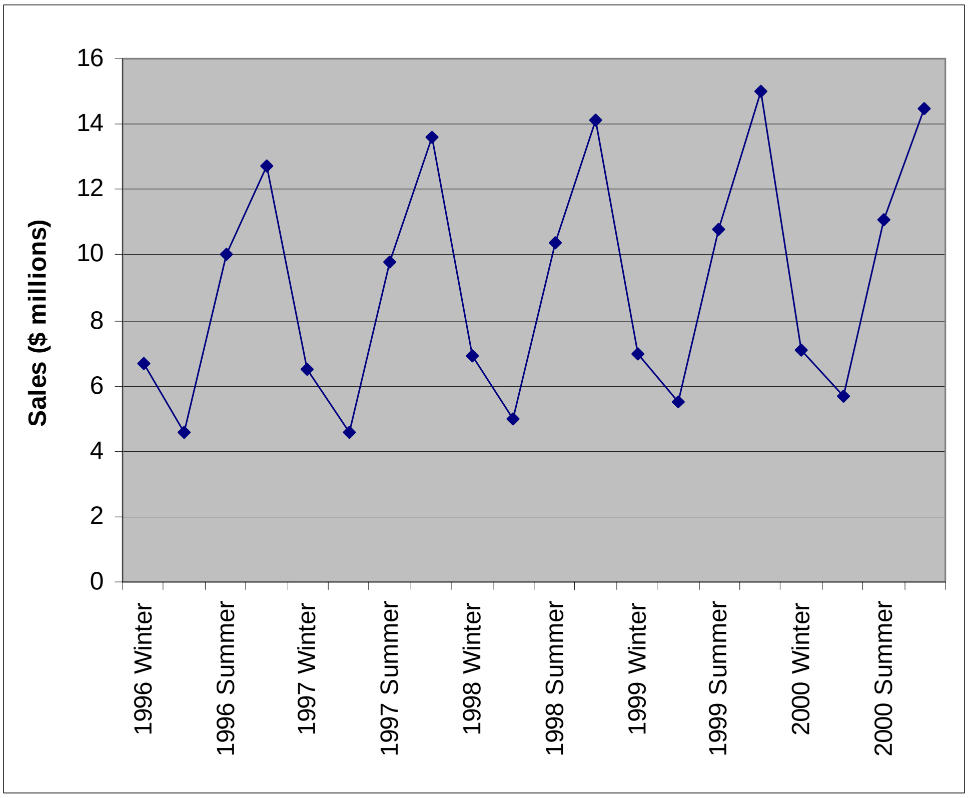


Figure 1.4 Seasonal component of a Time Series

1.4.4 Irregular Component

Irregular component is anything left over in a time series after the trend, cycle and seasonal components. These are erratic movements that follow no recognizable or regular pattern. These fluctuations may be caused by unusual events or may contain noisy or random component of the data and in a highly irregular series these fluctuations will prevent the detection of the trend and seasonality. Figure 1.5 displays an example of irregular component.

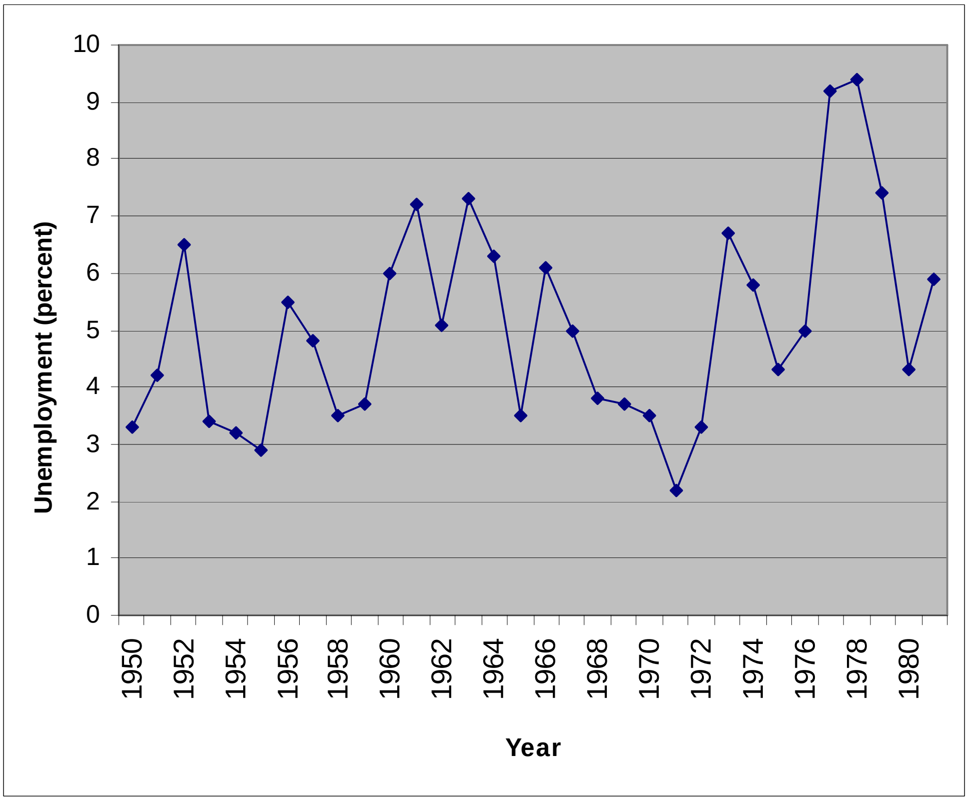


Figure 1.5 Irregular component of a time series

Figure 1.6 displays four components in a time series.

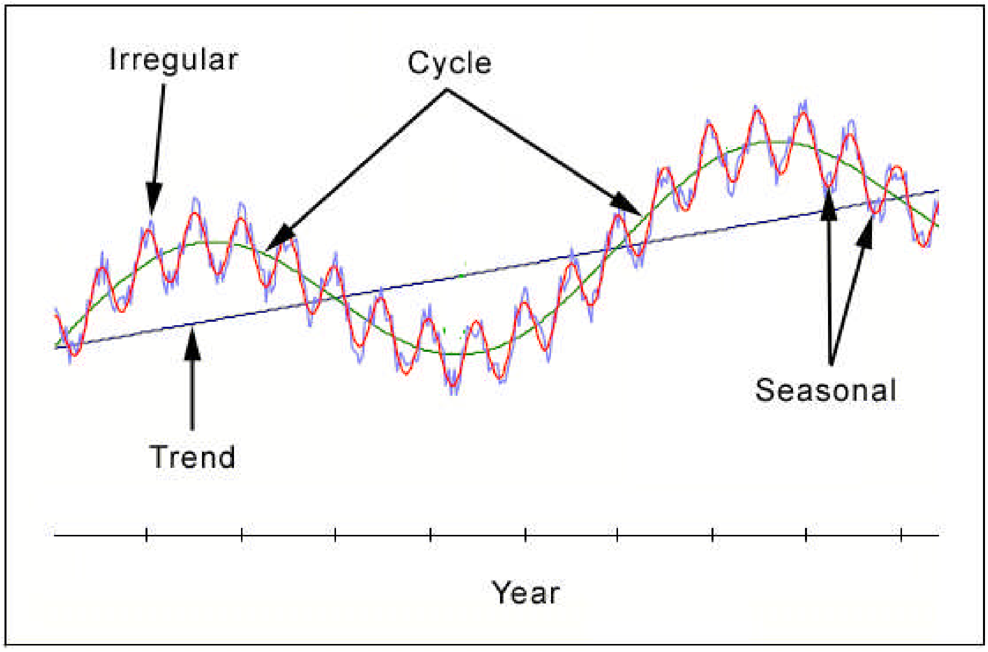


Figure 1.6 Four components of a time series

1.5 Time Series Models

There are many forecasting methods that can be used to predict future events. These methods can be divided in to two basic types; qualitative and quantitative methods. Time series models are quantitative methods that can have many forms. In such models, historical data is analyzed to identify a data pattern. Then, assuming that it will continue in the future, this data patterns is extrapolated in order to produce forecasts.

In all models, there is an underlying process that generates the observations in terms of a set of significant pattern in time, plus an unpredictable random element which can be described by a probability distribution having zero mean (Brown, 1964).

1.5.1 Algebraic Models

1.5.1.1 Constant Models

In constant models the observations are random samples from some distribution and the mean of the distribution doesn't change significantly with time. So, underlying process ξ_t doesn't change

$$\xi_t = a$$

where *a* is the true value which we shall never know. The observations X_t include some random error

$$X_t = \xi_t + \varepsilon_t = a + \varepsilon_t$$

It is always assumed that the expected value of the error is zero, it has constant variance and usually the distribution of it is Gaussian.

The true value of the average is not known but it can be estimated from recent observations. Then the forecast of the mean of the distribution for future samples will be represented by

$$\hat{X}_{t+m} = \hat{a}_t$$

1.5.1.2 Linear Models

If there is a significant trend then the underlying process will be

$$\xi_t = a + bt$$

where *a* is the average when the time *t* is zero and *b* is the trend. Again true values of *a* and *b* are not known but they must be estimated from the data in the recent past. After estimating these values the mean of the distribution from which future observations will be taken is forecast as

$$\hat{X}_{t+m} = \hat{a}_t + \hat{b}_t m$$

1.5.1.3 Polynomial Models

In general, any degree of polynomial can be used to represent the process by adding terms t^2, $t^3, \ldots, t^N$ to the model. The highest exponent in the model determines the degree of the polynomial. The number of coefficients which must be estimated is always one more than the degree of the polynomial.

For example, for a second-degree polynomial the following equation can be written as follows

$$\xi_t = a + bt + ct^2$$

After estimating the coefficients $\hat{a}_t$, $\hat{b}_t$ and $\hat{c}_t$ the forecast will then be

$$\hat{X}_{t+m} = \hat{a}_t + \hat{b}_t m + \hat{c}_t m^2$$

1.5.2 Transcendental Models

1.5.2.1 Exponential Models

An exponential function will describe the process where the rate of growth is proportional. The change in value from one observation to the next can be expressed as a constant percentage of the current value. A model of the process may

$$\log \xi_t = \log k + t \log a$$

where k is constant of proportionality and a is the ratio of one observation to the previous observation. A more complicated model would be

$$\log \xi_t = \log k + t \log a + t^2 \log b$$

and for the simple exponential function it would be

$$\xi_t = ka^t$$

In general form

$$\xi_t = k_1 \binom{t}{0} a^t + k_2 \binom{t}{1} a^{t-1} b + \ldots + k_n \binom{t}{n-1} a^{t-n+1} b^{n-1}$$

1.5.2.2 Trigonometric Models

When the process to be forecasted is periodic it is appropriate to describe it in terms of sines and cosines. A model would be

$$\xi_t = a \cos \frac{\pi t}{6}$$

or

$$\xi_t = a \cos \frac{2\pi}{p} (p - p_0) + c$$

1.5.3 Composite Models

It is possible to use algebraic and transcendental models together. Models that combine algebraic and transcendental models are called composite models. For example;

$$\xi_t = a_0 + a_1 t + (a_2 + a_4 t)\sin\frac{\pi t}{6}$$

1.5.4 Regression Models

The algebraic and transcendental models and their combination may exhaust to model the process. There is a very wide class of linear forecast models, in which the process is described by

$$\xi_t = a_1 f_1(t) + \ldots + a_n f_n(t)$$

where the functions $f_i(t)$ can be any arbitrary functions.

1.6 Errors in Forecasting

Unfortunately, all forecasting methods will include some degree of uncertainty (Bowerman & O'Connel, 1987). This is recognized by including an irregular component in the description of a time series. The presence of the irregular component means that some error in forecasting must be expected.

However, there are other sources of errors take place in forecasting. Predicted trend, seasonal and cyclical components may influence the magnitude of error in forecasts. So, large forecasting error may indicate that forecasting technique being used in not capable of accurately determine the trend, seasonal and cyclical components and, therefore, the technique being used is inappropriate.

1.6.1 Measuring Forecast Errors

If the actual value of the variable of interest at time period *t* is x_t and the predicted value of x_t is $\hat{x}_t$ then the forecast error e_t is difference of the actual value and predicted value

$$e_t = x_t - \hat{x}_t$$

It is possible to sum forecast errors to determine whether accurate forecasting is possible.

$$\sum_{t=1}^{n} (x_t - \hat{x}_t)$$

Summation of the difference between the predicted and actual values from time period *t*=1 through time period *t*=*n*, where *n* is the total number of observed time periods. However, this quantity is not appropriate since some errors will be positive while others are negative. If the errors display a random pattern then sum of the forecast errors will be close to zero. One way to solve this problem is to use absolute values of forecast errors where

$$\text{Absolute Error} = |e_t| = |x_t - \hat{x}_t|$$

Using absolute values mean absolute error (MAE) defined as the average of the absolute deviations

$$\text{MAE} = \frac{\sum_{t=1}^{n} |e_t|}{n} = \frac{\sum_{t=1}^{n} |x_t - \hat{x}_t|}{n}$$

Another way is to use square of the forecast errors

$$\text{Squared Error} = (e_t)^2 = (x_t - \hat{x}_t)^2$$

Then using squared errors, Mean Squared Error (MSE) is defined as the average of the squared errors

$$\text{MSE} = \frac{\sum_{t=1}^{n}(e_t)^2}{n} = \frac{\sum_{t=1}^{n}(x_t - \hat{x}_t)^2}{n}$$

These two measures MAE and MSE can be used the measure the magnitude of forecast errors. These measures can be used in the process of selecting a forecasting model. Historical data can be simulated to produce predictions and comparing these predictions with the actual values MAE and MSE can be calculated to measure accuracy of the selected model. For example, suppose we have two forecasting methods and from historical data given in Table 1.1, predictions, forecast errors, MAE and MSE are calculated (Table 1.2).

Table 1.2 Comparisons of the errors produced by two different forecasting methods

Actual y_t	Predicted y_{A_t}	Error e_{A_t}	Absolute Error	Squared Error	Predicted y_{B_t}	Error e_{B_t}	Absolute Error	Squared Error
1	2	-1	1	1	1	0	0	0
2	4	-2	2	4	1	1	1	1
3	2	1	1	1	2	1	1	1
4	3	1	1	1	3	1	1	1
1	3	-2	2	4	3	-2	2	4
2	4	-2	2	4	2	0	0	0
3	2	1	1	1	2	1	1	1
4	3	1	1	1	3	1	1	1
1	2	-1	1	1	2	-1	1	1
2	3	-1	1	1	1	1	1	1
3	1	2	2	4	2	1	1	1
4	2	2	2	4	3	1	1	1
Sum			17	27			11	13

From Table 1.2

$$\text{MAE}_\text{A} = \frac{17}{12} = 1.42 \;, \quad \text{MSE}_\text{A} = \frac{27}{12} = 2.25$$

and

$$\text{MAE}_\text{B} = \frac{11}{12} = 0.92 \,, \quad \text{MSE}_\text{B} = \frac{13}{12} = 1.08$$

It is possible to say that method B is more accurate than method A according to accuracy measures MAE and MSE.

In addition to comparing different methods, MAE and MSE can also be used to monitor a forecasting system. Forecasts cannot be expected to be accurate unless the historical data pattern that identified continues in the future. If there exists sudden changes in that pattern for an extended period of time then forecasting method used to forecast the variable of interest might now be expected to become inaccurate because of this change. At this situation, MAE and MSE can monitor the forecast errors and discover the change in pattern as quickly as possible before forecasts become very inaccurate.

There is also other accuracy measures have been used to evaluate the performance of forecasting methods. Mahmoud has been listed some of them (Mahmoud, 1984). Makridakis used MAPE, MSE, AR, MdAPE and PB (Makridakis et al., 1982). Chatfield (Chatfield, 1988) and Armstrong (Armstrong & Collopy, 1992) pointed out that the MSE is not appropriate for comparisons between series as it is scale dependent. Makridakis (Makridakis, Wheelwright & Hydman, 1998) noted that MAPE also has problems when the series has values close to zero.

Armstrong and Collopy recommended the use of relative absolute errors GMRAE and MdRAE although relative errors have infinite variance and undefined mean (Armstrong & Collopy, 1992). In a study MAPE, MdAPE, PB, AR, GMRAE and MdRAE is used (Fildes, Hibon, Makridakis & Meade, 1998). The M3-competition use three different measures: MdRAE, sMAPE and SMdAPE (Makridakis & Hibon, 2000). The symmetric measures were proposed by Makridakis (Makridakis, 1993). Table 1.3 displays commonly used forecast accuracy measures.

Table 1.3 Commonly used forecast accuracy measures (Gooijer and Hyndman, 2006)

MSE	***Mean squared error***	***=mean(*** e_t^2 ***)***
RMSE	***Root mean squared error***	$=\sqrt{\text{MSE}}$
MAE	***Mean Absolute error***	***=mean(*** $\lvert e_t \rvert$ ***)***
MdAE	***Median absolute error***	***=median(*** $\lvert e_t \rvert$ ***)***
MAPE	***Mean absolute percentage error***	***=mean(*** $\lvert p_t \rvert$ ***)***
MdAPE	***Median absolute percentage error***	***=median(*** $\lvert p_t \rvert$ ***)***
sMAPE	***Symmetric mean absolute percentage error***	***=mean(*** $2\lvert Y_t - \hat{Y}_t \rvert / \left(Y_t - \hat{Y}_t\right)$ ***)***
sMdAPE	***Symmetric median absolute percentage error***	***=median(*** $2\lvert Y_t - \hat{Y}_t \rvert / \left(Y_t - \hat{Y}_t\right)$ ***)***
MRAE	***Mean relative absolute error***	***=mean(*** $\lvert r_t \rvert$ ***)***
MdRAE	***Median relative absolute error***	***=median(*** $\lvert r_t \rvert$ ***)***
GMRAE	***Geometric mean relative absolute error***	***=gmean(*** $\lvert r_t \rvert$ ***)***
RelMAE	***Relative mean absolute error***	***=MAE/*** MAE_b
RelRMSE	***Relative root mean squared error***	***=RMSE/*** $RMSE_b$
LMR	***Log mean squared error***	***=log(RelMSE)***
PB	***Percentage better***	***=100 mean(I{|rt|<1})***
PB(MAE)	***Percentage better (MAE)***	***=100 mean(I{MAE<*** MAE_b ***})***
PB(MSE)	***Percentage better (MSE)***	***=100 mean(I{MSE<*** MSE_b ***})***

CHAPTER TWO

SMOOTHING

There are several smoothing techniques for estimating the numerical values of the coefficients from noisy observations of the underlying process. Smoothing is a process like curve fitting, but there is a distinction. In a curve-fitting problem, one has a set of data to which some appropriate curve is to be fitted. The computations are done once, and the curve should fit “equally well” to the entire set of data.

A smoothing problem starts the same way, with good clean data and a reasonable model to represent the process being forecast. The model is fitted to the data; that is, the coefficients in the model are estimated from the data available to date. So far, the problem is a simple curve-fitting problem. There are two differences. First, the model should fit current data very well, but it is not important that data obtained a long time ago fit so well. Second, the computations are repeated with each new observation. The process is essentially iterative, so that is it important that the computational procedures be fast and simple.

2.1 Moving Average

In moving average technique, model is assumed to be a constant model. Therefore, model for the underlying process is

$$\xi_t = a \tag{2.1}$$

and the observations include random noise

$$X_t = \xi_t + \varepsilon_t = a + \varepsilon_t \tag{2.2}$$

where the noise samples $\{\varepsilon_t\}$ have an average value of zero. It is quite possible that in different parts of the sequence of observations, widely separated from each other, the value of the single coefficient *a* will change. But in any local segment, a single value gives a reasonably good model of the process (Brown, 1964).

The current value of a can be estimated by some sort of an average. Since the value can change gradually with time, the average computed at any time should place more weight on current observations than on those obtained a long time ago. The moving average is in common use for that reason. Now,

$$M_t = \frac{X_t + X_{t-1} + \cdots + X_{t-N+1}}{N} \tag{2.3}$$

is the actual average of the N most recent observations, computed at time t. Its value is useful as an estimate of the coefficient $\hat{a}_t$.

The process of computing moving average is quite simple and straightforward. It is accurate: the average minimizes the sum of squares of the differences between the most recent N observations and the estimate of the coefficient in the model.

The rate of response is controlled by the choice of the number N of observations to be averaged. If N is large, the estimates will be very stable.

If the observations come from a constant process, where a has a true value, and where the noise samples $\{\varepsilon_t\}$ are random samples from normal distribution with zero mean and variance σ_ε^2, then the average is an unbiased estimate of the coefficient a, and the variance of the successive estimates is $\sigma_{M_t}^2 = \sigma_\varepsilon^2 / N$.

$$\begin{aligned}
E(M_t) &= E\left(\frac{X_1 + X_2 + \cdots + X_N}{N}\right) \\
&= \frac{E(X_1) + E(X_2) + \cdots + E(X_n)}{N} \\
&= \frac{E(a+\varepsilon_1) + E(a+\varepsilon_2) + \cdots + E(a+\varepsilon_N)}{N} \\
&= N\frac{a}{N} \\
&= a
\end{aligned} \tag{2.4}$$

$$V(M_t) = V\left(\frac{X_1 + X_2 + \cdots + X_N}{N}\right)$$
$$= \frac{V(X_1) + V(X_2) + \cdots + V(X_n)}{N^2}$$
$$= N\frac{\sigma_\varepsilon^2}{N^2} \tag{2.5}$$
$$= \frac{\sigma_\varepsilon^2}{N}$$

The average age of the data used in moving average is

$$\bar{k} = \frac{0+1+2+\ldots+N-1}{N} = \frac{N-1}{2} \tag{2.6}$$

Following table summarizes the process. If we choose N=3 then there will be no predicted values for the first two values of the time series. Beginning from observation three, predicted values will be calculated as the average of the last 3 observations.

Table 2.1 Moving average example

	Actual Values	Moving Average	Absolute Error	Squared Error
1	9			
2	8			
3	9	8.67	0.33	0.11
4	12	9.67	2.33	5.44
5	9	10.00	1.00	1.00
6	12	11.00	1.00	1.00
7	11	10.67	0.33	0.11
8	7	10.00	3.00	9.00
9	13	10.33	2.67	7.11
10	9	9.67	0.67	0.44
11	11	11.00	0.00	0.00
12	10	10.00	0.00	0.00
			11.33	24.22

For example;

$$M_3 = \left(x_3 + x_2 + x_1\right)/3 = (9+8+9)/3 = 8.667$$

or

$$M_9 = \left(x_9 + x_8 + x_7\right)/3 = (13+7+11)/3 = 10.333$$

Now, MAE or MSE can be calculated from the simulated predictions and actual values.

$$\text{MAE} = \frac{\sum_{t=1}^{n} |e_t|}{n} = \frac{11.33}{10} = 1.133$$

$$\text{MSE} = \frac{\sum_{t=1}^{n} (e_t)^2}{n} = \frac{24.22}{10} = 2.422$$

For moving average m-periods-ahead forecast for any future observation at time t is equal to moving average calculated at time t is

$$\hat{X}_{t+m} = M_t \tag{2.7}$$

and therefore one-period-ahead forecast is given by

$$\hat{X}_{t+1} = M_t \tag{2.8}$$

2.2 Exponential Smoothing

Exponential smoothing is probably the most widely used class of procedures for smoothing discrete time series in order to forecast the future. It weights past observations using exponentially decreasing weights. In other words, recent observations are given relatively more weight in forecasting than the older observations.

In exponential smoothing, there are one or more smoothing parameters to be determined and these choices determine the weights, which are exponentially decreasing weights as the observations getting older, assigned to the observations. This is a desired situation because future events usually depend more on recent data than on data from a long time ago. This gives the power of adjusting an early forecast with the latest observation. In the case of moving averages, which is another technique of smoothing, the weights assigned to the observations are the same and equal to $1/N$ so newest and oldest data have the same weights for forecasting.

There are also other different types of forecasting procedures but exponential smoothing methods are widely used in industry. Their popularity is due to several practical considerations in short-range forecasting (Gardner, 1985);

- model formulations are relatively simple
- model components and parameters have some intuitive meaning
- only limited data storage and computational effort is needed
- tracking signal tests for forecast control are easy to apply
- accuracy can be obtained with minimal effort in model identification

2.3 History of Exponential Smoothing

Exponential smoothing methods originated by the works of Brown (Brown, 1959), (Brown, 1964), Holt (Holt, 1957) and Winters (Winters, 1960). The method was independently developed by Brown and Holt. Roberts G. Brown originated the exponential smoothing while he was working for the US Navy during World War II (Gass & Harris, 2000). Brown was assigned to design a tracking system for fire-control information to compute the location of submarines. Brown’s tracking model was essentially simple exponential smoothing of continues data. During the early 1950s, Brown extended simple exponential to discrete data and developed methods for trends and seasonality. In 1956, Brown presented his work on exponential smoothing at a conference and this formed the basis of Brown’s first book (Brown, 1959).

By the way, Charles C. Holt, with the support of the Office of Naval Research, worked independently of Brown to develop a similar method for exponential smoothing of additive trends and entirely different method for smoothing seasonal data. Holt’s original work was documented in an ONR memorandum (Holt, 1957) and went unpublished until recently (Holt 2004a, 2004b).

A simple classification of the trend and seasonal patterns provided by Pegels (Pegels, 1969). Box and Jenkins (Box & Jenkins, 1970), Roberts (Roberts, 1982), and Abraham and Ledolter (Abraham & Ledolter, 1983) showed that some linear exponential smoothing forecasts originate from special cases of ARIMA models.

Gardner published his first paper providing a detailed review of exponential smoothing (Gardner, 1985). Up to this paper, many believed that exponential smoothing should be disregarded since it was a special case of ARIMA (Gardner, 2006). Since 1985, many works showed that exponential smoothing methods are optimal for every general class of models that is in fact broader than the ARIMA.

Since 1980, the empirical properties of the methods studied by Bartolomei (Bartolomei & Sweet, 1989) and Makridakis (Makridakis & Hibon, 1991), new proposals of estimation or initialization are introduced by Ledolter, (Ledolter & Abraham, 1984), forecasts are evaluated by McClain (McClain, 1988) and Sweet (Sweet & Wilson, 1988), and statistical models are concerned by McKenzie (McKenzie, 1984).

Numerous variations on the original methods have been proposed (Carreno & Madinaveitia, 1990), (Williams & Miller, 1999), (Rosas & Guerrero, 1994), (Lawton, 1998), (Roberts, 1982), (McKenzie, 1986).

Good forecasting performance of exponential smoothing methods has been showed by several authors (Satchell & Timmermann, 1995), (Chatfield et al., 2001), (Hyndman, 2001).

Many contributions were made by researchers to extend the original work of Brown and Holt. These contributions were made for different forecast profiles. These profiles are given in Figure 2.1.

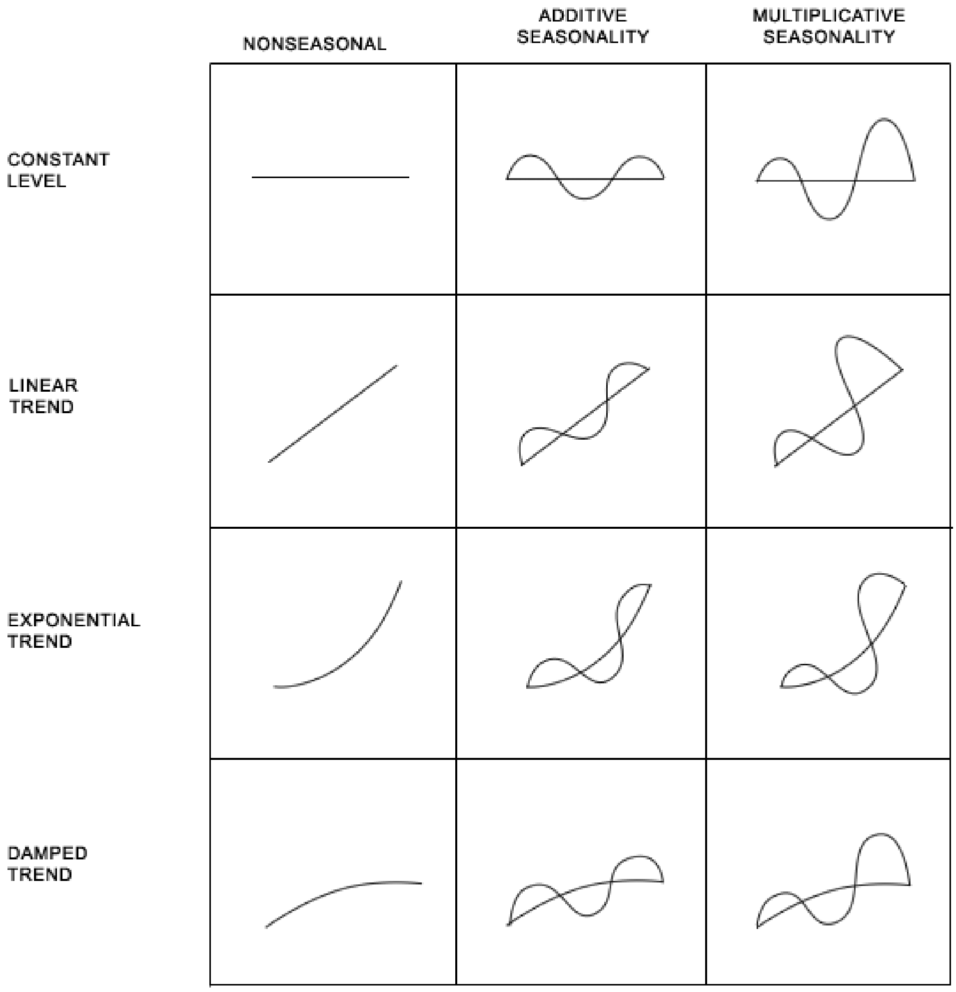


Figure 2.1 Forecast profiles from exponential smoothing (Gardner, 1985)

There are a lot of methods for the forecast profiles above. Table 2.2 contains equations for the standard methods of exponential smoothing, all of which are extensions of the work of Brown (1959, 1964), Holt (1957) and Winters (1960). For each type of trend, there are two sections of equations: the first give recurrence forms and the second gives equivalent error-correction forms. Recurrence forms were used in the original work by Brown and Holt and are still widely used in practice, but error-correction forms are simpler.

Table 2.2 Equations for the standard methods of exponential smoothing (Gardner, 2006)

Trend	Seasonality		
	N None	**A** Additive	**M** Multiplicative
N None	$S_t = \alpha X_t + (1-\alpha)S_{t-1}$ $\hat{X}_t(m) = S_t$	$S_t = \alpha(X_t - I_{t-p}) + (1-\alpha)S_{t-1}$ $I_t = \delta(X_t - S_t) + (1-\delta)I_{t-p}$ $\hat{X}_t(m) = S_t + I_{t-p+m}$	$S_t = \alpha(X_t / I_{t-p}) + (1-\alpha)S_{t-1}$ $I_t = \delta(X_t / S_t) + (1-\delta)I_{t-p}$ $\hat{X}_t(m) = S_t I_{t-p+m}$
	$S_t = S_{t-1} + \alpha e_t$ $\hat{X}_t(m) = S_t$	$S_t = S_{t-1} + \alpha e_t$ $I_t = I_{t-p} + \delta(1-\alpha)e_t$ $\hat{X}_t(m) = S_t + I_{t-p+m}$	$S_t = S_{t-1} + \alpha e_t / I_{t-p}$ $I_t = I_{t-p} + \delta(1-\alpha)e_t / S_t$ $\hat{X}_t(m) = S_t I_{t-p+m}$
A Additive	$S_t = \alpha X_t + (1-\alpha)(S_{t-1} + T_{t-1})$ $T_t = \gamma(S_t - S_{t-1}) + (1-\gamma)T_{t-1}$ $\hat{X}_t(m) = S_t + mT_t$	$S_t = \alpha(X_t - I_{t-p}) + (1-\alpha)(S_{t-1} + T_{t-1})$ $T_t = \gamma(S_t - S_{t-1}) + (1-\gamma)T_{t-1}$ $I_t = \delta(X_t - S_t) + (1-\delta)I_{t-p}$ $\hat{X}_t(m) = S_t + mT_t + I_{t-p+m}$	$S_t = \alpha(X_t / I_{t-p}) + (1-\alpha)(S_{t-1} + T_{t-1})$ $T_t = \gamma(S_t - S_{t-1}) + (1-\gamma)T_{t-1}$ $I_t = \delta(X_t / S_t) + (1-\delta)I_{t-p}$ $\hat{X}_t(m) = (S_t + mT_t)I_{t-p+m}$
	$S_t = S_{t-1} + T_{t-1} + \alpha e_t$ $T_t = T_{t-1} + \alpha\gamma e_t$ $\hat{X}_t(m) = S_t + mT_t$	$S_t = S_{t-1} + T_{t-1} + \alpha e_t$ $T_t = T_{t-1} + \alpha\gamma e_t$ $I_t = I_{t-p} + \delta(1-\alpha)e_t$ $\hat{X}_t(m) = S_t + mT_t + I_{t-p+m}$	$S_t = S_{t-1} + T_{t-1} + \alpha e_t / I_{t-p}$ $T_t = T_{t-1} + \alpha\gamma e_t / I_{t-p}$ $I_t = I_{t-p} + \delta(1-\alpha)e_t / S_t$ $\hat{X}_t(m) = (S_t + mT_t)I_{t-p+m}$
DA Damped Additive	$S_t = \alpha X_t + (1-\alpha)(S_{t-1} + \phi T_{t-1})$ $T_t = \gamma(S_t - S_{t-1}) + (1-\gamma)\phi T_{t-1}$ $\hat{X}_t(m) = S_t + \sum_{i=1}^{m}\phi^i T_t$	$S_t = \alpha(X_t - I_{t-p}) + (1-\alpha)(S_{t-1} + \phi T_{t-1})$ $T_t = \gamma(S_t - S_{t-1}) + (1-\gamma)\phi T_{t-1}$ $I_t = \delta(X_t - S_t) + (1-\delta)I_{t-p}$ $\hat{X}_t(m) = S_t + \sum_{i=1}^{m}\phi^i T_t + I_{t-p+m}$	$S_t = \alpha(X_t / I_{t-p}) + (1-\alpha)(S_{t-1} + \phi T_{t-1})$ $T_t = \gamma(S_t - S_{t-1}) + (1-\gamma)\phi T_{t-1}$ $I_t = \delta(X_t / S_t) + (1-\delta)I_{t-p}$ $\hat{X}_t(m) = (S_t + \sum_{i=1}^{m}\phi^i T_t)I_{t-p+m}$
	$S_t = S_{t-1} + \phi T_{t-1} + \alpha e_t$ $T_t = \phi T_{t-1} + \alpha\gamma e_t$ $\hat{X}_t(m) = S_t + \sum_{i=1}^{m}\phi^i T_t$	$S_t = S_{t-1} + \phi T_{t-1} + \alpha e_t$ $T_t = \phi T_{t-1} + \alpha\gamma e_t$ $I_t = I_{t-p} + \delta(1-\alpha)e_t$ $\hat{X}_t(m) = S_t + \sum_{i=1}^{m}\phi^i T_t + I_{t-p+m}$	$S_t = S_{t-1} + \phi T_{t-1} + \alpha e_t / I_{t-p}$ $T_t = \phi T_{t-1} + \alpha\gamma e_t / I_{t-p}$ $I_t = I_{t-p} + \delta(1-\alpha)e_t / S_t$ $\hat{X}_t(m) = (S_t + \sum_{i=1}^{m}\phi^i T_t)I_{t-p+m}$
M Multiplicative	$S_t = \alpha X_t + (1-\alpha)(S_{t-1}R_{t-1})$ $R_t = \gamma(S_t / S_{t-1}) + (1-\gamma)R_{t-1}$ $\hat{X}_t(m) = S_t R_t^m$	$S_t = \alpha(X_t - I_{t-p}) + (1-\alpha)S_{t-1}R_{t-1}$ $R_t = \gamma(S_t / S_{t-1}) + (1-\gamma)R_{t-1}$ $I_t = \delta(X_t - S_t) + (1-\delta)I_{t-p}$ $\hat{X}_t(m) = S_t R_t^m + I_{t-p+m}$	$S_t = \alpha(X_t / I_{t-p}) + (1-\alpha)S_{t-1}R_{t-1}$ $R_t = \gamma(S_t / S_{t-1}) + (1-\gamma)R_{t-1}$ $I_t = \delta(X_t / S_t) + (1-\delta)I_{t-p}$ $\hat{X}_t(m) = (S_t R_t^m)I_{t-p+m}$
	$S_t = S_{t-1}R_{t-1} + \alpha e_t$ $R_t = R_{t-1} + \alpha\gamma e_t / S_{t-1}$ $\hat{X}_t(m) = S_t R_t^m$	$S_t = S_{t-1}R_{t-1} + \alpha e_t$ $R_t = R_{t+1} + \alpha\gamma e_t / S_{t-1}$ $I_t = I_{t-p} + \delta(1-\alpha)e_t$ $\hat{X}_t(m) = S_t R_t^m + I_{t-p+m}$	$S_t = S_{t-1}R_{t-1} + \alpha e_t / I_{t-p}$ $R_t = R_{t-1} + (\alpha\gamma e_t / S_{t-1}) / I_{t-p}$ $I_t = I_{t-p} + \delta(1-\alpha)e_t / S_t$ $\hat{X}_t(m) = (S_t R_t^m)I_{t-p+m}$
DM Damped Multiplicative	$S_t = \alpha X_t + (1-\alpha)(S_{t-1}R_{t-1}^{\phi})$ $R_t = \gamma(S_t / S_{t-1}) + (1-\gamma)R_{t-1}^{\phi}$ $\hat{X}_t(m) = S_t R_t^{\sum_{i=1}^{m}\phi^i}$	$S_t = \alpha(X_t - I_{t-p}) + (1-\alpha)S_{t-1}R_{t-1}^{\phi}$ $R_t = \gamma(S_t / S_{t-1}) + (1-\gamma)R_{t-1}^{\phi}$ $I_t = \delta(X_t - S_t) + (1-\delta)I_{t-p}$ $\hat{X}_t(m) = S_t R_t^{\sum_{i=1}^{m}\phi^i} + I_{t-p+m}$	$S_t = \alpha(X_t / I_{t-p}) + (1-\alpha)(S_{t-1}R_{t-1}^{\phi})$ $R_t = \gamma(S_t / S_{t-1}) + (1-\gamma)R_{t-1}^{\phi}$ $I_t = \delta(X_t / S_t) + (1-\delta)I_{t-1}$ $\hat{X}_t(m) = (S_t R_t^{\sum_{i=1}^{m}\phi^i})I_{t-p+m}$
	$S_t = S_{t-1}R_{t-1}^{\phi} + \alpha e_t$ $R_t = R_{t-1}^{\phi} + \alpha\gamma e_t / S_{t-1}$ $\hat{X}_t(m) = S_t R_t^{\sum_{i=1}^{m}\phi^i}$	$S_t = S_{t-1}R_{t-1}^{\phi} + \alpha e_t$ $R_t = R_{t-1}^{\phi} + \alpha\gamma e_t / S_{t-1}$ $I_t = I_{t-p} + \delta(1-\alpha)e_t$ $\hat{X}_t(m) = S_t R_t^{\sum_{i=1}^{m}\phi^i} + I_{t-p+m}$	$S_t = S_{t-1}R_{t-1}^{\phi} + \alpha e_t / I_{t-p}$ $R_t = R_{t-1}^{\phi} + (\alpha\gamma e_t / S_{t-1}) / I_{t-p}$ $I_t = I_{t-p} + \delta(1-\alpha)e_t / S_t$ $\hat{X}_t(m) = (S_t R_t^{\sum_{i=1}^{m}\phi^i})I_{t-p+m}$

Table 2.3 Notation for exponential smoothing (Gardner, 2006)

Symbol	Definition
α	Smoothing parameter for the level of the series
γ	Smoothing parameter for the trend
δ	Smoothing parameter for seasonal indices
ϕ	Autoregressive or damping parameter
β	Discount factor, $0 \le \beta \le 1$
S_t	Smoothed level of the series, computed after X_t is observed
T_t	Smoothed additive trend at the end of period *t*
R_t	Smoothed multiplicative trend at the end of period *t*
I_t	Smoothed seasonal index at the end of period *t*
X_t	Observed value of the time series in period *t*
m	Number of periods in the forecast lead-time
p	Number of periods in the seasonal cycle
$\hat{X}_t(m)$	Forecast for *m* periods ahead from origin *t*
e_t	One-step-ahead forecast error, $e_t = X_t - \hat{X}_t(1)$
C_t	Cumulative renormalization factor for seasonal indices
V_t	Transition variable in smooth transition exponential smoothing
D_t	Observed value of nonzero demand in the Croston method
Q_t	Observed inter-arrival time of transactions in the Croston method
Z_t	Smoothed nonzero deman in the Croston method
P_t	Smoothed inter-arrival time in the Croston method
Y_t	Estimated demand per unit time in the Croston method

2.4 Simple Exponential Smoothing

In simple exponential smoothing method model for the underlying process is assumed to be a constant model like moving average and the time series is represented by

$$X_t = a + \varepsilon_t \tag{2.9}$$

where ε_t is random component with mean zero and variance σ_ε^2. The value of *a* is assumed to be constant in any local segment of the series but may change slowly over time. This is the model with no trend and no seasonality in Table 2.2 and the smoothing equation for simple exponential smoothing in recurrence form is given by

$$S_t = \alpha X_t + (1-\alpha)S_{t-1} \tag{2.10}$$

where S_t is the smoothing statistic (or smoothed value) and α is the smoothing constant. It can be seen that the new smoothed value is the weighted sum of the current observation and the previous smoothed value. The weight of the most recent observation is α and the weight of the most recent smoothed value is (1-α). Then, S_{t-1} can be written as

$$S_{t-1} = \alpha X_{t-1} + (1-\alpha)S_{t-2} \tag{2.11}$$

substituting S_{t-1} in equation 2.10 with its component (equation 2.11) we can write S_t as

$$\begin{aligned} S_t &= \alpha X_t + (1-\alpha)\left[\alpha X_{t-1} + (1-\alpha)S_{t-2}\right] \\ &= \alpha X_t + \alpha(1-\alpha)X_{t-1} + (1-\alpha)^2 S_{t-2} \end{aligned} \tag{2.12}$$

and replacing S_{t-2} in equation 2.12 with its component we have

$$\begin{aligned} S_t &= \alpha X_t + \alpha(1-\alpha)X_{t-1} + (1-\alpha)^2\left[\alpha X_{t-2} + (1-\alpha)S_{t-3}\right] \\ &= \alpha X_t + \alpha(1-\alpha)X_{t-1} + \alpha(1-\alpha)^2 X_{t-2} + (1-\alpha)^3 S_{t-3} \end{aligned} \tag{2.13}$$

repeating the substitution for S_{t-3}, S_{t-4} and so on up to S_0 finally we have

$$\begin{aligned} S_t = {} & \alpha X_t + \alpha(1-\alpha)X_{t-1} + \alpha(1-\alpha)^2 X_{t-2} + \alpha(1-\alpha)^3 X_{t-3} + \\ & \alpha(1-\alpha)^4 X_{t-4} + \cdots + \alpha(1-\alpha)^{t-1} X_1 + (1-\alpha)^t S_0 \end{aligned} \tag{2.14}$$

where S_0 is starting value and it is often called as initial value. Equation 2.14 can also be written like this

$$S_t = \alpha \sum_{k=0}^{t-1} (1-\alpha)^k X_{t-k} + (1-\alpha)^t S_0 \tag{2.15}$$

As it seen from Equation 2.14 or 2.15, S_t is the weighted average of all past observations and the starting value S_0. The weights are decrease exponentially depending on the value of parameter α (smoothing constant).

For example, if smoothing constant is equal to 0.3 then the weight associated with the last observation is equal to 0.3 and the weights assigned to previous observations are 0.210, 0.147, 0.103, 0.072, and so on. Figure 2.2 shows the weights given to observations when α value is 0.3. These weights appear to decline exponentially when connected by a smooth curve. This is why it is called "exponential smoothing". More weights given to most recent observations and weights decrease geometrically with age.

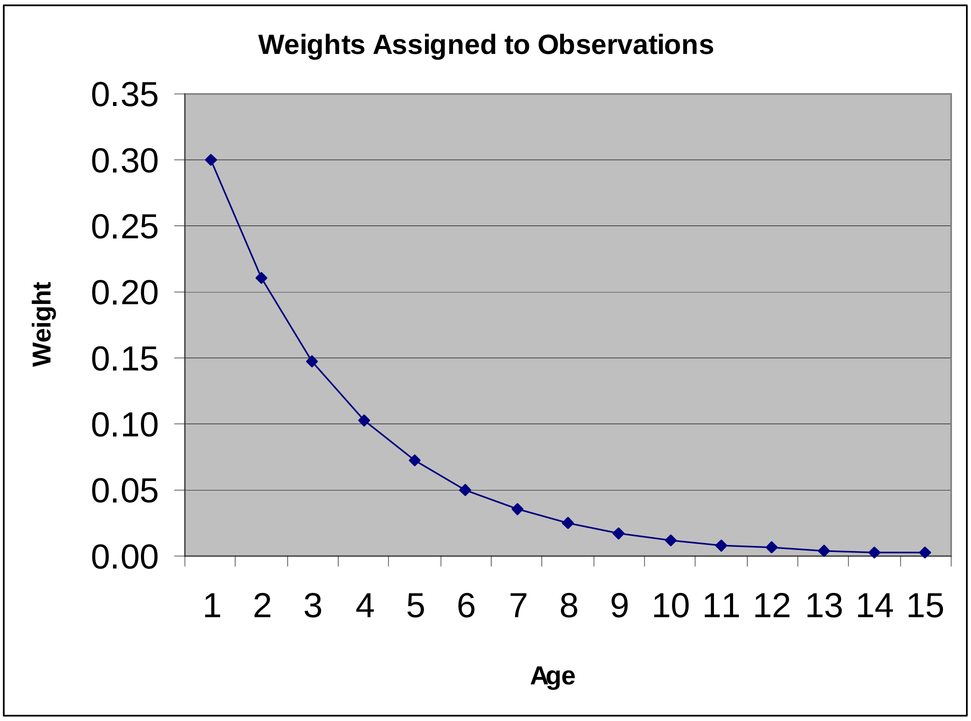


Figure 2.2 Weights assigned to observations when α is 0.3

Weights assigned by simple exponential smoothing are non-negative and sum to unity, since

$$\begin{aligned}
\alpha\sum_{k=0}^{t-1}(1-\alpha)^k+(1-\alpha)^t &= \alpha\frac{1-(1-\alpha)^t}{1-(1-\alpha)}+(1-\alpha)^t \\
&= \alpha\frac{1-(1-\alpha)^t}{\alpha}+(1-\alpha)^t \\
&= 1-(1-\alpha)^t+(1-\alpha)^t \\
&= 1
\end{aligned} \tag{2.16}$$

The value of the parameters α and S_0 must be given to calculate the smoothed values. Depending on the chosen value of these parameters, accuracy of simple exponential smoothing may vary. There a number of methods and suggestions to choose the smoothing constant and initial value which we discuss in detail in section 2.4.1.

Now, it is possible to calculate the expected value and variance of the smoothing statistic S_t. For sufficiently large *t*, the expected value of S_t is

$$\begin{aligned}
E(S_t) &= E\left(\alpha\sum_{k=0}^{\infty}(1-\alpha)^k X_{t-k} + (1-\alpha)^t S_0\right) \qquad (1-\alpha)^t S_0 \to 0 \text{ when } t\to\infty \\
&= \alpha\sum_{0}^{\infty}(1-\alpha)^k E(X_{t-k}) \\
&= E(X)\alpha\sum_{k=0}^{\infty}(1-\alpha)^k \qquad\qquad \text{Note that } \left[\sum_{i=0}^{\infty}(r)^i = \frac{1}{1-r}\right] \\
&= a\alpha\frac{1}{1-(1-\alpha)} \\
&= a\frac{\alpha}{\alpha} \\
&= a
\end{aligned} \tag{2.17}$$

so S_t is unbiased estimator of the constant *a* when $t\to\infty$. Therefore, S_t can be used for future forecasts. The variance of S_t is

$$\begin{aligned}
V(S_t) &= V\left(\alpha\sum_{k=0}^{\infty}(1-\alpha)^k X_{t-k} + (1-\alpha)^t S_0\right) \\
&= \alpha^2\sum_{0}^{\infty}\left((1-\alpha)^k\right)^2 V(X_{t-k}) \\
&= V(x)\,\alpha^2\sum_{k=0}^{\infty}\left((1-\alpha)^k\right)^2 \\
&= \sigma_\varepsilon^2\alpha^2\frac{1}{1-(1-\alpha)^2} \\
&= \frac{\alpha^2}{2\alpha-\alpha^2}\sigma_\varepsilon^2 \\
&= \frac{\alpha}{2-\alpha}\sigma_\varepsilon^2
\end{aligned} \tag{2.18}$$

The weight of the observation X_{t-k} is given as

$$w_{X_{t-k}} = \alpha(1-\alpha)^k \qquad k = 0,1,2,\dots,t-1 \tag{2.19}$$

and weight of the starting value is

$$w_{S_0} = (1-\alpha)^t \tag{2.20}$$

For simple exponential smoothing *m*-periods-ahead forecasting is given by

$$\hat{X}_{t+m} = S_t \qquad m = 1,2,3,\dots \tag{2. 21}$$

therefore one-period-ahead forecasting is given by

$$\hat{X}_{t+1} = S_t \tag{2.22}$$

The average age is the age of each piece of data used in the average. In the exponential smoothing process, the weight given to data *k* periods ago is $\alpha(1-\alpha)^k$ so that the average age of data is

$$\bar{k} = \alpha\sum_{k=0}^{\infty}(1-\alpha)^k k = \alpha\frac{1-\alpha}{(1-(1-\alpha))^2} = \frac{1-\alpha}{\alpha} \qquad \left[\sum ka^k = \frac{a}{(1-a)^2}\right] \tag{2.23}$$

Since it is possible to derive a smoothing parameter which gives approximately the same forecasts as an unweighted moving average of any given number of periods, some researchers has concluded that simple smoothing has no important accuracy (Adam, 1973), (McLeavey, Lee & Everett, 1981), (Armstrong, 1978), (Elton & Gruber, 1972), (Kirby, 1966). However Makridakis has found that simple smoothing was significantly more accurate than unweighted moving average in a sample of 1001 time seris (Makridakis, et all, 1982). Muth was the first of many to prove that simple smoothing is optimal for the ARIMA(0, 1, 1) (Muth, 1960). Harrison (1967), Nerlove and Wage (1964), and Theil and Wage (1964) showed that simple smoothing is optimal with α determined by the ratio of the variances of the noise processes.

Robustness of simple smoothing has also been predicted by other researches. Cogger (1973), Cohen (1963), Cox (1967) and Pandit and Wu (1974) argued that more complex models may not yield significantly smaller errors. Robustness was supported by Makridakis (Makridakis, et all, 1982). Simple smoothing was the best overall choice for one-period-ahead forecasting. More evidence of robustness is given by the simulation study of Gross and Craig (Gross & Craig, 1974).

2.4.1 Smoothing Constant and Starting Value

Parameter selection is an important problem of simple exponential smoothing. The value of smoothing constant and starting value must be initialized to start the recurrence formula of S_t. There are different methods for choosing both smoothing constant and starting value but there is no any proven evidence favoring any particular method.

The first problem is choosing the smoothing constant. It is certain that α value should fall into the interval between 0 and 1. There are two extreme cases when α is zero or one. If α is equal to zero then observations are ignored entirely and the smoothed value consists entirely of the starting value S_0. If α is equal to one then the previous observations are ignored and the value of the smoothed value will equal to current observation. Values of in-between 0 and 1 will produce intermediate results. However, it is obvious that when α is close to 1 more weights put on the recent observations and when it close to 0 more weight put on the earlier observations. So it is crucial to choose a proper α value.

The effect of smoothing constant α is shown in Figure 2.3. Data points with marker diamond is the actual data, marker square represents forecasts when $\alpha = 0.1$ and marker triangular represents forecasts when $\alpha = 0.9$. It can be seen that when $\alpha = 0.9$ simple exponential smoothing responses more rapidly to fluctuations. When $a = 0.1$ response to fluctuations are very slow.

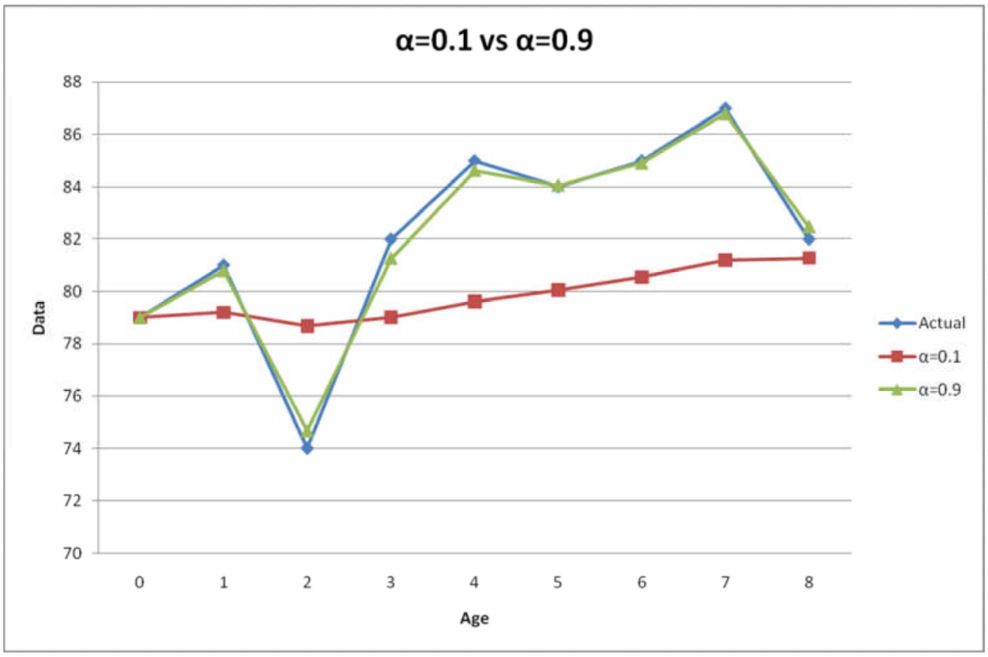


Figure 2.3 Effect of smoothing constant α

However, a big smoothing constant does not mean a better forecast. Figure 2.4 shows the forecasts for $a = 0.1$ and $a = 0.9$. As it seen from the graph using a big value for smoothing constant may cause to large forecast errors but a small value may also cause to not respond to a trend quickly. So, it is very important to decide the value of the smoothing constant.

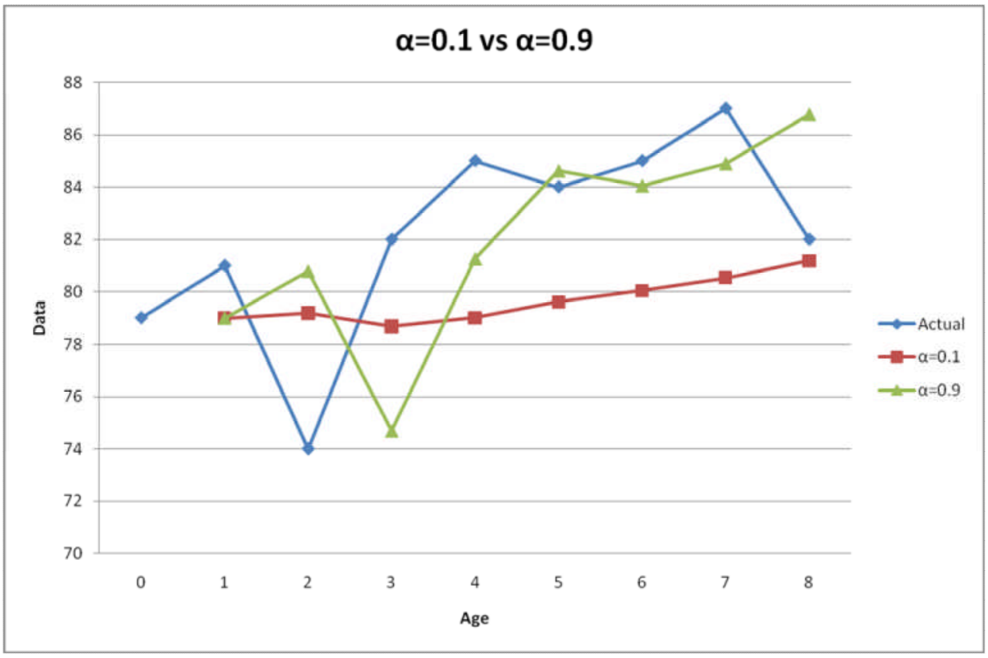


Figure 2.4 Forecasts

There are many theoretical and empirical arguments for selecting an appropriate smoothing value (Gardner, 1985). Gardner reports that an α smaller than 0.30 is usually recommended (Gardner, 1985). However, some studies recommend α values above 0.30 since frequently yielded the best forecasts (Montgomery & Johson, 1976, Makridakis et al., 1982). It was also concluded that it is best to determine an optimum α from the data rather than guessing it (Fildes et al., 1998). In practice, the smoothing parameter is often chosen by a grid search of the parameter space; that is, different solutions for α are tried starting, for example, from α = 0.1 to α = 0.9, with increments of 0.1. Then the α value which produces the smallest sum of squares (or mean squares) for the residuals is chosen as the smoothing constant. In addition, besides the ex post MSE criterion, there are other statistical measures (for example mean absolute error, or mean absolute percentage) error that can be used to determine the optimum α value.

The second problem is choosing the starting value and it is known as "initialization problem". The weight of S_0 may be quite large when a small α is chosen and the time series relatively short. Then the choice of the starting value becomes more important. Depending on the chosen value of α, starting value can effect the quality of forecasts for many observations.

Table 2.4 shows an example of the weights given to the starting value and observations when $\alpha = 0.1$ and $\alpha = 0.9$ for nine observations. The weight given to starting value is 0.387 which is bigger than all weights given to other values when $\alpha = 0.1$. Even if the weight of last observation is much smaller than the weight given to starting value. When $\alpha = 0.9$ the weight given to starting value is too small as expected.

Table 2.4 Weights given to the starting value and observations

	Weight when $\alpha = 0.1$	Weight when $\alpha = 0.9$
Starting Value	0.387	0.000000001
Observation		
1	0.043	0.000000009
2	0.048	0.000000090
3	0.053	0.000000900
4	0.059	0.000009000
5	0.066	0.000090000
6	0.073	0.000900000
7	0.081	0.009000000
8	0.090	0.090000000
9	0.100	0.900000000

Figure 2.5 shows a line graphic of the weights given in Table 2.4. It easy to see the effect of chosen value of α to the starting value. A small α value is often used when more weight wanted to given to the previous observations but it then causes to give more weight to starting value.

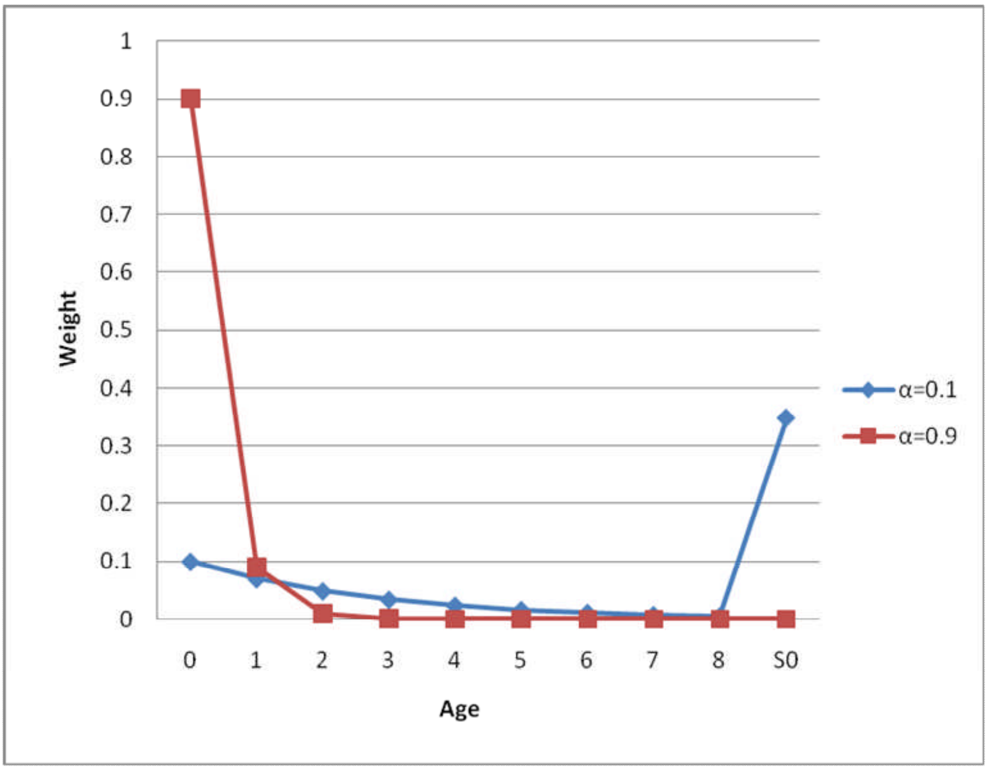


Figure 2.5 Weights given to observations and S_0 when $\alpha = 0.1$ and $\alpha = 0.9$

Methods for computing S_0 have been developed by a number of researchers. Brown's original suggestion is simply using the mean of the data for S_0. Ledolter and Abraham (Ledolter & Abraham, 1984) recommended backcasting to obtain S_0. When only a few data points are available, it can be difficult to choose a starting value. Gilchrist proposed using an exact DLS formulation for S_t (Gilchrist, 1976). Similar ideas for eliminating the need to estimate starting values are discussed by Cogger (Cogger, 1973), McClain (McClain, 1981), Taylor (Taylor, 1981) and Wade (Wade, 1967). Another alternative with a limited number of data points is to use Bayesian methods to combine a prior estimate of the level with an average of the available data (Cohen, 1966), (Jonhson & Montgomery, 1974) and (Taylor, 1981).

Table 2.5 includes an example. There are nine observations and first observation is also used as starting value. Smoothed values and weights are given in the table and Figure 2.6 displays the actual data and smoothed values together.

Table 2.5 Smoothed values for $\alpha = 0.1$ and $S_0 = x_1$

	Actual	Smoothed	Weight
Starting Value		79.000	0.387
Observation			
1	79	79.000	0.043
2	81	79.200	0.048
3	74	78.680	0.053
4	82	79.012	0.059
5	85	79.611	0.066
6	84	80.050	0.073
7	85	80.545	0.081
8	87	81.190	0.090
9	82	81.271	0.100

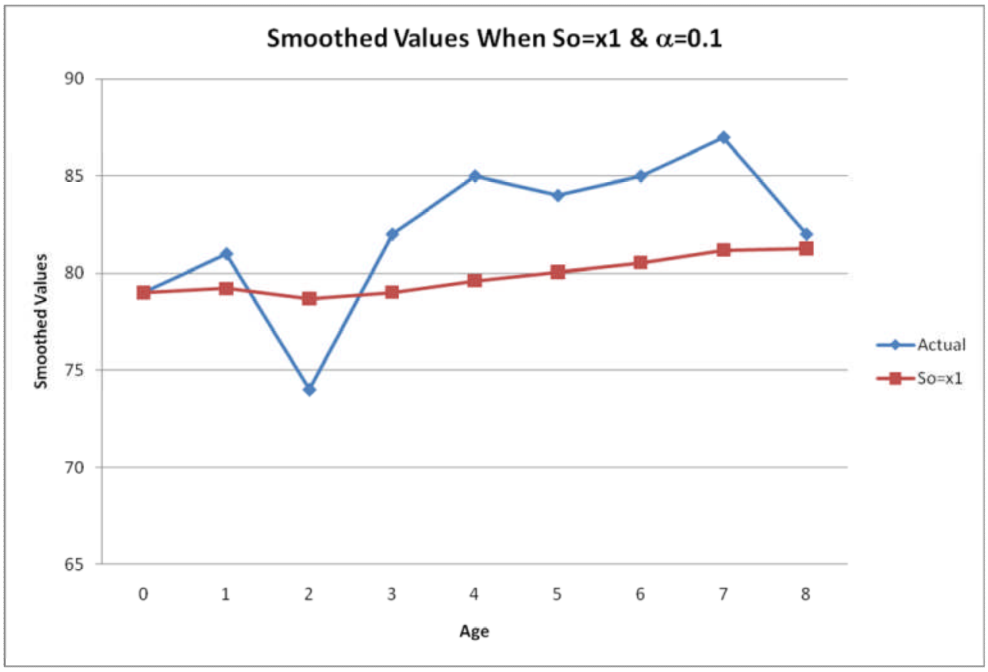


Figure 2.6 Smoothed values when $\alpha = 0.1$ and $S_0 = x_1$

Figure 2.7 shows the effect of using different methods for starting value when $\alpha = 0.1$. When a small a value is chosen, deciding which starting value will be used becomes more important. The chosen method affects the smoothed values for many observations.

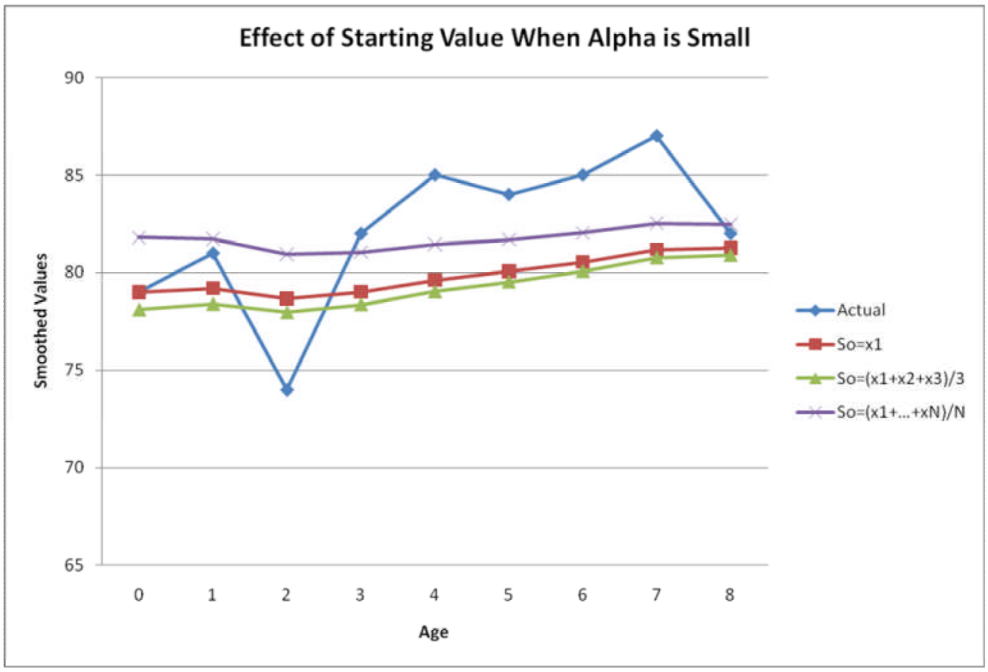


Figure 2.7 Using different methods for starting value when $\alpha = 0.1$

Figure 2.8 shows the effect of using different methods for starting value when $\alpha = 0.9$. It is shown that chosen method for starting value does not matter for big values of α.

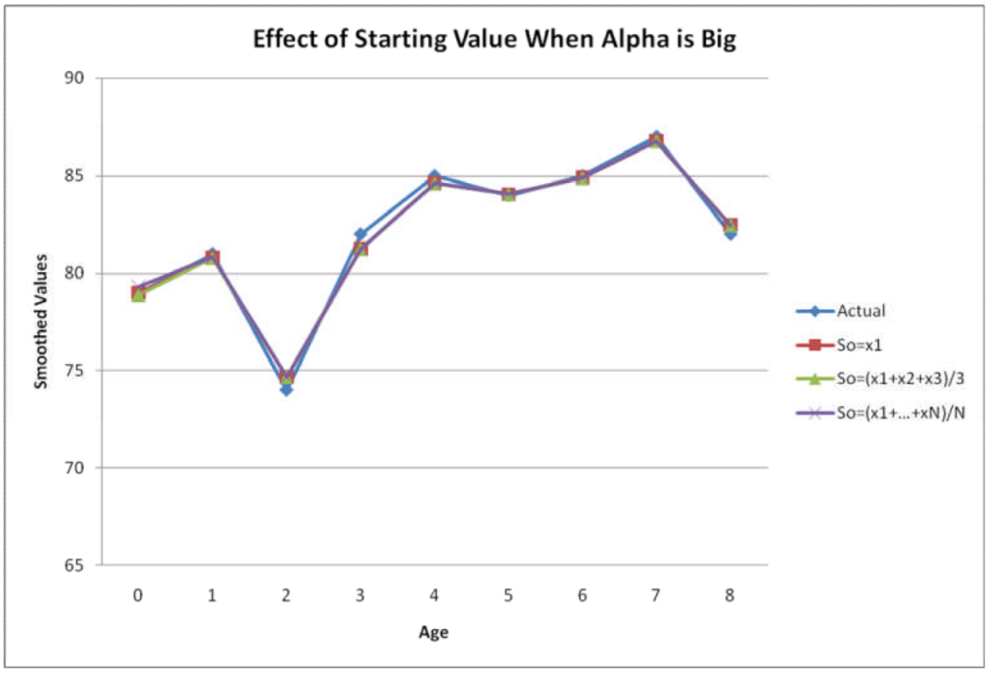


Figure 2.8 Using different methods for starting value when $\alpha = 0.9$

2.5 Double Exponential Smoothing

The ideas of exponential smoothing can be extended to provide estimates of the two coefficients in a linear model. When the process mean changes linearly with time then the model will be

$$X_t = a + bt + \varepsilon_t \tag{2.24}$$

In this model the average level of the time series changes in a linear fashion over time. The slope of the model is *b* while the intercept at time 0 is *a*. The time series can be described by the trend implied by this straight line combined with random fluctuations. If the slope *b* of the trend line is greater than 0, this implies that the average level of time series increases as time advance, whereas if the slope *b* is less than 0, this implies that the average level of the time series decreases as time advances.

The simple smoothing model will lag this process for infinite time. If simple exponential smoothing were applied to the observations from the linear process above, we would obtain at the end of period *t*

$$S_t = \alpha X_t + (1-\alpha)S_{t-1} \tag{2.25}$$

and then

$$S_t = \alpha \sum_{k=0}^{t-1} \beta^k X_{t-k} + \beta^t S_0 \quad \text{where } \beta = (1-\alpha) \tag{2.26}$$

By taking expected value

$$\begin{aligned} E(S_t) &= \alpha \sum_{k=0}^{t-1} \beta^k E(X_{t-k}) + \beta^t S_0 \\ &= \alpha \sum_{k=0}^{t-1} \beta^k E\left[a + b(t-k)\right] + \beta^t S_0 \end{aligned} \tag{2.27}$$

as $t \to \infty,\ \beta^t = 0,$ we obtain

$$E(S_t) = (a+bT)\alpha\sum_{k=0}^{\infty}\beta^k - b\alpha\sum_{k=0}^{\infty}k\beta^k$$
$$= a + bt - \frac{(1-\alpha)}{\alpha}b \tag{2.28}$$

Since $E(X_t) = a + bt$, we have

$$E(S_t) = E(X_t) - \frac{(1-\alpha)}{\alpha}b \tag{2.29}$$

This shows that, for a linear model, the first-order exponentially smoothed statistic, S_t , will tend to lag by an amount equal to $((1-\alpha)/\alpha)b$.

There are several ways to adjust for the lag in simple smoothing. Holt (Holt et al., 1960) and Winters (Winters, 1960), uses separate parameters to smooth the level and trend of the series. The Brown models use a single parameter to smooth both components. The approach often used to determine updated estimates of *a* and *b* is known as double exponential smoothing. The specific formula for double exponential smoothing for two parameter is given by

$$\begin{aligned} S_t &= \alpha X_t + (1-\alpha)(S_{t-1} + b_{t-1}) \\ b_t &= \gamma(S_t - S_{t-1}) + (1-\gamma)b_{t-1} \end{aligned} \tag{2.30}$$

The first smoothing equation adjust S_t directly for the trend of the previous period ,b_{t-1}, by adding it to the last smoothed value of S_{t-1}. This helps to eliminate the lag and brings S_t to the appropriate base of the current value.

As in the case for simple exponential smoothing, there are a variety of schemes to set initial values for S_0 and b_0 in double exponential smoothing. S_0 in general set to x_1. Here are three suggestions for b_0

$$\begin{aligned} b_0 &= x_2 - x_1 \\ b_0 &= \left[(x_2 - x_1) + (x_3 - x_2) + (x_4 - x_3)\right]/3 \\ b_0 &= (x_n - x_1)/(n-1) \end{aligned} \tag{2.31}$$

For parameters α and γ, values generally less than 0.3 have been recommended for the Holt-Winters models. For the Brown models, α values of 0.2 or less are generally accepted (Brown, 1964), (Coutie, et al., 1964), (Harrison, 1967), and (Montgomery and Johson, 1976). In other applications, a wider range of parameters should be considered. Makridakis (Makridakis, et all, 1982) and Chatfield (Chatfield, 1978) found that the most accurate parameters were frequently in the range 0.3-1. Even parameters above 1.0 should be considered. McClain and Thomas showed that the non-seasonal model is stable over the range 0 < α < 2 and 0 < γ < (4-2 α)/ α . The Brown non-seasonal linear trend model is stable for 0 < α < 2. Using computational methods, Sweet (Sweet, 1985) reached the following conclusions on the parameters for seasonal models: if the length of the seasonal cycle is four periods, the model is always stable for parameters between 0 and 1. If the cycle is 12 periods, the model is not necessarily stable for parameters in this range. A grid search can be used to find the parameter set which minimizes the fitted MSE.

The *m*-periods-ahead forecast is given by

$$\hat{X}_{t+m} = S_t + b_t m \tag{2.32}$$

The one-period-ahead forecast is given by

$$\hat{X}_{t+1} = S_t + b_t \tag{2.33}$$

Table 2.6 includes and example to compare the smoothed values obtained from simple exponential smoothing and double exponential smoothing. For simple exponential smoothing $\alpha = 0.1$ and $S_0 = x_1$ is used and for double exponential smoothing $\alpha = 0.1$, $\gamma = 0.1$, $S_0 = x_1$ and $b_0 = (x_4 - x_1)/3$ is used for initial values. Double exponential smoothing performs better than simple exponential smoothing since there is an adjustment for the trend in double exponential smoothing. It is easy to see the performance of the double exponential smoothing in Figure 2.9.

Table 2.6 Double exponential smoothing vs Single exponential smoothing

Data	Double Exponential Smoothing	Simple Exponential Smoothing

6.4		
5.6	6.40	7.12
7.8	6.32	7.68
8.8	6.47	8.38
11.0	6.70	9.11
11.6	7.13	9.98
16.7	7.58	10.84
15.3	8.49	12.13
21.6	9.17	13.19
22.4	10.41	14.80

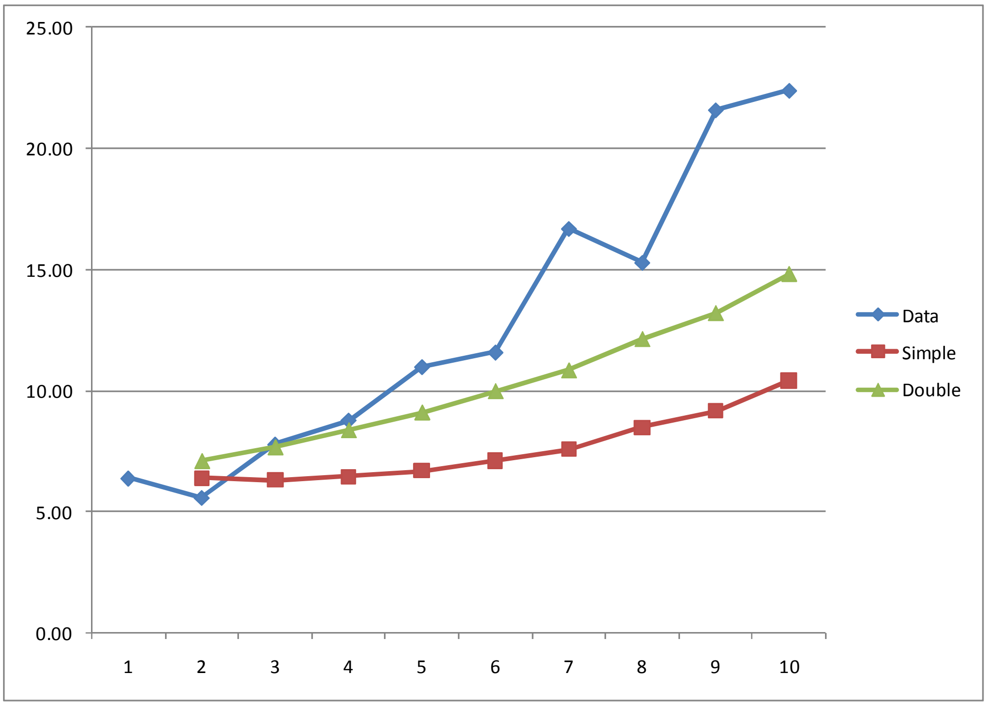


Figure 2.9 Double exponential smoothing vs simple exponential smoothing

When $\gamma = 0.9$ is used and other parameters left as the same, double exponential smoothing gives better response to trend component towards the end of the series (Figure 2.10). Figure 2.11 and Figure 2.12 displays other examples. For small α values trend component addition to the double exponential smoothing may cause better forecasts for double exponential smoothing. But when α value is close to 1, trend contribution seems to getting loose its importance for double exponential smoothing.

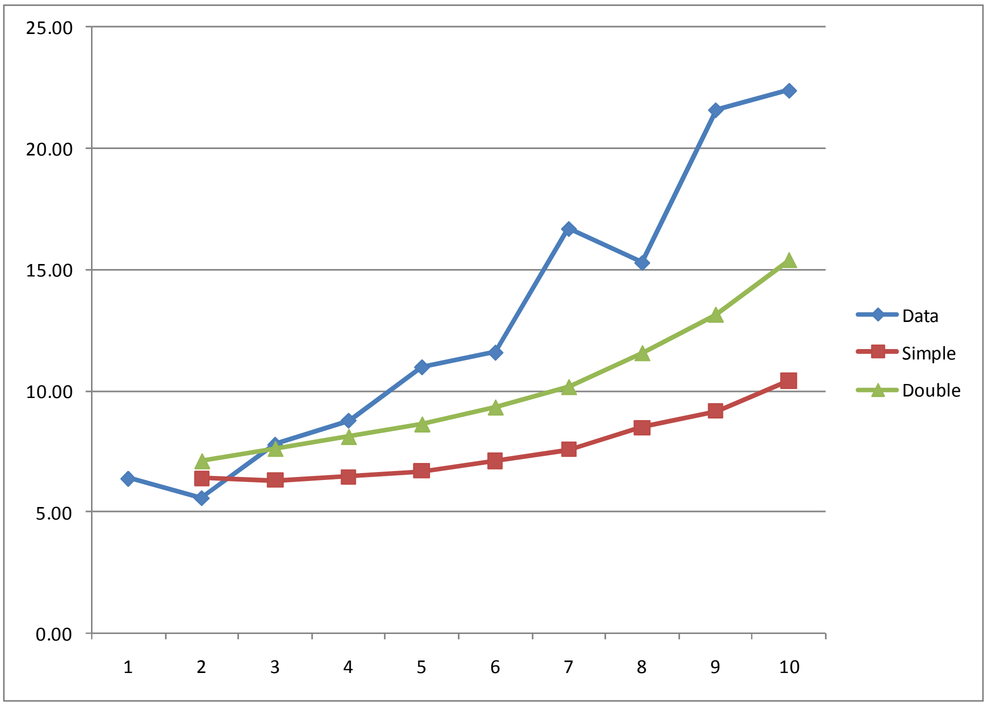


Figure 2.10 DES for $\alpha = 0.1$ and $\gamma = 0.9$ vs SES for $\alpha = 0.1$

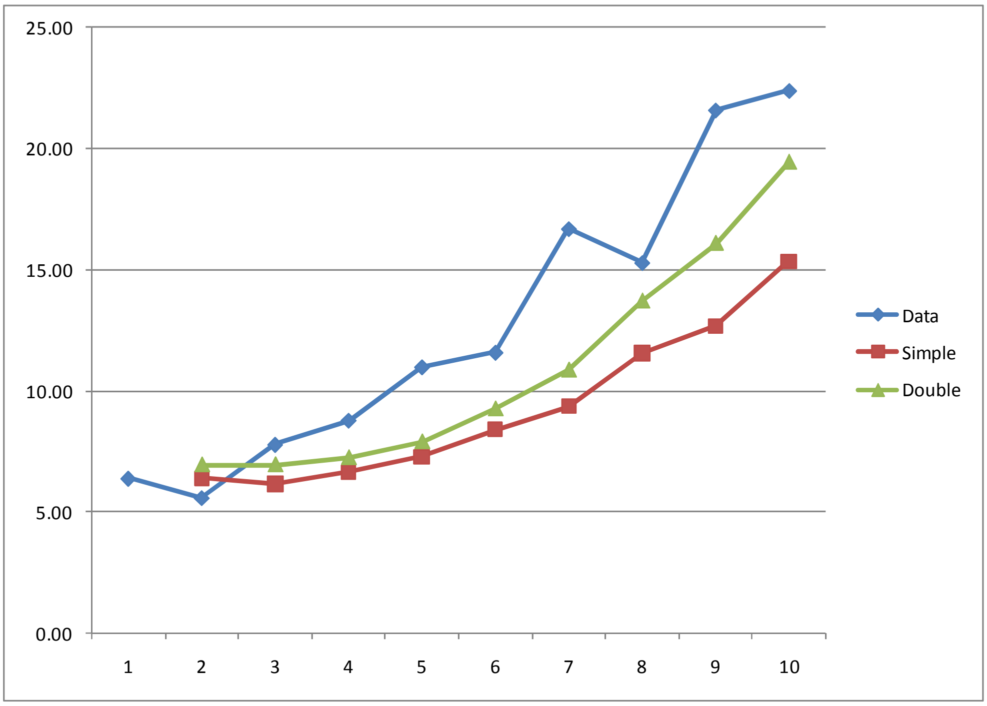


Figure 2.11 DES for $\alpha = 0.3$ and $\gamma = 0.9$ vs SES for $\alpha = 0.3$

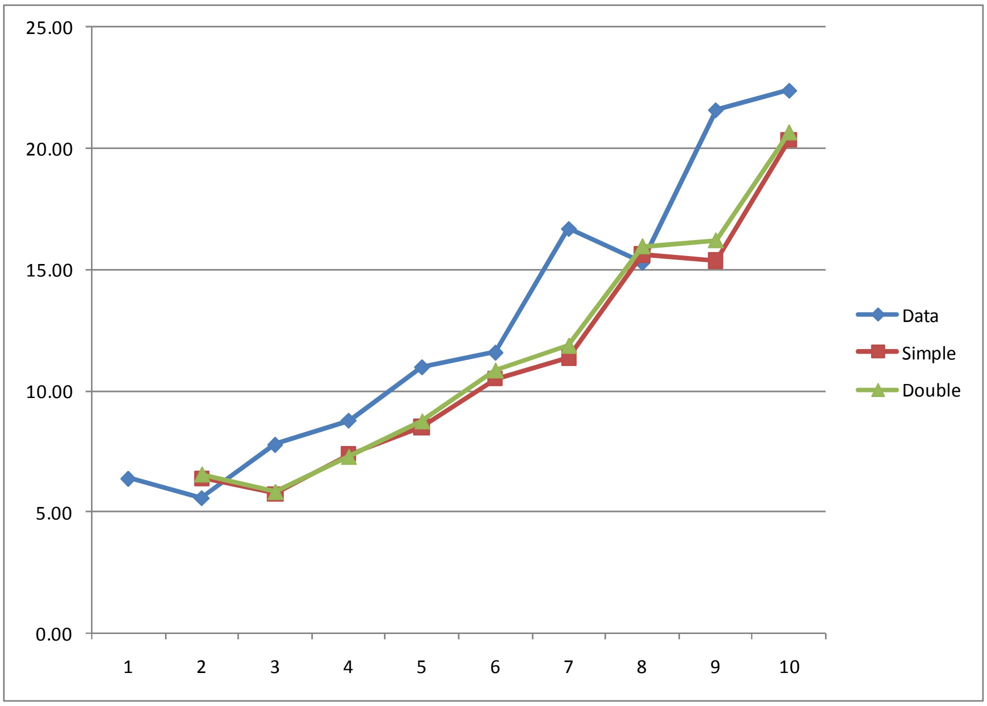


Figure 2.12 DES for $\alpha = 0.8$ and $\gamma = 0.9$ vs SES for $\alpha = 0.8$

2.6 Triple Exponential Smoothing

Triple exponential smoothing is used if there is a trend and seasonality in the data. A third equation is introduced to care of the seasonality. The equations for triple exponential smoothing are given by

$$\begin{aligned} S_t &= \alpha \frac{X_t}{I_{t-L}} + (1-\alpha)(S_{t-1} + b_{t-1}) \\ b_t &= \gamma(S_t - S_{t-1}) + (1-\gamma)b_{t-1} \\ I_t &= \beta \frac{X_t}{S_t} + (1-\beta)I_{t-L} \end{aligned} \tag{2.34}$$

where I is the seasonal index and β is a constant between 0 and 1. The general formula to estimate initial trend is given by

$$b_0 = \frac{1}{L}\left(\frac{X_{L+1} - X_1}{L} + \frac{X_{L+2} - X_2}{L} + \cdots + \frac{X_{L+L} - X_L}{L} \right) \tag{2.35}$$

Initial values for the seasonal indices are calculated in three steps. Let consider a data consist of 4 years with 3 periods. Then

Step 1. Compute the average of each of the 4 years

$$A_p = \frac{\sum_{i=1}^{3} X_i}{3} \quad p = 1, 2, \ldots, 4$$

Step 2. Divide the observations by the appropriate yearly mean

1	2	3	4
X_1 / A_1	X_4 / A_2	X_7 / A_3	X_{10} / A_4
X_2 / A_1	X_5 / A_2	X_8 / A_3	X_{11} / A_4
X_3 / A_1	X_6 / A_2	X_9 / A_3	X_{12} / A_4

Step 3. Calculate seasonal indices as the average of each row

$$I_1 = (X_1 / A_1 + X_4 / A_2 + X_7 / A_3 + X_{10} / A_4) / 4$$
$$I_2 = (X_2 / A_1 + X_5 / A_2 + X_8 / A_3 + X_{11} / A_4) / 4$$
$$I_3 = (X_3 / A_1 + X_6 / A_2 + X_9 / A_3 + X_{12} / A_4) / 4$$

The *m*-periods-ahead forecast is given by

$$\hat{X}_{t+m} = (S_t + b_t m) I_{t-L+m} \tag{2.36}$$

The one-period-ahead forecast is given by

$$\hat{X}_{t+1} = (S_t + b_t) I_{t-L+1} \tag{2.37}$$

CHAPTER THREE

MODIFIED EXPONENTIAL SMOOTHING

3.1 Modified Simple Exponential Smoothing

If m is any integer ($1 \le m \le t$) and letting $\alpha = (m/t)$ then simple exponential smoothing equation can be written as

$$S_t = \left(\frac{m}{t}\right)X_t + \left(\frac{t-m}{t}\right)S_{t-1} \tag{3.1}$$

then S_t is weighted average of all past observations. We first demonstrate S_t can be written as a linear combination of past data and then observe that the weights given to past observations are nonnegative and sum to unity, thus making it possible to interpret S_t as a weighted average of observations. Now S_{t-1} can be written as

$$S_{t-1} = \left(\frac{m}{t-1}\right)X_{t-1} + \left(\frac{t-m-1}{t-1}\right)S_{t-2} \tag{3.2}$$

substituting for S_{t-1} with its component in equation (3.1) we obtain

$$S_t = \left(\frac{m}{t}\right)X_t + \left(\frac{m}{t}\right)\left(\frac{t-m}{t-1}\right)X_{t-1} + \left(\frac{t-m}{t}\right)\left(\frac{t-m-1}{t-1}\right)S_{t-2} \tag{3.3}$$

Now S_{t-2} can be written as

$$S_{t-2} = \left(\frac{m}{t-2}\right)X_{t-2} + \left(\frac{t-m-2}{t-2}\right)S_{t-3} \tag{3.4}$$

and substituting S_{t-2} we obtain

$$\begin{aligned} S_t = {} & \left(\frac{m}{t}\right)X_t + \left(\frac{m}{t}\right)\left(\frac{t-m}{t-1}\right)X_{t-1} + \left(\frac{m}{t}\right)\left(\frac{t-m}{t-1}\right)\left(\frac{t-m-1}{t-2}\right)X_{t-2} \\ & + \left(\frac{t-m}{t}\right)\left(\frac{t-m-1}{t-1}\right)\left(\frac{t-m-2}{t-2}\right)S_{t-3} \end{aligned} \tag{3.5}$$

and repeating for S_{t-3} and so on we may finally obtain the general form of S_t such that

$$S_t = \left(\frac{m}{t}\right)X_t + \left(\frac{m}{t}\right)\left(\frac{t-m}{t-1}\right)X_{t-1} + \left(\frac{m}{t}\right)\left(\frac{t-m}{t-1}\right)\left(\frac{t-m-1}{t-2}\right)X_{t-2}$$
$$+\left(\frac{m}{t}\right)\left(\frac{t-m}{t-1}\right)\left(\frac{t-m-1}{t-2}\right)\left(\frac{t-m-2}{t-3}\right)X_{t-3} + . \quad . \quad . + \tag{3.6}$$
$$+\left(\frac{m}{t}\right)\left(\frac{t-m}{t-1}\right)\left(\frac{t-m-1}{t-2}\right). \quad . \quad \left(\frac{3}{m+2}\right).\left(\frac{2}{m+1}\right)X_{m+1}$$
$$+\left(\frac{t-m}{t}\right)\left(\frac{t-m-1}{t-1}\right). \quad . \quad .\left(\frac{2}{m+2}\right)\left(\frac{1}{m+1}\right)S_m$$

or

$$S_t = \left(\frac{m}{t}\right)\sum_{k=0}^{t-(m+1)} \frac{(t-m)!(t-k-1)!}{(t-m-k)!(t-1)!} X_{t-k} + \frac{(t-m)!m!}{t!} S_m \tag{3.7}$$

or

$$S_t = \sum_{k=0}^{t-(m+1)} \frac{\binom{t-k-1}{m-1}}{\binom{t}{m}} X_{t-k} + \frac{1}{\binom{t}{m}} S_m \tag{3.8}$$

where S_m is a simple average of first *m* observations i.e.

$$S_m = \frac{X_1 + X_2 + . \quad . \quad + X_m}{m} \tag{3.9}$$

We observed that the current smoothed estimate S_t is the weighted average of the observations for all earlier periods and the starting value S_m. Note that the weight for observation X_{t-k} is

$$w_{X_{t-k}} = \left(\frac{m}{t}\right)\frac{(t-m)!(t-k-1)!}{(t-m-k)!(t-1)!} \qquad k = 0,1,\cdots,t-(m+1) \tag{3.10}$$

and it is between 0 and 1 for all k and any given value of m. So the statistic S_t is a weighted average of all past observations. Now we must prove that these weights sum to unity. Suppose t=3 and m=2 then

$$w_{x_{t-k}} = \left(\frac{2}{3}\right)\frac{(1)!(2-k)!}{(1-k)!(2)!} \qquad k=0 \tag{3.11}$$

so

$$w_{x_3} = \left(\frac{2}{3}\right)\frac{(1)!(2)!}{(1)!(2)!} = \frac{2}{3} \tag{3.12}$$

and

$$w_{S_2} = \left(\frac{2}{3}\right)\frac{(1)!(1)!}{(0)!(2)!} = \frac{1}{3} \tag{3.13}$$

and sum of the weights is one. And suppose t=*5* and m=2 then

$$w_{x_{t-k}} = \left(\frac{2}{5}\right)\frac{(3)!(4-k)!}{(3-k)!(4)!} \qquad k=0,1,2 \tag{3.14}$$

corresponding weights are 4/10, 3/10, 2/10 and the weight of S_2 is 1/10 which are sum to unity again. For a general form, using probabilistic arguments we can prove that sum of the weights (t>m) for X_t,

$$\left(\frac{m}{t}\right)\begin{bmatrix} 1+\left(\frac{t-m}{t-1}\right)+\left(\frac{t-m}{t-1}\right)\left(\frac{t-m-1}{t-2}\right)+\ldots \\ +\left(\frac{t-m}{t-1}\right)\left(\frac{t-m-1}{t-2}\right)\ldots\left(\frac{3}{m+2}\right)\left(\frac{2}{m+1}\right) \end{bmatrix} \tag{3.15}$$

and weight of S_m

$$\left[\left(\frac{t-m}{t}\right)\left(\frac{t-m-1}{t-1}\right).\ .\ \left(\frac{2}{m+2}\right)\left(\frac{1}{m+1}\right)\right] \tag{3.16}$$

is equal to one. Consider an urn that contains t balls such that a number of m minority balls are of one color (white, say) and (t-m) balls are of another majority color (black, say). The distribution of the number of draws y until a specified number *c* of white ball is obtained as the negative hyper geometric distribution (Johnson & Kots, 1969), given by

$$f(y;m;t;c) = P(Y = y) = \frac{\binom{y-1}{c-1}\binom{t-y}{m-c}}{\binom{t}{m}} \quad y = c, c+1, \ldots, c+t-m \qquad (3.17)$$

with parameters satisfying $1 \le c \le m \le t$. Assume that *y* is the number of draws until first white ball is obtained , i.e., *c*=1. This yield us

$$f(y;m;t) = P(Y = y) = \frac{\binom{t-y}{m-1}}{\binom{t}{m}} \quad y = 1, 2, \ldots, t-m+1 \qquad (3.18)$$

and expected value and variance of random variable *Y* are

$$E(Y) = \frac{t+1}{m+1} \ , \ Var(Y) = \frac{(t+1)(t-m)}{(m+1)(m+2)}\left[1 - \frac{1}{m+1}\right] \qquad (3.19)$$

Let $X = Y - 1$ then we obtain weight of observations for modified simple exponential smoothing process with $E(X) = (t-m)/(m+1)$. Now it is clear that the weights for the observations and initial value are nothing more than probabilities of negative hyper geometric for given *m* and *t* from *y*=1, 2, … , *t*-*m*+1. Therefore it is clear that sum of the weights $X_t, X_{t-1}, \ldots, X_{m+1}$ and weight of S_m is equal to 1.

Table 3.1 Weights given by Modified Simple Exponential Smoothing and Simple Exponential Smoothing

	k							
	0	1	…	t-(m+1)	t-m	…	t-2	t-1
	X_t	X_{t-1}	…	X_{m+1}	X_m	…	X_2	X_1
MSES	$\frac{m}{t}$	$\frac{m}{t}\left(\frac{t-m}{t-1}\right)$	…	$\frac{m}{t}\left(\frac{t-m}{t-1}\right)\cdots\left(\frac{2}{m+1}\right)$	-	…	-	-
SES	α	$\alpha(1-\alpha)$	…	$\alpha(1-\alpha)^m$	$\alpha(1-\alpha)^{t-m-1}$	…	$\alpha(1-\alpha)^{t-2}$	$\alpha(1-\alpha)^{t-1}$

	Starting Value
MSES	$\left(\frac{t-m}{t}\right)\left(\frac{t-m-1}{t-1}\right)\cdots\left(\frac{1}{m+1}\right)$
SES	$(1-\alpha)^t$

Table 3.2 Age of data

	Age of data
MSES	$\left(\frac{t-m}{m+1}\right)$
SES	$\frac{1-\alpha}{\alpha}$

If we use corresponding α level for a selected *m* values and for any *t*, then the weights given by MSES and SES can be compared by using Table 3.3.

Table 3.3 Weights given by Modified Simple Exponential Smoothing and Simple Exponential Smoothing

	k							
	0	1	…	*t*-(*m*+1)	*t*-*m*	…	*t*-2	*t*-1
	X_t	X_{t-1}	…	X_{m+1}	X_m	…	X_2	X_1
MSES	$\frac{m}{t}$	$\frac{m}{t}\left(\frac{t-m}{t-1}\right)$	…	$\frac{m}{t}\left(\frac{t-m}{t-1}\right)\cdots\left(\frac{t}{t-m}\right)$	-	…	-	-
SES	$\frac{m}{t}$	$\frac{m}{t}\left(\frac{t-m}{t}\right)$	…	$\frac{m}{t}\left(\frac{t-m}{t}\right)^{m}$	$\frac{m}{t}\left(\frac{t-m}{t}\right)^{t-m-1}$	…	$\frac{m}{t}\left(\frac{t-m}{t}\right)^{t-2}$	$\frac{m}{t}\left(\frac{t-m}{t}\right)^{t-1}$

	Starting Value
MSES	$\left(\frac{t-m}{t}\right)\left(\frac{t-m-1}{t-1}\right)\cdots\left(\frac{1}{m+1}\right)$
SES	$\left(\frac{t-m}{t}\right)^{t}$

There are two extreme cases in the definition of S_t according to selected *m* value. When *m* is equal to 1 then

$$S_t = \left(\frac{1}{t}\right)X_t + \left(\frac{1}{t}\right)X_{t-1} + . \quad . \quad . \quad + \left(\frac{1}{t}\right)X_2 + \left(\frac{1}{t}\right)S_1 \quad \text{where } S_1 = X_1 \qquad (3.20)$$

and the weight of current and all past observations are equal to $\left(\frac{1}{t}\right)$. When *m* is equal to *t* then all the weights are given to the last observation

$$S_t = X_t \qquad (3.21)$$

. When 1<*m*<*t* then the weights decrease geometrically with the age of the observations. For the sake of simplicity and demonstration, choose *m*=3 then

$$S_t = \left(\frac{3}{t}\right)X_t + \left(\frac{t-3}{t}\right)S_{t-1} \qquad (3.22)$$

and if the number of observations is equal to 10 then

$$S_{10} = \left(\frac{3}{10}\right)X_{10} + \left(\frac{3}{10}\right)\left(\frac{7}{9}\right)X_9 + \left(\frac{3}{10}\right)\left(\frac{7.6}{9.8}\right)X_8 + \left(\frac{3}{10}\right)\left(\frac{7.6.5}{9.8.7}\right)X_7 + \left(\frac{3}{10}\right)\left(\frac{7.6.5.4}{9.8.7.6}\right)X_6 +$$
$$\left(\frac{3}{10}\right)\left(\frac{7.6.5.4.3}{9..8.7.6.5}\right)X_5 + \left(\frac{3}{10}\right)\left(\frac{7.6.5.4.3.2}{9.8.7.6.5.4}\right)X_4 + \left(\frac{7.6.5.4.3.2.1}{10.9.8.7.6.5.4}\right)S_3$$

$$S_{10} = 0.30X_{10} + 0.23X_9 + 0.18X_8 + 0.13X_7 + 0.08X_6 + 0.05X_5 + 0.03X_4 + 0.01S_3$$

is obtained where S_3 is a simple average of first three observation. The weight associated with the current observation is 0.30 and the weights assigned to previous observations are 0.23, 0.18, 0.13, and so on respectively, as it seen the weights of older observations decrease geometrically with the age of the observations (Figure 3.1). Note that, the weight of the starting value S_3 is smaller than the weight of X_4.

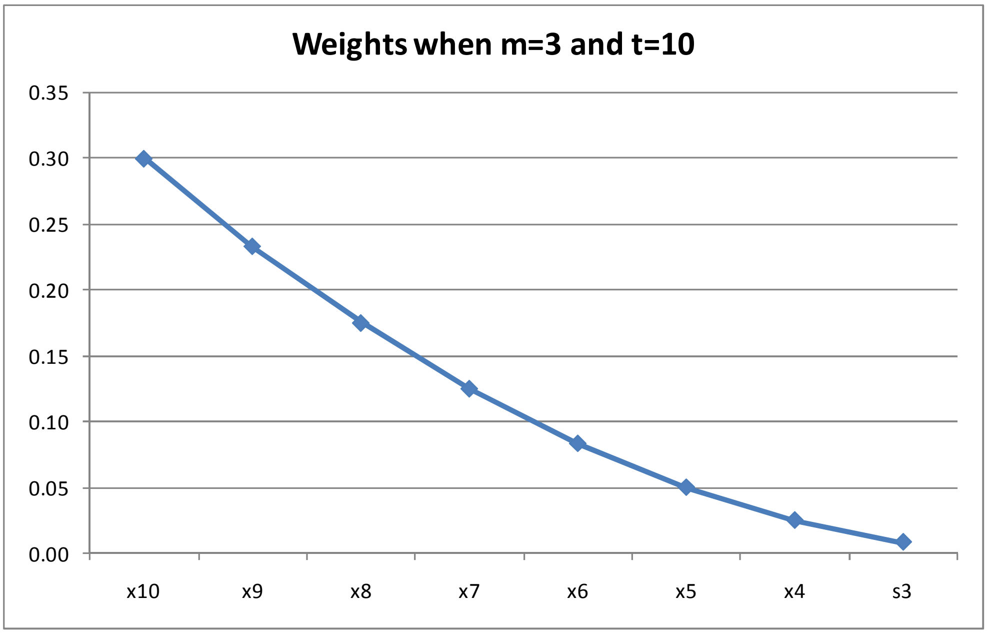


Figure 3.1 Weights given by modified simple exponential smoothing when *m*=3 and *t*=10

Figure 3.2 shows the weights assigned by modified simple exponential smoothing when *m*=4. They are still decreasing with the age of observations and the weight of the starting value S_4 is smaller than the weight of X_5.

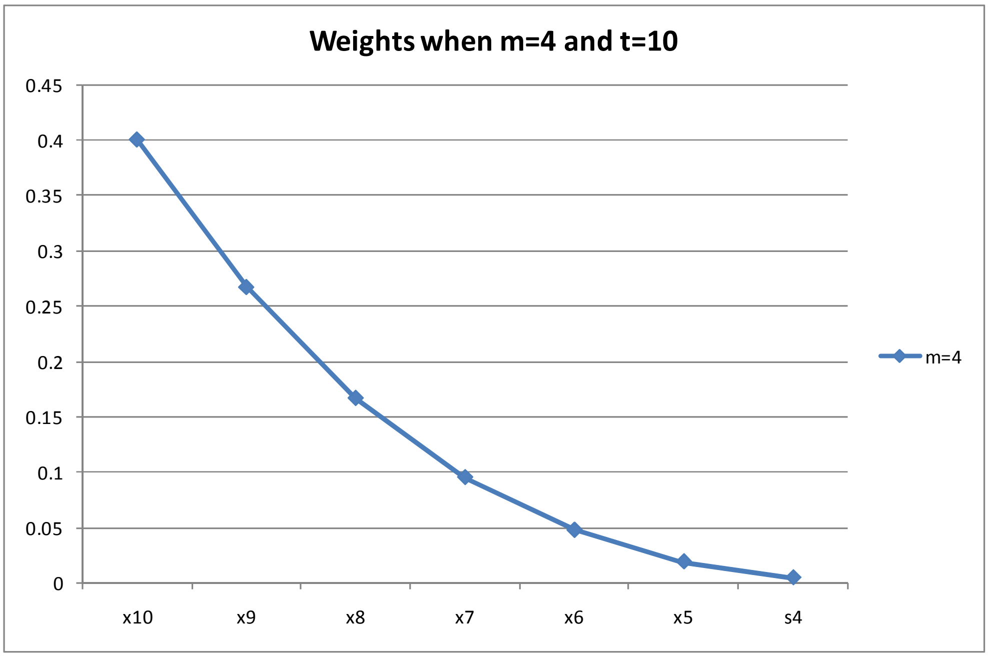


Figure 3.2 Weights given by modified simple exponential smoothing when *m*=4 and *t*=10

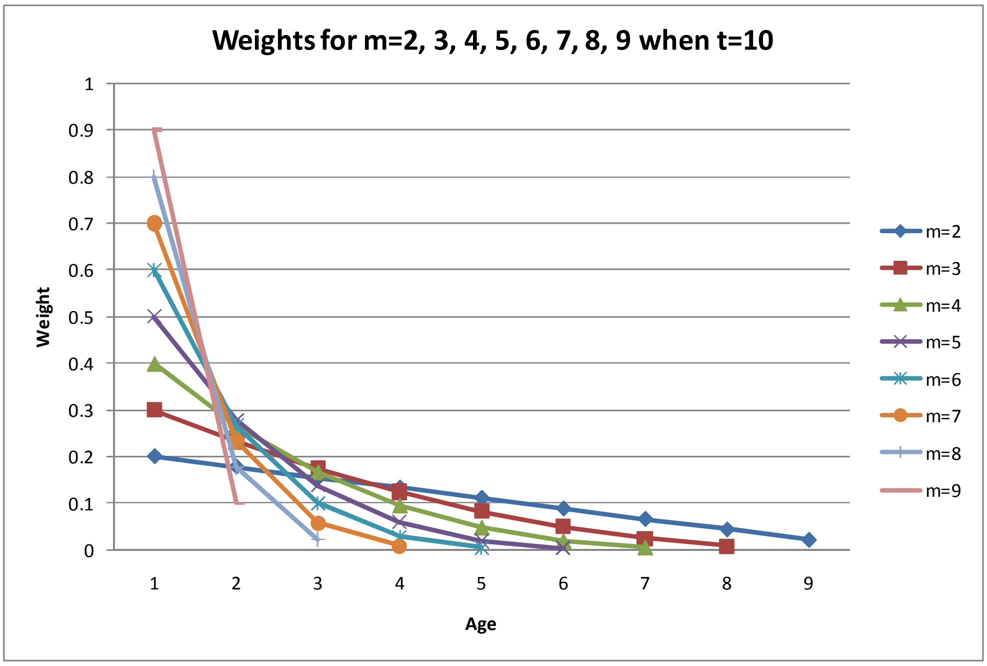


Figure 3.3 Weight of X_k for k=10, 9, … , m and m=2, 3, 4, 5, 6, 7, 8 when t=10

A comparison of the weights assigned by modified simple exponential smoothing for t=10 and different value of m=2, 3, 4, 5, 6, 7, 8, 9 are shown in Figure 3.3. Because these weights appear to decline exponentially when connected by a smooth curve, the name exponential smoothing can be applied to this procedure.

Another result is that, the weight assigned to starting value is always smaller than the weight of previous observation for all m values. Whether the value of m is small or not, it does not affect the contribution of the starting value to the smoothed value (and also to forecast). However, for simple exponential smoothing it is seen that small α value might cause to give more weight to starting value than the weights given to many previous observations and this may effect the forecasts.

We can compare the effect of starting value when a small smoothing constant is chosen for both methods simple exponential smoothing and modified simple exponential smoothing. When we add smoothed values obtained from modified simple exponential to the Figure 2.6, it can be see that starting value does not effects the smoothed values too much for modified simple exponential smoothing.

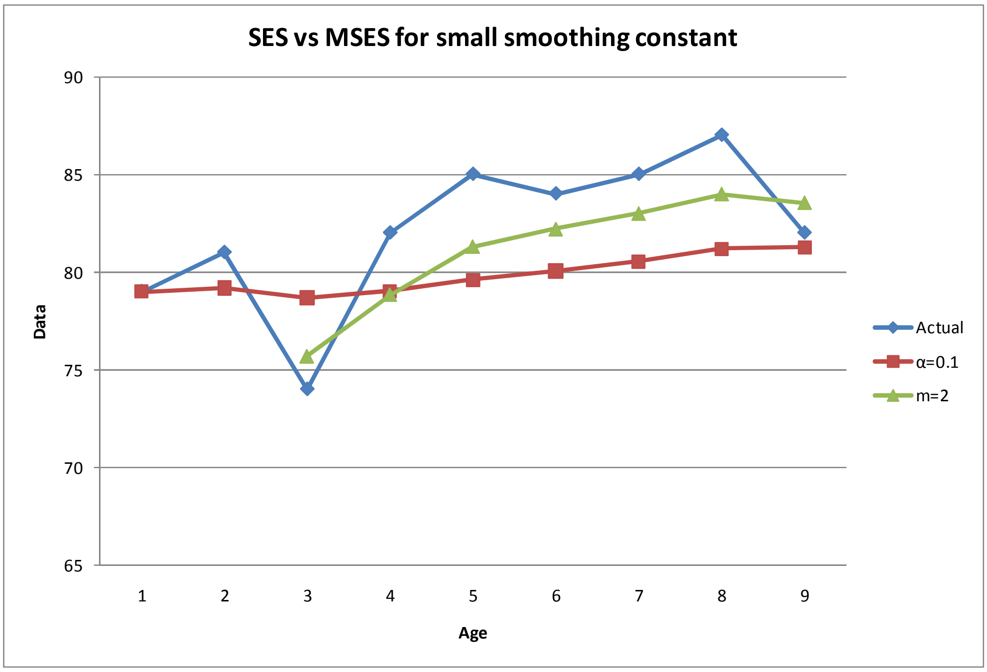


Figure 3.4 Effect of starting value for small smoothing constant

The weight given to the observations and initial value of simple exponential smoothing for α=0.3 and modified simple exponential smoothing for m=3 for t=10 is given in Figure 3.5 As it seen, the weight of last five observations for modified simple exponential smoothing is greater than weight of simple exponential smoothing. Both methods assign equal weight for fourth observation but before this observation weight of modified simple exponential smoothing for other observations decline faster than simple exponential smoothing. In contrast to simple exponential smoothing, weight of initial value S_3 smaller than last weight x_4 for modified simple exponential smoothing.

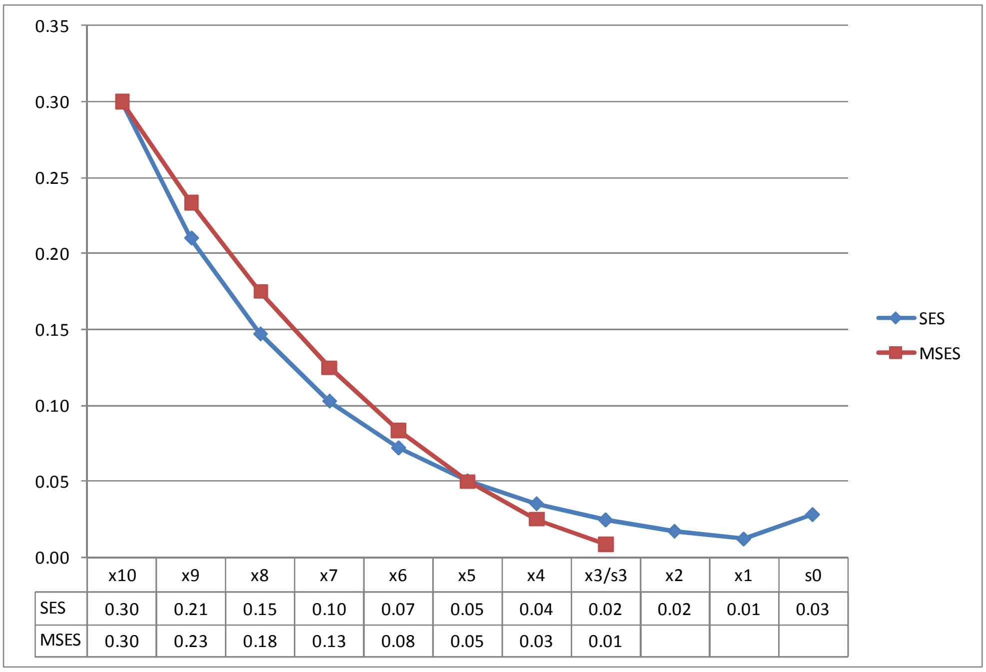
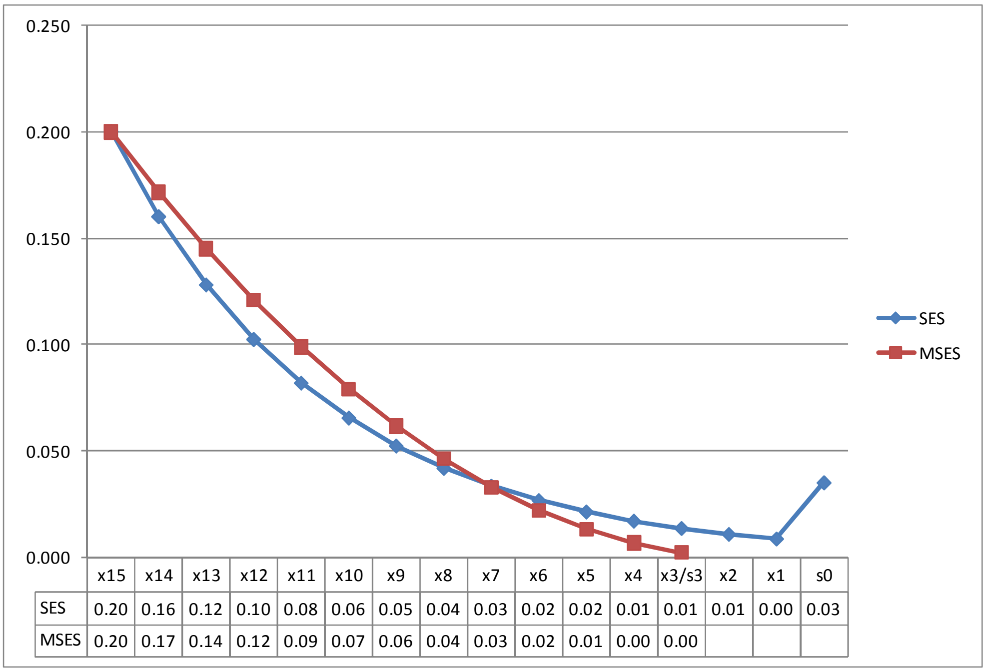


Figure 3.5 Comparison of weights for simple exponential smoothing (α=0.3) and modified simple exponential smoothing (T=10, m=3)

The weight given to the observations and initial value for simple exponential smoothing for α=0.2 and for modified simple exponential smoothing for m=3 and t=10 is given in Figure 3.6. Modified simple exponential smoothing assigns more weight to recent observations up to seventh observation. The weights assigned by both methods are equal for seventh observation and from seventh observation to first observation more weight is given by simple exponential smoothing. Notice that, weight of starting value S_0 is greater than the weights assigned to observations up to seventh observation for simple exponential smoothing. However, weight of starting value S_3 is smaller than the weight of all observations for modified simple exponential smoothing.



	x15	x14	x13	x12	x11	x10	x9	x8	x7	x6	x5	x4	x3/s3	x2	x1	s0
SES	0.20	0.16	0.12	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.00	0.03
MSES	0.20	0.17	0.14	0.12	0.09	0.07	0.06	0.04	0.03	0.02	0.01	0.00	0.00			

Figure 3.6 Comparison of weights for simple exponential smoothing (α=0.2) and modified simple exponential smoothing (t=15, m=3)

The assigned weight for more recent data by modified simple exponential smoothing for any given t and m is always greater than simple exponential smoothing with corresponding α value. The difference between weights for two methods is strictly increasing up to certain time, after reaching maximum point this difference starts to decrease until both method equal to each other. After equality, simple exponential smoothing gives more weight then modified simple exponential smoothing for middle part of the observations.

Let compare the weight differences of MSES and SES for different values of m, t and corresponding α value. When m is equal to 1 smoothing process for MSES can be written as

$$S_t = \left(\frac{1}{t}\right)X_t + \left(\frac{1}{t}\right)X_{t-1} + \cdots + \left(\frac{1}{t}\right)X_2 + \left(\frac{1}{t}\right)S_1$$

where $S_1 = X_1$ and the weight of current and all past observations are equal to $1/t$ and that can not be achieved in the SES. However if we choose α=$1/t$ in the SES then

$$S_t = \alpha X_t + \alpha(1-\alpha)X_{t-1} + \alpha(1-\alpha)^2 X_{t-2} + \cdots + \alpha(1-\alpha)^{t-1}X_1 + (1-\alpha)^t S_0$$
$$= \frac{1}{t}X_t + \frac{1}{t}\left(\frac{t-1}{t}\right)X_{t-1} + \frac{1}{t}\left(\frac{t-1}{t}\right)^2 X_{t-2} + \cdots + \frac{1}{t}\left(\frac{t-1}{t}\right)^{t-1} X_1 + \left(\frac{t-1}{t}\right)^t S_0$$

is obtained. Therefore when m is equal to 1 weight of X_k in MSES will always be greater than that in SES for k=0, 1, 2, … , t-1 for any value of t. Figure 2 shows the graphs of differences when m=1 and t=10, 30 and 50. All differences are positive since weights of MSES are greater than weights of SES.

Figure 3.7 Weight differences when m=1 and t=10, 30 and 50

When m is equal to two, MSES gives more weights to recent observations up to a certain point and after that point SES weights become bigger for older observations. Figure 3 shows the weight differences for t=10, t=30 and t=50. As it seen from the graph, the weight differences for recent observations are getting large when t value is getting smaller.

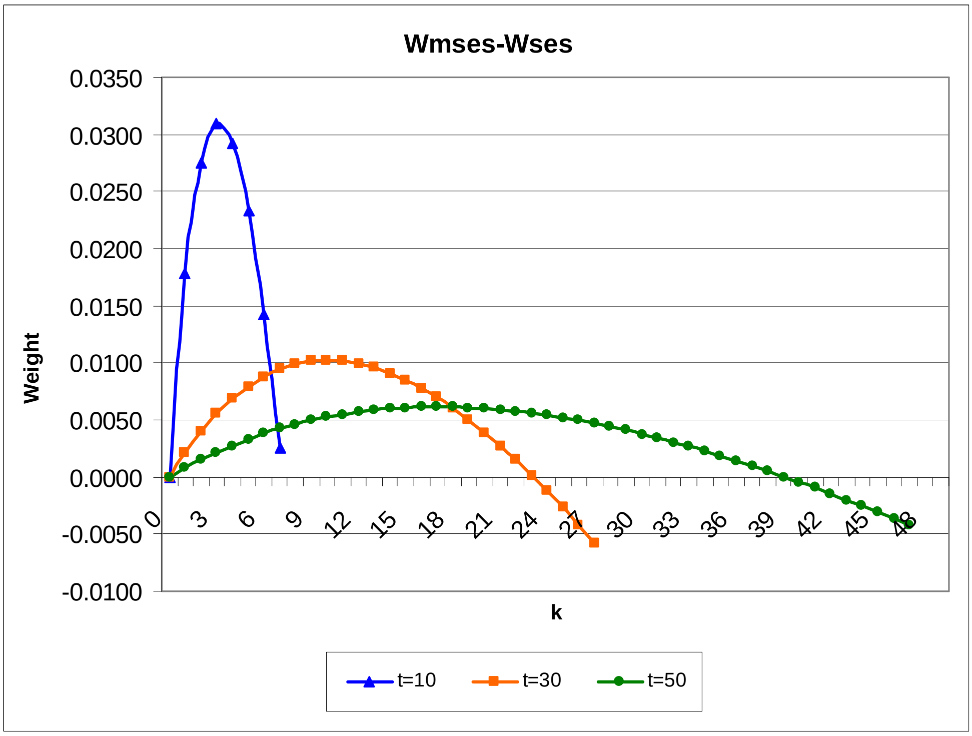


Figure 3.8 Weight differences when *m*=2 and *t*=10, 30 and 50

The same result is also obtained for all *m* values between 2 and *t*-1. Weights given by MSES are bigger up to a certain point and after that point weights of SES are bigger. Notice that MSES gives more weights to recent observations. Following figures show the weight differences for different *m* (m>2) and *t* values.

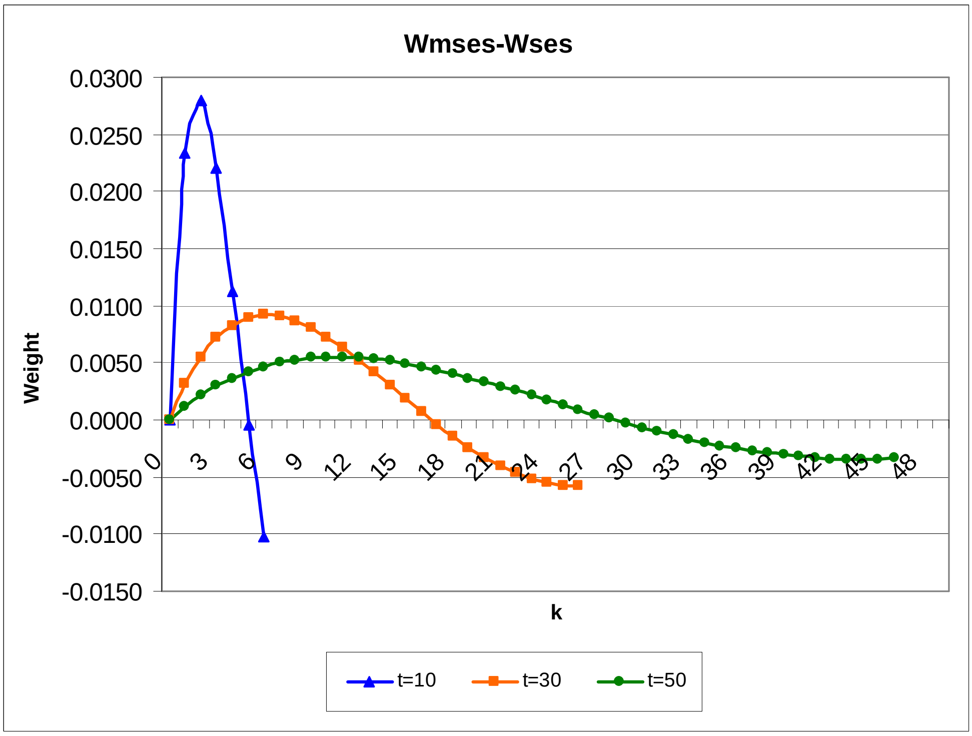


Figure 3.9 Weight differences when m=3 and t=10, 30 and 50

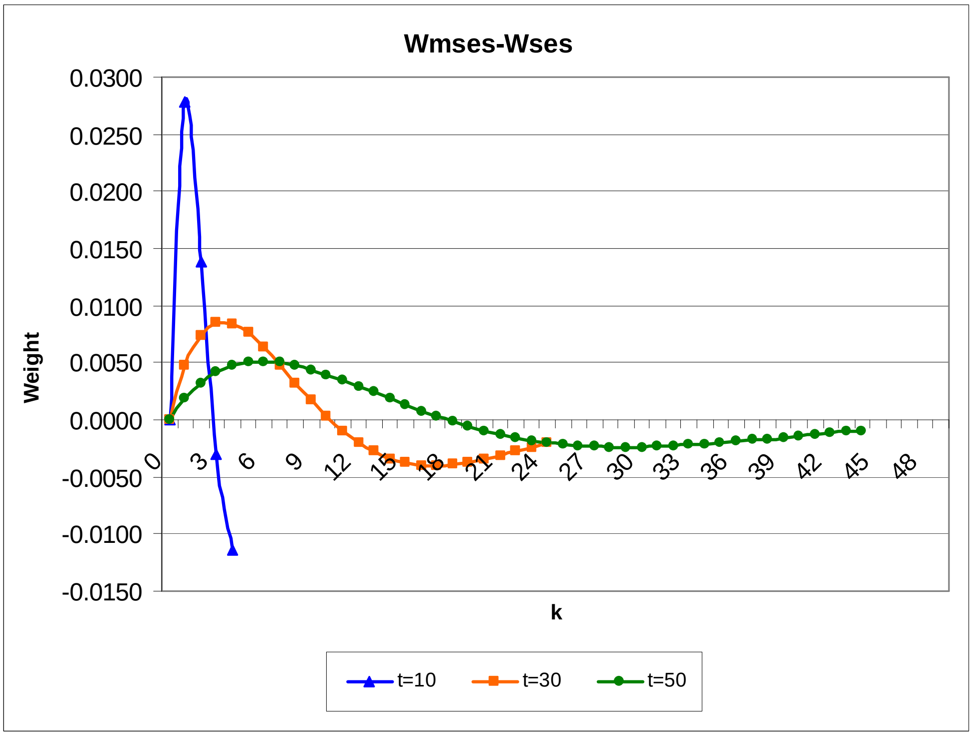


Figure 3.10 Weight differences when m=5 and t=10, 30 and 50.

Up to now, we showed that modified simple exponential smoothing assigns exponentially decreasing weights to observations, weights are non-negative and sum to unity. Smoothing statistic S_t can be written as a linear combination of the observations and starting value. In addition, the chosen value of smoothing constant does not influence the contribution of the starting constant to latter smoothed values. And modified simple exponential smoothing assigns even more weight than simple exponential smoothing to most recent observations and less weight to earlier observations. Now we can find the expected value of S_t for modified simple exponential smoothing to prove that S_t is also an unbiased estimator of unknown parameter a.

$$\begin{aligned} E(S_t) &= E\left(\sum_{k=0}^{t-(m+1)} \frac{\binom{t-k-1}{m-1}}{\binom{t}{m}} x_{t-k} + \frac{1}{\binom{t}{m}} S_m \right) \\ &= \left(\sum_{k=0}^{t-(m+1)} \frac{\binom{t-k-1}{m-1}}{\binom{t}{m}} + \frac{1}{\binom{t}{m}} \right) E(X) \\ &= E(X) = a \end{aligned} \tag{3.23}$$

Therefore S_t is unbiased estimator of the unknown parameter a.

Variance of S_t for modified simple exponential smoothing is

$$V(S_t) = V\left(\sum_{k=1}^{t-m} \frac{\binom{t-k}{m-1}}{\binom{t}{m}} X_{t+1-k} + \frac{(t-m)!m!}{t!} S_m \right)$$

$$= V(X) \sum_{k=1}^{t-m} \left(\frac{\binom{t-k}{m-1}}{\binom{t}{m}} \right)^2 + \left(\frac{(t-m)!m!}{t!} \right)^2 V(S_m) \tag{3.24}$$

$$= V(X) \sum_{k=1}^{t-m} \left(\frac{\binom{t-k}{m-1}}{\binom{t}{m}} \right)^2$$

Average age of data for MSES is

$$\bar{k} = \left(\frac{t-m}{m+1} \right) \tag{3.25}$$

since this sum is expected value of sum for negative hyper geometric random variable if Y starts from 0. Average age of MSES is smaller than average age of SES since MSES gives more weight to recent observations

m-periods-ahead forecast made by modified simple exponential smoothing is

$$\hat{X}_{t+m} = S_t \tag{3.26}$$

And one-period-ahead forecast made by modified simple exponential smoothing is

$$\hat{X}_{t+1} = S_t \tag{3.27}$$

3.2 Modified Double Exponential Smoothing

The same idea can be applied to double exponential smoothing. If m is any integer ($1 \le m \le t$) and letting $\alpha = (m/t)$ then double exponential smoothing equations can be written as

$$S_t = \left(\frac{m}{t}\right) X_t + \left(\frac{t-m}{t}\right)(S_{t-1} + b_{t-1})$$
$$b_t = \gamma (S_t - S_{t-1}) + (1-\gamma) b_{t-1} \tag{3.28}$$

where S_m is again the average of first *m* observations. b_t is the trend factor and it left as it was. The parameter γ used in the second equation gives exponentially decreasing weights to the differences of successive smoothed values. The value of γ is between 0 and 1. Initial value for second equation is b_0 and there are different suggestions to set it. Taking the first value in the data, or average of the differences of first three couple data, or fitting a linear regression model are some of the suggested methods to set the initial value of b_0.

The smoothing equation of modified double exponential smoothing is similar to the smoothing equation of modified simple exponential smoothing. The only difference is the term b_{t-1} added to S_{t-1}. So, it is obvious that weights are decreasing exponentially and sum to unity. Modified double exponential smoothing gives also more weights than double exponential smoothing to recent observations like modified simple exponential smoothing.

m-periods-ahead forecast made by modified double exponential smoothing is

$$\hat{X}_{t+m} = S_t + b_t m \tag{3.29}$$

And one-period-ahead forecast made by modified double exponential smoothing is

$$\hat{X}_{t+1} = S_t + b_t \tag{3.30}$$

3.3 Modified Triple Exponential Smoothing

The same idea can also be applied to triple exponential smoothing. If m is any integer ($1 \le m \le t$) and letting $\alpha = (m/t)$ then triple exponential smoothing equations can be rewritten as

$$S_t = \left(\frac{m}{t}\right)\frac{X_t}{I_{t-L}} + \left(\frac{t-m}{t}\right)(S_{t-1} + b_{t-1})$$
$$b_t = \gamma(S_t - S_{t-1}) + (1-\gamma)b_{t-1} \qquad (3.31)$$
$$I_t = \beta\frac{X_t}{S_t} + (1-\beta)I_{t-L}$$

where S_m is the average of first *m* observations. b is the trend factor and I is the seasonal index. The recurring equations b_t and I_t left as it was. The value of parameters γ and β are between 0 and 1. Initial value for second equation is b_0 and the general formula to estimate the initial trend is given by

$$b_0 = \frac{1}{L}\left(\frac{X_{L+1} - X_1}{L} + \frac{X_{L+2} - X_2}{L} + \cdots + \frac{X_{L+L} - x_L}{L}\right) \qquad (3.32)$$

The smoothing equation of modified triple exponential smoothing is similar to the smoothing equation of modified simple exponential smoothing. The only difference is the term b_{t-1} added to S_{t-1} and term I_{t-L} dividing X_t. So, it is obvious that weights are decreasing exponentially and sum to unity. Modified triple exponential smoothing gives also more weights than double exponential smoothing to recent observations like modified simple exponential smoothing.

The m-periods-ahead forecast is given by

$$\hat{X}_{t+m} = (S_t + b_t m)I_{t-L+m} \qquad (3.33)$$

and one-period-ahead forecast is given by

$$\hat{X}_{t+1} = (S_t + b_t)I_{t-L+1} \qquad (3.34)$$

CHAPTER FOUR

APPLICATION

A computer program is written to compare exponential smoothing methods and modified exponential smoothing methods. Php programming language is used for programming. Data is stored in a database using Mysql. A web server is used to construct user interface (Figure 4.1).

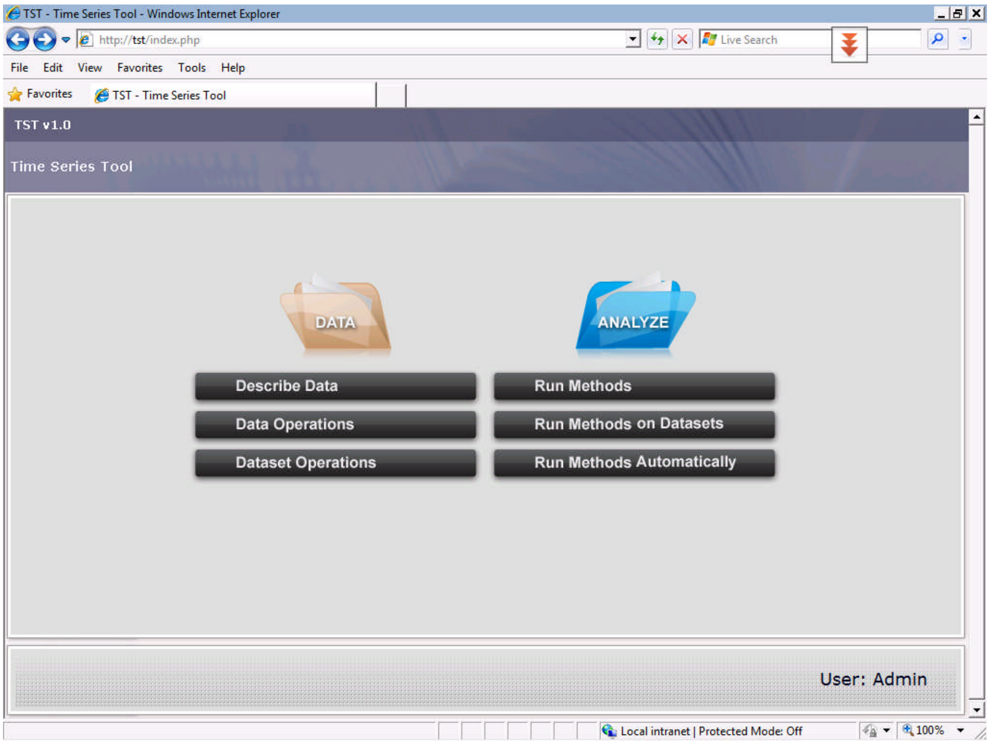


Figure 4.1 User Interface

Computer program consists of two parts; Data operations and Analysis operations. Data is stored in a database and in the analysis pages it is possible to choose a data set from the database. Since it is serving as a web site any one who have an internet connection may access to it. Using a centralized database will contribute to construct a data pool.

4.1 Data Operations

Data operations provide us to store data in a database to be used later in the analysis. Creating or importing a new data set, updating and deleting an existing data set are the basic jobs of the data operations (Figure 4.2).

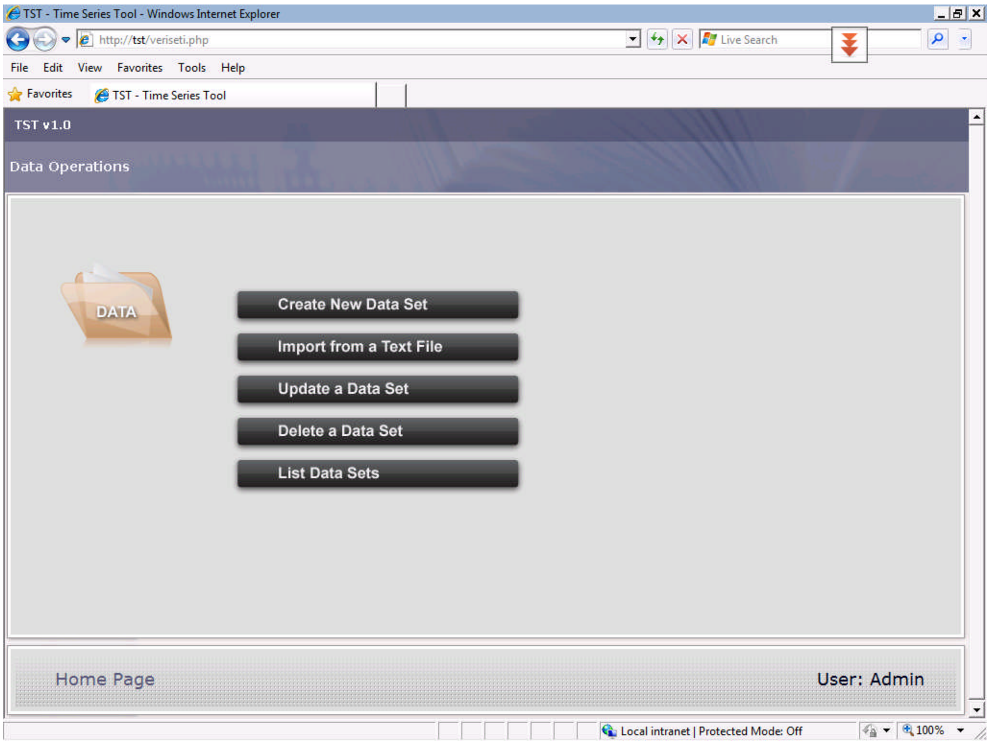


Figure 4.2 Data Operations

After clicking the button "Create New Data Set" a page will load to create a new data set (Figure 4.3). Data and some other info to describe the data will be entered here. A new input box will be added to the form every time after a new data is entered to the last input box although there seems to be only one input box to enter data.

New data set can be saved by clicking the button "SAVE" after entering the required info and data. Data sets are stored in mysql database and in the analysis pages a desired data set can be chosen easily.

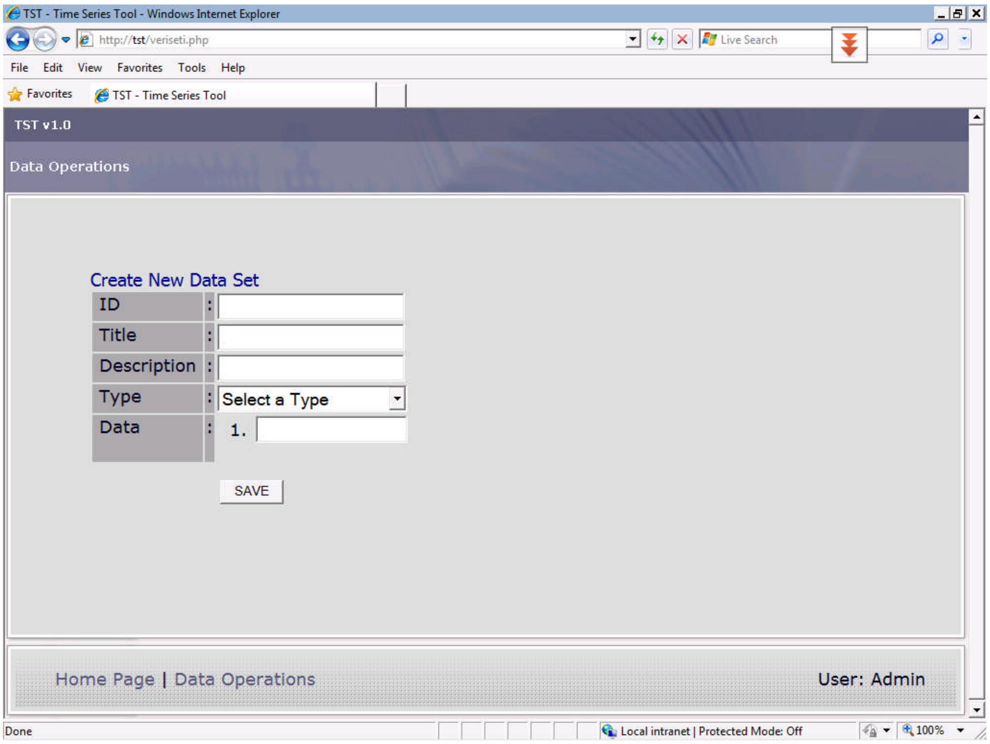


Figure 4.3 Creating a New Data Set

It is possible to display some descriptive info of any dataset. Data itself, time chart plot and some descriptive statistics can be displayed at this page (Figure 4.4).

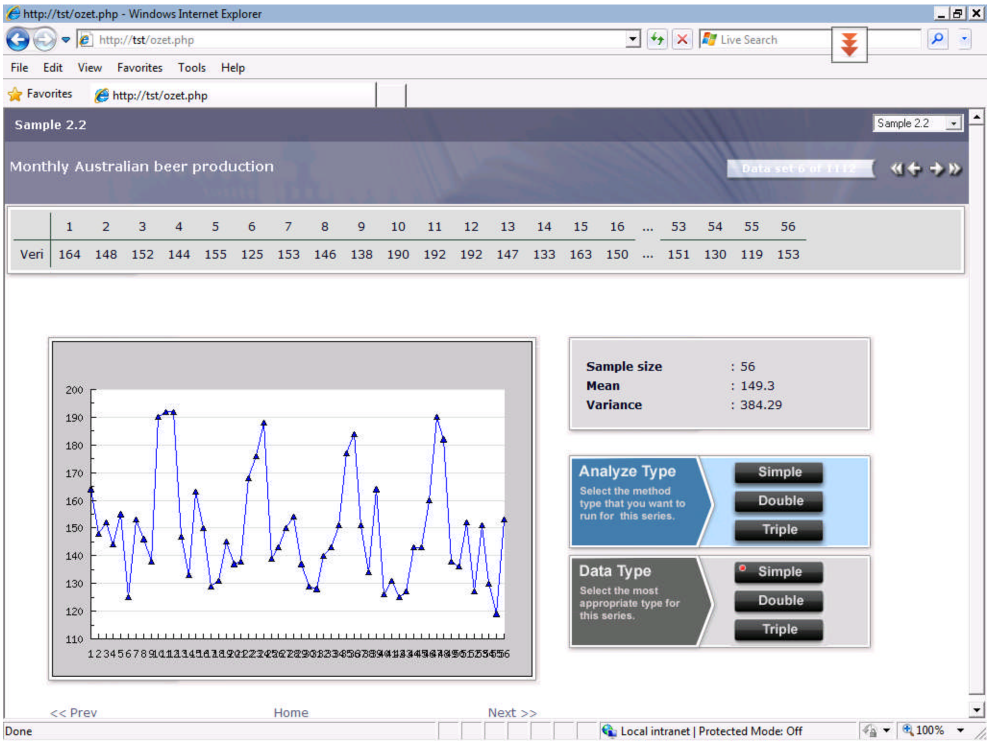


Figure 4.4 Describing a Data Set

4.2 Analysis Operations

The second part of the program is the analysis part. Here, smoothed values, fits, errors for the existing methods and modified methods can be calculated, graphics for smoothed values, fits or errors can be displayed and different accuracy measures can be calculated to compare the methods. There are three buttons at the right side of the main page to run analyses (Figure 4.1). In fact there is no difference about the calculations made by these three types of run, only difference is the reporting format and the number of the data set that will be used in the analysis.

4.2.1 Run Methods

When "Run Methods" selected then only one selected data set will be used and all the calculations and graphics will be displayed in detail while reporting. After clicking "Run Methods" button a new page will load to allow user to select a data set from the database and exponential smoothing type (ie, single, double or triple) (Figure 4.5).

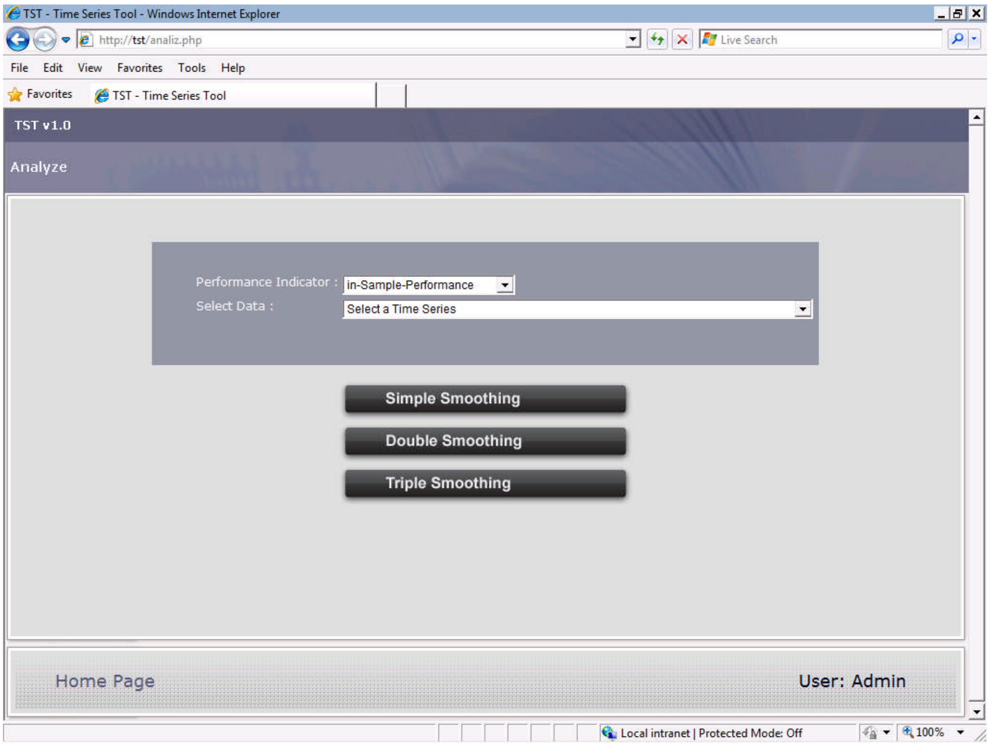


Figure 4.5 Run Methods Screen

A new screen will be displayed to allow user to enter the necessary values for the parameters that will be used by the methods after selecting a data set from the select box and clicking the button of the desired smoothing type.

For example, if “Simple Exponential” button is clicked then simple exponential smoothing and modified simple exponential smoothing will be compared. Value of α for simple exponential smoothing and value of *m* for modified simple exponential smoothing must be entered in this page (Figure 4.6). A value for *m* will be suggested after entering a value for α. User can choose suggested value or enter another value. Also a method to calculate initial value for simple exponential smoothing must be selected from the select box that includes the most frequently mentioned methods in the literature.

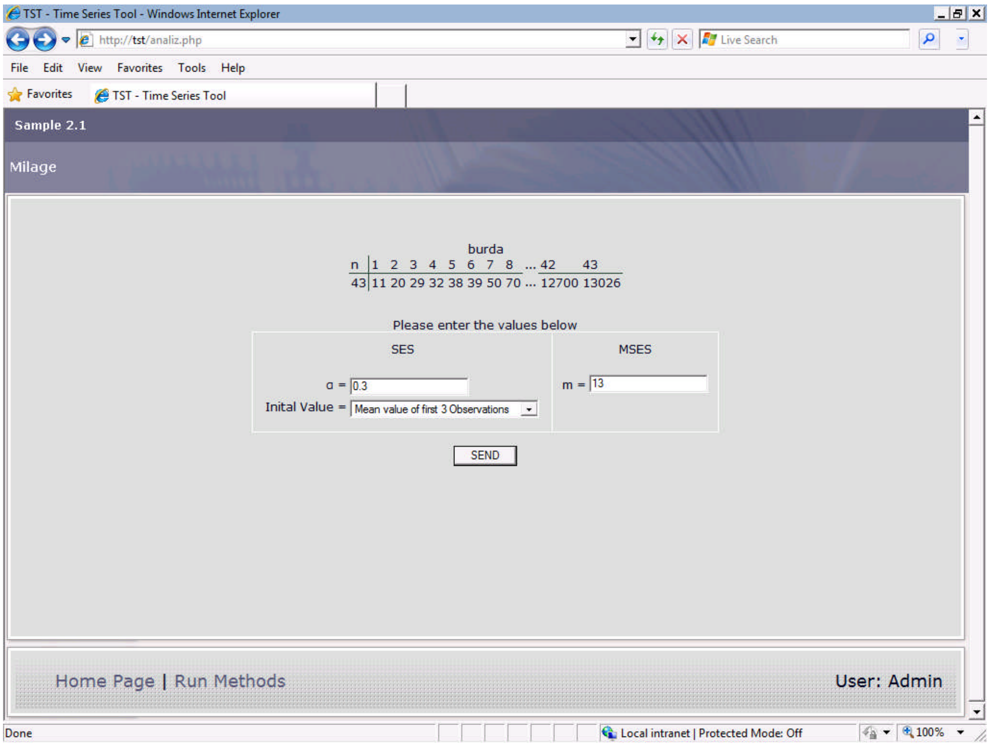


Figure 4.6 Parameter Screen

There are various tables and graphics in the reporting page to compare the methods. Several tabs are used for simplicity. The first tab includes a table that displays the original data and smoothed values for simple exponential smoothing and modified simple exponential smoothing. A time chart plot of original data and smoothed values is also displayed in the first tab (Figure 4.7).

It is possible to see the related calculation of a smoothed value moving mouse over a cell of the table. The values used in the calculation of smoothed value will be colorized and the formula will be displayed in a pop up message balloon.

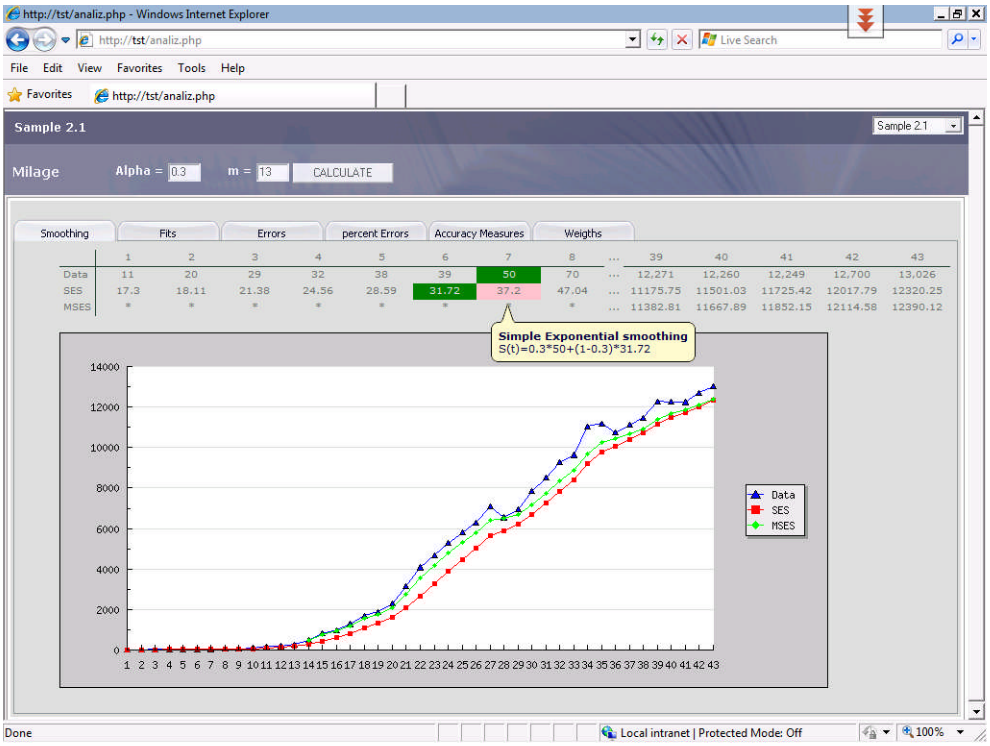


Figure 4.7 Smoothed values

At the top of the page, analyzed data set is listed in a select box and used parameters are also displayed as a web form. It is possible to enter a new α or m value to rerun the analysis for different values of α and m. It is also possible to change the data set from the list box to run same analysis for a different time series data.

Second tab in the reporting page displays the forecasted values (fits) and graph of those values (Figure 4.8). Third and fourth tabs are display the errors and percent errors respectively (Figure 4.9, Figure 4.10).

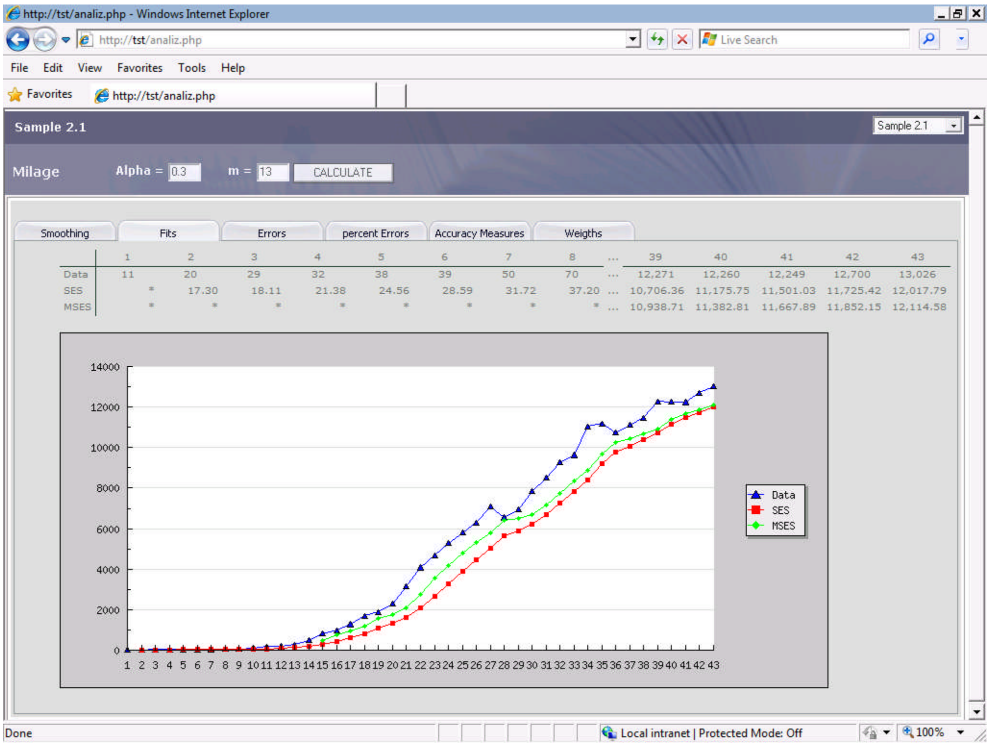


Figure 4.8 Fits

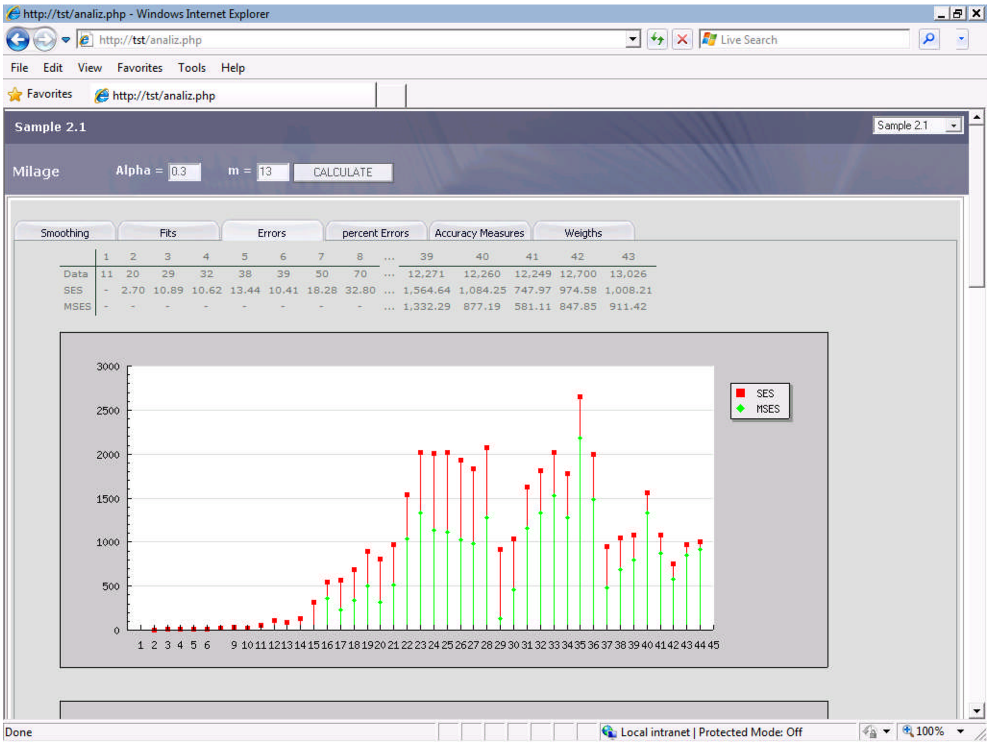


Figure 4.9 Errors

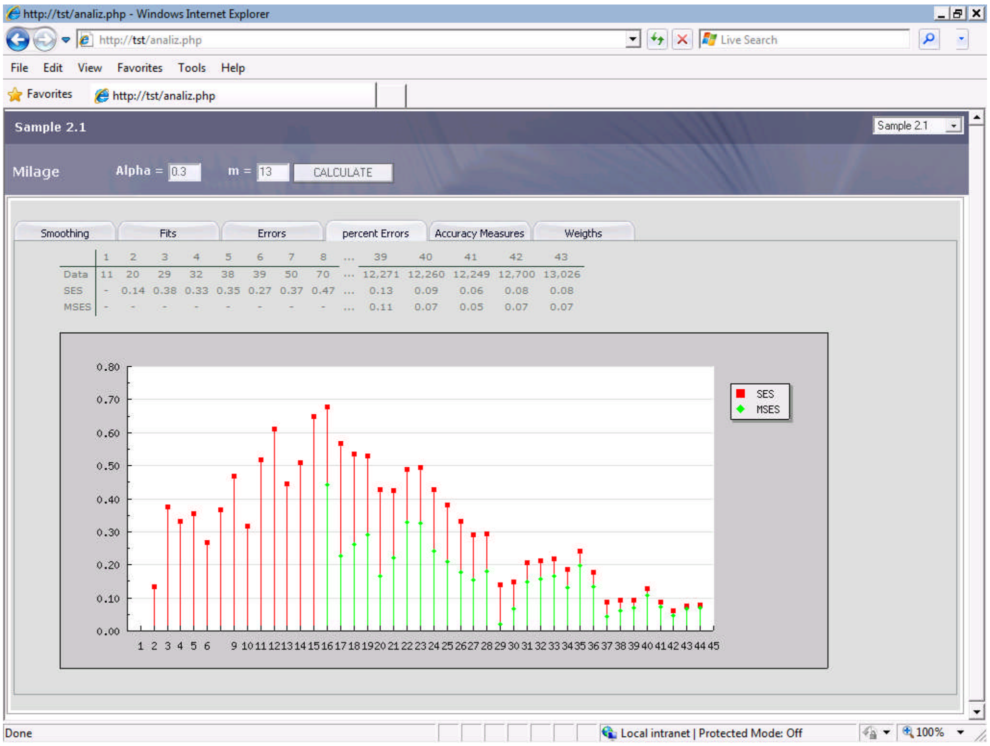


Figure 4.10 Percent Error

The fifth tab displays the accuracy measures to compare the methods. Seven error measures are calculated here; Mean Absolute Error (MAE), Mean Squared Error (MSE), root Mean Squared Error (rMSE), Mean Absolute Percent Error (MAPE), Symmetric Mean Absolute Percent Error (sMAPE), Relative Average Ranking of Absolute Percent Error (rARsAPE) and Percent Better (pBetter) (Figure 4.11).

$$\text{MAE} = \frac{\sum_{t=1}^{n} |x_t - \hat{x}_t|}{n}$$

$$\text{MSE} = \frac{\sum_{t=1}^{n} (x_t - \hat{x}_t)^2}{n} \qquad \text{rMSE} = \sqrt{\text{MSE}}$$

$$\text{MAPE} = \frac{\sum_{t=1}^{n} |(x_t - \hat{x}_t)/x_t|}{n} * 100$$

$$\text{sMAPE} = \frac{\sum_{t=1}^{n} |(x_t - \hat{x}_t)/((x_t + \hat{x}_t)/2)|}{n} * 100$$

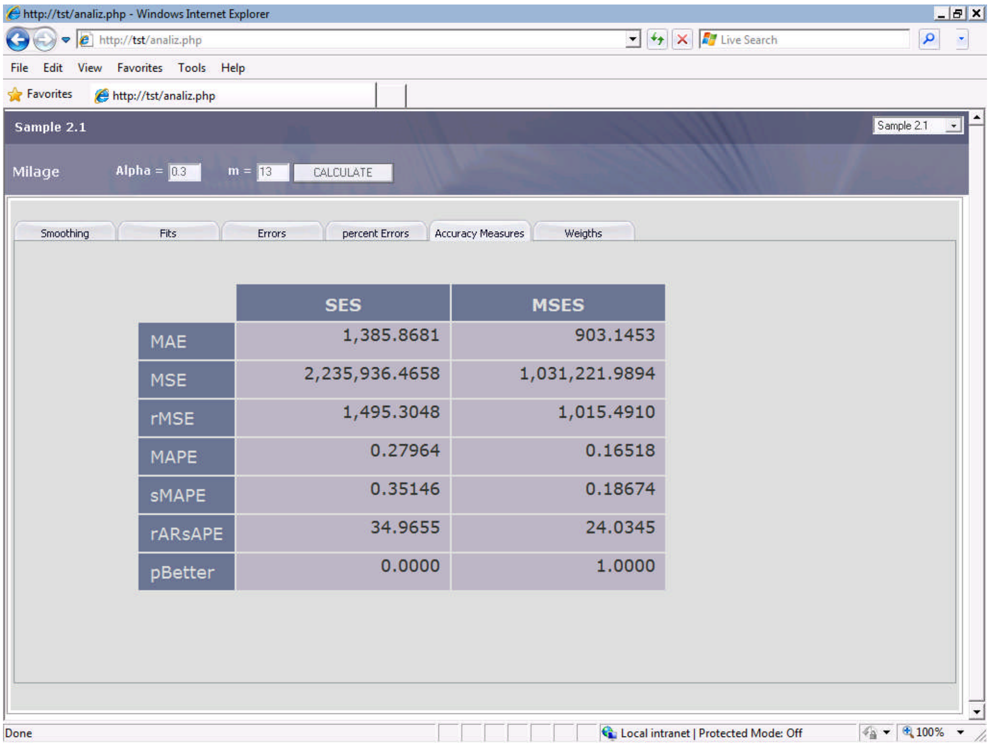


Figure 4.11 Accuracy Measures

And the last tab displays the weights assigned by the methods (Figure 4.12).

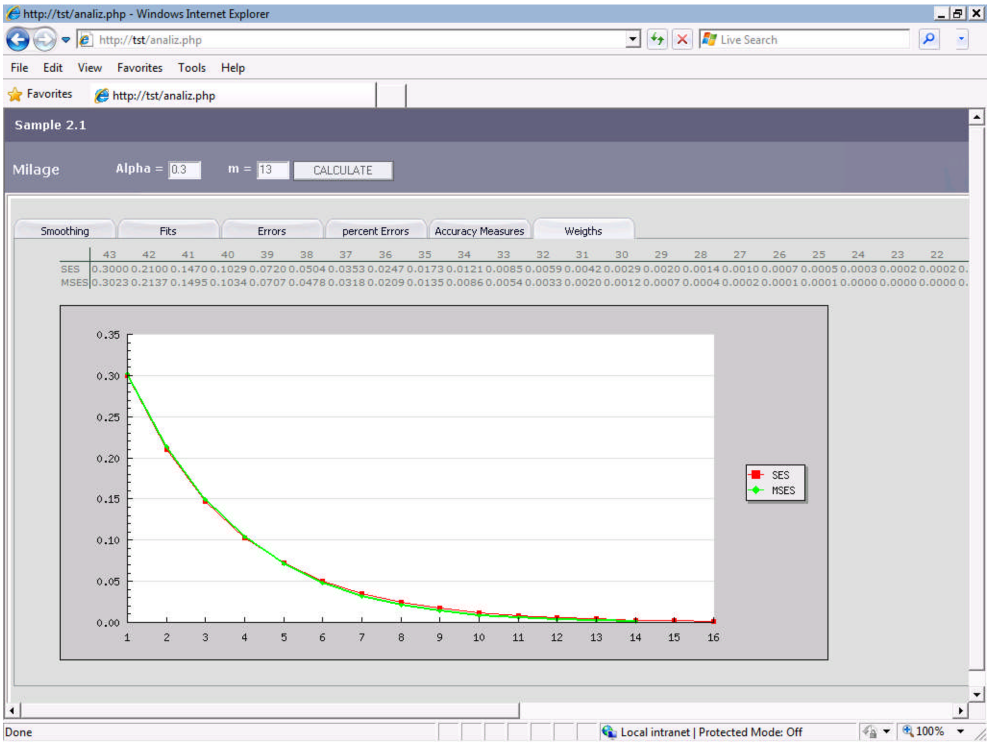


Figure 4.12 Weights

4.2.2 Run Methods on Datasets

The second type of analyses is to make same analysis for a group of data sets. Some of data sets can be grouped when creating them, for example 111 time series data from Makridakis competition can be combined in a group. All the time series in this group will automatically be analyzed when this group is selected.

A new page will be loaded and there will be a select box to select a data group and four buttons to describe selected data group or run an analysis on a desired method after clicking “Run Methods on Datasets” in main menu (Figure 4.13).

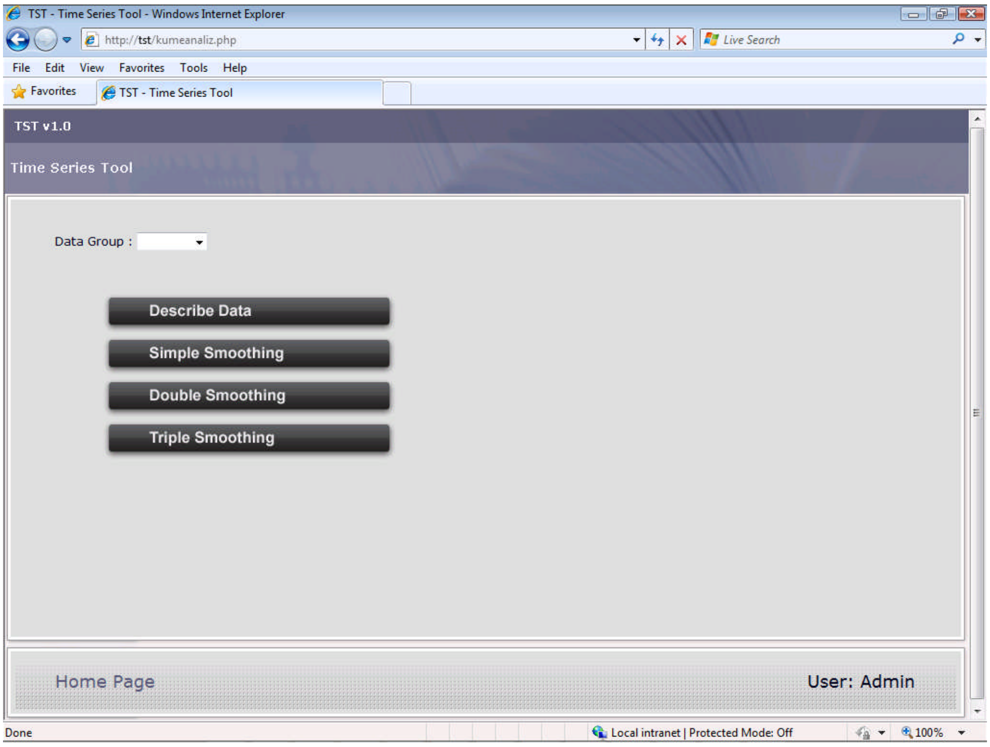
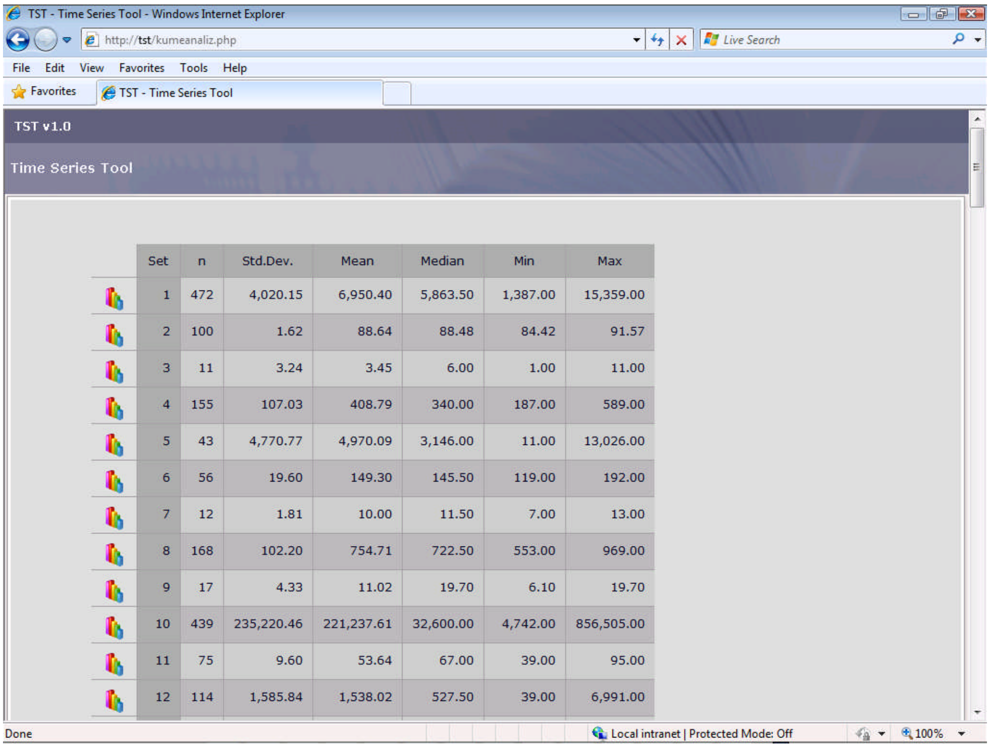


Figure 4.13 Run Methods on Datasets

After selecting a data group from select box, size, mean and variance of each dataset in the group can be listed by clicking “Describe Data” button (Figure 4.14). This will give some introductory information to user about the size, mean, variance, median, min and max value of each the data set in that group. The set number listed in the report includes a link to change display to detailed data description page. Detailed information about each data set can be displayed by clicking the corresponding set number or graph icon in the list.



Set	n	Std.Dev.	Mean	Median	Min	Max
1	472	4,020.15	6,950.40	5,863.50	1,387.00	15,359.00
2	100	1.62	88.64	88.48	84.42	91.57
3	11	3.24	3.45	6.00	1.00	11.00
4	155	107.03	408.79	340.00	187.00	589.00
5	43	4,770.77	4,970.09	3,146.00	11.00	13,026.00
6	56	19.60	149.30	145.50	119.00	192.00
7	12	1.81	10.00	11.50	7.00	13.00
8	168	102.20	754.71	722.50	553.00	969.00
9	17	4.33	11.02	19.70	6.10	19.70
10	439	235,220.46	221,237.61	32,600.00	4,742.00	856,505.00
11	75	9.60	53.64	67.00	39.00	95.00
12	114	1,585.84	1,538.02	527.50	39.00	6,991.00

Figure 4.14 Describing a group of data sets

One of the three buttons named as “Simple Smoothing”, “Double Smoothing” and “Triple Smoothing” must be clicked after selecting a group from the select box to make the analysis on a desired smoothing method (Figure 4.13). First, a page will be displayed to allow user to enter required values for parameters that used in the calculations of methods. For example, α value and initial value method for simple exponential smoothing and m value for modified simple exponential smoothing will be asked for simple smoothing. The values entered here will be used for all data sets included in the selected data group. Since the sizes of data sets are different, corresponding m value must also be different. Regardless of the dataset size the entered m value will be used since there is only one input box to enter m value. However, leaving m value as empty will cause to selecting corresponding m value automatically by the program for each data set in the data group for a given α value (Figure 4.15).

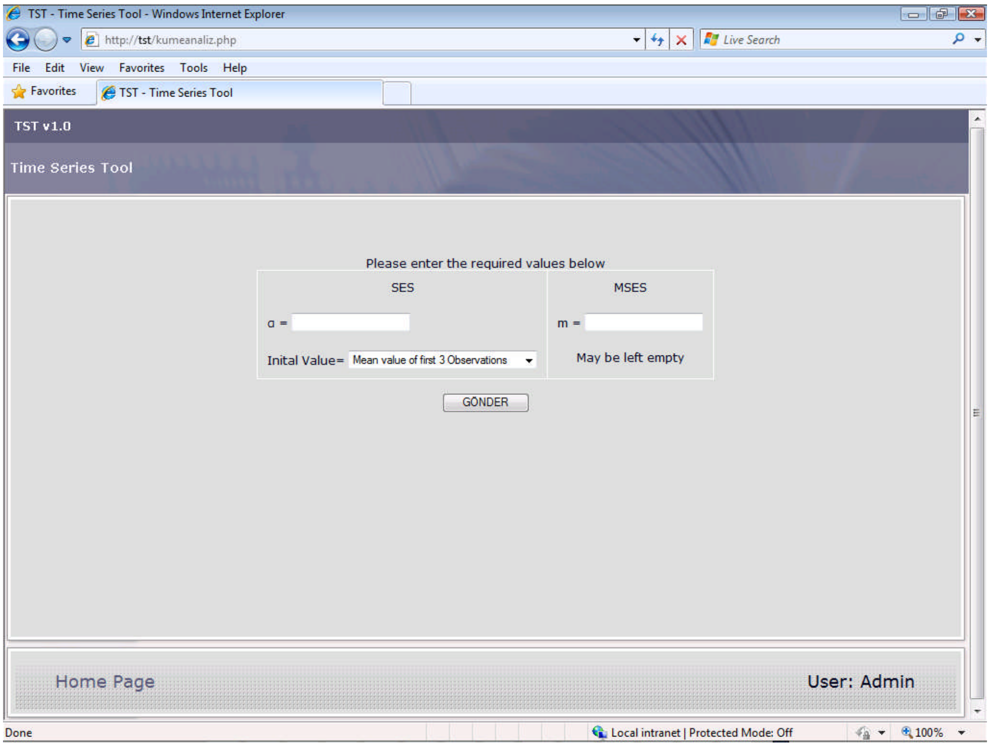
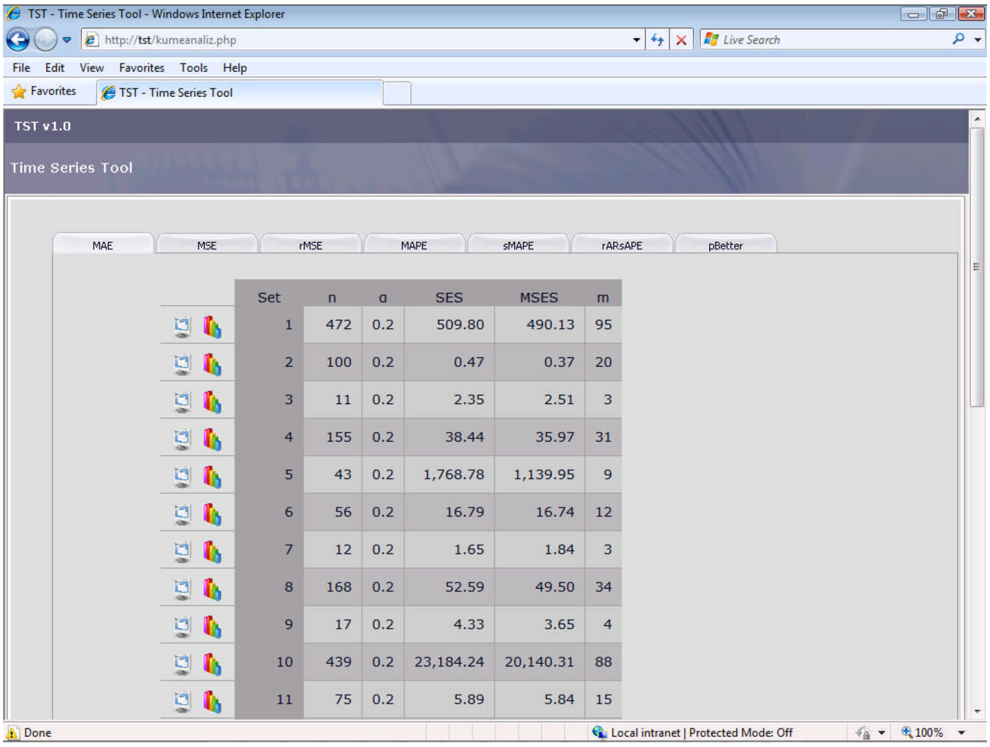


Figure 4.15 Simple Smoothing

Reporting page includes seven tabs (Figure 4.16). Each tab displays the results for a different accuracy measure. For example, results for MAE is included in the first tab. Data set number, size of the data set, α value, accuracy measures calculated for classical and modified method, and corresponding m value are listed in a row for each data set in the selected data group. Performance of the classical method and modified method can be compared for each data set using the seven different accuracy measures included here.

There are also two icons in each row in the list. One may open the detailed analysis page for any data set by clicking the first icon and data describe page can be opened for any data set by clicking the second icon.



Set	n	α	SES	MSES	m
1	472	0.2	509.80	490.13	95
2	100	0.2	0.47	0.37	20
3	11	0.2	2.35	2.51	3
4	155	0.2	38.44	35.97	31
5	43	0.2	1,768.78	1,139.95	9
6	56	0.2	16.79	16.74	12
7	12	0.2	1.65	1.84	3
8	168	0.2	52.59	49.50	34
9	17	0.2	4.33	3.65	4
10	439	0.2	23,184.24	20,140.31	88
11	75	0.2	5.89	5.84	15

Figure 4.16 Report page

4.2.3 Run Methods Automatically

The third button to make analysis in the main menu (Figure 4.1) is "Run Methods Automatically". It is important to try different α values since we don't know the optimum α value for a data set. Accuracy measures are calculated for different values of α and corresponding *m* values for a selected data set or a data group when this type of analysis selected. Different α values, starting from 0.1 and incrementing by 0.1 up to 0.9, and corresponding *m* values are used and accuracy measures are calculated to compare the methods for different levels of α .

A new page will be loaded after clicking the button "Run Methods Automatically" (Figure 4.17). There are two sections in this page. Left side is used to run only one data set for different α levels and corresponding *m* values, right side is used to run a data group again for different α levels and corresponding *m* values.

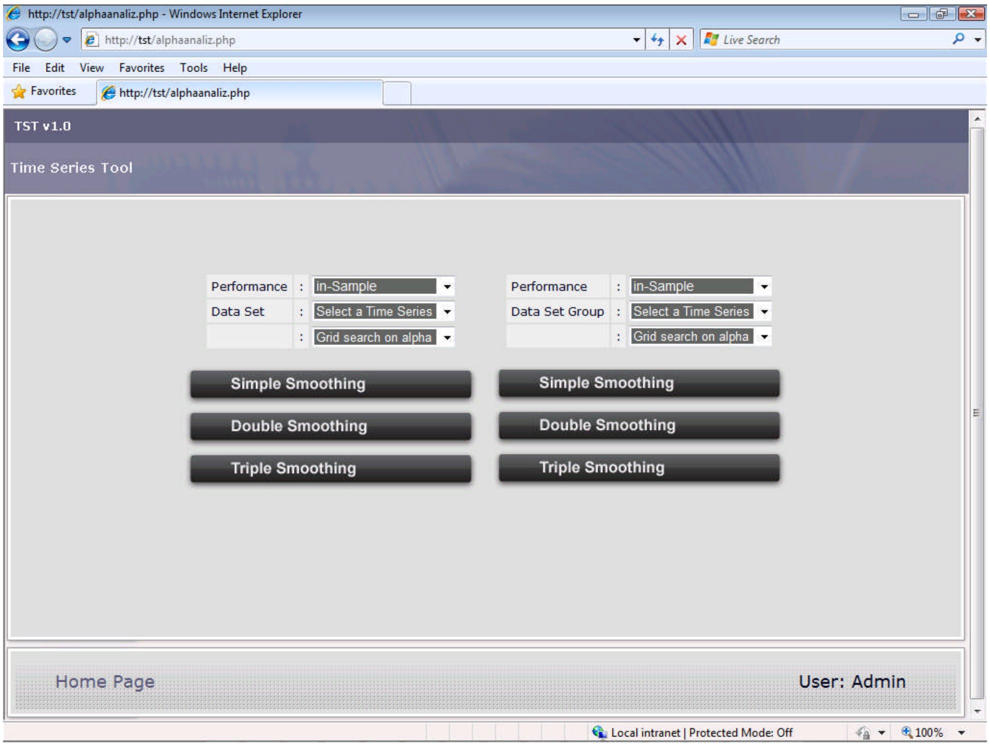
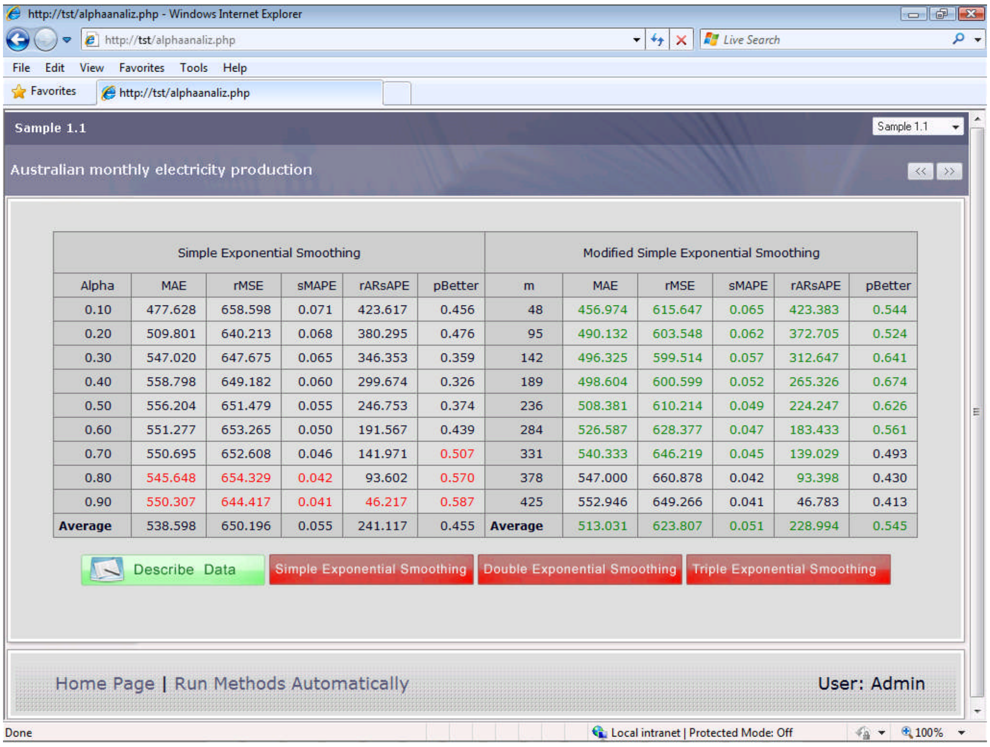


Figure 4.17 Run Methods Automatically

When a data set is selected and a button is clicked from left side related smoothing type will be analyzed. Different α values, starting from 0.1 up to 0.9 incrementing by 0.1, and corresponding m values will be used and accuracy measures will be calculated and displayed for each level of α (Figure 4.18).

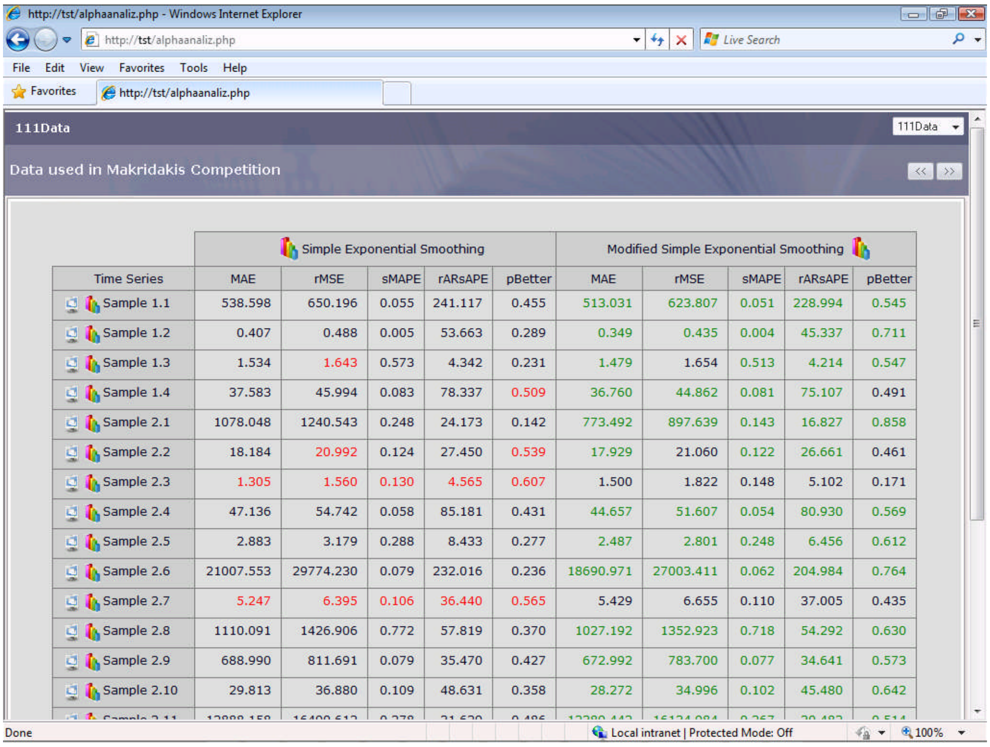


Simple Exponential Smoothing						Modified Simple Exponential Smoothing					
Alpha	MAE	rMSE	sMAPE	rARsAPE	pBetter	m	MAE	rMSE	sMAPE	rARsAPE	pBetter
0.10	477.628	658.598	0.071	423.617	0.456	48	456.974	615.647	0.065	423.383	0.544
0.20	509.801	640.213	0.068	380.295	0.476	95	490.132	603.548	0.062	372.705	0.524
0.30	547.020	647.675	0.065	346.353	0.359	142	496.325	599.514	0.057	312.647	0.641
0.40	558.798	649.182	0.060	299.674	0.326	189	498.604	600.599	0.052	265.326	0.674
0.50	556.204	651.479	0.055	246.753	0.374	236	508.381	610.214	0.049	224.247	0.626
0.60	551.277	653.265	0.050	191.567	0.439	284	526.587	628.377	0.047	183.433	0.561
0.70	550.695	652.608	0.046	141.971	0.507	331	540.333	646.219	0.045	139.029	0.493
0.80	545.648	654.329	0.042	93.602	0.570	378	547.000	660.878	0.042	93.398	0.430
0.90	550.307	644.417	0.041	46.217	0.587	425	552.946	649.266	0.041	46.783	0.413
Average	538.598	650.196	0.055	241.117	0.455	**Average**	513.031	623.807	0.051	228.994	0.545

Figure 4.18 Analysis results for only one data set

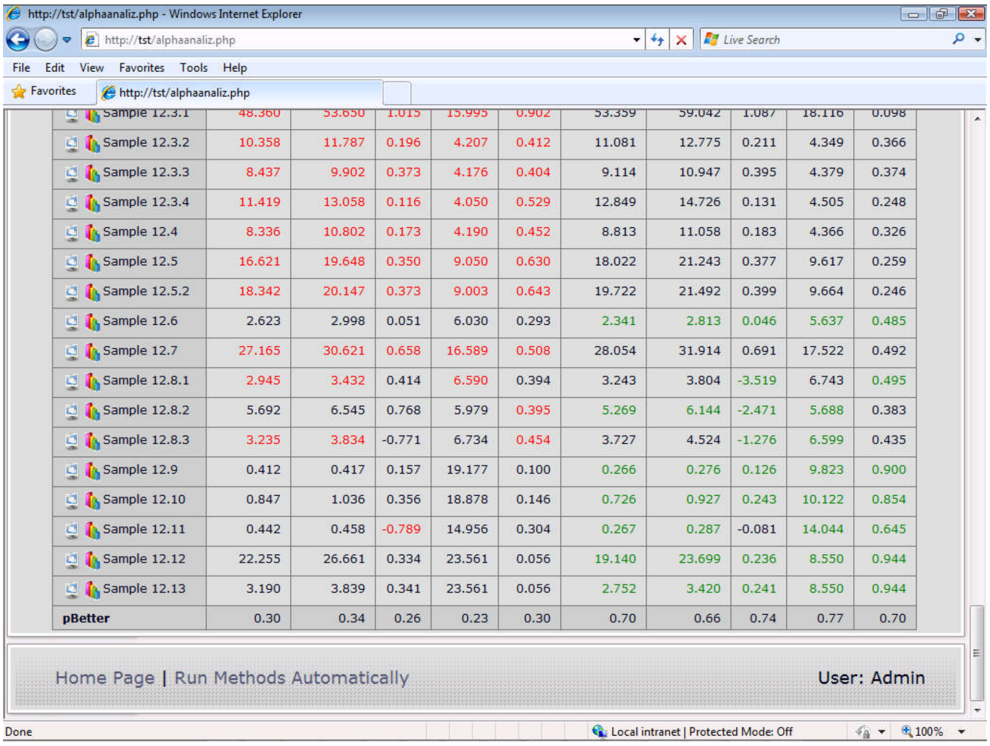
When a data group is selected from right side and clicked a button below related smoothing type will be analyzed for each data set in that group. Starting from 0.1 up to 0.9 incrementing by 0.1, different α values and corresponding m values will be used and accuracy measures will be calculated for each data set in the selected data group. Data set averages will be calculated for each accuracy measure and displayed in a tabulated list (Figure 4.19).

Probably, classical method will perform better for some data sets in the data group and modified method will perform better for others. So, number of times that each method performed better than other is calculated and percentages are displayed at the end of the list for each accuracy measures (Figure 4.20).



Time Series	Simple Exponential Smoothing					Modified Simple Exponential Smoothing				
	MAE	rMSE	sMAPE	rARsAPE	pBetter	MAE	rMSE	sMAPE	rARsAPE	pBetter
Sample 1.1	538.598	650.196	0.055	241.117	0.455	513.031	623.807	0.051	228.994	0.545
Sample 1.2	0.407	0.488	0.005	53.663	0.289	0.349	0.435	0.004	45.337	0.711
Sample 1.3	1.534	1.643	0.573	4.342	0.231	1.479	1.654	0.513	4.214	0.547
Sample 1.4	37.583	45.994	0.083	78.337	0.509	36.760	44.862	0.081	75.107	0.491
Sample 2.1	1078.048	1240.543	0.248	24.173	0.142	773.492	897.639	0.143	16.827	0.858
Sample 2.2	18.184	20.992	0.124	27.450	0.539	17.929	21.060	0.122	26.661	0.461
Sample 2.3	1.305	1.560	0.130	4.565	0.607	1.500	1.822	0.148	5.102	0.171
Sample 2.4	47.136	54.742	0.058	85.181	0.431	44.657	51.607	0.054	80.930	0.569
Sample 2.5	2.883	3.179	0.288	8.433	0.277	2.487	2.801	0.248	6.456	0.612
Sample 2.6	21007.553	29774.230	0.079	232.016	0.236	18690.971	27003.411	0.062	204.984	0.764
Sample 2.7	5.247	6.395	0.106	36.440	0.565	5.429	6.655	0.110	37.005	0.435
Sample 2.8	1110.091	1426.906	0.772	57.819	0.370	1027.192	1352.923	0.718	54.292	0.630
Sample 2.9	688.990	811.691	0.079	35.470	0.427	672.992	783.700	0.077	34.641	0.573
Sample 2.10	29.813	36.880	0.109	48.631	0.358	28.272	34.996	0.102	45.480	0.642

Figure 4.19 Analysis results for a data group



Sample 12.3.1	48.360	53.650	1.015	15.995	0.902	53.359	59.042	1.087	18.116	0.098
Sample 12.3.2	10.358	11.787	0.196	4.207	0.412	11.081	12.775	0.211	4.349	0.366
Sample 12.3.3	8.437	9.902	0.373	4.176	0.404	9.114	10.947	0.395	4.379	0.374
Sample 12.3.4	11.419	13.058	0.116	4.050	0.529	12.849	14.726	0.131	4.505	0.248
Sample 12.4	8.336	10.802	0.173	4.190	0.452	8.813	11.058	0.183	4.366	0.326
Sample 12.5	16.621	19.648	0.350	9.050	0.630	18.022	21.243	0.377	9.617	0.259
Sample 12.5.2	18.342	20.147	0.373	9.003	0.643	19.722	21.492	0.399	9.664	0.246
Sample 12.6	2.623	2.998	0.051	6.030	0.293	2.341	2.813	0.046	5.637	0.485
Sample 12.7	27.165	30.621	0.658	16.589	0.508	28.054	31.914	0.691	17.522	0.492
Sample 12.8.1	2.945	3.432	0.414	6.590	0.394	3.243	3.804	-3.519	6.743	0.495
Sample 12.8.2	5.692	6.545	0.768	5.979	0.395	5.269	6.144	-2.471	5.688	0.383
Sample 12.8.3	3.235	3.834	-0.771	6.734	0.454	3.727	4.524	-1.276	6.599	0.435
Sample 12.9	0.412	0.417	0.157	19.177	0.100	0.266	0.276	0.126	9.823	0.900
Sample 12.10	0.847	1.036	0.356	18.878	0.146	0.726	0.927	0.243	10.122	0.854
Sample 12.11	0.442	0.458	-0.789	14.956	0.304	0.267	0.287	-0.081	14.044	0.645
Sample 12.12	22.255	26.661	0.334	23.561	0.056	19.140	23.699	0.236	8.550	0.944
Sample 12.13	3.190	3.839	0.341	23.561	0.056	2.752	3.420	0.241	8.550	0.944
pBetter	0.30	0.34	0.26	0.23	0.30	0.70	0.66	0.74	0.77	0.70

Figure 4.20 Percentages for each accuracy measures

CHAPTER FIVE

EMPIRICAL COMPARISONS

Empirical studies play an important role to understand various behaviors of forecasting methods therefore an empirical study is developed to compare the performance of the modified and classical exponential smoothing methods.

First of all, real time series from Makridakis competitions that are well known and mostly used by the researchers are used in the study. There are 111 time series in Makridakis competition (Makridakis, 1979) and 1001 time series in M-competition (Makridakis, 1982).

Secondly, there are many accuracy measures have been used to evaluate the performance of forecasting. Most commonly used accuracy measures are included in the study which are Mean Absolute Error (MAE), Mean Squared Error (MSE), root Mean Squared Error (rMSE), Mean Absolute Percent Error (MAPE), Symmetric Mean Absolute Percent Error (sMAPE), Relative Average Ranking of Absolute Percent Error (rARsAPE) and percent Better (pBetter).

Finally, both in-sample performance and out-of-sample performance is compared. The in-sample performance comparison is based on one-step-ahead forecasts and mostly used comparison type for the earlier studies. Later, the out-of-sample performance have been started to be use which is based on forecasting the data in the hold-out period.

5.1 Modified Simple Exponential Smoothing vs. Simple Exponential Smoothing

5.1.1 In-sample Performance

There are 111 time series in the Makridakis competition (Makridakis, 1979) and 1001 time series in M-Competition (Makridakis, 1982). All time series are used to compare in-sample performance of the methods modified simple exponential smoothing and simple exponential smoothing and summary of the comparison results are given in a brief table at the end of this section. Let first look at some detailed comparison results for a few time series from these total 1112 time series.

Let start with the first time series from Makridakis Competition. There are 472 data in this series. Mean of the data is 6950.4 and variance is 16161586.93. The time series plot is given in Figure 5.1.

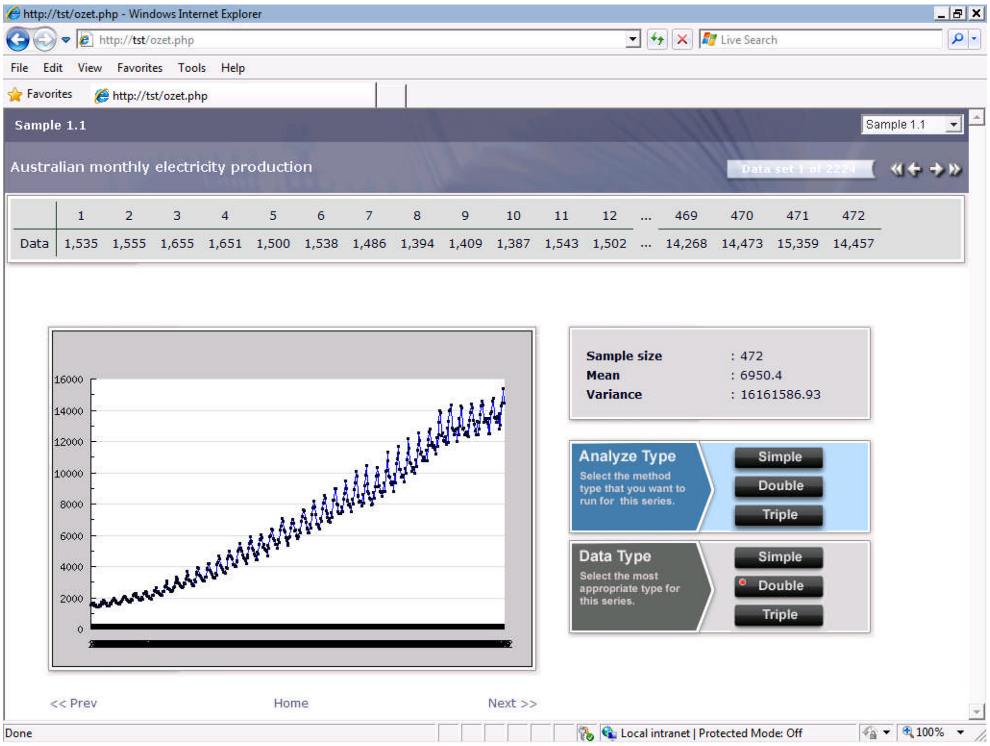


Figure 5.1 Time series plot of first sample

To see the detailed comparison between the methods modified simple exponential smoothing and simple exponential smoothing "Run Methods" must be clicked from the home page (Figure 5.2).

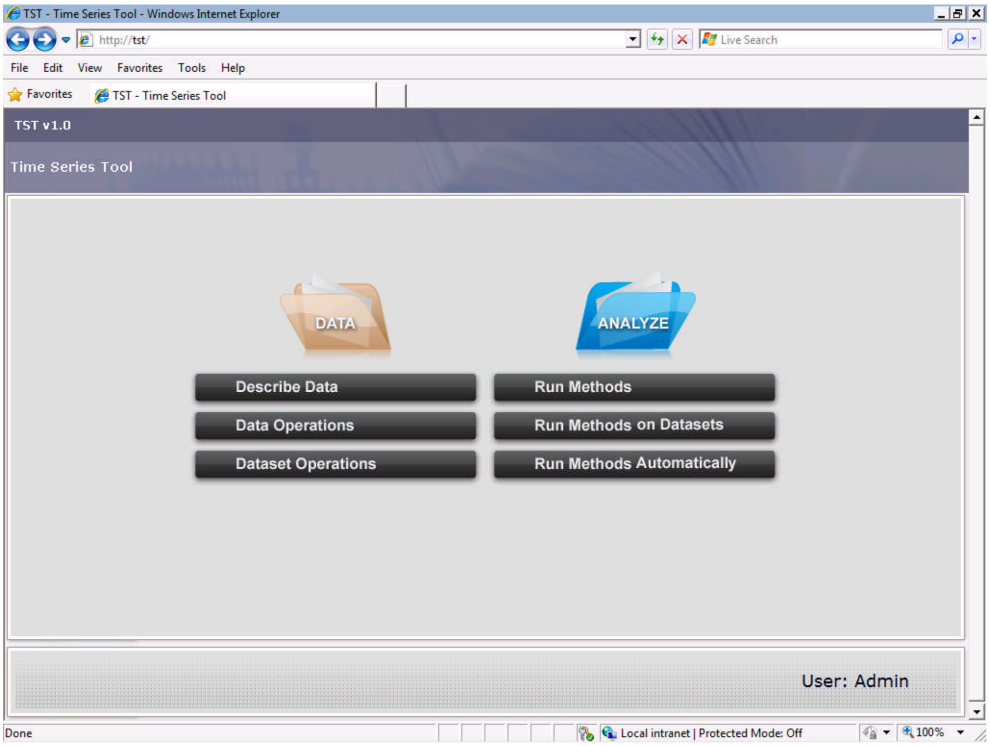


Figure 5.2 Home page

A new page will be displayed to select a time series from the database and the smoothing type. Choose Sample 1.1 from the select box and click “Simple Smoothing” button to compare modified simple exponential smoothing and simple exponential smoothing (Figure 5.3).

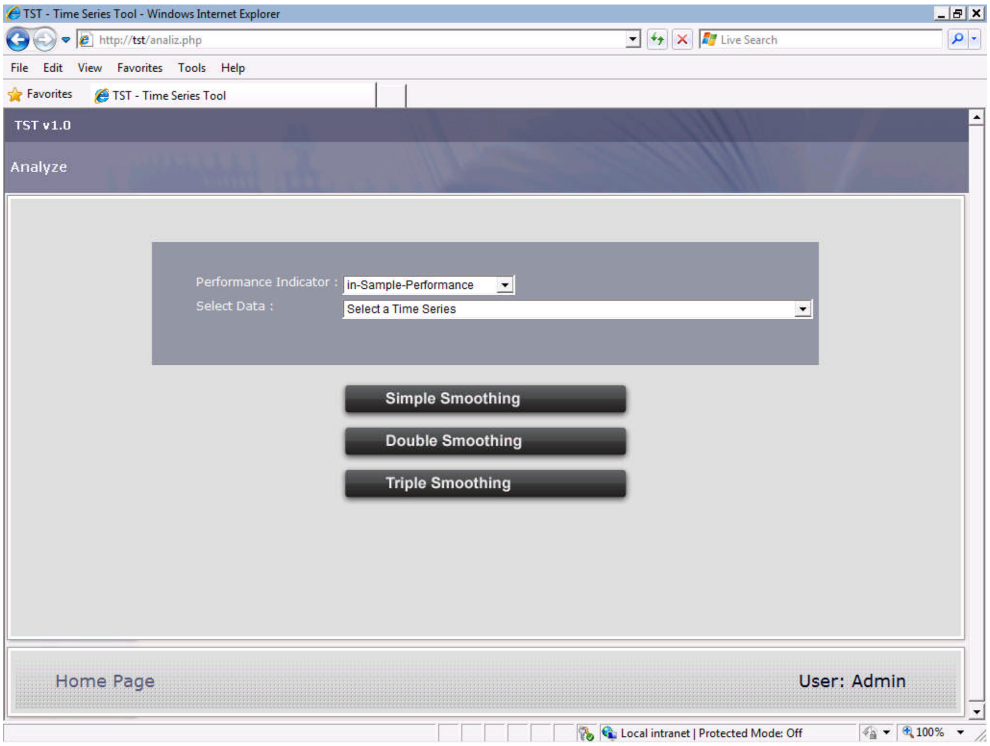


Figure 5.3 Selecting a time series and smoothing type

Next step is entering the values required to run analysis. Corresponding value for m will be recommended after entering a value for α. User may choose to enter recommended value or enter another value. Let enter 0.1 for α then the corresponding value for m is recommended as 47. Let use recommended m value so enter 47 for m. After selecting a method for calculating initial value for simple exponential smoothing click “SEND” button to start analysis (Figure 5.4).

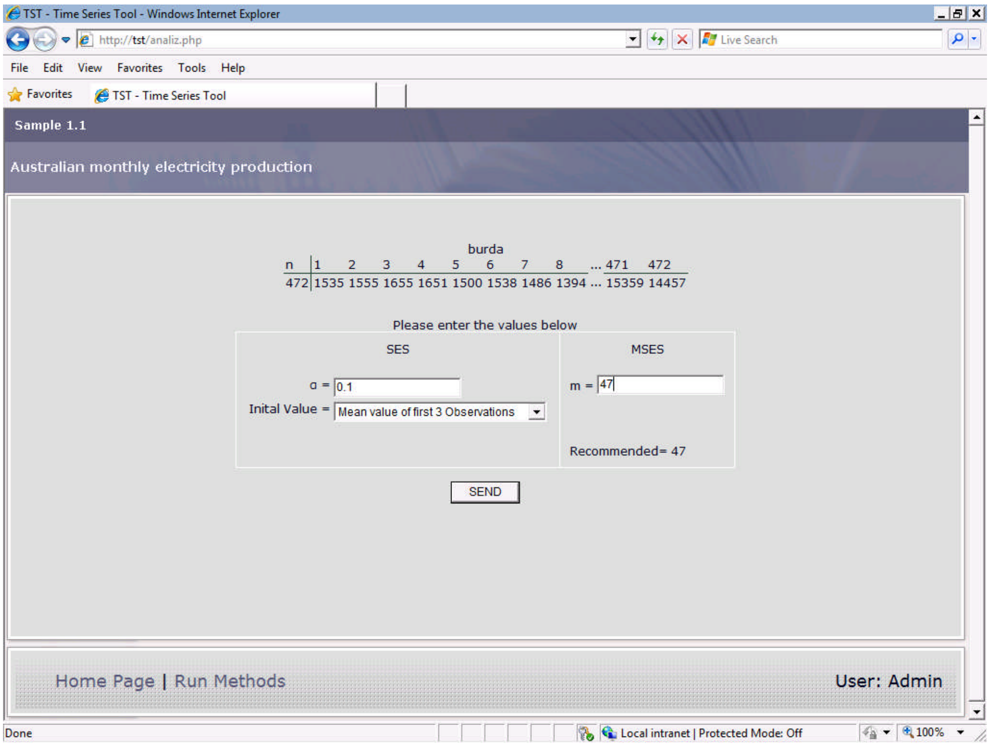


Figure 5.4 Entering required values to start the analysis

Report page includes some description about the selected time series and entered values for the parameters and 7 tabs to display result for the analysis. The first tab displays the smoothed values and a graph of original values and the smoothed values obtained from each method. It is possible to see the calculation of a smoothed value moving mouse over a related table cell (Figure 5.5).

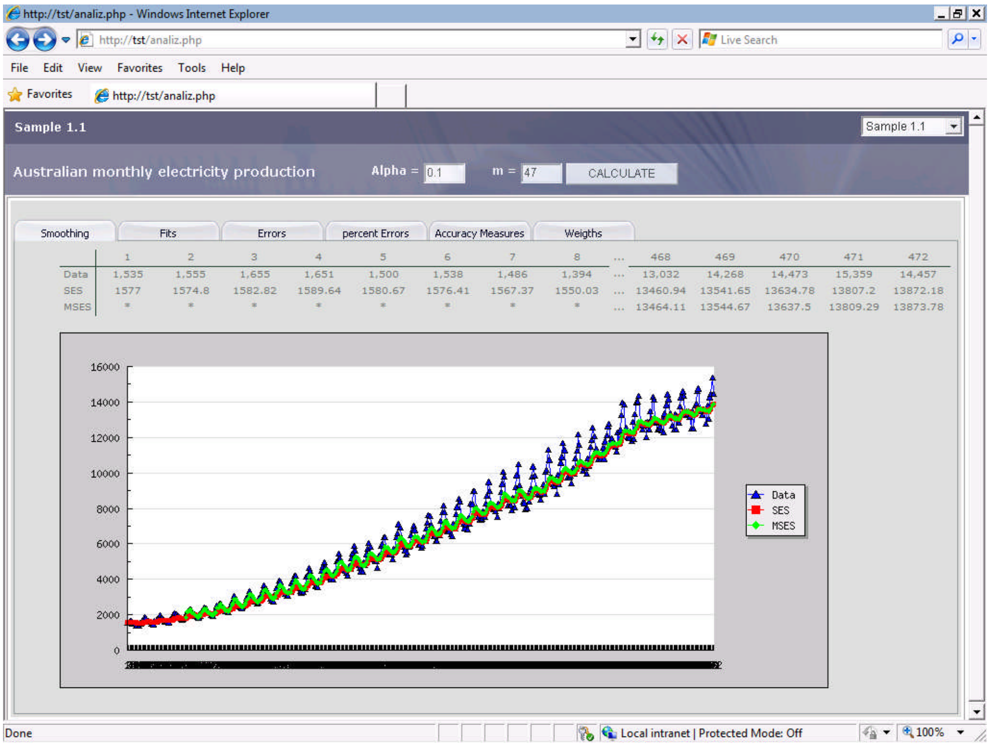


Figure 5.5 Original data and smoothed values obtained from each method

In the graph, blue color is used for original data, red color is used classical method and green color is used for modified method. It is easy to see that smoothed values for each method are far away from the original data. This may be a visual clue to user to increase the values of α and m. The second tab displays the forecasts. Remember that the forecast value at time t was the previous smoothed value for simple exponential smoothing. This tab displays the original data and forecasts obtained from each method and includes a graph of them (Figure 5.6). When we look at to the graph it can be said that forecasted values are not fit good enough to original data since smoothed values were also far away from the original data. By the way selecting another α and m values may produce better results. It may be better to rerun the analysis for a different value of α and corresponding m value after finishing the examining all tabs.

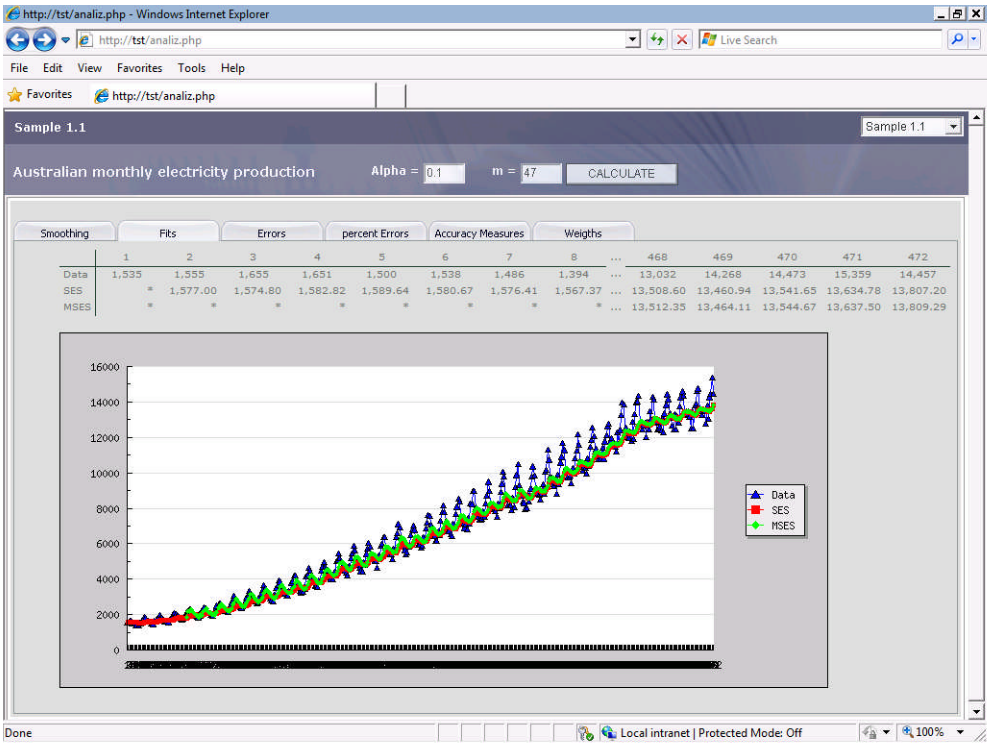


Figure 5.6 One-step-ahead forecasts

The third tab is the Errors tab. Errors calculated for each method listed in this tab and also a graph of the errors is displayed (Figure 5.7). Here red color is used for simple exponential smoothing and green color is used for modified simple exponential smoothing. It is hard to say something about the errors when we look at to the graph since there are a lot of data in the graph. However, it seems to be that errors obtained from modified simple exponential smoothing are mostly smaller than the errors obtained from simple exponential smoothing.

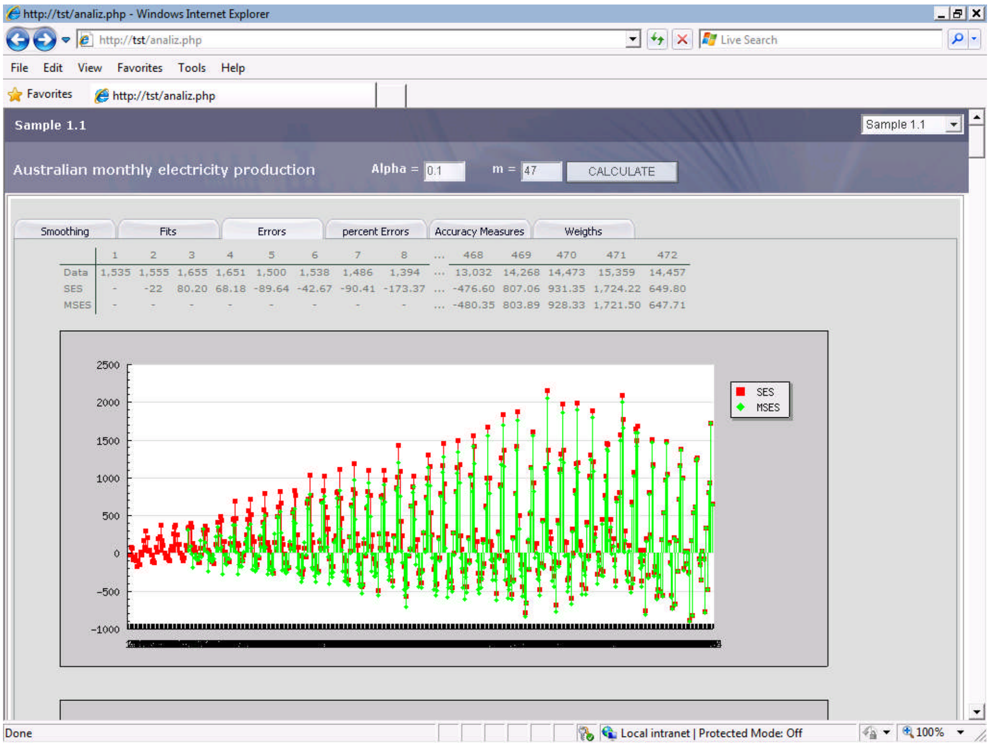


Figure 5.7 Errors

The next tab is percent Errors tab which displays the percent errors (Figure 5.8). Percent errors for modified simple exponential smoothing are mostly smaller than simple exponential smoothing when we look at to the graphic in Figure 5.8.

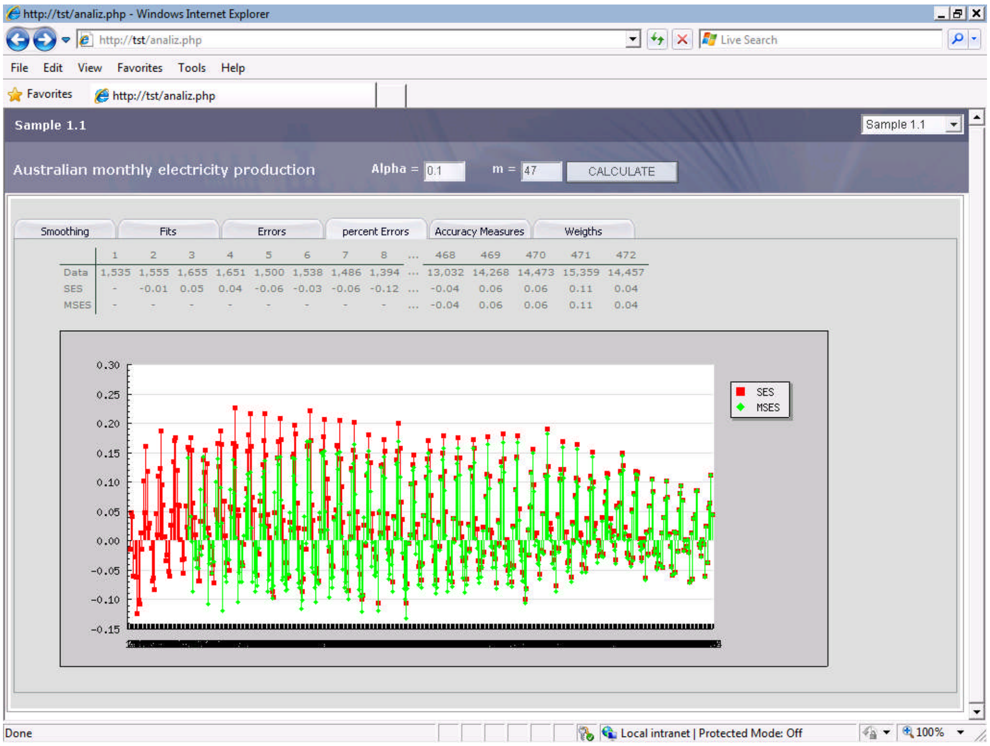
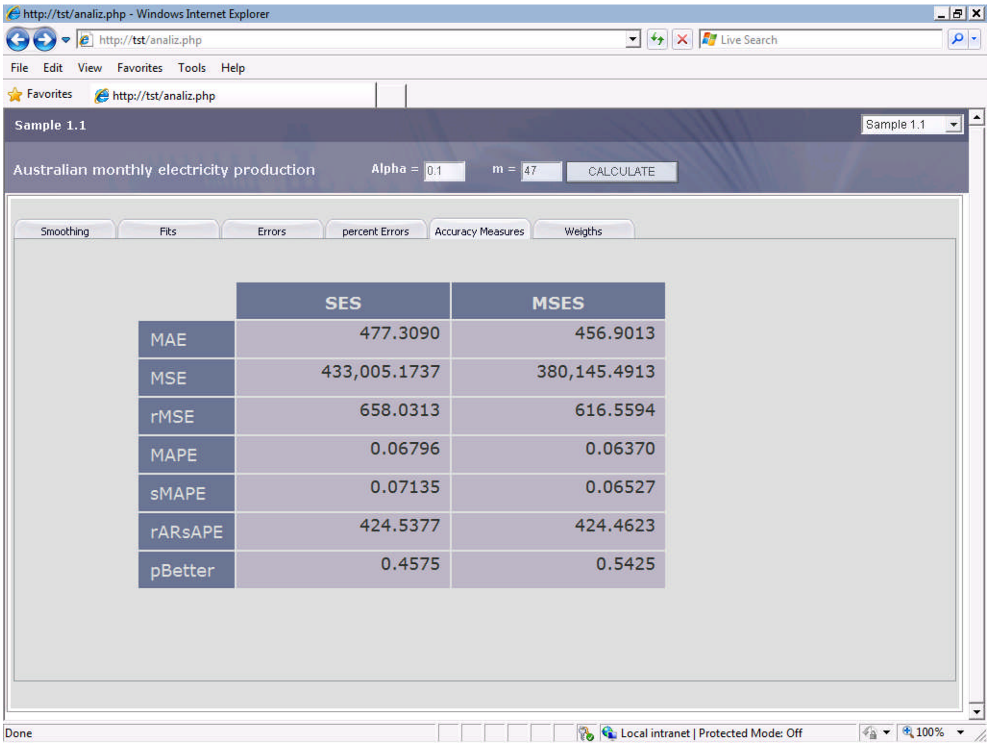


Figure 5.8 Percent errors

The fifth tab is the tab that includes the results for the accuracy measures. This is probably the most important tab of the report page. According to the values of accuracy measures listed in this tab the accuracy of the modified simple exponential smoothing and simple exponential smoothing can be compared. The other tabs have some intuitive meanings to user but this tab helps to see the accuracy of each methods.

When α value is 0.1 and the corresponding m value is 47, for the time series Sample 1.1 from Makridakis Competition, MAE value is 477.3090 for simple exponential smoothing and it is 456.9013 for modified simple exponential smoothing (Figure 5.9). It can be said that modified simple exponential smoothing is performed better then simple exponential smoothing according to MAE.



	SES	MSES
MAE	477.3090	456.9013
MSE	433,005.1737	380,145.4913
rMSE	658.0313	616.5594
MAPE	0.06796	0.06370
sMAPE	0.07135	0.06527
rARsAPE	424.5377	424.4623
pBetter	0.4575	0.5425

Figure 5.9 Accuracy measures

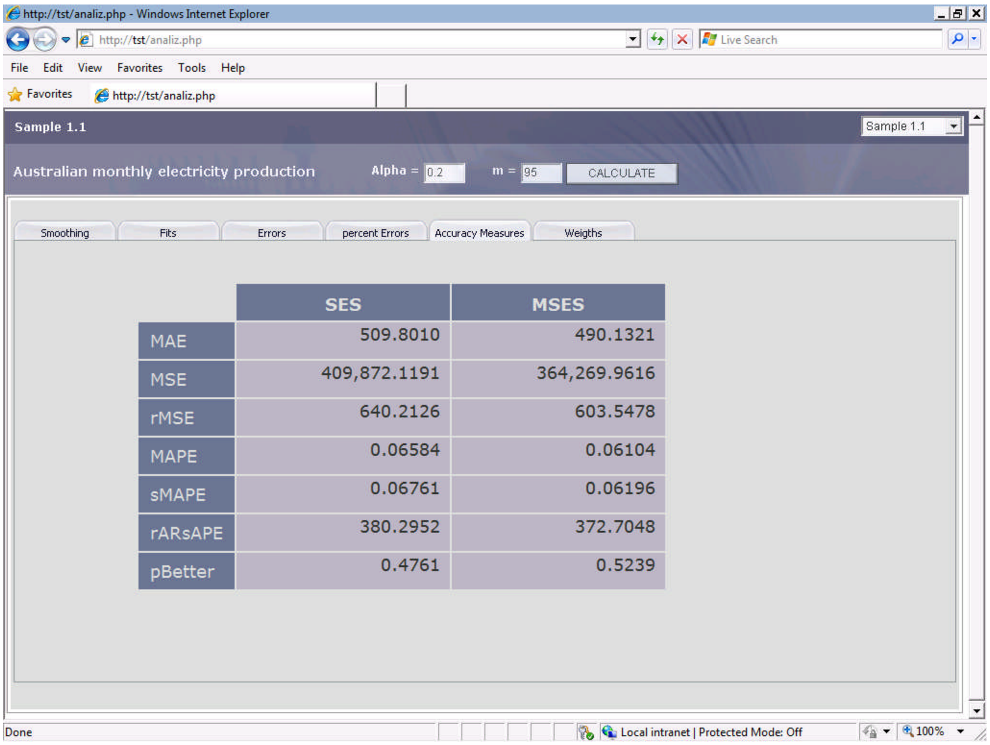
MSE value for modified simple exponential smoothing (MSES), that is 380145.4913, is smaller than MSE value for simple exponential smoothing (SES) that is 433005.1737. It can be said that MSES performed better than SES according to the MSE. Of course rMSE value for MSES is smaller than rMSE value for SES since rMSE is squared root of MSE.

Mean Absolute Percent Error (MAPE) value for MSES is 0.0637 which is smaller than MAPE value for SES that is 0.06796. sMAPE value for MSES is smaller than sMAPE value for SES and rARsAPE value for MSES is smaller than rARsAPE value for SES. MSES still performs better than SES according to these three accuracy measures.

The bigger value is better for the accuracy measure pBetter. pBetter value for MSES is 0.5425 and pBetter value for SES is 0.4575. MSES again performs better according to the accuracy measure pBetter since this time bigger value is better.

All accuracy measures used in the empirical study showed that modified simple exponential smoothing performs better than simple exponential smoothing when α

is 0.1 and the corresponding *m* value is 47. However, this does not mean that these are the best results for this time series. Analysis must be repeated for different α and corresponding *m* value. Let take α as 0.2 and then corresponding *m* value as 95 and repeat the analysis. Although it is possible to investigate each tab from first to fourth tab let look at to the accuracy measures tab directly (Figure 5.10).



	SES	MSES
MAE	509.8010	490.1321
MSE	409,872.1191	364,269.9616
rMSE	640.2126	603.5478
MAPE	0.06584	0.06104
sMAPE	0.06761	0.06196
rARsAPE	380.2952	372.7048
pBetter	0.4761	0.5239

Figure 5.10 Accuracy measures when α =0.2 and *m*=95

Values of all accuracy measures, of course except pbetter, for modified simple exponential smoothing is smaller than those for simple exponential smoothing and pBetter value for modified simple exponential smoothing is bigger than simple exponential smoothing when α =0.2 and the corresponding *m*=95. It is possible to say that modified simple exponential smoothing again performs better than simple exponential smoothing according to all accuracy measures when α =0.2 and *m*=95.

Now we can increment α value by 0.1 and rerun the analysis for α =0.3 and corresponding *m*=142 then again incrementing α by 0.1 rerun again for α =0.4 and corresponding *m*=189 and so on. However it is possible to do analysis automatically for different values of α starting from 0.1 incremented by 0.1 up to 0.9 and the corresponding *m* values for the related α value.

After clicking "Run Methods Automatically" button from home page (Figure 5.2), select Sample 1.1 for Data Set from the select box and click the simple smoothing button on the left side (Figure 5.11).

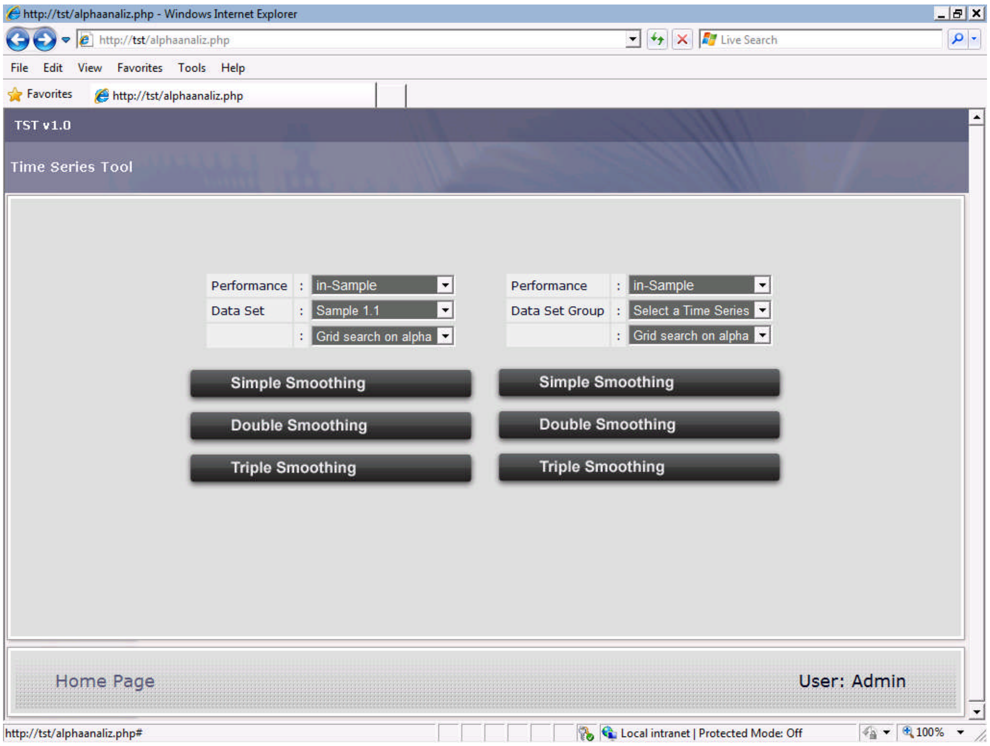


Figure 5.11 Running simple smoothing automatically for Sample 1.1

Starting from 0.1 and incrementing by 0.1 up to 0.9 different α values and corresponding m values will be used and accuracy measures will be calculated for each α level automatically. Only calculated values of accuracy measures will be displayed in a table except MSE and MAPE since rMSE is already squared root of MSE and there is no remarkable difference between MAPE and sMAPE (Figure 5.12).

Simple Exponential Smoothing						Modified Simple Exponential Smoothing					
Alpha	MAE	rMSE	sMAPE	rARsAPE	pBetter	m	MAE	rMSE	sMAPE	rARsAPE	pBetter
0.10	477.628	658.598	0.071	423.617	0.456	48	456.974	615.647	0.065	423.383	0.544
0.20	509.801	640.213	0.068	380.295	0.476	95	490.132	603.548	0.062	372.705	0.524
0.30	547.020	647.675	0.065	346.353	0.359	142	496.325	599.514	0.057	312.647	0.641
0.40	558.798	649.182	0.060	299.674	0.326	189	498.604	600.599	0.052	265.326	0.674
0.50	556.204	651.479	0.055	246.753	0.374	236	508.381	610.214	0.049	224.247	0.626
0.60	551.277	653.265	0.050	191.567	0.439	284	526.587	628.377	0.047	183.433	0.561
0.70	550.695	652.608	0.046	141.971	0.507	331	540.333	646.219	0.045	139.029	0.493
0.80	545.648	654.329	0.042	93.602	0.570	378	547.000	660.878	0.042	93.398	0.430
0.90	550.307	644.417	0.041	46.217	0.587	425	552.946	649.266	0.041	46.783	0.413
Average	538.598	650.196	0.055	241.117	0.455	Average	513.031	623.807	0.051	228.994	0.545

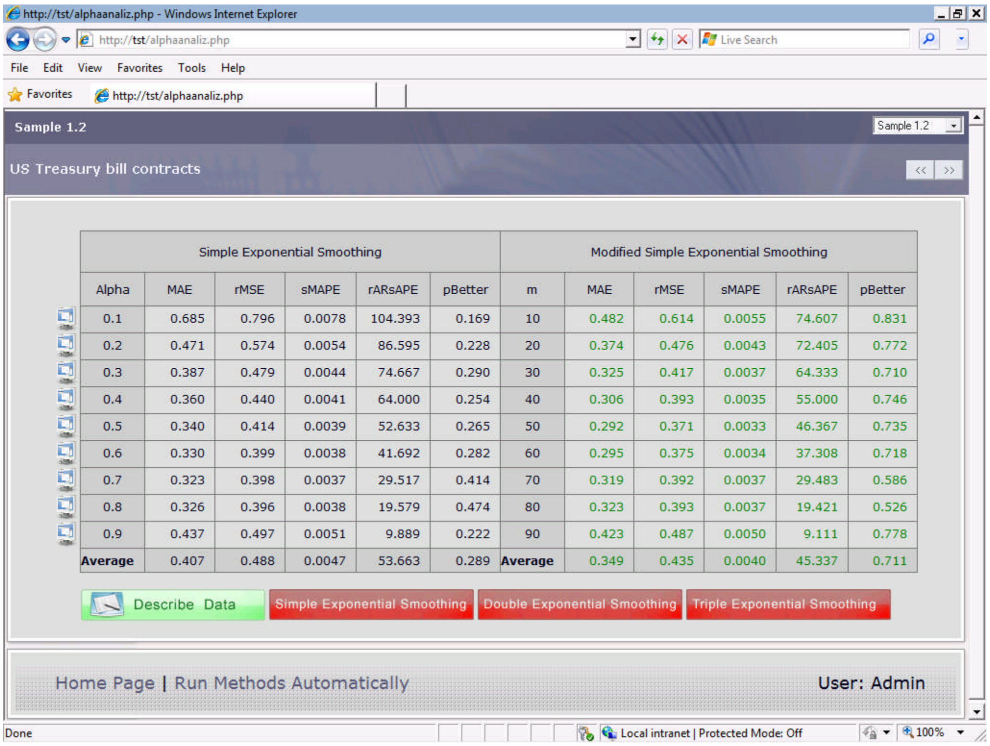
Figure 5.12 Results for Sample 1.1

As it seen from the table modified simple exponential smoothing performs better than simple exponential smoothing for all accuracy measures for α values starting 0.1 up to 0.8 except pBetter value for α =0.7. And simple exponential smoothing performs better than modified simple exponential smoothing for all accuracy measures for α values 0.8 and 0.9 except rARsAPE value when α =0.8.

It can be said that modified simple exponential smoothing mostly performed better than simple exponential smoothing according to the accuracy measures for different α levels. There are 5 accuracy measures and 9 different α levels so there are total 45 values for accuracy measures. Simple exponential smoothing performed better 10 times and modified simple exponential smoothing performed better 35 times for this time series. As a result modified simple exponential smoothing 78% performed better than simple exponential smoothing according to the accuracy measures for this time series.

The last row in the table includes the average values of each column. Modified simple exponential smoothing performed better than simple exponential smoothing according to all accuracy measures on the average.

Now we can move to next time series in the database. There is a select box that listing all time series and navigation buttons on the top-right of the report page. It is possible to move previous, next or a desired time series directly using select box or navigation buttons. Let select Sample 1.2 from the select box. A new analysis will be done automatically for the time series selected from the list and results for accuracy measures will be listed again (Figure 5.13).



Simple Exponential Smoothing						Modified Simple Exponential Smoothing					
Alpha	MAE	rMSE	sMAPE	rARsAPE	pBetter	m	MAE	rMSE	sMAPE	rARsAPE	pBetter
0.1	0.685	0.796	0.0078	104.393	0.169	10	0.482	0.614	0.0055	74.607	0.831
0.2	0.471	0.574	0.0054	86.595	0.228	20	0.374	0.476	0.0043	72.405	0.772
0.3	0.387	0.479	0.0044	74.667	0.290	30	0.325	0.417	0.0037	64.333	0.710
0.4	0.360	0.440	0.0041	64.000	0.254	40	0.306	0.393	0.0035	55.000	0.746
0.5	0.340	0.414	0.0039	52.633	0.265	50	0.292	0.371	0.0033	46.367	0.735
0.6	0.330	0.399	0.0038	41.692	0.282	60	0.295	0.375	0.0034	37.308	0.718
0.7	0.323	0.398	0.0037	29.517	0.414	70	0.319	0.392	0.0037	29.483	0.586
0.8	0.326	0.396	0.0038	19.579	0.474	80	0.323	0.393	0.0037	19.421	0.526
0.9	0.437	0.497	0.0051	9.889	0.222	90	0.423	0.487	0.0050	9.111	0.778
Average	0.407	0.488	0.0047	53.663	0.289	**Average**	0.349	0.435	0.0040	45.337	0.711

Figure 5.13 Accuracy measures for Sample 1.2

We see that all MAE, rMSE, sMAPE, rARsAPE values for modified simple exponential smoothing are smaller than those values for simple exponential smoothing and all pBetter values for modified simple exponential smoothing are bigger than those values for simple exponential smoothing for all α levels for Sample 1.2. Therefore it is possible to say that modified simple exponential smoothing performs better than simple exponential smoothing according to the all accuracy measures for all α levels. Modified simple exponential smoothing performs 100% better than simple exponential smoothing for this time series. Next time series is Sample 1.3 (Figure 5.14)

Simple Exponential Smoothing						Modified Simple Exponential Smoothing					
Alpha	MAE	rMSE	sMAPE	rARsAPE	pBetter	m	MAE	rMSE	sMAPE	rARsAPE	pBetter
0.10	2.472	2.574	0.764	8.250	0.500	2	2.854	3.142	0.808	8.750	0.500
0.20	2.348	2.433	0.743	7.143	0.429	3	2.506	2.607	0.788	7.857	0.571
0.30	2.383	2.455	0.794	6.000	0.500	4	2.446	2.562	0.786	7.000	0.500
0.40	2.354	2.465	0.817	5.600	0.400	5	2.370	2.634	0.787	5.400	0.600
0.50	2.064	2.261	0.829	4.750	0.250	6	1.962	2.367	0.727	4.250	0.750
0.60	1.614	1.951	0.793	4.333	0.000	7	0.944	1.302	0.525	2.667	1.000
0.70	0.566	0.643	0.419	3.000	0.000	8	0.225	0.270	0.194	2.000	1.000
0.80	*	*	*	*	*	9	*	*	*	*	*
0.90	*	*	*	*	*	10	*	*	*	*	*
Average	1.972	2.112	0.737	5.582	0.297	Average	1.901	2.126	0.659	5.418	0.703

Figure 5.14 Results for sample 1.3

This time simple exponential smoothing performs better than modified simple exponential smoothing for small α values and modified simple exponential smoothing performs better than simple exponential smoothing for big α values. There is no any value for accuracy measures for α values 0.8 and 0.9 because the sample size of this time series is 11 and there is no enough smoothed value for higher value of α for this time series. It will not be appropriate to calculate accuracy measures so the asterisks are displayed for α levels 0.8 and 0.9

Simple exponential smoothing 14 times performed better and modified simple exponential smoothing 21 times performed better. So modified simple exponential smoothing 67% performs better than simple exponential smoothing for this time series. When we look at to the average values, modified simple exponential smoothing performs better for 4 accuracy measures and simple exponential smoothing performs better for one accuracy measure.

All time series in the Makridakis competition can be analyzed by this way but there is also another way of considering the performance of all time series. All time series in a predefined time series group can be automatically analyzed by using the right side of the “Run Methods Automatically” page (Figure 5.15). Data Set Group select box will display the data group names if created while entering new time series to database. There are two data group in our database, one for 111 time series for Makridakis Competition and one for 1001 time series for M-Competition. When a data set group is analyzed, all the time series in that group will take place in the analysis. Accuracy measures will be calculated as usual way for different α values starting from 0.1 up to 0.9 incrementing by 0.1 and corresponding m values for each time series in the group. Average values will be calculated for each accuracy measure for all time series and these averages will be tabulated in the report page.

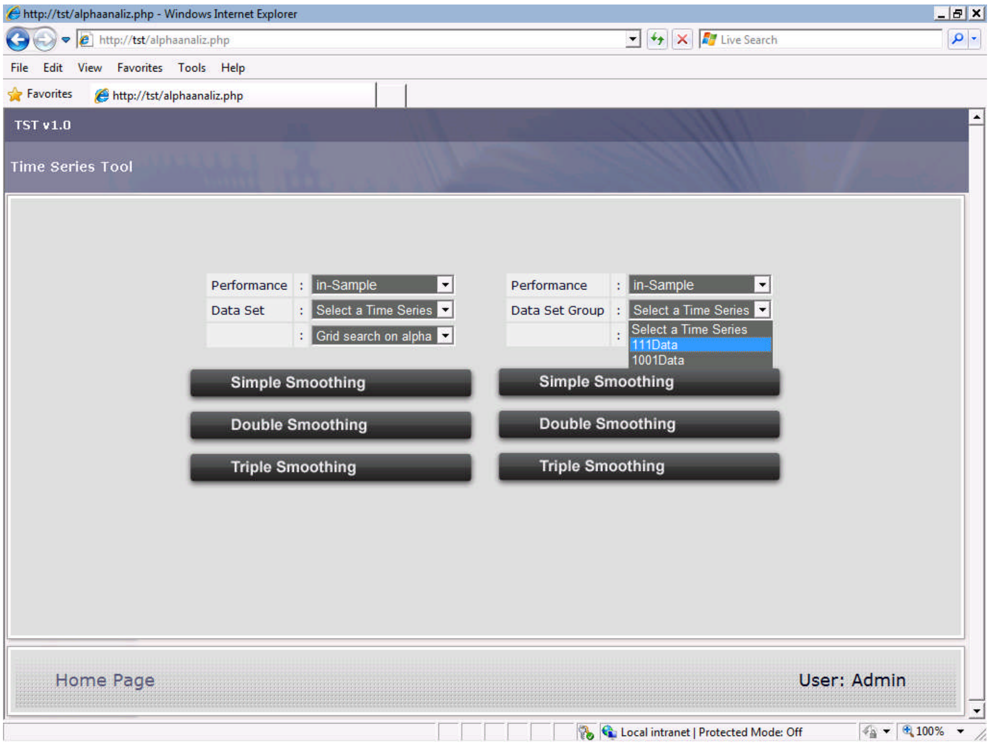
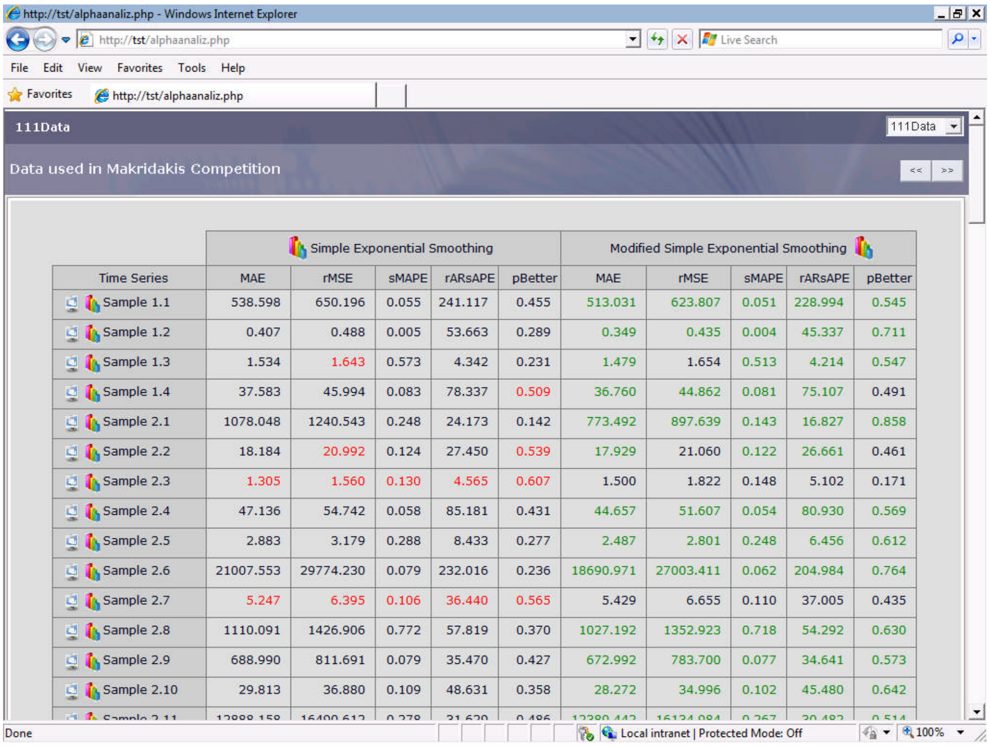


Figure 5.15 Running analysis for a data group

Let select 111Data from select box list and click to “Simple Smoothing” button. The average values of all accuracy measures will be displayed for α values starting from 0.1 up to 0.9 incrementing by 0.1 and corresponding m values for 111 times series included in the Makridakis competition (Figure 5.16).



	Simple Exponential Smoothing					Modified Simple Exponential Smoothing				
Time Series	MAE	rMSE	sMAPE	rARsAPE	pBetter	MAE	rMSE	sMAPE	rARsAPE	pBetter
Sample 1.1	538.598	650.196	0.055	241.117	0.455	513.031	623.807	0.051	228.994	0.545
Sample 1.2	0.407	0.488	0.005	53.663	0.289	0.349	0.435	0.004	45.337	0.711
Sample 1.3	1.534	1.643	0.573	4.342	0.231	1.479	1.654	0.513	4.214	0.547
Sample 1.4	37.583	45.994	0.083	78.337	0.509	36.760	44.862	0.081	75.107	0.491
Sample 2.1	1078.048	1240.543	0.248	24.173	0.142	773.492	897.639	0.143	16.827	0.858
Sample 2.2	18.184	20.992	0.124	27.450	0.539	17.929	21.060	0.122	26.661	0.461
Sample 2.3	1.305	1.560	0.130	4.565	0.607	1.500	1.822	0.148	5.102	0.171
Sample 2.4	47.136	54.742	0.058	85.181	0.431	44.657	51.607	0.054	80.930	0.569
Sample 2.5	2.883	3.179	0.288	8.433	0.277	2.487	2.801	0.248	6.456	0.612
Sample 2.6	21007.553	29774.230	0.079	232.016	0.236	18690.971	27003.411	0.062	204.984	0.764
Sample 2.7	5.247	6.395	0.106	36.440	0.565	5.429	6.655	0.110	37.005	0.435
Sample 2.8	1110.091	1426.906	0.772	57.819	0.370	1027.192	1352.923	0.718	54.292	0.630
Sample 2.9	688.990	811.691	0.079	35.470	0.427	672.992	783.700	0.077	34.641	0.573
Sample 2.10	29.813	36.880	0.109	48.631	0.358	28.272	34.996	0.102	45.480	0.642
Sample 2.11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Figure 5.16 Accuracy measures for all time series in Makridakis Competition

The first row includes the results for first time series that is Sample 1.1. If we check the values with the average row of the Figure 5.12, we can see that the results of the first row and the average row in Figure 5.12 are identical as expected. It is possible to say that modified simple exponential smoothing performs better than simple exponential smoothing according to all accuracy measures for Sample 1.1.

The second row includes the results for Sample 1.2. Modified simple exponential smoothing again performs better than simple exponential smoothing for all accuracy measures for Sample 1.2. Sample 2.1, Sample 2.4, Sample 2.5, Sample 2.6, Sample 2.8, Sample 2.9 and Sample 2.10 are the others time series that modified simple exponential smoothing performs better than simple exponential smoothing according to all accuracy measures. For Sample 1.4 and Sample 2.2, modified simple exponential smoothing performs better than simple exponential smoothing according to most of the accuracy measures, simple exponential smoothing performs better for 3 of them.

Simple exponential smoothing performs better than modified simple exponential for Sample 2.3 and Sample 2.7 according to all accuracy measures. As result it is possible to say that modified simple exponential smoothing performs better for 8 time series and simple exponential smoothing performs better for 2 time series for first 10 time series in the Makridakis competition. Looking time plot of the series Sample 2.3 and Sample 2.7 may helpful to understand why modified simple exponential smoothing does not perform better for these two series (Figure 5.17, Figure 5.18).

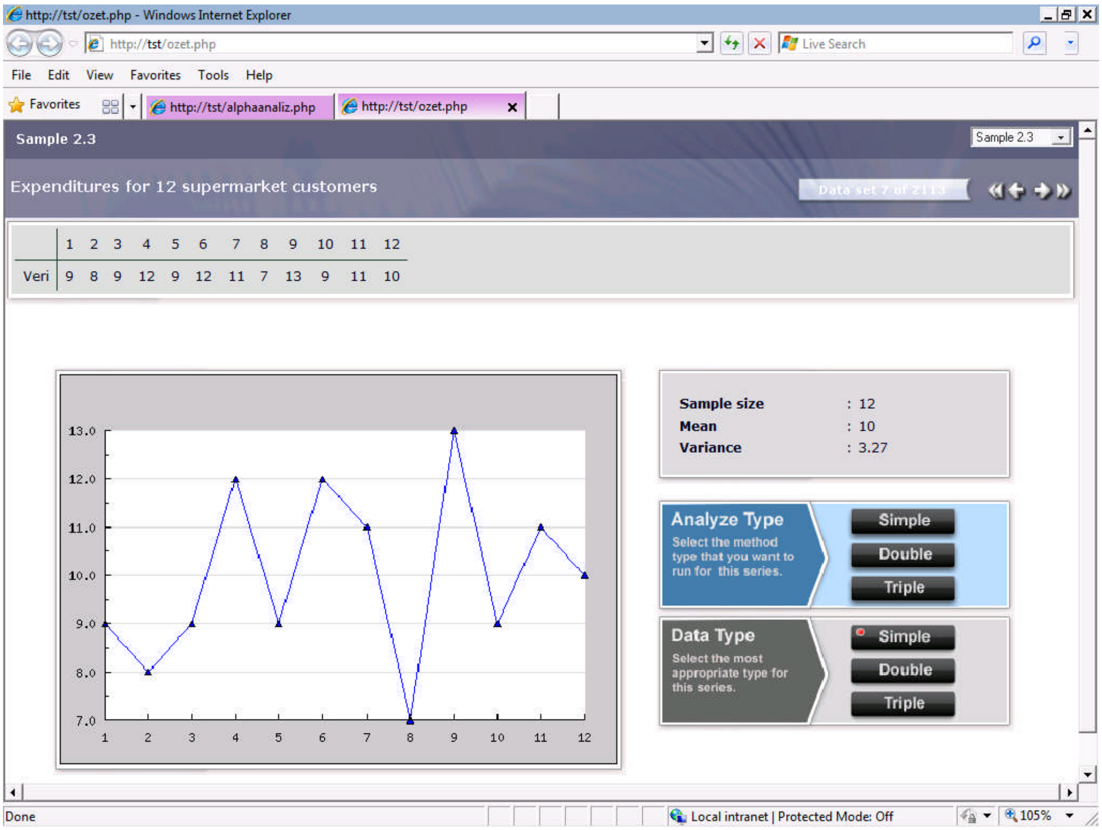


Figure 5.17 Time series plot for Sample 2.3

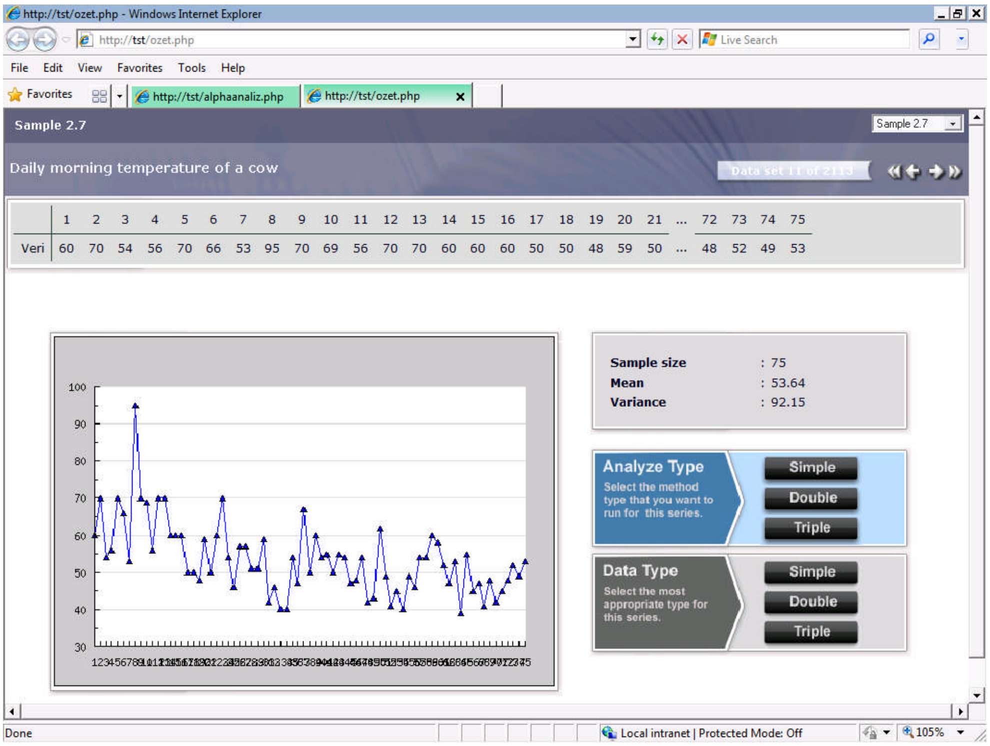


Figure 5.18 Time series plot for Sample 2.7

The first salient thing when we look at to the graphs is the irregular component (refer to Figure 1.5). There seems to be irregular movements that follow no recognizable or regular pattern for both time series. These fluctuations may be caused by unusual events or may contain noisy or random component of the data. Producing big errors for this type of series may be an advantage. So, we can say that modified simple exponential smoothing react better than simple exponential smoothing for irregular time series instead of saying modified simple exponential did not performed well.

Results for 111 time series given in Table 5.1. From the table it can bee seen that modified simple exponential smoothing performs better for some series and simple exponential smoothing performs better for others according to accuracy measures. So it is important to know how many times each method performed better than the other. The last row of the table displays the percentage of success for each method. Modified simple exponential smoothing performed 70% better according to MAE, 66% better according to rMSE, 74% better according to sMAPE, 77% better according to rARsAPE and 70% better according to pBetter.

Table 5.1 Accuracy measures for 111 time series

	Simple Exponential Smoothing					Modified Simple Exponential Smoothing				
Time Series	MAE	rMSE	sMAPE	rARsAPE	pBetter	MAE	rMSE	sMAPE	rARsAPE	pBetter
Sample 1.1	538.598	650.196	0.055	241.117	0.455	513.031	623.807	0.051	228.994	0.545
Sample 1.2	0.407	0.488	0.005	53.663	0.289	0.349	0.435	0.004	45.337	0.711
Sample 1.3	1.534	1.643	0.573	4.342	0.231	1.479	1.654	0.513	4.214	0.547
Sample 1.4	37.583	45.994	0.083	78.337	0.509	36.760	44.862	0.081	75.107	0.491
Sample 2.1	1078.048	1240.543	0.248	24.173	0.142	773.492	897.639	0.143	16.827	0.858
Sample 2.2	18.184	20.992	0.124	27.450	0.539	17.929	21.060	0.122	26.661	0.461
Sample 2.3	1.305	1.560	0.130	4.565	0.607	1.500	1.822	0.148	5.102	0.171
Sample 2.4	47.136	54.742	0.058	85.181	0.431	44.657	51.607	0.054	80.930	0.569
Sample 2.5	2.883	3.179	0.288	8.433	0.277	2.487	2.801	0.248	6.456	0.612
Sample 2.6	21007.553	29774.230	0.079	232.016	0.236	18690.971	27003.411	0.062	204.984	0.764
Sample 2.7	5.247	6.395	0.106	36.440	0.565	5.429	6.655	0.110	37.005	0.435
Sample 2.8	1110.091	1426.906	0.772	57.819	0.370	1027.192	1352.923	0.718	54.292	0.630
Sample 2.9	688.990	811.691	0.079	35.470	0.427	672.992	783.700	0.077	34.641	0.573
Sample 2.10	29.813	36.880	0.109	48.631	0.358	28.272	34.996	0.102	45.480	0.642
Sample 2.11	12888.158	16490.612	0.278	31.629	0.486	12389.442	16134.984	0.267	30.482	0.514
Sample 2.12	15.356	17.781	0.075	10.505	0.177	12.548	14.980	0.061	8.162	0.712
Sample 2.13	0.784	0.982	0.007	42.442	0.281	0.557	0.716	0.005	33.669	0.719
Sample 3.1	5.900	7.564	0.114	140.771	0.394	5.472	7.043	0.106	132.673	0.606
Sample 3.2	90.079	107.316	0.210	16.779	0.476	94.018	109.866	0.221	17.332	0.524
Sample 3.3	61.509	65.721	0.270	8.880	0.093	48.360	53.890	0.190	4.453	0.796
Sample 3.4	13.110	15.759	0.095	7.951	0.367	10.745	13.142	0.075	6.049	0.522
Sample 3.5	177.193	202.121	0.143	31.741	0.295	156.686	184.241	0.126	27.259	0.705
Sample 3.6	89.896	101.078	0.138	11.325	0.386	85.965	95.382	0.130	10.453	0.503
Sample 3.7	81.625	106.772	0.010	108.304	0.512	78.614	104.576	0.009	100.696	0.488
Sample 4.1	42.150	48.461	0.205	4.001	0.425	44.242	49.766	0.214	4.555	0.353
Sample 4.2	17.110	19.726	0.082	12.049	0.218	14.447	17.110	0.068	9.729	0.671
Sample 4.3	89.896	101.078	0.138	11.325	0.386	85.965	95.382	0.130	10.453	0.503
Sample 4.4	0.587	0.635	0.091	2.531	0.050	0.443	0.499	0.069	1.802	0.506
Sample 4.5	20.645	25.525	0.415	7.039	0.420	20.591	26.177	0.413	6.961	0.469
Sample 4.6	2.437	3.006	0.025	13.695	0.325	2.033	2.455	0.021	12.083	0.564
Sample 4.7	28.389	32.977	0.141	14.176	0.581	29.795	34.725	0.149	14.824	0.419
Sample 5.1	4.760	6.048	0.201	14.449	0.162	3.904	5.471	0.158	8.662	0.727
Sample 5.2	15.316	26.600	0.235	8.941	0.536	16.169	26.832	0.254	9.726	0.353

Sample 5.3	0.058	0.060	0.007	10.686	0.056	0.041	0.044	0.005	6.203	0.833
Sample 5.4	0.100	0.109	0.011	9.711	0.198	0.079	0.089	0.009	7.178	0.691
Sample 5.5	8.325	8.572	0.316	6.067	0.056	5.885	6.089	0.200	2.489	0.722
Sample 5.6	1.249	1.461	0.070	4.727	0.482	1.311	1.528	0.074	4.939	0.296
Sample 5.7	0.875	0.982	0.019	12.406	0.193	0.563	0.682	0.012	8.260	0.696
Sample 5.8	10696.778	18837.577	0.391	41.528	0.321	10766.669	19163.637	0.384	40.583	0.679
Sample 5.9	1.544	1.985	0.246	76.002	0.507	1.575	2.059	0.250	77.443	0.493
Sample 5.10	11.604	14.366	0.197	9.928	0.347	8.628	11.137	0.162	8.738	0.542
Sample 6.1	0.357	0.473	0.061	30.519	0.402	0.300	0.388	0.052	28.481	0.598
Sample 6.2	2275.432	2569.482	0.164	16.882	0.483	2275.771	2598.953	0.164	16.563	0.517
Sample 6.3	3.548	4.273	0.041	10.706	0.507	3.698	4.429	0.043	11.072	0.382
Sample 7.1.1	1.386	1.698	0.050	25.082	0.104	1.094	1.466	0.038	18.362	0.896
Sample 7.1.2	2257.152	2914.775	0.207	21.626	0.538	2324.154	3005.706	0.211	21.818	0.462
Sample 7.2	7963.144	9997.194	0.087	92.502	0.586	8130.848	10204.297	0.089	93.609	0.414
Sample 7.3	25.105	32.766	0.007	153.299	0.359	21.914	28.960	0.006	136.812	0.641
Sample 7.4	11.629	13.893	0.082	54.573	0.158	9.132	11.410	0.063	44.427	0.842
Sample 7.5	128.436	185.471	0.187	59.893	0.501	131.581	189.546	0.195	59.107	0.499
Sample 7.6	646.354	817.596	0.267	65.064	0.568	662.464	833.137	0.270	63.936	0.432
Sample 7.7	8.224	11.184	0.020	192.726	0.366	7.127	9.762	0.018	174.274	0.634
Sample 7.8	1.399	1.558	2.841	14.298	0.555	1.459	1.613	-5.595	14.702	0.445
Sample 7.9	591.607	700.290	0.126	15.374	0.521	556.086	664.535	0.117	13.626	0.479
Sample 7.10	22.082	25.289	0.241	63.313	0.295	19.372	22.570	0.212	55.687	0.705
Sample 7.11	87.563	111.325	0.051	36.982	0.388	77.941	99.591	0.046	34.018	0.612
Sample 7.12	42.352	51.418	0.089	24.389	0.367	38.488	46.988	0.080	22.611	0.633
Sample 7.13	18.757	21.984	0.076	69.591	0.470	18.557	21.817	0.075	70.520	0.530
Sample 7.14	6.848	7.852	0.035	100.491	0.285	6.086	7.021	0.031	89.620	0.715
Sample 7.15	5.470	7.006	0.106	53.704	0.404	5.210	6.713	0.100	51.296	0.596
Sample 8.1.1	0.878	1.080	0.049	128.232	0.488	0.855	1.054	0.046	121.879	0.512
Sample 8.1.2	5.678	7.411	0.078	124.866	0.622	5.797	7.553	0.080	125.245	0.378
Sample 8.1.3	0.781	1.128	0.061	134.788	0.330	0.660	0.995	0.048	115.323	0.670
Sample 8.1.4	2.150	2.755	0.140	128.025	0.475	2.125	2.757	0.138	122.086	0.525
Sample 8.2	4.663	5.374	0.192	17.848	0.320	4.286	4.985	0.177	16.264	0.680
Sample 8.3.1	17.448	21.058	0.139	41.346	0.400	16.036	19.566	0.129	38.766	0.600
Sample 8.3.2	2.287	2.676	0.112	41.883	0.393	2.102	2.556	0.103	38.228	0.607
Sample 8.3.3	0.232	0.279	0.024	44.846	0.327	0.171	0.212	0.018	35.265	0.673
Sample 8.4	158.418	202.198	0.106	60.078	0.447	153.942	195.402	0.103	58.922	0.553

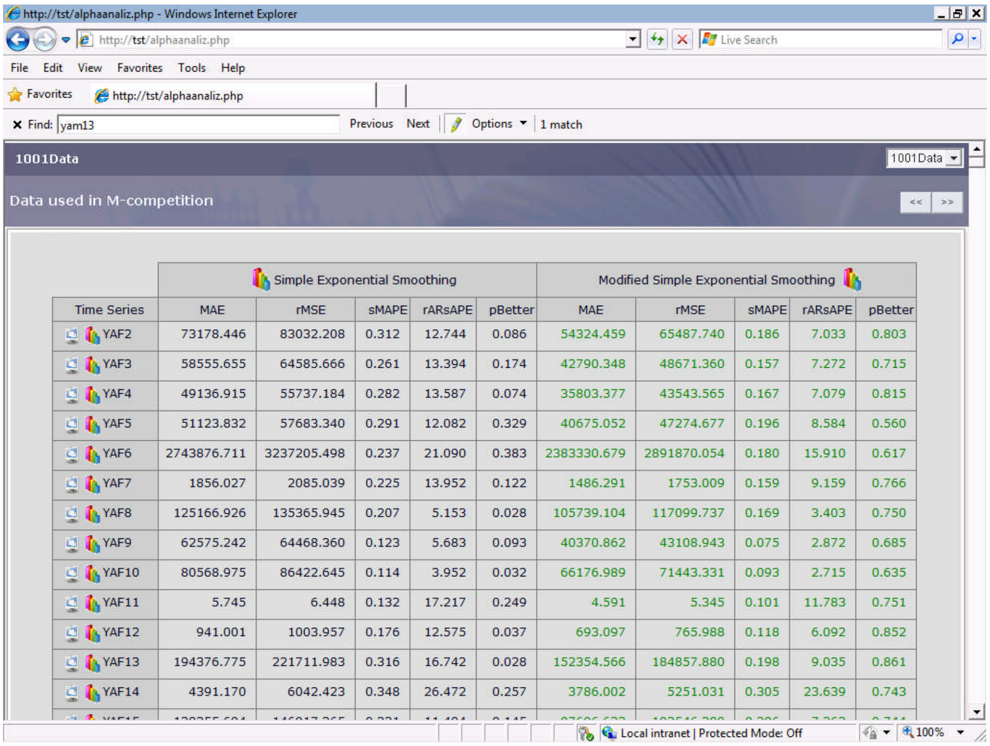
Sample 8.5.1	853.059	1728.483	0.177	46.286	0.235	778.391	1696.835	0.158	39.825	0.765
Sample 8.5.1	980.031	1345.211	0.124	45.821	0.221	887.347	1269.791	0.106	40.290	0.779
Sample 8.6	0.791	0.951	0.095	49.558	0.361	0.741	0.902	0.089	46.553	0.639
Sample 8.7	24.557	29.902	0.447	13.981	0.666	25.680	30.861	0.472	15.019	0.334
Sample 8.8.1	34.590	42.035	0.084	91.100	0.585	35.871	43.298	0.088	93.011	0.415
Sample 8.8.2	3.082	3.824	0.097	92.984	0.487	3.110	3.854	0.097	91.127	0.513
Sample 8.9	3.326	3.617	0.038	37.208	0.080	1.922	2.172	0.020	22.903	0.920
Sample 8.10	6.524	8.562	0.155	59.791	0.538	6.614	8.777	0.157	59.209	0.462
Sample 9.1	0.259	0.280	0.076	15.935	0.191	0.159	0.183	0.049	9.843	0.698
Sample 9.2	0.196	0.291	0.051	5.505	0.388	0.227	0.303	0.058	6.162	0.390
Sample 9.3	0.442	0.565	0.108	21.188	0.336	0.412	0.529	0.098	19.812	0.664
Sample 9.4	26.780	35.698	0.147	101.056	0.375	24.411	33.162	0.135	95.055	0.625
Sample 9.5	63.665	84.086	0.130	367.091	0.425	63.136	84.283	0.129	363.909	0.575
Sample 9.6	4.608	6.278	0.088	103.502	0.261	3.710	5.262	0.074	91.498	0.739
Sample 9.7	9.880	12.656	0.215	38.249	0.331	6.871	9.152	0.176	30.751	0.669
Sample 9.8	19.059	23.824	0.133	48.372	0.363	16.803	21.617	0.121	43.739	0.637
Sample 9.9	5.053	7.445	0.276	47.387	0.228	1.578	2.605	0.185	32.724	0.772
Sample 9.10	0.738	1.169	0.062	375.948	0.343	0.701	1.135	0.058	357.496	0.657
Sample 9.11	0.585	0.780	-0.084	98.185	0.506	0.534	0.726	1.628	97.926	0.494
Sample 9.12	0.083	0.110	0.081	205.644	0.298	0.069	0.092	0.066	180.467	0.702
Sample 10.1	12.199	12.797	0.352	2.819	0.044	9.315	9.909	0.257	1.515	0.511
Sample 10.2	3.119	3.120	0.002	93.942	0.018	2.016	2.116	0.001	32.170	0.982
Sample 11.1	56.801	66.808	0.094	30.517	0.638	57.983	68.306	0.096	30.483	0.362
Sample 12.1	6.637	7.946	0.243	25.441	0.178	4.996	6.195	0.146	14.670	0.822
Sample 12.2	1.077	1.279	0.345	21.370	0.343	0.958	1.168	0.253	13.630	0.657
Sample 12.3.1	48.360	53.650	1.015	15.995	0.902	53.359	59.042	1.087	18.116	0.098
Sample 12.3.2	10.358	11.787	0.196	4.207	0.412	11.081	12.775	0.211	4.349	0.366
Sample 12.3.3	8.437	9.902	0.373	4.176	0.404	9.114	10.947	0.395	4.379	0.374
Sample 12.3.4	11.419	13.058	0.116	4.050	0.529	12.849	14.726	0.131	4.505	0.248
Sample 12.4	8.336	10.802	0.173	4.190	0.452	8.813	11.058	0.183	4.366	0.326
Sample 12.5	16.621	19.648	0.350	9.050	0.630	18.022	21.243	0.377	9.617	0.259
Sample 12.5.2	18.342	20.147	0.373	9.003	0.643	19.722	21.492	0.399	9.664	0.246
Sample 12.6	2.623	2.998	0.051	6.030	0.293	2.341	2.813	0.046	5.637	0.485
Sample 12.7	27.165	30.621	0.658	16.589	0.508	28.054	31.914	0.691	17.522	0.492
Sample 12.8.1	2.945	3.432	0.414	6.590	0.394	3.243	3.804	-3.519	6.743	0.495
Sample 12.8.2	5.692	6.545	0.768	5.979	0.395	5.269	6.144	-2.471	5.688	0.383

Sample 12.8.3	3.235	3.834	-0.771	6.734	0.454	3.727	4.524	-1.276	6.599	0.435
Sample 12.9	0.412	0.417	0.157	19.177	0.100	0.266	0.276	0.126	9.823	0.900
Sample 12.10	0.847	1.036	0.356	18.878	0.146	0.726	0.927	0.243	10.122	0.854
Sample 12.11	0.442	0.458	-0.789	14.956	0.304	0.267	0.287	-0.081	14.044	0.645
Sample 12.12	22.255	26.661	0.334	23.561	0.056	19.140	23.699	0.236	8.550	0.944
Sample 12.13	3.190	3.839	0.341	23.561	0.056	2.752	3.420	0.241	8.550	0.944
pBetter	0.30	0.34	0.26	0.23	0.30	0.70	0.66	0.74	0.77	0.70

Time series plots of the series for which modified simple exponential smoothing seems to be not performed better given in Appendix A. The common characteristic of those series seems to be the irregular component. They appear to have random fluctuations which causes modified simple exponential smoothing to produce forecasts error bigger then simple exponential smoothing.

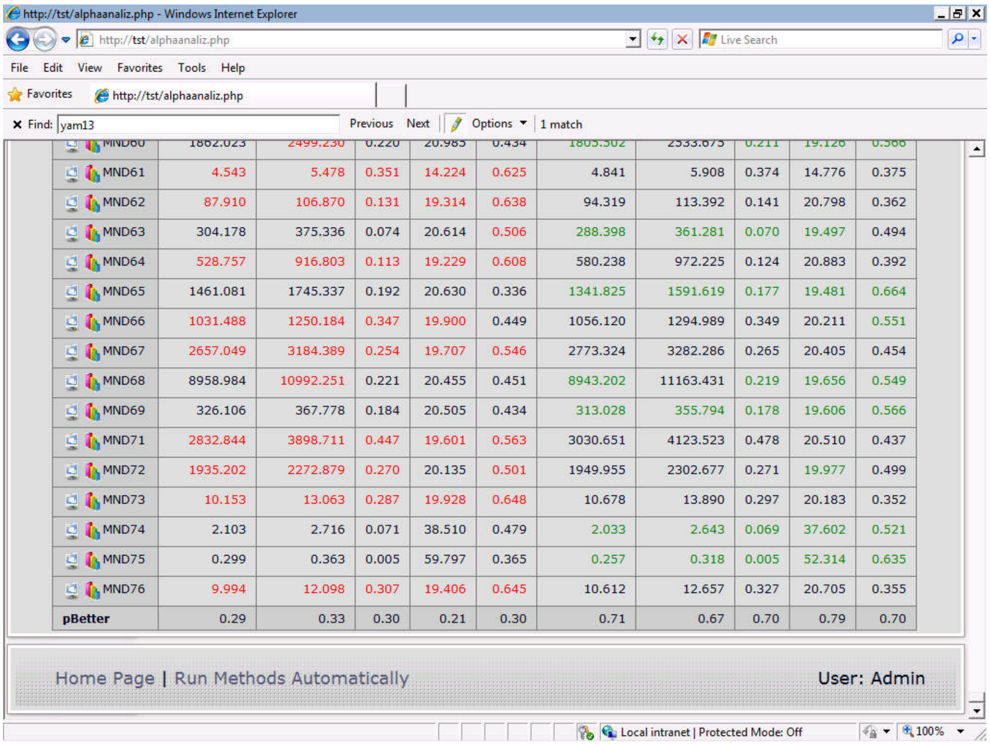
The other set used to compare modified simple exponential smoothing and simple exponential smoothing is the time series used in M-Competition (Makridakis et al,. 1982). There are 1001 time series different sources and these series also used by a lot of researchers. The same analysis is repeated for 1001 time series in M-Competition and result table given in Appendix B. The first and the last screen is given in Figure 5.19, Figure 5.20 respectively.

When we look at to the last row of the table to see the percentages of success for both methods, modified simple exponential smoothing again performs better than simple exponential smoothing. Modified simple exponential smoothing performed 71%, 67%, 70%, 79% and 70% better than simple exponential smoothing according to accuracy measures MAE, rMSE, sMAPE, rARsAPE and pBetter respectively.



Time Series	Simple Exponential Smoothing MAE	rMSE	sMAPE	rARsAPE	pBetter	Modified Simple Exponential Smoothing MAE	rMSE	sMAPE	rARsAPE	pBetter
YAF2	73178.446	83032.208	0.312	12.744	0.086	54324.459	65487.740	0.186	7.033	0.803
YAF3	58555.655	64585.666	0.261	13.394	0.174	42790.348	48671.360	0.157	7.272	0.715
YAF4	49136.915	55737.184	0.282	13.587	0.074	35803.377	43543.565	0.167	7.079	0.815
YAF5	51123.832	57683.340	0.291	12.082	0.329	40675.052	47274.677	0.196	8.584	0.560
YAF6	2743876.711	3237205.498	0.237	21.090	0.383	2383330.679	2891870.054	0.180	15.910	0.617
YAF7	1856.027	2085.039	0.225	13.952	0.122	1486.291	1753.009	0.159	9.159	0.766
YAF8	125166.926	135365.945	0.207	5.153	0.028	105739.104	117099.737	0.169	3.403	0.750
YAF9	62575.242	64468.360	0.123	5.683	0.093	40370.862	43108.943	0.075	2.872	0.685
YAF10	80568.975	86422.645	0.114	3.952	0.032	66176.989	71443.331	0.093	2.715	0.635
YAF11	5.745	6.448	0.132	17.217	0.249	4.591	5.345	0.101	11.783	0.751
YAF12	941.001	1003.957	0.176	12.575	0.037	693.097	765.988	0.118	6.092	0.852
YAF13	194376.775	221711.983	0.316	16.742	0.028	152354.566	184857.880	0.198	9.035	0.861
YAF14	4391.170	6042.423	0.348	26.472	0.257	3786.002	5251.031	0.305	23.639	0.743

Figure 5.19 First result screen of 1001 time series



Time Series	Simple Exponential Smoothing MAE	rMSE	sMAPE	rARsAPE	pBetter	Modified Simple Exponential Smoothing MAE	rMSE	sMAPE	rARsAPE	pBetter
MND61	4.543	5.478	0.351	14.224	0.625	4.841	5.908	0.374	14.776	0.375
MND62	87.910	106.870	0.131	19.314	0.638	94.319	113.392	0.141	20.798	0.362
MND63	304.178	375.336	0.074	20.614	0.506	288.398	361.281	0.070	19.497	0.494
MND64	528.757	916.803	0.113	19.229	0.608	580.238	972.225	0.124	20.883	0.392
MND65	1461.081	1745.337	0.192	20.630	0.336	1341.825	1591.619	0.177	19.481	0.664
MND66	1031.488	1250.184	0.347	19.900	0.449	1056.120	1294.989	0.349	20.211	0.551
MND67	2657.049	3184.389	0.254	19.707	0.546	2773.324	3282.286	0.265	20.405	0.454
MND68	8958.984	10992.251	0.221	20.455	0.451	8943.202	11163.431	0.219	19.656	0.549
MND69	326.106	367.778	0.184	20.505	0.434	313.028	355.794	0.178	19.606	0.566
MND71	2832.844	3898.711	0.447	19.601	0.563	3030.651	4123.523	0.478	20.510	0.437
MND72	1935.202	2272.879	0.270	20.135	0.501	1949.955	2302.677	0.271	19.977	0.499
MND73	10.153	13.063	0.287	19.928	0.648	10.678	13.890	0.297	20.183	0.352
MND74	2.103	2.716	0.071	38.510	0.479	2.033	2.643	0.069	37.602	0.521
MND75	0.299	0.363	0.005	59.797	0.365	0.257	0.318	0.005	52.314	0.635
MND76	9.994	12.098	0.307	19.406	0.645	10.612	12.657	0.327	20.705	0.355
pBetter	0.29	0.33	0.30	0.21	0.30	0.71	0.67	0.70	0.79	0.70

Figure 5.20 Last result screen of 1001 time series

It is also possible to run automatic analysis based on the grid search for *m* value. This time all *m* values and corresponding α values will be used in comparison. “Grid search on m" must be selected to make analysis based on the different values of *m* and corresponding α values (Figure 5.21).

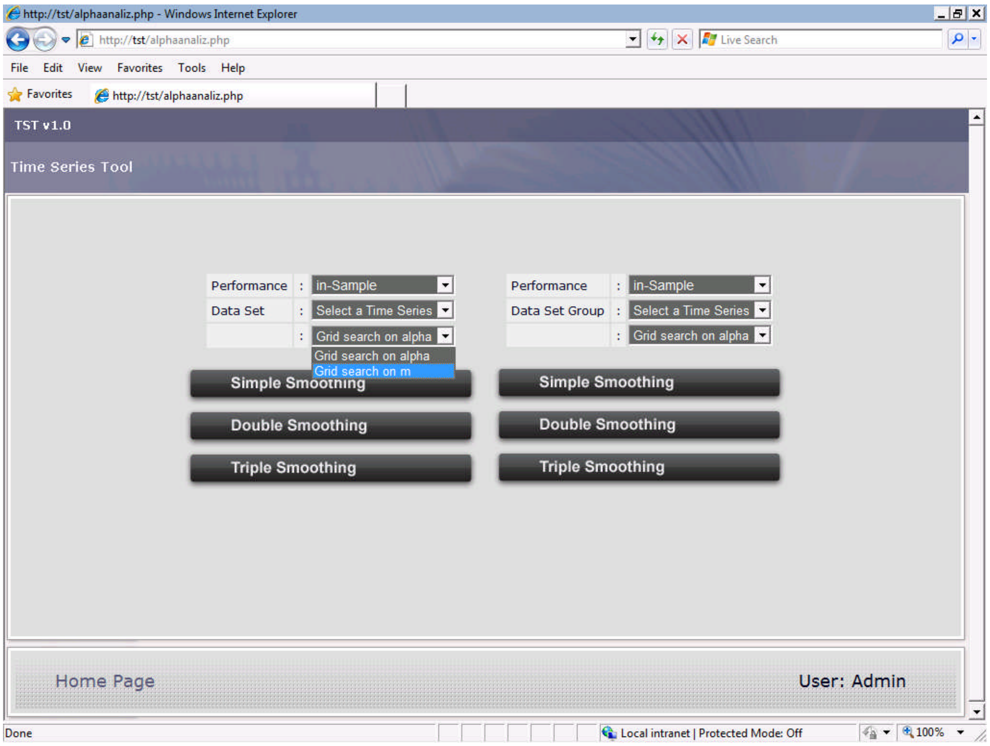
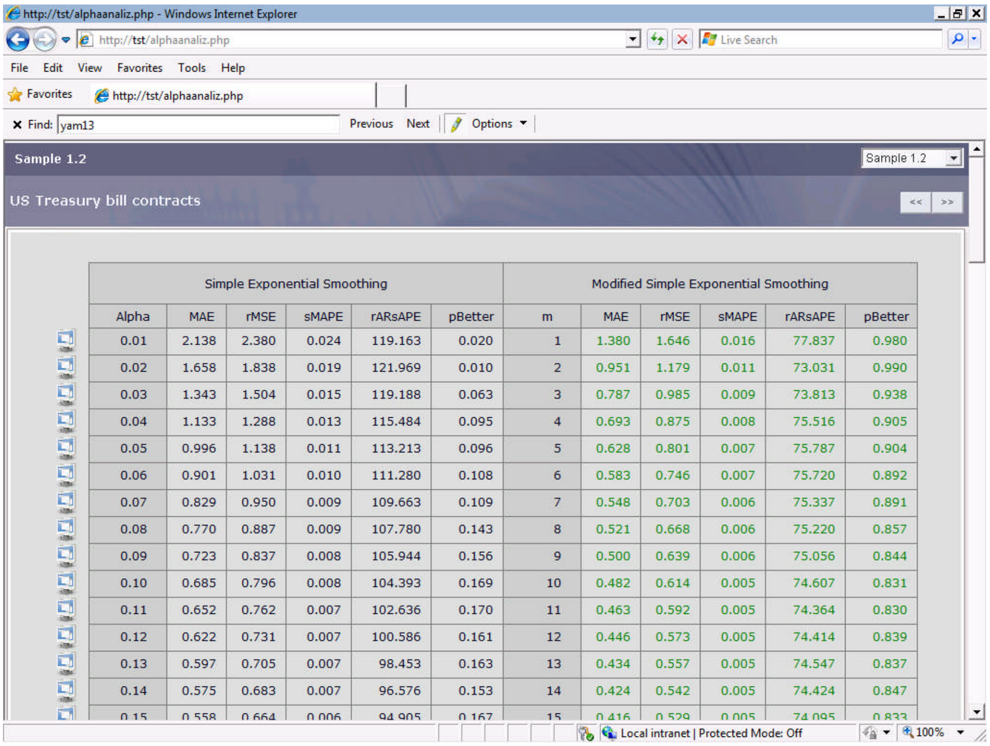


Figure 5.21 Grid search on *m*



Simple Exponential Smoothing						Modified Simple Exponential Smoothing					
Alpha	MAE	rMSE	sMAPE	rARsAPE	pBetter	m	MAE	rMSE	sMAPE	rARsAPE	pBetter
0.01	2.138	2.380	0.024	119.163	0.020	1	1.380	1.646	0.016	77.837	0.980
0.02	1.658	1.838	0.019	121.969	0.010	2	0.951	1.179	0.011	73.031	0.990
0.03	1.343	1.504	0.015	119.188	0.063	3	0.787	0.985	0.009	73.813	0.938
0.04	1.133	1.288	0.013	115.484	0.095	4	0.693	0.875	0.008	75.516	0.905
0.05	0.996	1.138	0.011	113.213	0.096	5	0.628	0.801	0.007	75.787	0.904
0.06	0.901	1.031	0.010	111.280	0.108	6	0.583	0.746	0.007	75.720	0.892
0.07	0.829	0.950	0.009	109.663	0.109	7	0.548	0.703	0.006	75.337	0.891
0.08	0.770	0.887	0.009	107.780	0.143	8	0.521	0.668	0.006	75.220	0.857
0.09	0.723	0.837	0.008	105.944	0.156	9	0.500	0.639	0.006	75.056	0.844
0.10	0.685	0.796	0.008	104.393	0.169	10	0.482	0.614	0.005	74.607	0.831
0.11	0.652	0.762	0.007	102.636	0.170	11	0.463	0.592	0.005	74.364	0.830
0.12	0.622	0.731	0.007	100.586	0.161	12	0.446	0.573	0.005	74.414	0.839
0.13	0.597	0.705	0.007	98.453	0.163	13	0.434	0.557	0.005	74.547	0.837
0.14	0.575	0.683	0.007	96.576	0.153	14	0.424	0.542	0.005	74.424	0.847
0.15	0.558	0.664	0.006	94.905	0.167	15	0.416	0.529	0.005	74.095	0.833

Figure 5.22 Results for Sample 1.2

Results for Sample 1.2 are given in Figure 5.22. Starting from 1, all values for *m* and corresponding α values are used to calculate the accuracy measures. Table 5.2 shows the result. Modified simple exponential smoothing performed 74%, 70%, 78%, 76% and 72% better than simple exponential smoothing according to accuracy measures which are very similar to the values in Table 5.1.

Table 5.2 Accuracy measures of 111 time series for grid search on *m* value

	Simple Exponential Smoothing					Modified Simple Exponential Smoothing				
Time Series	MAE	rMSE	sMAPE	rARsAPE	pBetter	MAE	rMSE	sMAPE	rARsAPE	pBetter
Sample 1.1	589.118	710.009	0.064	247.596	0.442	543.264	664.975	0.055	225.404	0.558
Sample 1.2	0.465	0.552	0.005	55.316	0.289	0.382	0.476	0.004	45.684	0.711
Sample 1.3	2.038	2.219	0.72	5.99	0.301	2.067	2.356	0.683	6.01	0.699
Sample 1.4	40.493	49.145	0.091	81.278	0.485	37.955	46.145	0.084	74.722	0.515
Sample 2.1	1218.15	1431.398	0.297	25.837	0.12	932.139	1111.595	0.19	18.163	0.88
Sample 2.2	18.13	20.957	0.123	28.926	0.516	17.826	21.003	0.121	28.074	0.484
Sample 2.3	1.746	2.105	0.172	6.199	0.718	1.965	2.406	0.194	6.801	0.282
Sample 2.4	48.097	56.049	0.059	87.007	0.434	45.09	52.231	0.055	81.993	0.566
Sample 2.5	3.274	3.666	0.322	9.966	0.378	2.879	3.259	0.284	8.034	0.622
Sample 2.6	23622.46	33757.63	0.096	235.357	0.227	20782.81	30426.63	0.073	204.643	0.773
Sample 2.7	5.355	6.548	0.107	37.778	0.57	5.526	6.818	0.111	38.222	0.43
Sample 2.8	1101.087	1412.133	0.777	59.217	0.362	1026.542	1339.639	0.724	55.783	0.638
Sample 2.9	687.872	811.256	0.079	36.837	0.437	672.032	783.373	0.077	36.163	0.563
Sample 2.10	31.065	38.257	0.117	50.706	0.358	28.898	35.862	0.106	46.294	0.642
Sample 2.11	12874.62	16511.35	0.276	33.131	0.479	12407.27	16099.51	0.265	31.869	0.521
Sample 2.12	17.802	20.599	0.088	11.784	0.255	14.852	17.743	0.072	9.216	0.745
Sample 2.13	0.937	1.175	0.008	43.671	0.263	0.701	0.897	0.006	35.329	0.737
Sample 3.1	6.027	7.741	0.117	142.138	0.394	5.561	7.167	0.108	133.862	0.606
Sample 3.2	93.316	112.902	0.223	18.196	0.501	96.873	115.176	0.232	18.804	0.499
Sample 3.3	69.03	74.483	0.313	10.301	0.082	56.362	63.314	0.235	5.699	0.918
Sample 3.4	15.239	18.177	0.112	9.572	0.358	12.871	15.558	0.091	7.428	0.642
Sample 3.5	186.584	212.078	0.152	33.093	0.286	163.045	189.839	0.132	27.907	0.714
Sample 3.6	103.042	116.717	0.16	12.87	0.438	100.056	111.369	0.153	12.13	0.562
Sample 3.7	99.491	126.142	0.012	112.198	0.486	87.86	115.328	0.011	99.802	0.514
Sample 4.1	54.515	62.659	0.265	5.719	0.516	56.389	63.781	0.272	6.281	0.484
Sample 4.2	19.289	22.64	0.093	13.588	0.249	17.042	20.412	0.081	11.412	0.751
Sample 4.3	103.042	116.717	0.16	12.87	0.438	100.056	111.369	0.153	12.13	0.562

Sample 4.4	0.931	1.035	0.145	4.438	0.113	0.777	0.882	0.12	3.563	0.888
Sample 4.5	24.023	30.12	0.478	8.496	0.49	23.944	30.52	0.474	8.504	0.51
Sample 4.6	2.963	3.6	0.03	15.52	0.369	2.453	2.948	0.025	13.48	0.631
Sample 4.7	27.634	32.669	0.139	15.142	0.61	29.106	34.57	0.147	15.858	0.39
Sample 5.1	5.744	7.152	0.245	15.951	0.194	4.901	6.553	0.202	10.049	0.806
Sample 5.2	17.715	30.072	0.269	10.659	0.621	18.476	30.322	0.287	11.341	0.379
Sample 5.3	0.067	0.07	0.008	12.257	0.075	0.049	0.053	0.006	7.743	0.925
Sample 5.4	0.118	0.128	0.013	11.367	0.231	0.096	0.108	0.011	8.633	0.769
Sample 5.5	10.194	10.601	0.399	8.154	0.09	8.274	8.67	0.306	3.846	0.91
Sample 5.6	1.625	1.881	0.091	6.353	0.596	1.665	1.933	0.094	6.647	0.404
Sample 5.7	1.031	1.147	0.022	14.201	0.242	0.721	0.839	0.016	9.799	0.758
Sample 5.8	10983.2	19077.86	0.401	43.4	0.329	10985.52	19315.7	0.387	41.6	0.671
Sample 5.9	1.553	1.995	0.247	77.421	0.51	1.581	2.062	0.25	78.579	0.49
Sample 5.10	13.785	16.674	0.227	11.283	0.374	10.365	13.044	0.19	9.717	0.626
Sample 6.1	0.367	0.488	0.062	31.593	0.397	0.311	0.404	0.053	29.407	0.603
Sample 6.2	2153.326	2500.812	0.155	18.162	0.494	2139.117	2508.816	0.154	17.838	0.506
Sample 6.3	4.031	4.851	0.047	12.307	0.552	4.158	4.972	0.048	12.693	0.448
Sample 7.1.1	1.515	1.864	0.056	26.484	0.05	1.201	1.622	0.043	19.516	0.948
Sample 7.1.2	2320.784	2982.153	0.21	22.775	0.561	2411.58	3103.769	0.216	23.225	0.439
Sample 7.2	8658.1	10735.41	0.094	95.38	0.577	8582.876	10653.29	0.093	93.62	0.423
Sample 7.3	27.243	35.106	0.007	155.169	0.36	23.524	30.721	0.006	137.831	0.64
Sample 7.4	12.65	15.032	0.09	55.79	0.171	9.93	12.388	0.069	45.21	0.829
Sample 7.5	131.904	186.775	0.194	61.101	0.497	134.389	190.694	0.201	59.899	0.503
Sample 7.6	674.89	856.529	0.291	67.244	0.555	683.16	864.901	0.283	63.756	0.445
Sample 7.7	9.737	13.065	0.024	195.755	0.366	8.159	11.254	0.02	174.245	0.634
Sample 7.8	1.353	1.517	-0.276	15.24	0.572	1.412	1.571	-1.383	15.76	0.428
Sample 7.9	611.828	724.568	0.13	16.373	0.519	569.625	682.819	0.119	14.627	0.481
Sample 7.10	22.673	25.908	0.247	64.128	0.293	20.096	23.238	0.22	56.872	0.707
Sample 7.11	94.692	119.037	0.055	39.107	0.373	81.336	103.861	0.048	34.893	0.627
Sample 7.12	43.415	53.166	0.091	25.648	0.383	40.552	49.856	0.085	24.352	0.617
Sample 7.13	18.914	22.362	0.077	71.208	0.464	18.688	22.113	0.076	71.792	0.536
Sample 7.14	7.079	8.141	0.036	102.642	0.29	6.195	7.181	0.032	90.358	0.71
Sample 7.15	5.623	7.182	0.109	55.304	0.39	5.316	6.826	0.103	52.696	0.61
Sample 8.1.1	1.005	1.216	0.061	133.498	0.46	0.92	1.136	0.051	119.502	0.54
Sample 8.1.2	5.829	7.554	0.081	127.248	0.605	5.873	7.635	0.081	125.752	0.395
Sample 8.1.3	0.882	1.243	0.073	137.996	0.329	0.713	1.058	0.054	115.004	0.671

Sample 8.1.4	2.231	2.827	0.148	130.797	0.456	2.179	2.796	0.142	122.203	0.544
Sample 8.2	4.712	5.463	0.192	19.35	0.351	4.367	5.084	0.178	17.65	0.649
Sample 8.3.1	18.098	21.725	0.144	43.159	0.422	16.527	20.118	0.132	39.841	0.578
Sample 8.3.2	2.378	2.794	0.118	43.83	0.393	2.162	2.625	0.106	39.17	0.607
Sample 8.3.3	0.285	0.337	0.029	46.513	0.33	0.203	0.248	0.021	36.487	0.67
Sample 8.4	159.514	203.076	0.105	60.901	0.43	156.343	198.403	0.103	60.099	0.57
Sample 8.5.1	943.83	1817.806	0.197	47.914	0.25	865.56	1776.489	0.177	41.086	0.75
Sample 8.5.1	1062.502	1448.087	0.138	47.468	0.244	965.967	1368.28	0.118	41.532	0.756
Sample 8.6	0.807	0.971	0.096	51.337	0.359	0.747	0.91	0.09	47.663	0.641
Sample 8.7	23.82	29.223	0.447	14.954	0.655	24.96	30.18	0.474	16.046	0.345
Sample 8.8.1	35.501	42.923	0.087	93.211	0.565	36.299	43.662	0.089	93.789	0.435
Sample 8.8.2	3.295	4.06	0.108	96.586	0.45	3.213	3.979	0.102	90.414	0.55
Sample 8.9	4.301	4.687	0.051	39.16	0.085	2.661	2.998	0.029	23.84	0.915
Sample 8.10	6.977	8.922	0.163	61.388	0.538	6.913	9.043	0.162	59.612	0.462
Sample 9.1	0.31	0.336	0.089	17.532	0.234	0.204	0.231	0.062	11.468	0.766
Sample 9.2	0.258	0.379	0.067	7.13	0.498	0.289	0.389	0.074	7.87	0.502
Sample 9.3	0.475	0.6	0.12	23.332	0.314	0.429	0.551	0.104	20.668	0.686
Sample 9.4	29.042	38.039	0.155	102.96	0.367	25.92	34.76	0.142	96.04	0.633
Sample 9.5	62.542	82.2	0.13	368.896	0.422	61.915	82.177	0.128	365.104	0.578
Sample 9.6	6.161	8.044	0.104	105.881	0.26	4.496	6.206	0.084	92.119	0.74
Sample 9.7	12.09	15.083	0.234	39.15	0.318	8.667	10.975	0.194	31.85	0.682
Sample 9.8	20.958	25.994	0.142	49.71	0.351	18.493	23.457	0.13	45.29	0.649
Sample 9.9	10.486	12.999	0.335	49.032	0.215	3.313	4.495	0.237	33.968	0.785
Sample 9.10	0.843	1.344	0.069	379.51	0.329	0.796	1.303	0.063	356.49	0.671
Sample 9.11	0.608	0.805	-0.354	99.584	0.506	0.558	0.75	-3.583	99.416	0.494
Sample 9.12	0.093	0.121	0.09	207.696	0.292	0.077	0.101	0.073	181.304	0.708
Sample 10.1	20.161	21.267	0.582	4.708	0.1	17.325	18.429	0.489	3.292	0.9
Sample 10.2	4.406	4.508	0.002	95.021	0.027	2.797	3.013	0.001	33.979	0.973
Sample 11.1	60.711	70.579	0.103	32.838	0.607	59.619	70.022	0.099	31.162	0.393
Sample 12.1	7.188	8.787	0.287	27.179	0.187	5.755	7.244	0.188	15.821	0.813
Sample 12.2	1.055	1.286	0.376	23.197	0.327	0.937	1.177	0.277	14.803	0.673
Sample 12.3.1	46.355	51.998	0.984	17.533	0.876	51.019	56.905	1.059	19.467	0.124
Sample 12.3.2	13.317	15.155	0.252	5.409	0.529	14.247	16.425	0.271	5.591	0.471
Sample 12.3.3	10.848	12.731	0.48	5.37	0.519	11.718	14.075	0.508	5.63	0.481
Sample 12.3.4	14.682	16.789	0.149	5.207	0.681	16.52	18.934	0.168	5.793	0.319
Sample 12.4	10.717	13.888	0.222	5.387	0.581	11.332	14.217	0.236	5.613	0.419

Sample 12.5	18.282	21.63	0.383	10.137	0.726	19.911	23.372	0.417	10.863	0.274
Sample 12.5.2	20.533	22.579	0.416	10.114	0.731	22.148	24.116	0.448	10.886	0.269
Sample 12.6	3.274	3.769	0.064	7.707	0.438	3.054	3.639	0.059	7.293	0.562
Sample 12.7	26.774	30.341	0.653	18.088	0.514	27.701	31.59	0.681	18.912	0.486
Sample 12.8.1	3.361	3.924	-7.901	7.859	0.468	3.633	4.274	-3.521	8.141	0.532
Sample 12.8.2	7.184	8.214	4.305	7.568	0.545	6.882	7.941	-1.333	7.432	0.455
Sample 12.8.3	3.694	4.418	-0.929	7.943	0.566	4.174	5.079	-1.785	8.057	0.434
Sample 12.9	0.48	0.49	0.191	20.43	0.077	0.313	0.326	0.157	10.57	0.923
Sample 12.10	0.834	1.051	0.395	20.653	0.108	0.735	0.97	0.288	11.347	0.892
Sample 12.11	0.512	0.534	0.399	16.14	0.311	0.335	0.361	0.14	15.86	0.636
Sample 12.12	22.317	27.535	0.37	25.24	0.037	19.569	25.089	0.272	9.76	0.963
Sample 12.13	3.193	3.958	0.376	25.243	0.037	2.807	3.614	0.277	9.757	0.963
pBetter	0.26	0.3	0.22	0.24	0.28	0.74	0.70	0.78	0.76	0.72

5.1.2 Out-of-sample Performance

The first competition by Makridakis (1979) was designed as an in-sample performance comparison so only 1001 series in M-Competition (1982) is used to get the out-of-sample performance of the methods. There is different number of observations left as post forecast values for each series and these observations are used to compare forecast accuracy of the methods.

The code of the first series is YAF2. There is 22 observations for calculate the smoothed values and 6 observations to use post forecasting. Figure 5.23 displays the smoothed values and observations. And, Figure 5.24 displays the forecasts for 6 observations. α value is chosen as 0.1 and corresponding m value is used as 2. When look at to the figures, it is easy to see that modified simple exponential smoothing is perform better than simple exponential smoothing for both smoothing and forecasting when $\alpha = 0.1$ and $m = 2$.

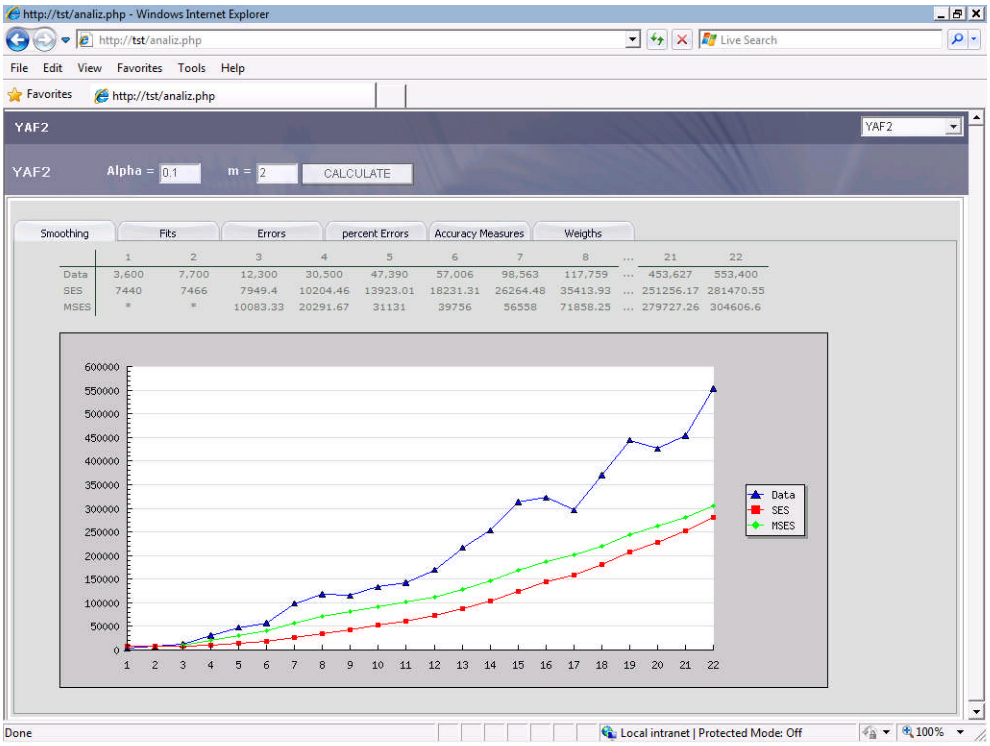


Figure 5.23 Smoothed values

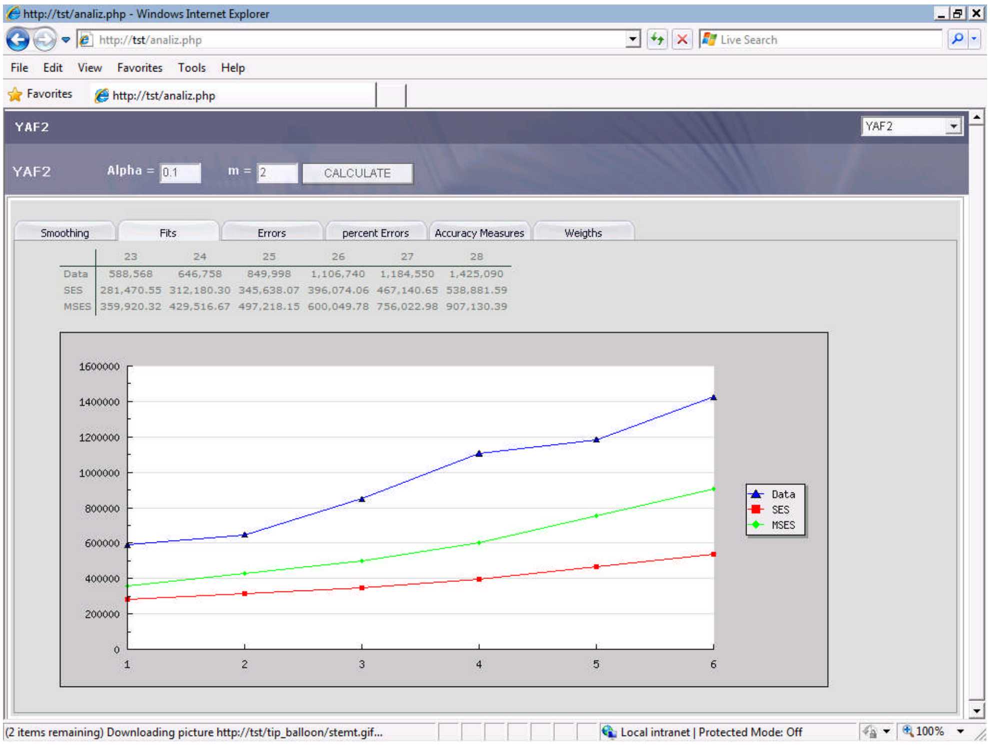
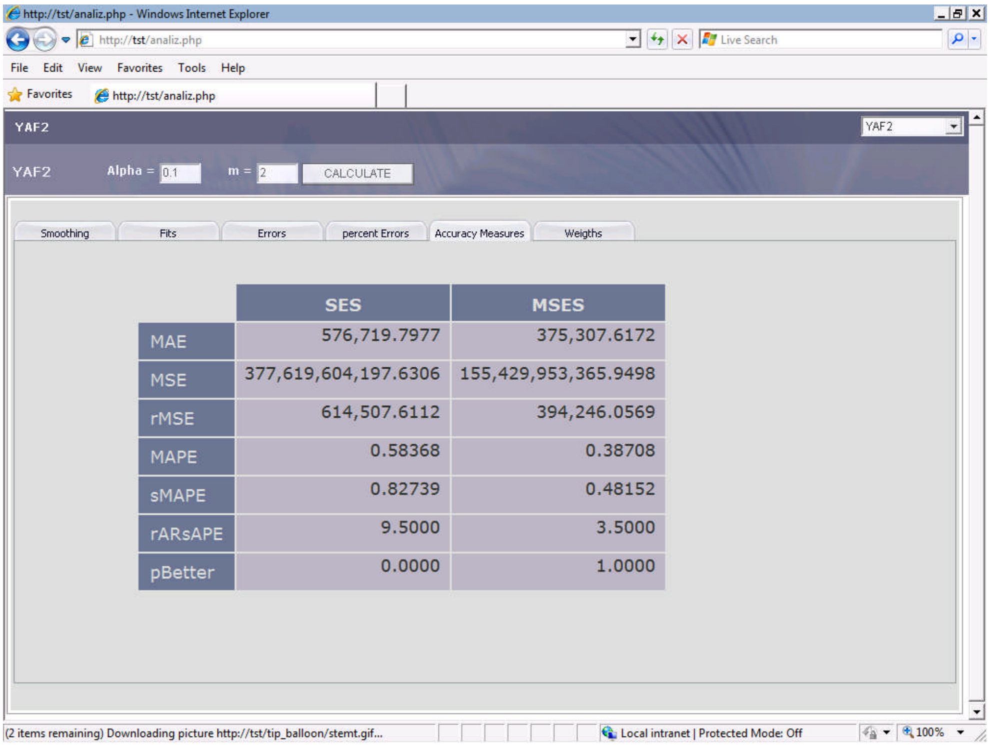


Figure 5.24 Forecasts



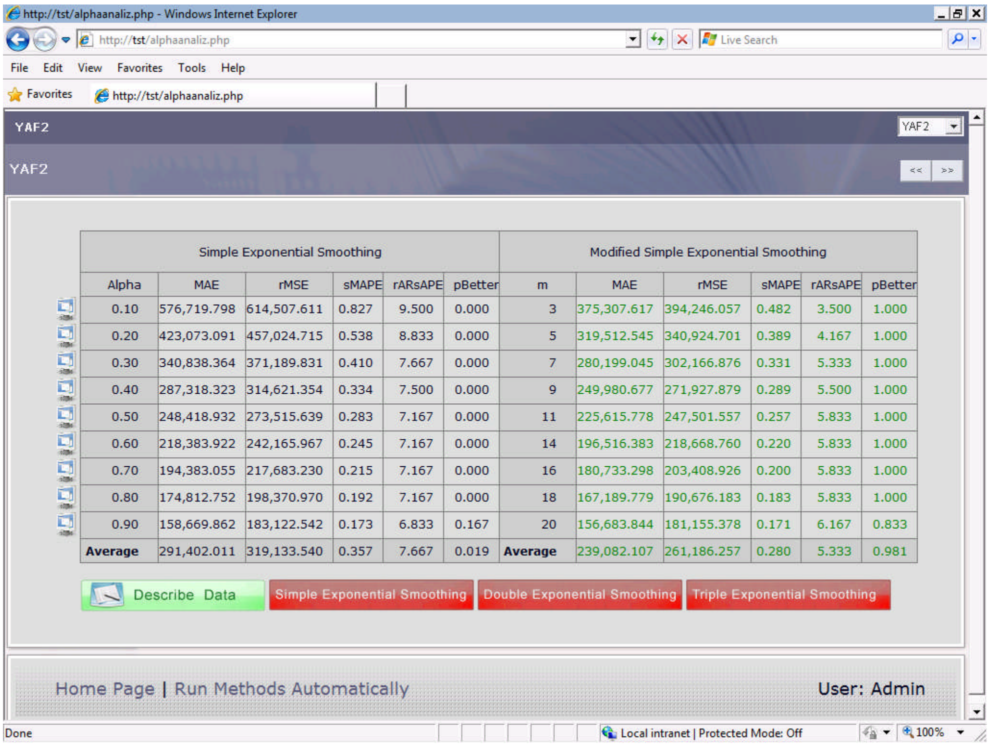
	SES	MSES
MAE	576,719.7977	375,307.6172
MSE	377,619,604,197.6306	155,429,953,365.9498
rMSE	614,507.6112	394,246.0569
MAPE	0.58368	0.38708
sMAPE	0.82739	0.48152
rARsAPE	9.5000	3.5000
pBetter	0.0000	1.0000

Figure 5.25 Accuracy measures for YAF2 when $\alpha = 0.1$ and $m = 2$

It can be seen that modified simple exponential smoothing performs better than simple exponential smoothing according to all accuracy measures for YAF2 when $\alpha = 0.1$ and $m = 2$ (Figure 5.25).

For different α values and corresponding m values automated analysis can be run. The results are given in Figure 5.26. It can be said that modified simple exponential smoothing performs better than simple exponential smoothing according to all accuracy measures for all α values from 0.1 to 0.9 incremented by 0.1 and corresponding m values.

Appendix C includes the out-of-sample performance for all 1001 series. Modified simple exponential smoothing performs 71%, 67%, 70%, 79% and 70% better than simple exponential smoothing according to MAE, rMSE, sMAPE, rARsAPE and pbetter respectively.



Simple Exponential Smoothing						Modified Simple Exponential Smoothing					
Alpha	MAE	rMSE	sMAPE	rARsAPE	pBetter	m	MAE	rMSE	sMAPE	rARsAPE	pBetter
0.10	576,719.798	614,507.611	0.827	9.500	0.000	3	375,307.617	394,246.057	0.482	3.500	1.000
0.20	423,073.091	457,024.715	0.538	8.833	0.000	5	319,512.545	340,924.701	0.389	4.167	1.000
0.30	340,838.364	371,189.831	0.410	7.667	0.000	7	280,199.045	302,166.876	0.331	5.333	1.000
0.40	287,318.323	314,621.354	0.334	7.500	0.000	9	249,980.677	271,927.879	0.289	5.500	1.000
0.50	248,418.932	273,515.639	0.283	7.167	0.000	11	225,615.778	247,501.557	0.257	5.833	1.000
0.60	218,383.922	242,165.967	0.245	7.167	0.000	14	196,516.383	218,668.760	0.220	5.833	1.000
0.70	194,383.055	217,683.230	0.215	7.167	0.000	16	180,733.298	203,408.926	0.200	5.833	1.000
0.80	174,812.752	198,370.970	0.192	7.167	0.000	18	167,189.779	190,676.183	0.183	5.833	1.000
0.90	158,669.862	183,122.542	0.173	6.833	0.167	20	156,683.844	181,155.378	0.171	6.167	0.833
Average	291,402.011	319,133.540	0.357	7.667	0.019	**Average**	239,082.107	261,186.257	0.280	5.333	0.981

Figure 5.26 Accuracy measures for YAF2 for different α levels from 0.1 to 0.9 incremented by 0.1 and corresponding m values

5.2 Modified Double Exponential Smoothing vs Double Exponential Smoothing

5.2.1 In-sample Performance

Same operations can be run for double exponential smoothing. Click “Run Methods” button at home page (Figure 5.2) to run the analysis manually and then click “Double Smoothing” button after selecting a data set from select box (Figure 5.3). A new page will be loaded to enter the required parameters for double exponential smoothing and modified double exponential smoothing

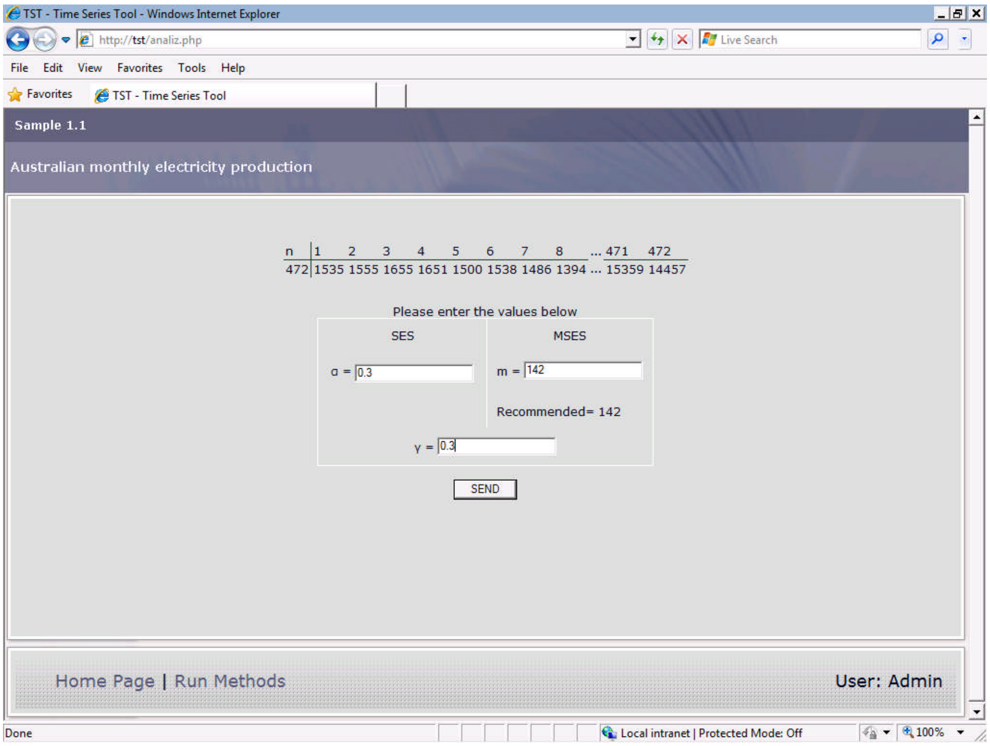


Figure 5.27 Parameter input screen for double exponential smoothing

Generally, values less than 0.3 have been recommended for parameters α and β for the Holt-Winters models (Gardner, 1985). Let enter 0.3 for both α and β, and recommended value 142 for m. And click “SEND” button. A similar page to simple exponential smoothing will load but this time the results for double exponential smoothing will be displayed. Figure 5.28, Figure 5.29, Figure 5.30, Figure 5.31 and Figure 5.32 displays smoothed values, fits, errors, percent errors and accuracy measures respectively for modified double exponential smoothing and double exponential smoothing for Sample 1.2. When we look at to accuracy measures in Figure 5.32, it can be concluded that modified double exponential smoothing performs better than double exponential smoothing. Figure 5.33 and Figure 5.34 displays the accuracy measures when γ is equal to 0.5 and 0.7 respectively while α and m remain same. Modified double exponential smoothing performs better than double exponential smoothing with these settings. Different values for γ, α and m can be tried but it is also possible to run analysis automatically by clicking “Run Methods Automatically” from home page (Figure 5.2). Figure 5.35 displays the result of automated analyzing.

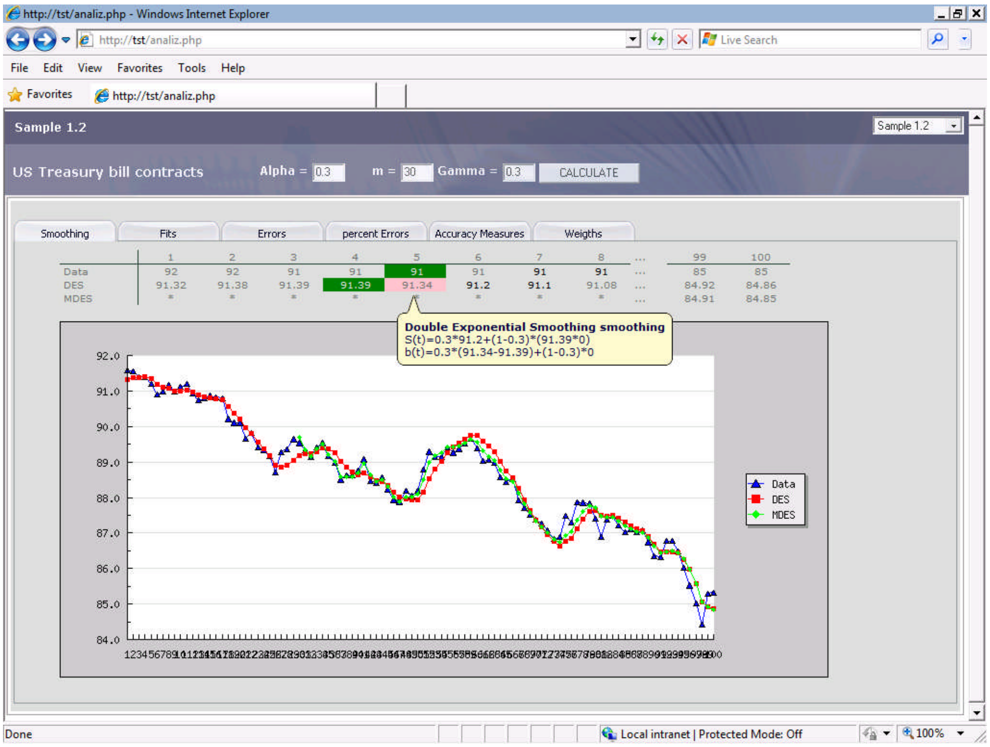


Figure 5.28 Smoothed values

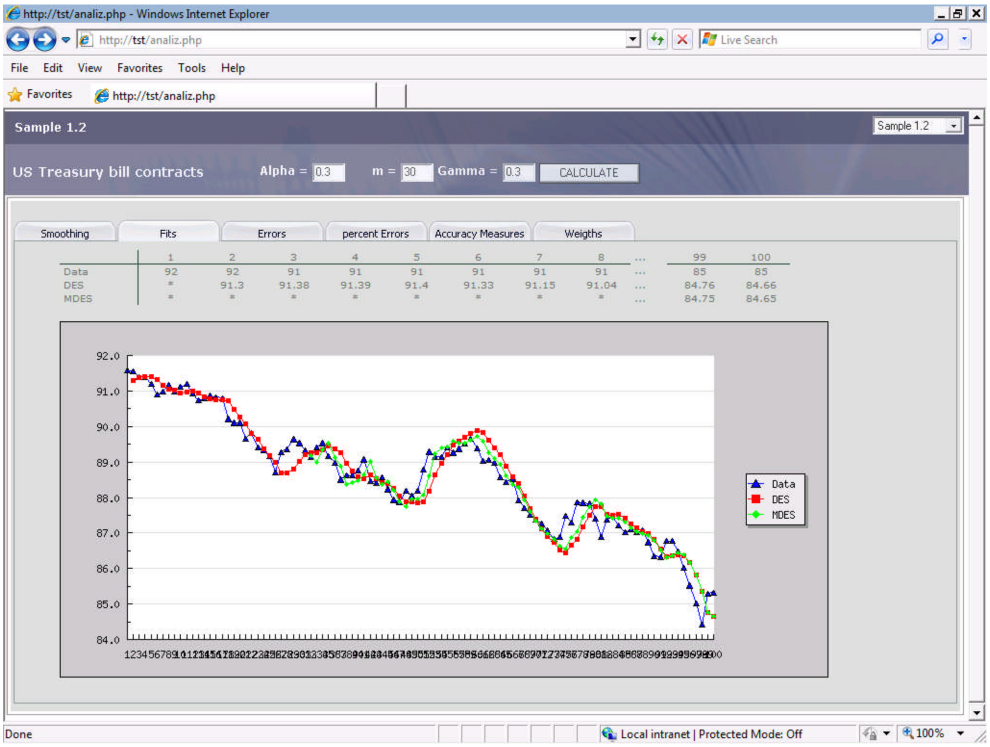
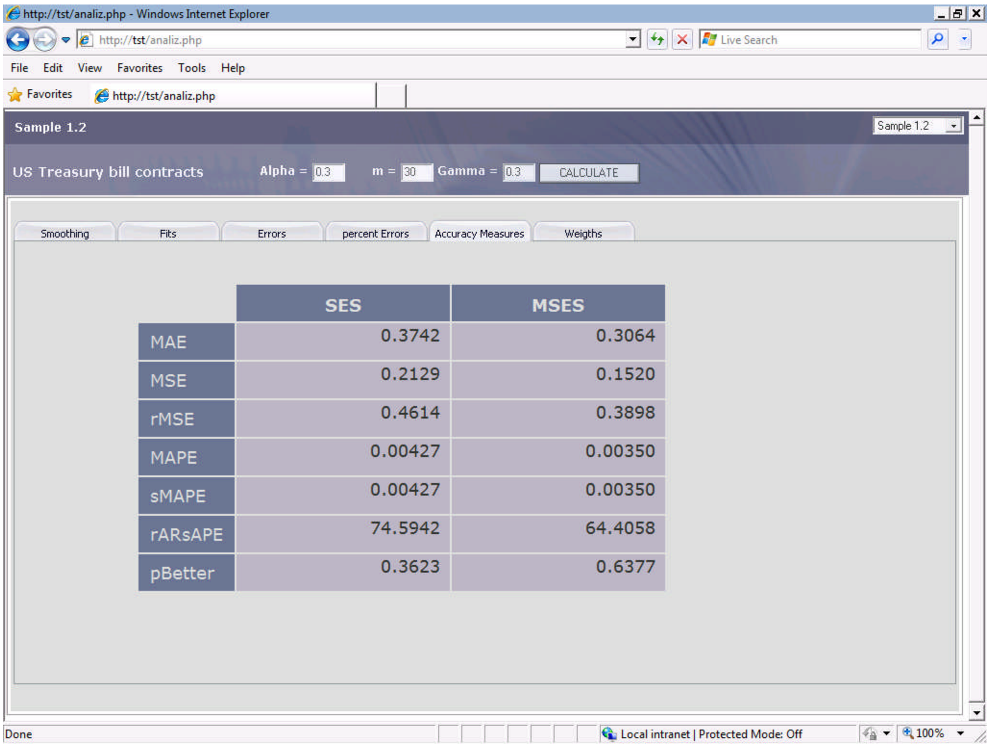


Figure 5.29 Fits

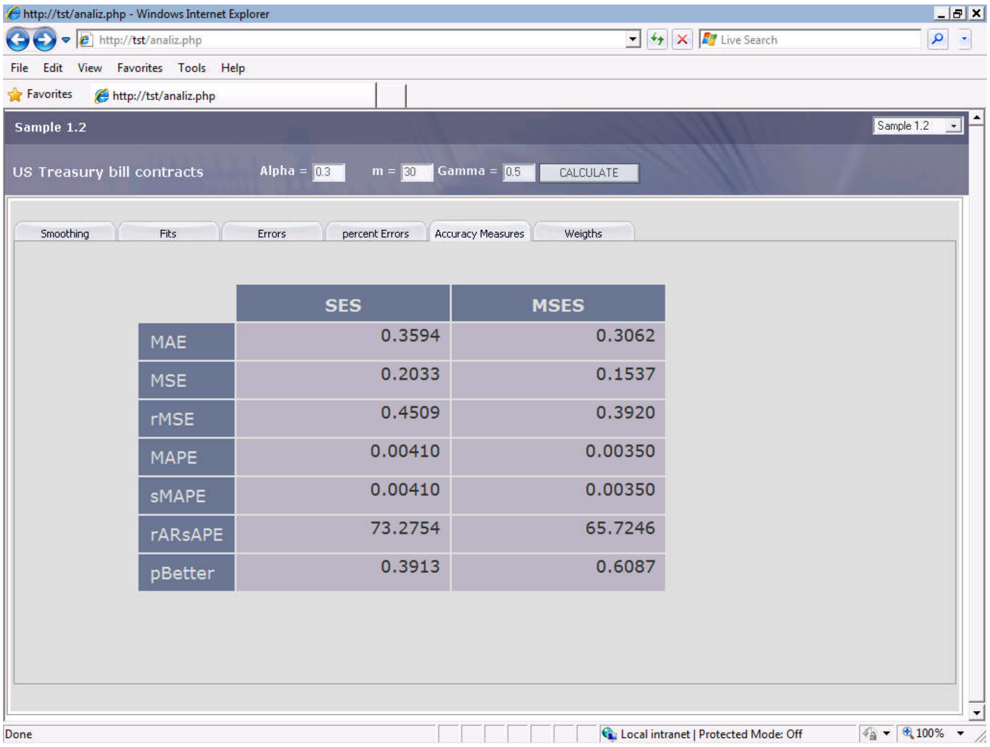
Figure 5.30 Errors

Figure 5.31 Percent errors



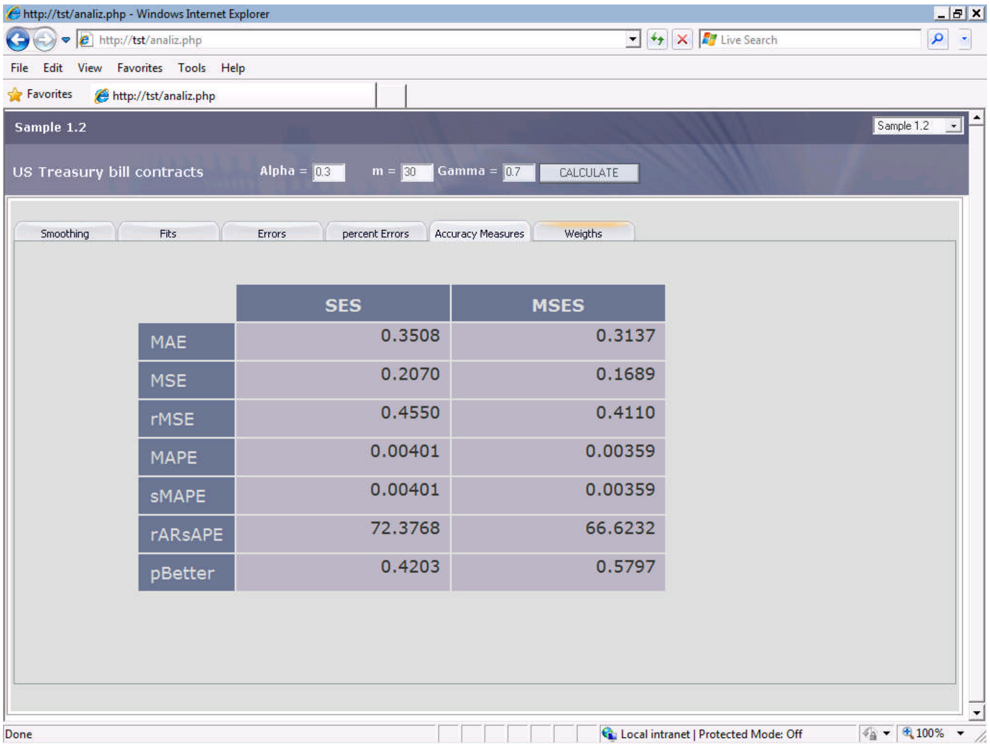
	SES	MSES
MAE	0.3742	0.3064
MSE	0.2129	0.1520
rMSE	0.4614	0.3898
MAPE	0.00427	0.00350
sMAPE	0.00427	0.00350
rARsAPE	74.5942	64.4058
pBetter	0.3623	0.6377

Figure 5.32 Accuracy measures



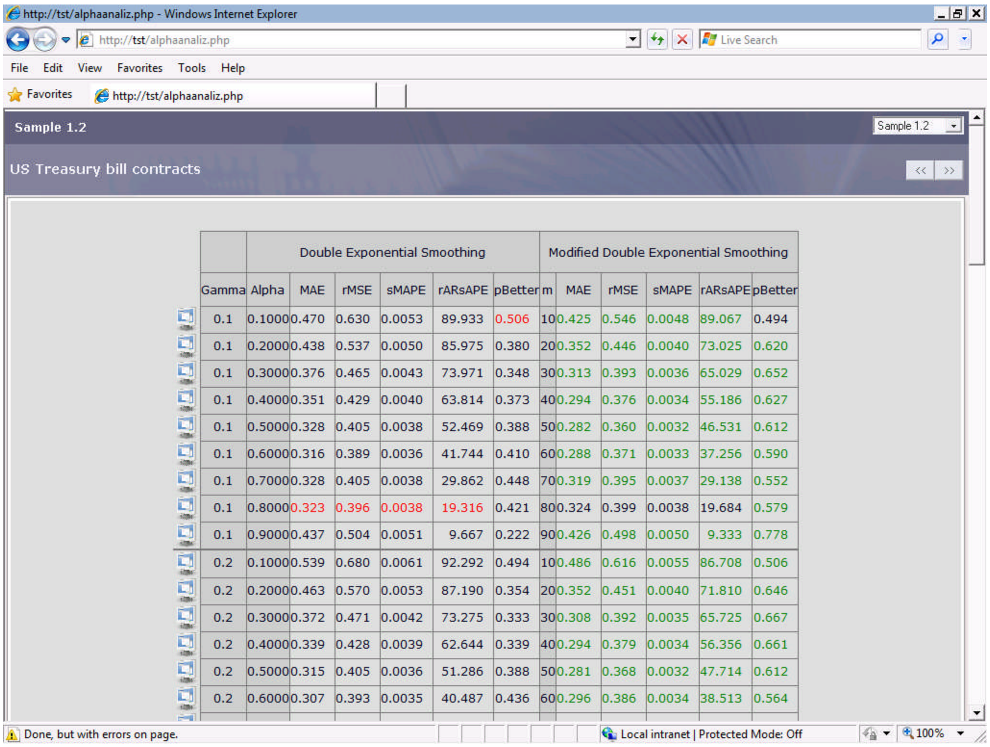
	SES	MSES
MAE	0.3594	0.3062
MSE	0.2033	0.1537
rMSE	0.4509	0.3920
MAPE	0.00410	0.00350
sMAPE	0.00410	0.00350
rARsAPE	73.2754	65.7246
pBetter	0.3913	0.6087

Figure 5.33 Accuracy measures when $\gamma = 0.5$, $\alpha = 0.3$ and m=30



	SES	MSES
MAE	0.3508	0.3137
MSE	0.2070	0.1689
rMSE	0.4550	0.4110
MAPE	0.00401	0.00359
sMAPE	0.00401	0.00359
rARsAPE	72.3768	66.6232
pBetter	0.4203	0.5797

Figure 5.34 Accuracy measures when $\gamma = 0.7$, $\alpha = 0.3$ and m=30



	Double Exponential Smoothing						Modified Double Exponential Smoothing					
Gamma	Alpha	MAE	rMSE	sMAPE	rARsAPE	pBetter	m	MAE	rMSE	sMAPE	rARsAPE	pBetter
0.1	0.1000	0.470	0.630	0.0053	89.933	0.506	10	0.425	0.546	0.0048	89.067	0.494
0.1	0.2000	0.438	0.537	0.0050	85.975	0.380	20	0.352	0.446	0.0040	73.025	0.620
0.1	0.3000	0.376	0.465	0.0043	73.971	0.348	30	0.313	0.393	0.0036	65.029	0.652
0.1	0.4000	0.351	0.429	0.0040	63.814	0.373	40	0.294	0.376	0.0034	55.186	0.627
0.1	0.5000	0.328	0.405	0.0038	52.469	0.388	50	0.282	0.360	0.0032	46.531	0.612
0.1	0.6000	0.316	0.389	0.0036	41.744	0.410	60	0.288	0.371	0.0033	37.256	0.590
0.1	0.7000	0.328	0.405	0.0038	29.862	0.448	70	0.319	0.395	0.0037	29.138	0.552
0.1	0.8000	0.323	0.396	0.0038	19.316	0.421	80	0.324	0.399	0.0038	19.684	0.579
0.1	0.9000	0.437	0.504	0.0051	9.667	0.222	90	0.426	0.498	0.0050	9.333	0.778
0.2	0.1000	0.539	0.680	0.0061	92.292	0.494	10	0.486	0.616	0.0055	86.708	0.506
0.2	0.2000	0.463	0.570	0.0053	87.190	0.354	20	0.352	0.451	0.0040	71.810	0.646
0.2	0.3000	0.372	0.471	0.0042	73.275	0.333	30	0.308	0.392	0.0035	65.725	0.667
0.2	0.4000	0.339	0.428	0.0039	62.644	0.339	40	0.294	0.379	0.0034	56.356	0.661
0.2	0.5000	0.315	0.405	0.0036	51.286	0.388	50	0.281	0.368	0.0032	47.714	0.612
0.2	0.6000	0.307	0.393	0.0035	40.487	0.436	60	0.296	0.386	0.0034	38.513	0.564

Figure 5.35 Analyzing automatically for different γ , α and m values

The 64 time series out of 111 time series seems to be a candidate for double exponential smoothing. Table 5.3 displays the results for them

Table 5.3 Results for 64 time series out of 111

	Double Exponential Smoothing					Modified Double Exponential Smoothing				
Time Series	MAE	rMSE	SMAPE	rARsAPE	pBetter	MAE	rMSE	sMAPE	rARsAPE	pBetter
Sample 1.1	624.42	731.93		348.27	0.41	562.55	685.82	0.07	310.73	0.59
Sample 1.2	0.41	0.51	0.01	73.69	0.39	0.34	0.44	0.00	65.31	0.61
Sample 1.4	41.36	54.22	0.09	106.39	0.50	41.58	52.56	0.09	109.01	0.50
Sample 2.1	715.09	834.71	0.24	31.66	0.28	454.20	555.33	0.14	26.55	0.72
Sample 2.5	4.15	4.76	0.39	11.80	0.37	3.28	4.11	0.31	10.00	0.64
Sample 2.6	19647.04	28716.75	0.11	321.37	0.36	17237.39	25523.94	0.54	291.64	0.64
Sample 2.12	10.23	13.44	0.05	13.15	0.57	11.56	15.04	0.06	13.85	0.43
Sample 2.13	0.79	0.95	0.01	60.69	0.31	0.54	0.70	0.01	46.71	0.70
Sample 3.2	66.71	83.68	0.19	23.47	0.62	72.19	88.77	0.21	25.13	0.38
Sample 3.3	22.66	28.80	0.09	10.37	0.33	19.79	26.85	0.07	9.03	0.68
Sample 3.7	71.96	93.97	0.01	143.94	0.56	76.98	99.94	0.01	149.06	0.45
Sample 4.2	11.90	15.14	0.06	15.81	0.49	12.59	16.00	0.06	15.99	0.51
Sample 4.4	0.38	0.42	0.06	3.83	0.59	0.41	0.49	0.06	3.97	0.41
Sample 4.6	3.65	4.36	0.04	19.70	0.44	3.08	3.59	0.03	17.70	0.56
Sample 4.7	28.98	33.01	0.15	19.82	0.57	31.86	36.94	0.16	21.18	0.43
Sample 5.1	3.00	5.85	0.11	17.81	0.30	2.77	5.77	0.11	15.59	0.70
Sample 5.3	0.02	0.02	0.00	12.82	0.47	0.01	0.02	0.00	12.18	0.53
Sample 5.4	0.06	0.07	0.01	11.97	0.57	0.06	0.08	0.01	13.03	0.43
Sample 5.5	1.44	1.61	0.05	6.71	0.39	1.37	1.49	0.05	6.29	0.61
Sample 5.7	0.61	0.73	0.01	15.28	0.43	0.62	0.76	0.01	14.92	0.57
Sample 5.10	13.25	16.19	0.27	13.99	0.48	13.08	16.30	0.27	13.01	0.52
Sample 6.1	0.59	0.77	0.10	44.69	0.35	0.45	0.59	0.08	38.31	0.65
Sample 7.1.1	0.74	1.04	0.03	32.66	0.36	0.63	0.91	0.02	28.74	0.64
Sample 7.1.2	2617.76	3460.38	0.21	29.93	0.57	2872.06	3812.52	0.22	31.47	0.43
Sample 7.2	7666.82	9654.71	0.09	129.43	0.54	7980.87	10016.39	0.09	131.97	0.46
Sample 7.3	30.85	39.81	0.01	213.76	0.37	26.22	34.26	0.01	193.24	0.63
Sample 7.4	13.10	15.59	0.10	78.80	0.22	8.50	10.48	0.07	60.21	0.78
Sample 7.6	477.14	666.52	0.24	89.71	0.54	492.59	683.92	0.25	91.29	0.46
Sample 7.7	9.06	11.87	0.02	269.02	0.37	7.93	10.64	0.02	245.98	0.63
Sample 7.9	640.23	767.34	0.14	22.37	0.34	531.19	674.41	0.11	18.63	0.66
Sample 7.11	108.83	137.25	0.06	51.47	0.41	97.60	121.56	0.06	48.73	0.59
Sample 7.12	65.78	80.71	0.14	35.09	0.39	57.02	69.52	0.12	31.91	0.61
Sample 8.1.1	0.83	1.06	0.05	176.15	0.50	0.83	1.05	0.05	174.85	0.50
Sample 8.1.2	6.22	8.53	0.09	175.66	0.55	6.20	8.52	0.09	175.34	0.45
Sample 8.1.3	0.83	1.18	0.06	183.69	0.37	0.73	1.08	0.06	167.31	0.63
Sample 8.1.4	1.83	2.47	0.14	177.05	0.49	1.82	2.48	0.13	173.96	0.51
Sample 8.3.3	0.22	0.27	0.02	62.54	0.32	0.17	0.21	0.02	50.46	0.69
Sample 8.5.1	658.81	1382.08	0.14	66.68	0.29	562.03	1345.61	0.12	54.72	0.71
Sample 8.5.1	821.83	1137.33	0.14	65.66	0.32	692.75	1031.79	0.11	55.74	0.68
Sample 8.6	0.99	1.19	0.12	70.59	0.39	0.89	1.10	0.11	64.81	0.61
Sample 8.7	22.46	28.96	0.50	19.87	0.53	23.26	29.51	0.54	21.13	0.47
Sample 8.9	1.33	1.66	0.01	47.46	0.28	0.99	1.29	0.01	37.54	0.72
Sample 8.10	7.69	10.52	0.17	82.79	0.54	8.13	11.19	0.17	84.21	0.47
Sample 9.1	0.11	0.14	0.04	18.77	0.40	0.11	0.14	0.04	18.63	0.60
Sample 9.3	0.48	0.62	0.12	30.37	0.40	0.44	0.61	0.11	27.83	0.60
Sample 9.4	37.31	50.14	0.19	142.97	0.39	33.37	46.07	0.17	132.43	0.61
Sample 9.6	6.55	9.34	0.12	143.04	0.36	5.73	8.32	0.11	130.76	0.64
Sample 9.7	14.11	18.42	0.39	54.15	0.34	8.91	12.27	0.21	42.85	0.66
Sample 9.8	24.72	32.74	0.14	67.89	0.44	21.44	28.53	0.13	61.91	0.56
Sample 9.9	5.32	8.39	0.24	59.62	0.43	2.89	4.73	0.40	53.38	0.58
Sample 9.10	0.69	1.09	0.08	522.43	0.42	0.66	1.06	0.08	504.97	0.58
Sample 9.12	0.11	0.15	0.12	292.90	0.33	0.08	0.11	0.08	248.51	0.67
Sample 10.1	3.78	4.76	0.09	3.44	0.84	4.66	5.45	0.11	4.36	0.16
Sample 10.2	0.00	0.00	0.00	89.78	0.04	0.00	0.00	0.00	87.62	0.41
Sample 11.1	51.53	61.30	0.09	42.20	0.60	55.19	66.46	0.10	44.00	0.40
Sample 12.1	4.60	5.57	0.21	32.98	0.23	3.13	4.18	0.11	24.02	0.77
Sample 12.2	0.68	0.94	0.25	27.88	0.33	0.58	0.88	0.18	21.92	0.67
Sample 12.9	0.09	0.11	0.05	22.54	0.31	0.07	0.08	0.04	18.46	0.69
Sample 12.10	0.47	0.63	0.25	23.79	0.25	0.35	0.53	0.16	17.22	0.75
Sample 12.11	0.13	0.16	-0.11	20.38	0.45	0.10	0.12	-0.10	20.62	0.46
Sample 12.12	12.83	15.78	0.28	29.36	0.10	8.82	12.20	0.17	16.44	0.90
Sample 12.13	1.86	2.29	0.29	29.34	0.10	1.28	1.78	0.17	16.46	0.90
pBetter	0.27	0.29	0.32	0.26	0.23	0.73	0.71	0.68	0.74	0.77

It can be said that modified double exponential smoothing performs 73%, 71%, 68%, 74% and 77 better than double exponential smoothing according to accuracy measures MAE, MSE, rMSE, rARsAPE and pBetter respectively for 64 time series appear to be have a trend and proper for double smoothing. Appendix D includes the time series plot of the series that modified double exponential smoothing seems to be not performed well. The common characteristic of the series is the irregular component they have although there seems to be a long term trend.

5.2.2 Out-of-sample Performance

1001 time series from M-Competition is used to compare the out-of-sample performance of the methods. Appedix E includes the results. It can be said that modified double exponential smoothing performed 74%, 71%, 74%, 75% and 72% better than double exponential smoothing according to accuracy measures MAE, rMSE, sMAPE, rARsAPE and pBetter respectively.

CHAPTER SIX

CONCLUSION

A new method named modified exponential smoothing is introduced in this thesis. A new smoothing constant and starting value is developed. The aim is to give even more weights than given by classical methods to most recent observations by a new smoothing constant and introduce a new starting value whose contribution to the forecasts is not influenced by the value of smoothing constant.

First, it is proved that modified method provides the basic properties of the classical one. Such as, weights given by modified method are exponentially decreasing giving higher weights to most recent observations and weights sum to unity. So, the smoothed statistic S_t can be written as a linear combination of previous observation. For example, S_t is given below for simple exponential smoothing and modified simple exponential smoothing respectively

$$S_t = \alpha X_t + (1-\alpha)S_{t-1}$$
$$S_t = \left(\frac{m}{t}\right)X_t + \left(\frac{t-m}{t}\right)S_{t-1}$$

It is also proved that S_t is unbiased estimator for both simple exponential smoothing and modified simple exponential smoothing. The general form of S_t for simple exponential smoothing and modified simple exponential smoothing is given by

$$S_t = \alpha \sum_{k=0}^{t-1} (1-\alpha)^k X_{t-k} + (1-\alpha)^t S_0$$

and

$$S_t = \sum_{k=0}^{t-(m+1)} \frac{\binom{t-k-1}{m-1}}{\binom{t}{m}} x_{t-k} + \frac{1}{\binom{t}{m}} S_m$$

Weight of observation X_{t-k} for simple exponential smoothing is given as

$$w_{X_{t-k}} = \alpha(1-\alpha)^k \qquad k = 0,1,2,\ldots,t-1$$

and weight of the starting for simple exponential smoothing value is

$$w_{S_0} = (1-\alpha)^t$$

Weight of observation X_{t-k} for modified simple exponential smoothing is given as

$$w_{X_{t-k}} = \left(\frac{m}{t}\right)\frac{(t-m)!(t-k-1)!}{(t-m-k)!(t-1)!} \qquad k = 0,1,\cdots,t-(m+1)$$

and weight of the starting value for modified simple exponential smoothing is

$$w_{S_m} = \left(\frac{t-m}{t}\right)\left(\frac{t-m-1}{t-1}\right)\cdots\left(\frac{1}{m+1}\right)$$

It is also proved that modified method give higher weights to most recent observations and starting value is not affected by the value of smoothing constant.

An empirical study is developed to compare methods. 111 time series of Makridakis Competition and 1001 time series of M-Competition are included in the empirical study. Seven accuracy measures are used to compare in-sample performance and out-of-sample performance of. Empirical results showed us that modified methods performed better than classical methods for most of the time.

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APPENDIX A

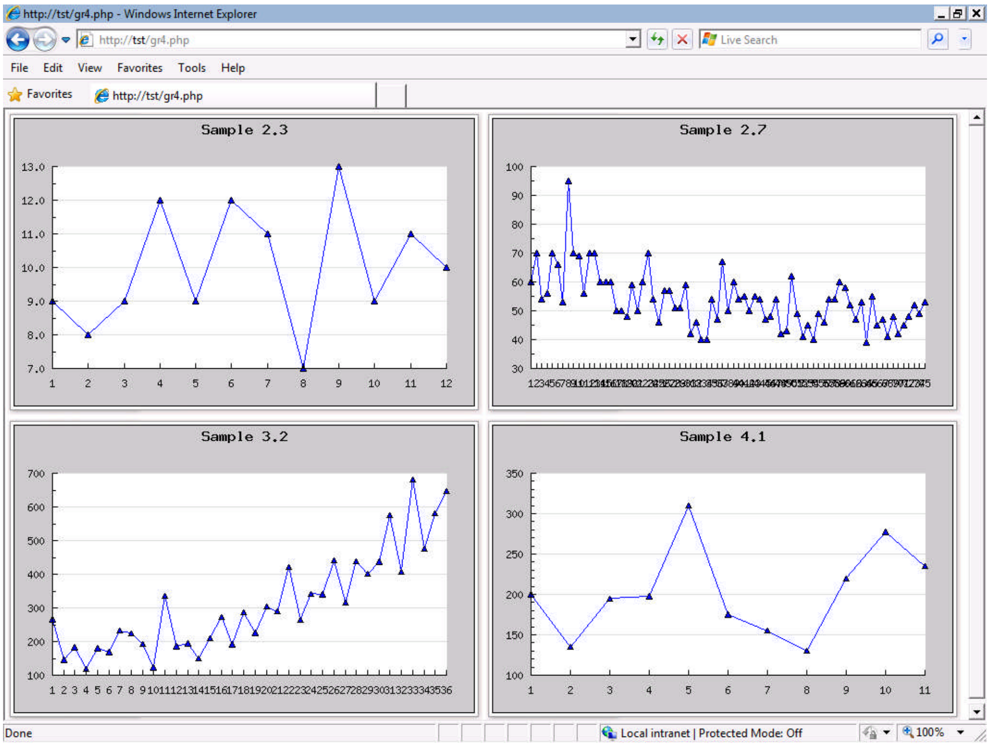

Figure 6.1 Time series plot of Sample 2.3, Sample 2.7, Sample 3.2, Sample 4.1

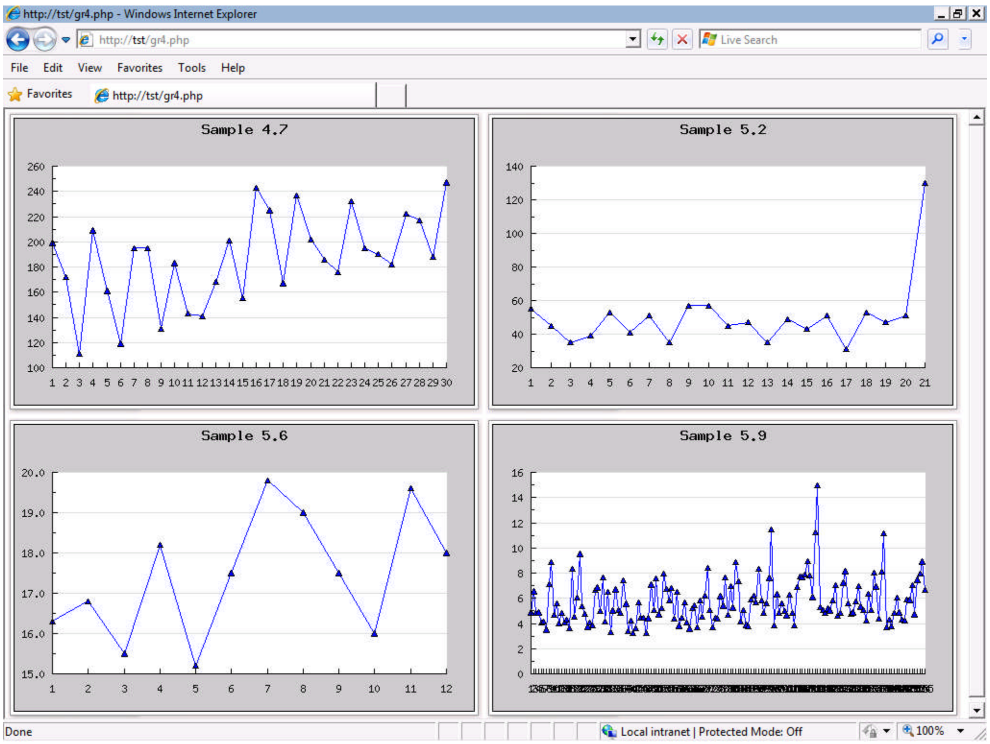

Figure 6.2 Time series plot of Sample 4.7, Sample 5.2, Sample 5.6, Sample 5.9

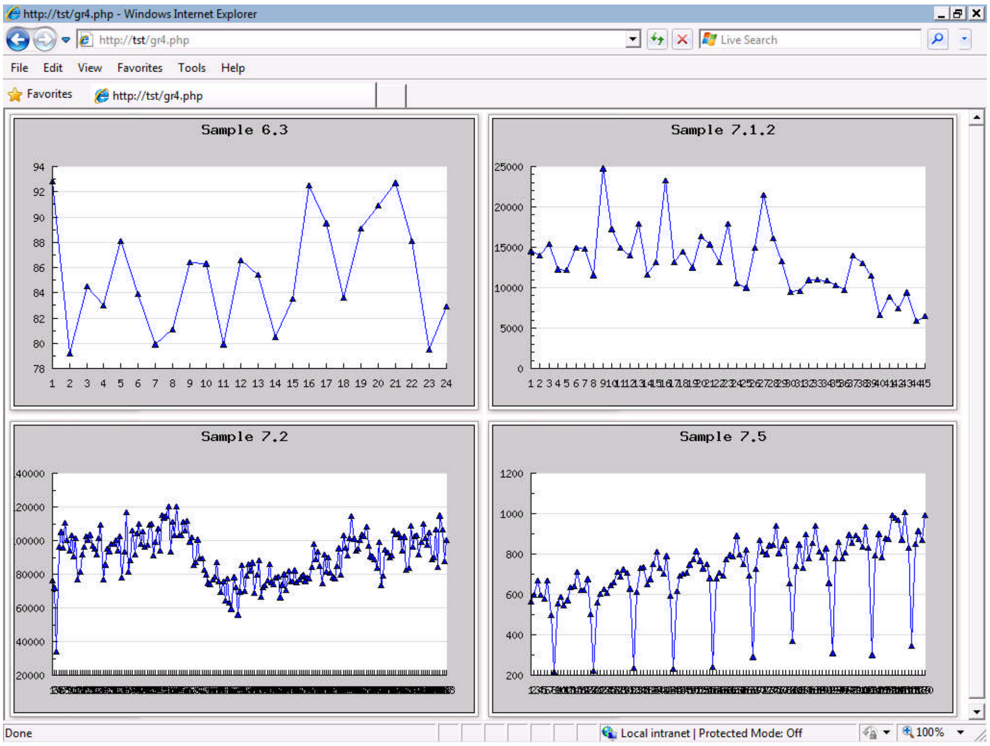

Figure 6.3 Time series plot of Sample 6.3, Sample 7.1.2, Sample 7.2, Sample 7.5

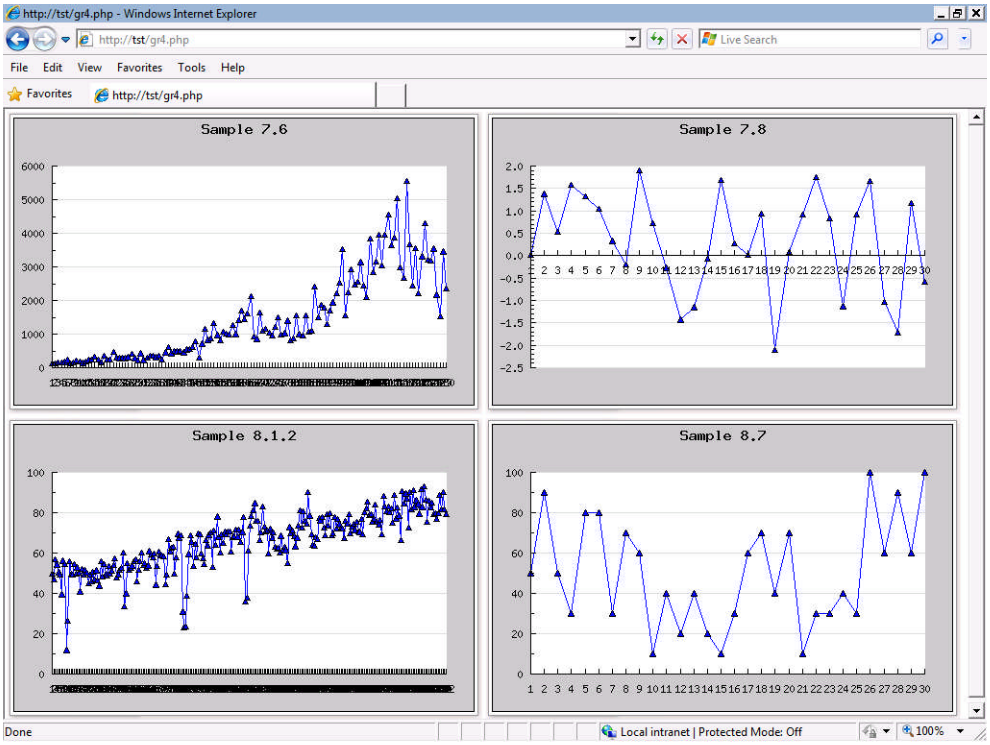

Figure 6.4 Time series plot of Sample 7.6, Sample 7.8, Sample 8.1.2, Sample 8.7

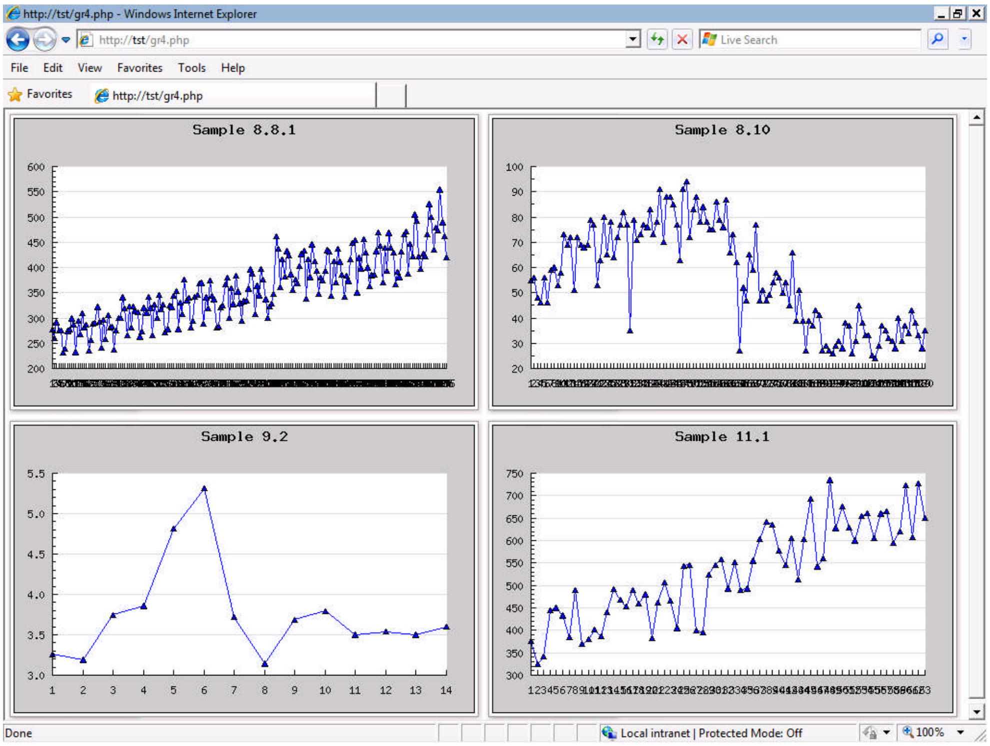

Figure 6.5 Time series plot of Sample 8.8.1, Sample 8.10, Sample 9.2, Sample 11.1

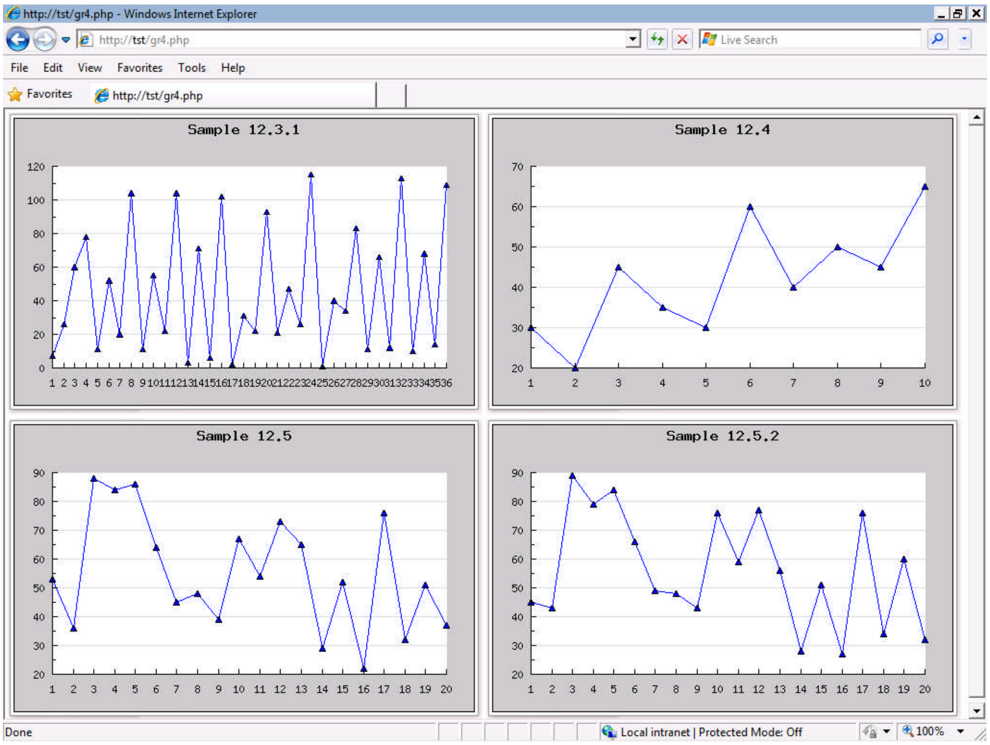

Figure 6.6 Time series plot of Sample 12.3.1, Sample 12.4, Sample 12.5, Sample 12.5.2

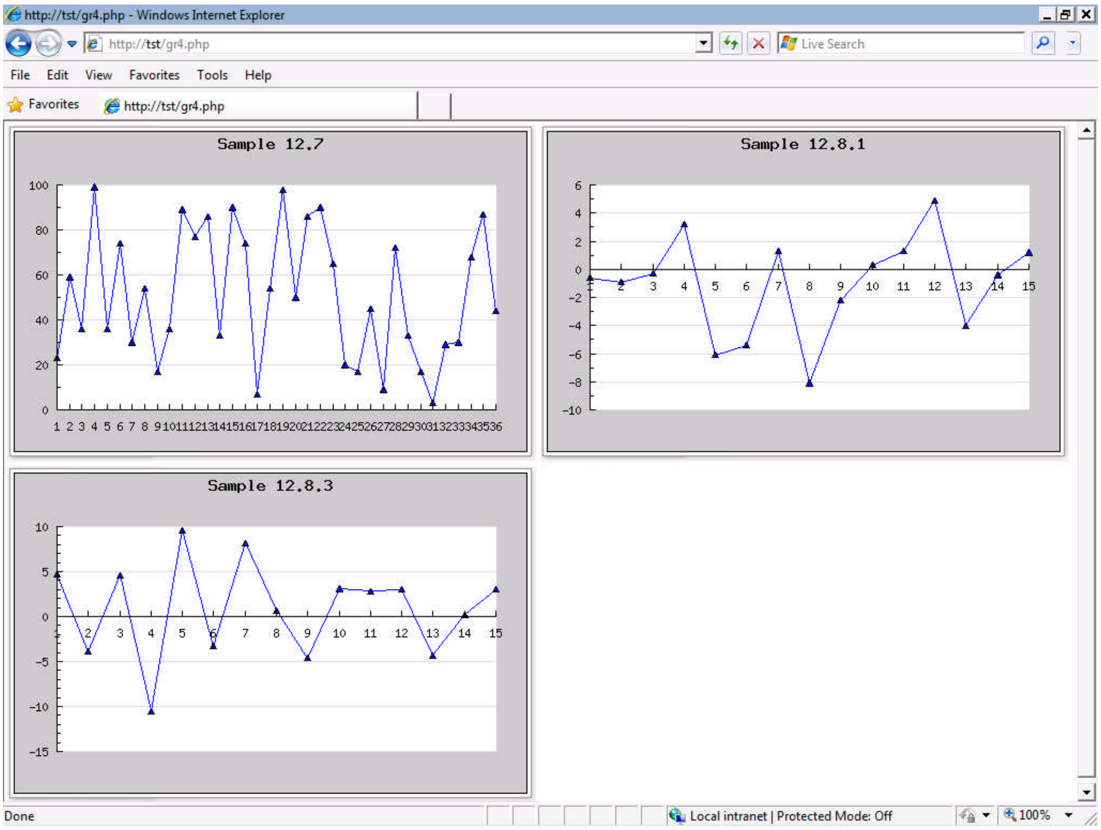

Figure 6.7 Time series plot of Sample 12.7, Sample 12.8.1, Sample 12.8.3

APPENDIX B

Table 7.1 Accuracy Measures for all time series in M-Competition

	Simple Exponential Smoothing					Modified Simple Exponential Smoothing				
Series	MAE	rMSE	sMAPE	rARsAPE	pB	MAE	rMSE	sMAPE	rARsAPE	pB
YAF2	73178.446	83032.208	0.312	12.744	0.086	54324.459	65487.740	0.186	7.033	0.803
YAF3	58555.655	64585.666	0.261	13.394	0.174	42790.348	48671.360	0.157	7.272	0.715
YAF4	49136.915	55737.184	0.282	13.587	0.074	35803.377	43543.565	0.167	7.079	0.815
YAF5	51123.832	57683.340	0.291	12.082	0.329	40675.052	47274.677	0.196	8.584	0.560
YAF6	2743876.711	3237205.498	0.237	21.090	0.383	2383330.679	2891870.054	0.180	15.910	0.617
YAF7	1856.027	2085.039	0.225	13.952	0.122	1486.291	1753.009	0.159	9.159	0.766
YAF8	125166.926	135365.945	0.207	5.153	0.028	105739.104	117099.737	0.169	3.403	0.750
YAF9	62575.242	64468.360	0.123	5.683	0.093	40370.862	43108.943	0.075	2.872	0.685
YAF10	80568.975	86422.645	0.114	3.952	0.032	66176.989	71443.331	0.093	2.715	0.635
YAF11	5.745	6.448	0.132	17.217	0.249	4.591	5.345	0.101	11.783	0.751
YAF12	941.001	1003.957	0.176	12.575	0.037	693.097	765.988	0.118	6.092	0.852
YAF13	194376.775	221711.983	0.316	16.742	0.028	152354.566	184857.880	0.198	9.035	0.861
YAF14	4391.170	6042.423	0.348	26.472	0.257	3786.002	5251.031	0.305	23.639	0.743
YAF15	128355.694	146917.365	0.331	11.404	0.145	87696.633	103546.380	0.206	7.263	0.744
YAF16	113.315	121.855	0.139	5.898	0.012	85.459	93.873	0.101	3.768	0.765
YAF17	0.467	0.482	0.065	12.639	0.075	0.294	0.314	0.039	6.028	0.814
YAM1	9317.386	11852.240	0.185	11.006	0.436	8077.209	10438.710	0.149	9.661	0.453
YAM2	102189.925	117241.204	0.335	11.996	0.296	83687.472	98297.238	0.221	7.782	0.593
YAM3	645.185	694.560	0.123	11.837	0.185	414.250	474.984	0.071	6.830	0.704
YAM4	3354.650	4297.948	0.254	10.521	0.448	2804.097	3555.998	0.200	9.257	0.441
YAM5	6.632	7.086	0.172	6.069	0.152	5.397	5.741	0.142	4.487	0.625
YAM6	0.028	0.029	0.010	7.456	0.000	0.018	0.020	0.007	4.211	0.778
YAM7	283.608	313.527	0.169	9.089	0.160	176.866	200.975	0.095	5.800	0.729
YAM8	9.127	10.381	0.103	5.812	0.249	7.527	8.386	0.086	4.744	0.528
YAM10	23.564	27.788	0.219	11.592	0.239	16.366	19.696	0.160	8.186	0.650
YAM11	1627385.067	1882522.052	0.090	5.663	0.271	1374726.813	1673531.400	0.076	4.892	0.507
YAM12	963585.268	1149114.567	0.079	5.627	0.357	835252.496	1041077.616	0.068	4.929	0.421
YAM13	570.380	679.065	0.219	15.215	0.534	563.700	659.497	0.221	15.785	0.466
YAM14	38.980	44.483	0.050	10.205	0.319	32.468	37.035	0.041	8.461	0.570
YAM15	41.943	48.536	0.055	11.116	0.376	31.210	36.302	0.040	8.662	0.513
YAM16	7.223	8.475	0.076	10.632	0.327	6.467	7.746	0.069	9.146	0.561
YAM17	30.271	35.208	0.160	5.993	0.307	28.781	33.325	0.149	5.674	0.471
YAM18	524.893	562.737	0.136	12.988	0.022	356.410	412.021	0.084	6.790	0.867
YAM19	1.647	1.906	0.017	10.693	0.305	1.373	1.603	0.014	9.085	0.584
YAM20	400.663	458.139	0.048	9.996	0.283	352.945	406.799	0.042	8.670	0.606
YAM21	9.335	10.990	0.049	9.215	0.359	8.655	10.516	0.045	7.674	0.530
YAM22	8.530	10.277	0.096	10.156	0.432	7.979	9.688	0.090	9.621	0.457
YAM23	1182.871	1283.921	0.150	12.552	0.059	874.845	991.030	0.103	7.226	0.830
YAM24	931.633	1037.472	0.148	11.785	0.074	688.805	804.611	0.101	6.881	0.815
YAM25	784.051	907.403	0.083	11.200	0.074	572.225	706.973	0.058	7.467	0.815
YAM26	1483.399	1776.768	0.069	10.336	0.255	1144.961	1407.547	0.052	8.331	0.634
YAM27	79.144	86.301	0.301	12.762	0.037	60.363	67.766	0.198	5.904	0.852
YAM28	142.625	154.726	0.199	12.520	0.022	106.958	120.465	0.136	6.146	0.867
YAM29	606.098	663.299	0.091	8.464	0.180	517.417	582.318	0.077	6.425	0.709
YAM30	9127.852	12373.594	0.296	23.680	0.355	8681.553	11813.991	0.267	21.320	0.645
YAB1	3891.252	4275.235	0.221	11.007	0.127	3053.649	3404.759	0.157	7.660	0.762
YAB2	1221.256	1723.025	0.409	10.760	0.261	1122.190	1618.286	0.345	9.018	0.628
YAB3	107536.096	117219.351	0.403	10.731	0.182	92114.564	103014.925	0.289	6.158	0.706
YAB4	12164.909	14425.850	0.237	8.824	0.442	11678.822	13742.424	0.221	8.065	0.447
YAB5	944.484	1035.629	0.120	9.350	0.056	673.928	766.261	0.082	5.539	0.833
YAB6	151.307	184.480	0.277	21.100	0.593	150.169	180.503	0.270	21.011	0.407
YAB7	62860.571	69039.835	0.112	5.835	0.000	48789.036	54252.718	0.085	3.832	0.778
YAB8	13855.625	17395.797	0.081	4.906	0.505	13602.813	16999.506	0.079	4.761	0.273
YAB9	46294.090	48932.877	0.441	6.548	0.056	34470.236	37373.469	0.284	3.119	0.722
YAB10	5045.591	5588.297	0.176	5.924	0.207	2995.044	3677.966	0.094	3.743	0.570
YAB11	13271.189	16875.534	0.112	5.538	0.056	9841.173	13641.341	0.081	4.129	0.722
YAB12	1054.124	1190.029	0.041	9.346	0.481	1097.203	1267.430	0.043	9.320	0.408
YAI1	180.546	196.270	0.298	10.436	0.102	138.674	159.166	0.196	5.564	0.787
YAI2	3511.060	4265.323	0.129	12.193	0.335	3393.139	4134.069	0.124	11.585	0.554
YAI3	130.763	204.554	0.462	18.666	0.507	129.549	210.218	0.454	18.334	0.493
YAI4	549.722	728.266	0.312	18.767	0.549	532.396	702.354	0.301	18.233	0.451
YAI5	196.234	237.666	0.528	19.261	0.327	178.463	220.230	0.478	17.739	0.673
YAI6	175951.391	194475.343	0.165	18.748	0.136	137534.480	157996.713	0.115	12.252	0.864
YAI7	1835630.774	2225795.499	0.151	20.193	0.194	1515243.691	1899929.237	0.115	15.918	0.806
YAI8	952.891	1065.392	0.140	8.451	0.370	879.751	977.371	0.126	7.549	0.519
YAI9	42.250	43.254	0.230	6.126	0.000	29.046	30.235	0.145	2.430	0.778
YAI10	12527.095	13497.188	0.068	6.368	0.000	9759.625	10709.804	0.052	4.188	0.778

YAI11	63.919	69.632	0.141	9.514	0.197	46.929	53.516	0.095	6.486	0.692
YAI12	241.018	254.316	0.366	10.711	0.056	177.160	192.880	0.226	5.289	0.833
YAI13	173.870	218.496	0.435	9.801	0.019	151.411	199.258	0.324	6.199	0.870
YAI14	149.552	173.972	0.471	7.465	0.000	124.483	148.794	0.347	4.201	0.778
YAI15	33.575	36.591	0.246	10.084	0.137	23.996	27.709	0.156	5.916	0.752
YAI16	21.103	24.177	0.274	9.939	0.019	16.695	20.237	0.194	6.061	0.870
YAI17	168.511	202.206	0.227	9.196	0.202	139.297	171.076	0.177	6.804	0.687
YAI18	5.874	7.238	0.048	5.446	0.220	5.533	6.806	0.045	5.109	0.558
YAI19	2.450	2.764	0.073	5.900	0.185	2.072	2.329	0.061	4.656	0.593
YAI20	0.856	1.008	0.058	5.215	0.431	0.870	0.996	0.059	5.341	0.347
YAI21	142.625	154.726	0.199	12.520	0.022	106.958	120.465	0.136	6.146	0.867
YAI22	344.754	387.923	0.129	13.739	0.183	270.217	313.309	0.095	10.039	0.706
YAI23	1.995	2.595	0.082	9.137	0.518	1.994	2.588	0.082	9.530	0.370
YAI24	12189.043	13292.438	0.145	14.746	0.028	8848.048	10481.568	0.094	8.365	0.861
YAI25	9.244	11.504	0.185	10.906	0.293	7.106	9.359	0.133	7.760	0.595
YAI26	155.470	184.840	0.262	8.546	0.404	151.294	180.255	0.261	8.343	0.484
YAI27	652.119	751.566	0.388	10.144	0.112	543.318	650.876	0.303	6.745	0.777
YAI28	40.256	44.293	0.167	11.632	0.096	27.644	31.692	0.106	7.035	0.793
YAI29	14.789	16.801	0.151	11.007	0.100	11.323	13.692	0.108	7.660	0.789
YAI30	2.149	2.337	0.200	6.571	0.078	1.464	1.716	0.123	3.985	0.700
YAI31	0.608	0.663	0.103	5.700	0.217	0.447	0.510	0.073	3.966	0.560
YAI32	0.846	1.081	0.067	5.313	0.307	0.776	0.992	0.062	5.243	0.471
YAI33	0.507	0.655	0.067	8.181	0.529	0.572	0.721	0.076	8.708	0.360
YAI34	0.468	0.551	0.128	8.877	0.139	0.360	0.455	0.094	6.012	0.750
YAI35	0.198	0.252	0.064	7.836	0.465	0.203	0.246	0.066	8.164	0.424
YAG1	27.608	28.928	0.114	11.195	0.056	20.760	22.415	0.081	5.694	0.833
YAG2	3.639	3.856	0.068	10.577	0.069	2.774	3.035	0.051	6.312	0.819
YAG3	15.995	17.056	0.185	11.166	0.069	12.322	13.370	0.134	5.723	0.819
YAG4	1.818	2.301	0.225	8.761	0.434	1.717	2.198	0.208	8.128	0.455
YAG5	9.978	10.489	0.112	9.477	0.056	7.357	7.977	0.079	5.412	0.833
YAG6	13.611	15.431	0.165	4.738	0.179	12.434	14.027	0.150	3.817	0.599
YAG7	8.015	10.871	0.087	18.113	0.301	7.793	10.798	0.085	16.887	0.699
YAG8	19.463	22.470	0.183	18.257	0.214	16.878	19.809	0.159	16.743	0.786
YAG9	14.168	16.176	0.162	17.307	0.243	12.294	14.528	0.141	14.804	0.757
YAG10	8.062	9.188	0.119	11.224	0.085	5.856	6.988	0.083	7.442	0.804
YAG11	29449.674	30263.882	0.102	7.228	0.056	20564.689	21379.040	0.068	3.327	0.722
YAG12	11378.764	12085.408	0.139	6.379	0.147	9353.492	10307.659	0.111	4.176	0.631
YAG13	7029.685	7659.012	0.091	6.552	0.139	4881.244	5608.129	0.061	4.003	0.639
YAG14	2136.356	2430.958	0.665	4.994	0.497	2162.993	2478.758	0.734	5.561	0.281
YAG15	2647.798	3007.001	0.109	6.005	0.142	2136.552	2410.204	0.086	4.551	0.636
YAG16	36005.488	37421.121	0.096	6.946	0.056	24761.999	26360.252	0.063	3.610	0.722
YAG17	4.519	5.141	0.140	7.610	0.305	4.139	4.684	0.125	6.390	0.584
YAG18	74.116	80.159	0.173	6.000	0.026	58.510	63.680	0.131	3.667	0.752
YAG19	72.622	79.257	0.176	5.793	0.026	57.695	63.488	0.135	3.873	0.752
YAG20	34.410	36.264	0.049	23.263	0.074	25.536	28.067	0.035	12.848	0.926
YAG21	0.468	0.490	0.103	8.627	0.115	0.343	0.373	0.072	4.706	0.774
YAG22	0.918	0.947	0.116	8.913	0.093	0.668	0.698	0.081	4.420	0.796
YAG23	14.605	15.284	0.152	8.852	0.056	10.676	11.464	0.105	4.481	0.833
YAG24	6.130	6.381	0.125	8.892	0.056	4.545	4.828	0.089	4.441	0.833
YAG25	1.873	1.968	0.107	8.550	0.111	1.396	1.523	0.076	4.784	0.778
YAG26	0.880	0.956	0.096	8.154	0.056	0.688	0.768	0.073	5.180	0.833
YAG27	0.629	0.659	0.141	8.505	0.078	0.478	0.517	0.102	4.828	0.811
YAG28	0.645	0.684	0.110	8.133	0.056	0.490	0.534	0.080	5.200	0.833
YAG29	0.582	0.607	0.092	8.524	0.056	0.440	0.473	0.067	4.810	0.833
YAG30	0.370	0.390	0.112	8.396	0.056	0.289	0.313	0.084	4.937	0.833
YAC1	4.366	4.469	0.068	7.203	0.000	3.006	3.136	0.045	3.352	0.778
YAC2	2.050	2.278	0.091	6.313	0.106	1.536	1.783	0.066	4.243	0.672
YAC3	1.676	1.858	0.120	6.255	0.000	1.323	1.496	0.092	4.301	0.778
YAC4	3.134	3.339	0.222	7.025	0.028	2.398	2.622	0.158	3.530	0.750
YAC5	6.485	6.993	0.081	6.391	0.152	4.799	5.265	0.058	4.164	0.626
YAC6	0.943	1.087	0.052	5.685	0.233	0.863	1.042	0.047	4.870	0.544
YAC7	1.735	1.883	0.060	6.166	0.132	1.396	1.520	0.048	4.389	0.645
YAC8	2.779	3.096	0.146	6.040	0.072	2.340	2.618	0.121	4.515	0.706
YAC9	4.825	5.195	0.177	6.681	0.035	3.789	4.127	0.133	3.874	0.743
YAC10	3286.284	3460.632	0.049	6.601	0.093	2717.930	2850.781	0.041	3.955	0.685
YAC11	1867.509	1980.047	0.068	6.431	0.028	1381.829	1513.329	0.049	4.125	0.750
YAC12	5402.597	5499.375	0.138	7.539	0.056	3684.871	3788.894	0.089	3.017	0.722
YAC13	3015.692	3397.593	0.091	6.024	0.234	2438.652	2841.794	0.072	4.531	0.544
YAC14	3592.031	3894.949	0.081	6.458	0.138	2429.409	2796.090	0.052	4.098	0.640
YAC15	6581.379	6904.420	0.171	7.192	0.000	4902.676	5211.213	0.120	3.364	0.778
YAC16	1725.151	2196.695	0.074	5.712	0.344	1525.172	1963.165	0.064	4.844	0.434
YAC17	2476.162	2798.891	0.092	6.026	0.278	2094.232	2325.336	0.076	4.529	0.500
YAC18	4.150	4.237	0.097	7.460	0.056	2.857	2.947	0.064	3.096	0.722
YAC19	2656187.011	3036742.248	0.129	17.875	0.259	2206415.542	2593336.452	0.102	13.125	0.741
YAC20	407.320	413.208	0.097	7.290	0.083	252.251	257.055	0.057	3.266	0.694
YAC21	152.012	159.322	0.090	6.909	0.000	105.159	112.637	0.061	3.647	0.778
YAC22	216.406	229.488	0.151	6.710	0.000	163.378	177.030	0.108	3.846	0.778

YAC23	197.595	211.610	0.163	6.799	0.111	129.970	145.767	0.101	3.756	0.667
YAC24	117.600	128.349	0.077	6.470	0.110	75.920	90.042	0.047	4.085	0.668
YAC25	352.706	368.096	0.151	7.178	0.056	259.945	274.917	0.106	3.377	0.722
YAC26	88.520	95.773	0.130	6.659	0.050	59.778	70.539	0.081	3.896	0.728
YAC27	208.715	219.518	0.200	7.054	0.000	154.968	166.557	0.139	3.502	0.778
YAC28	270.548	290.288	0.156	6.908	0.111	186.657	204.878	0.102	3.647	0.667
YAC29	124.168	133.369	0.069	6.688	0.050	86.812	95.904	0.047	3.867	0.728
YAD1	14.831	18.130	0.128	4.311	0.409	14.354	18.990	0.123	4.244	0.369
YAD2	419.238	439.046	0.012	24.093	0.214	252.600	268.593	0.007	12.907	0.786
YAD3	10.506	12.877	0.037	19.297	0.399	10.045	12.567	0.036	17.703	0.601
YAD4	224.555	238.019	0.121	3.154	0.462	243.736	258.604	0.131	3.512	0.204
YAD5	12.753	15.929	0.026	18.360	0.448	13.127	16.160	0.027	18.640	0.552
YAD6	31.004	41.709	0.071	18.297	0.536	31.615	42.845	0.072	18.703	0.464
YAD7	28.362	38.075	0.065	18.137	0.498	29.952	39.523	0.069	18.863	0.502
YAD8	57.840	79.168	0.066	18.192	0.527	60.422	81.783	0.069	18.808	0.473
YAD9	22.612	27.596	0.025	18.170	0.536	23.347	28.071	0.026	18.830	0.464
YAD10	24.878	30.681	0.026	18.237	0.523	25.584	31.122	0.027	18.763	0.477
YAD11	507.220	600.404	0.149	6.738	0.450	511.148	606.032	0.150	6.595	0.439
YAD12	0.791	0.977	0.020	7.250	0.232	0.692	0.897	0.018	6.084	0.657
YAD13	0.454	0.542	0.011	6.969	0.256	0.419	0.506	0.010	6.365	0.633
YAD14	277.836	334.330	0.180	10.332	0.217	255.186	311.857	0.163	9.446	0.672
YAD15	0.429	0.471	0.018	3.613	0.119	0.377	0.415	0.016	3.054	0.548
YAD16	0.071	0.083	0.008	3.249	0.479	0.076	0.088	0.008	3.417	0.187
YAD17	9227.223	11173.699	0.023	6.103	0.238	8793.795	11044.750	0.022	5.564	0.540
YAD18	0.051	0.061	0.023	4.917	0.377	0.048	0.055	0.021	4.750	0.401
YAD19	32186.724	37378.799	0.021	5.955	0.335	30831.518	34673.489	0.020	5.712	0.442
YAD20	56.810	62.177	0.108	4.887	0.083	49.244	54.835	0.093	3.669	0.694
YAD21	427.984	450.372	0.017	8.312	0.056	326.944	349.484	0.013	5.022	0.833
YAD22	17.261	19.419	0.039	8.392	0.240	15.749	17.927	0.036	7.608	0.649
YAD23	16.059	18.177	0.039	8.437	0.233	14.551	16.854	0.035	7.563	0.656
YAD24	7947.285	8856.096	0.025	5.165	0.519	8161.043	8785.624	0.025	5.390	0.258
YAD25	342.683	357.962	0.013	8.518	0.056	261.156	276.257	0.010	4.816	0.833
YAD26	8710.257	9992.401	0.028	5.302	0.515	8804.789	9761.199	0.029	5.253	0.263
YAD27	526.755	598.132	0.046	5.017	0.243	484.602	560.182	0.043	4.649	0.535
YAD28	329.226	362.185	0.039	5.114	0.170	289.254	331.531	0.034	4.552	0.608
YAD29	0.505	0.572	0.009	10.204	0.240	0.477	0.551	0.009	9.574	0.649
YAD30	103.433	136.397	0.101	10.536	0.422	93.497	128.244	0.091	9.241	0.467
QRF1	1.418	1.636	0.443	21.208	0.249	1.229	1.423	0.387	17.792	0.751
QRF2	3.656	4.696	0.039	32.259	0.210	3.117	4.290	0.033	26.741	0.790
QRM1	37.356	45.071	0.174	23.418	0.575	37.658	46.393	0.176	22.693	0.425
QNF1	4371.860	5067.109	0.140	51.058	0.488	4303.221	5092.389	0.137	47.942	0.512
QNF2	50991.160	63460.602	0.081	16.662	0.448	48075.377	60738.935	0.076	14.338	0.552
QNF3	81.457	99.484	0.150	16.767	0.404	75.895	93.749	0.140	15.344	0.596
QNM1	7.143	9.006	0.271	5.324	0.478	7.451	9.700	0.282	5.231	0.300
QNM2	19.041	22.706	0.153	25.028	0.543	18.612	22.050	0.145	23.972	0.457
QNM3	865.941	975.315	0.285	15.863	0.804	940.710	1052.628	0.310	17.582	0.196
QNM4	1102.253	1338.315	0.121	25.472	0.500	1073.706	1296.493	0.116	24.639	0.500
QNM5	18.292	21.812	0.153	25.028	0.543	17.880	21.182	0.145	23.972	0.457
QNM6	45.579	52.330	0.188	9.698	0.462	43.082	49.952	0.179	8.969	0.427
QNM7	27.786	35.082	0.054	32.192	0.365	20.189	26.265	0.040	26.808	0.635
QNM8	1624.698	1810.441	0.066	17.175	0.353	1405.560	1594.020	0.056	13.825	0.647
QNM9	9140.514	10422.730	0.078	17.846	0.480	7394.480	8555.533	0.061	14.265	0.520
QNM10	5547.858	6551.424	0.201	16.680	0.464	5245.470	6270.124	0.189	15.431	0.536
QNM11	49190.119	61858.261	0.098	17.264	0.371	44988.598	57962.787	0.089	14.848	0.629
QNM12	9159.509	11366.692	0.079	17.237	0.510	7788.690	9605.634	0.064	14.874	0.490
QNM13	6850.794	8244.318	0.248	16.981	0.416	6410.682	7885.770	0.232	15.131	0.584
QNM14	81458.794	99485.466	0.150	16.767	0.404	75897.099	93750.560	0.140	15.344	0.596
QNM15	4225.632	5226.251	0.036	12.235	0.278	3392.483	4409.243	0.028	9.542	0.611
QNM16	8285.575	9872.283	0.060	21.719	0.377	7624.367	9377.763	0.055	18.392	0.623
QNM17	11.077	21.932	0.044	57.455	0.103	10.180	21.132	0.039	46.656	0.897
QNM18	192.494	233.302	0.150	20.077	0.562	199.796	236.272	0.156	20.923	0.438
QNM19	207.447	230.566	0.165	20.447	0.381	208.657	230.259	0.166	20.553	0.619
QNM20	208.135	231.367	0.166	20.428	0.394	209.403	231.626	0.167	20.572	0.606
QNB1	23.764	28.512	0.100	14.978	0.327	19.279	25.372	0.080	10.799	0.562
QNB2	2.672	3.224	0.327	7.846	0.572	2.804	3.499	0.342	8.154	0.317
QNB3	21504.761	26660.031	0.314	14.456	0.596	22585.986	27598.955	0.327	14.544	0.404
QNB4	211.235	278.634	0.250	14.341	0.557	227.616	304.773	0.268	14.659	0.443
QNB5	46.945	58.803	0.198	33.049	0.533	47.302	59.332	0.198	31.062	0.467
QNB6	53.434	63.652	0.136	13.578	0.436	49.605	59.757	0.127	12.200	0.453
QNB7	27412.098	33559.682	0.247	14.347	0.559	29228.052	36042.013	0.265	14.653	0.441
QNB8	22.464	30.379	0.025	16.043	0.378	22.156	30.022	0.025	14.957	0.622
QNB10	329.650	429.921	0.346	15.947	0.401	306.053	410.940	0.328	15.053	0.599
QNB11	1032.812	1432.988	0.086	47.887	0.330	939.147	1339.008	0.076	42.225	0.670
QNB12	35.298	45.598	0.160	42.551	0.624	37.412	48.026	0.169	43.560	0.376
QNB13	5505.889	7018.094	0.343	16.435	0.469	5320.185	6787.436	0.330	15.676	0.531
QNB14	1980.979	2462.139	0.225	17.224	0.496	1829.602	2324.089	0.199	14.887	0.504
QNB15	25236.169	32098.785	0.190	17.553	0.390	21870.725	28784.044	0.161	14.558	0.610

QNB16	5955.184	7225.193	0.377	16.731	0.435	5676.945	6938.141	0.354	15.380	0.565
QNB17	8247.559	11272.358	0.498	25.351	0.411	8231.453	11644.225	0.493	24.761	0.589
QRI1	195.031	223.996	0.104	26.954	0.515	194.419	228.501	0.104	27.157	0.485
QRI2	9.633	11.055	0.099	29.016	0.468	8.855	10.435	0.089	25.095	0.532
QRI3	9.124	10.948	0.133	17.097	0.575	8.948	10.459	0.129	17.014	0.425
QRI4	0.104	0.142	0.079	18.379	0.256	0.081	0.109	0.060	15.732	0.744
QRI5	9.251	10.698	0.099	26.866	0.744	9.730	11.185	0.103	27.245	0.256
QNI1	13.608	15.056	0.139	15.498	0.501	13.689	15.718	0.141	14.613	0.499
QNI2	6.237	7.418	0.060	15.099	0.642	6.333	7.435	0.061	15.012	0.358
QNI3	3.227	3.618	0.182	15.132	0.574	3.262	3.745	0.185	14.979	0.426
QNI4	10.932	12.913	0.070	21.509	0.242	9.361	11.509	0.059	17.491	0.758
QNI5	3.199	3.740	0.152	18.196	0.377	2.966	3.445	0.134	15.915	0.623
QNI6	4.266	5.066	0.154	17.262	0.317	4.163	4.856	0.151	16.849	0.683
QNI7	7.997	9.981	0.136	17.153	0.353	7.868	9.686	0.134	16.959	0.647
QNI8	11.416	12.954	0.125	17.102	0.355	11.583	13.007	0.127	17.009	0.645
QNI9	74.822	106.198	0.110	32.063	0.403	68.524	101.298	0.099	26.937	0.597
QNI10	5.499	7.090	0.056	28.233	0.497	5.477	7.097	0.055	26.767	0.503
QNI11	374.169	470.532	0.098	17.264	0.371	342.208	440.899	0.089	14.848	0.629
QNI12	81.554	93.757	0.103	17.859	0.605	80.651	96.745	0.102	17.141	0.395
QNI13	8285.574	9872.282	0.060	21.719	0.377	7624.369	9377.765	0.055	18.392	0.623
QNG1	12.374	17.155	0.121	28.459	0.280	9.456	13.897	0.081	21.652	0.720
QNG2	3.524	3.965	0.036	30.691	0.209	2.423	2.972	0.023	19.420	0.791
QNG3	3.603	4.499	0.037	25.785	0.434	3.431	4.349	0.035	24.326	0.566
QNG4	0.330	0.386	0.019	22.532	0.442	0.295	0.353	0.017	19.579	0.558
QNG5	4.523	5.222	0.044	27.838	0.229	3.453	4.359	0.033	18.273	0.771
QNG6	4.079	4.309	0.025	6.127	0.219	2.906	3.118	0.018	3.540	0.559
QNG7	2.356	2.561	0.030	6.070	0.231	1.758	2.013	0.022	3.597	0.547
QNG8	9.175	9.500	0.061	6.268	0.093	6.431	6.854	0.042	3.399	0.685
QNG9	2.087	2.293	0.071	5.334	0.378	2.049	2.325	0.070	5.222	0.400
QNG10	9.609	10.921	0.144	5.698	0.181	7.810	9.673	0.117	4.858	0.597
QNG11	4.427	5.323	0.044	5.262	0.382	4.277	4.951	0.043	5.293	0.395
QNG12	5.668	5.925	0.042	30.483	0.070	4.055	4.536	0.029	16.517	0.930
QNG13	4.971	5.186	0.043	5.313	0.028	3.964	4.145	0.034	3.242	0.750
QNG14	4.871	5.050	0.042	5.380	0.083	3.813	3.949	0.033	3.175	0.694
QNG15	6.820	7.268	0.057	5.089	0.028	5.637	6.037	0.047	3.467	0.750
QNG16	5.274	5.512	0.045	5.394	0.028	4.177	4.371	0.035	3.162	0.750
QNG17	27.763	29.397	0.025	5.377	0.139	20.613	22.282	0.018	3.179	0.639
QNG18	369.786	463.895	0.040	31.918	0.209	294.118	372.754	0.031	27.082	0.791
QNG19	383.305	436.876	0.040	33.933	0.180	297.418	355.787	0.030	25.067	0.820
QNG20	3292.350	3568.691	0.057	36.563	0.035	2530.286	2932.737	0.041	22.437	0.965
QNG21	1133.334	1195.954	0.063	39.223	0.039	846.893	954.921	0.043	19.777	0.961
QNG22	378.379	443.873	0.066	36.294	0.199	291.045	366.547	0.047	22.706	0.801
QNG23	3607.850	4051.323	0.105	37.952	0.029	2878.905	3472.676	0.073	21.048	0.971
QNG24	891.380	1059.750	0.113	34.917	0.112	724.864	930.969	0.079	24.083	0.888
QNG25	12.733	14.897	0.085	15.989	0.453	11.355	13.277	0.074	14.122	0.547
QNG26	10.037	11.420	0.089	32.311	0.401	9.197	10.779	0.078	26.689	0.599
QNG27	23.215	31.826	0.149	20.392	0.426	21.396	30.196	0.138	18.608	0.574
QNC1	1041.604	1109.368	0.033	37.121	0.080	752.892	862.889	0.023	21.879	0.920
QNC2	11.873	12.862	0.116	15.624	0.445	11.532	12.900	0.113	14.487	0.555
QNC3	0.869	1.050	0.052	22.000	0.423	0.832	1.034	0.049	20.111	0.577
QNC4	0.673	0.828	0.044	23.654	0.459	0.644	0.803	0.042	22.457	0.541
QNC5	1.522	1.742	0.271	4.862	0.589	1.753	1.964	0.313	5.694	0.189
QNC6	4.553	5.430	0.178	5.802	0.302	3.726	4.508	0.142	4.753	0.475
QNC7	49.673	54.845	0.291	5.726	0.328	44.520	48.955	0.245	4.830	0.449
QNC8	4.214	4.970	0.115	5.544	0.297	3.845	4.444	0.103	5.012	0.481
QNC9	3.045	4.000	0.059	5.438	0.361	3.076	3.990	0.060	5.118	0.417
QNC10	87.403	97.468	0.231	5.893	0.249	77.629	86.943	0.197	4.663	0.529
QNC11	146.377	164.247	0.183	6.202	0.161	116.629	129.573	0.139	4.354	0.616
QNC12	57.242	65.198	0.182	6.042	0.194	45.507	53.706	0.138	4.514	0.584
QNC13	3.855	4.710	0.054	27.400	0.266	2.860	3.377	0.041	22.711	0.734
QNC14	76.572	84.511	0.258	8.156	0.443	75.300	83.899	0.254	7.844	0.446
QNC15	3.717	4.991	0.031	41.635	0.055	3.147	4.569	0.026	32.477	0.945
QNC16	704.840	825.669	0.061	33.255	0.190	589.813	716.886	0.049	25.745	0.810
QNC17	15.132	16.592	0.098	19.891	0.335	12.771	14.477	0.079	14.221	0.665
QNC18	30.996	38.915	0.098	33.197	0.275	26.885	35.647	0.078	25.803	0.725
QNC19	9.974	11.560	0.076	32.776	0.311	8.689	10.384	0.063	26.224	0.689
QNC20	21.221	23.889	0.160	7.419	0.435	19.775	22.170	0.147	6.581	0.453
QNC21	4.848	6.101	0.043	30.481	0.407	4.512	5.656	0.039	28.519	0.593
QNC22	493.936	588.155	0.165	21.681	0.390	439.415	534.832	0.133	17.319	0.610
QNC23	1890.672	3097.216	0.220	22.416	0.209	1689.650	2970.685	0.188	16.584	0.791
QNC24	19.752	21.988	0.172	17.190	0.742	21.737	24.382	0.190	18.922	0.258
QNC25	280.604	329.439	0.116	19.313	0.555	269.442	315.049	0.107	16.798	0.445
QNC26	15.000	18.914	0.039	31.802	0.215	12.670	16.712	0.032	27.198	0.785
QNC27	42.312	55.933	0.233	15.839	0.310	37.915	49.910	0.201	14.272	0.690
QNC28	987.588	1192.756	0.131	19.250	0.363	881.563	1093.083	0.111	15.750	0.637
QNC29	8.591	10.853	0.070	31.200	0.506	8.122	10.383	0.065	27.800	0.494
QRG1	22.313	23.074	0.043	35.937	0.060	15.706	17.416	0.029	18.174	0.940

QRG2	13.323	14.111	0.040	34.789	0.066	9.336	10.689	0.026	19.322	0.934
QRG3	7.505	7.788	0.053	35.812	0.064	5.098	5.635	0.033	18.299	0.936
QRG4	3.848	4.417	0.040	31.656	0.194	2.794	3.419	0.027	22.455	0.806
QRG5	10.245	12.434	0.059	42.804	0.103	8.054	10.513	0.043	31.307	0.897
QRG6	0.574	0.662	0.038	20.467	0.225	0.407	0.494	0.026	13.644	0.775
QRG7	31.942	33.582	0.047	22.178	0.074	23.193	25.376	0.033	11.933	0.926
QRG8	4.733	5.545	0.039	19.336	0.168	3.689	4.588	0.030	14.775	0.832
QRG9	2.790	3.334	0.068	19.477	0.346	2.155	2.668	0.051	14.635	0.654
QRG10	1.568	1.832	0.113	17.372	0.447	1.528	1.781	0.110	16.739	0.553
QRG11	6.392	7.179	0.063	23.340	0.421	5.817	6.674	0.056	18.771	0.579
QRG12	28.387	30.521	0.031	31.243	0.040	21.253	24.025	0.022	18.868	0.960
QRG13	247.772	265.475	0.051	31.501	0.048	181.660	210.332	0.035	18.610	0.952
QRG14	11.706	13.618	0.074	28.884	0.167	9.500	11.800	0.056	21.227	0.833
QRG15	5.500	6.053	0.062	31.344	0.111	4.208	4.867	0.044	18.767	0.889
QRG16	307.343	311.679	0.028	36.742	0.048	207.817	221.426	0.018	13.369	0.952
QRG17	1215.738	1300.861	0.042	21.738	0.184	827.804	939.780	0.027	12.373	0.816
QRG18	444.985	473.973	0.021	21.064	0.166	308.000	345.064	0.015	13.048	0.834
QRC1	315.122	396.917	0.527	32.559	0.328	293.214	380.880	0.482	29.552	0.672
QRC2	26.211	31.243	0.092	19.217	0.292	21.606	27.030	0.073	14.894	0.708
QRC3	6.055	6.894	0.052	19.244	0.341	4.941	5.649	0.042	14.867	0.659
QRC4	4.328	5.310	0.049	28.434	0.263	3.409	4.498	0.037	21.677	0.737
QRC5	1.937	2.262	0.077	27.931	0.225	1.629	1.976	0.062	22.180	0.775
QRC6	3.347	4.068	0.071	37.516	0.266	2.916	3.630	0.061	32.595	0.734
QRC7	16.424	19.339	0.162	27.111	0.518	16.762	20.309	0.166	27.000	0.482
QRC8	10.192	11.143	0.104	28.768	0.460	10.004	11.206	0.102	25.343	0.540
QRC9	2.499	2.842	0.027	30.899	0.304	1.998	2.343	0.021	23.212	0.696
QRC10	4.174	4.828	0.043	31.064	0.296	3.202	3.859	0.031	23.047	0.704
QRC11	7.815	9.420	0.078	27.726	0.484	7.622	9.154	0.076	26.385	0.516
QRC12	6.346	6.916	0.023	31.473	0.205	4.205	4.936	0.015	18.638	0.795
QRC13	6.046	6.887	0.052	19.225	0.341	4.934	5.642	0.042	14.886	0.659
QRC14	4.030	4.370	0.037	20.931	0.140	2.935	3.308	0.026	13.180	0.860
QRC15	4.408	4.994	0.040	20.346	0.235	3.173	3.830	0.028	13.765	0.765
QRC16	6.471	7.548	0.054	19.647	0.217	4.782	5.884	0.039	14.464	0.783
QRC17	3.640	4.138	0.034	20.570	0.301	2.655	3.195	0.024	13.541	0.699
QRC18	4.654	5.272	0.042	19.877	0.289	3.432	4.046	0.030	14.234	0.711
QRC19	0.184	0.221	0.087	17.176	0.437	0.181	0.218	0.086	16.935	0.563
QRC20	0.470	0.587	0.114	17.034	0.524	0.476	0.599	0.115	17.077	0.476
QRC21	6.954	8.042	0.070	28.282	0.471	6.649	7.854	0.066	25.829	0.529
QRC22	8.044	9.447	0.078	27.445	0.654	8.105	9.268	0.078	26.667	0.346
QRC23	6.392	7.179	0.063	23.340	0.421	5.817	6.674	0.056	18.771	0.579
QRC24	42.216	50.207	0.087	27.952	0.246	34.837	43.649	0.069	22.159	0.754
QRC25	4.955	5.744	0.056	28.053	0.285	3.897	4.736	0.043	22.058	0.715
QRC26	55.605	58.878	0.058	32.676	0.048	40.289	45.812	0.039	17.435	0.952
QRC27	5.451	6.376	0.058	29.191	0.265	4.178	5.295	0.042	20.920	0.735
QRC28	9.398	10.956	0.065	29.560	0.130	7.070	8.961	0.045	20.551	0.870
QRC29	17.292	18.766	0.150	18.161	0.450	16.919	19.070	0.147	15.950	0.550
QRC30	20.672	22.665	0.176	17.810	0.454	20.208	23.003	0.172	16.302	0.546
QND1	21.636	27.711	0.204	21.734	0.167	18.293	24.859	0.161	17.266	0.833
QND2	13.096	15.374	0.101	23.200	0.187	10.210	12.107	0.076	17.800	0.813
QND3	7.111	8.622	0.197	23.591	0.295	6.004	7.353	0.154	18.520	0.705
QND4	23.541	28.778	0.133	25.417	0.089	19.169	25.048	0.097	16.694	0.911
QND5	0.053	0.059	0.009	31.248	0.161	0.039	0.044	0.007	22.863	0.839
QND6	0.790	0.956	0.008	5.135	0.488	0.824	0.992	0.008	5.421	0.290
QND7	3.942	4.170	0.036	6.871	0.083	2.397	2.642	0.021	3.685	0.694
QND8	2.023	2.069	0.019	7.280	0.056	1.284	1.317	0.012	3.276	0.722
QND9	4.352	4.413	0.039	7.417	0.056	2.842	2.883	0.025	3.139	0.722
QND10	25.642	30.183	0.098	27.639	0.224	20.354	24.144	0.074	21.361	0.776
QND11	10.689	12.206	0.110	25.481	0.201	7.833	9.008	0.072	18.630	0.799
QND12	6.836	8.136	0.199	27.484	0.210	5.332	6.368	0.157	22.627	0.790
QND13	19.738	26.130	0.197	25.641	0.216	16.914	23.628	0.156	20.470	0.784
QND14	13.725	16.280	0.095	24.530	0.381	11.348	13.684	0.076	20.470	0.619
QND15	0.363	0.440	0.020	18.291	0.251	0.307	0.370	0.017	15.821	0.749
QND16	0.297	0.353	0.088	17.092	0.478	0.296	0.352	0.087	17.019	0.522
QND17	27.952	36.644	0.088	18.457	0.208	23.224	31.053	0.071	15.654	0.792
QND18	0.614	0.773	0.317	16.791	0.547	0.632	0.777	0.330	17.320	0.453
QND19	125.003	155.735	0.016	19.426	0.188	93.219	127.529	0.012	14.685	0.812
QND20	0.014	0.017	0.012	18.945	0.249	0.011	0.014	0.010	15.166	0.751
QND21	14.142	18.682	0.355	17.482	0.579	13.694	17.946	0.345	16.629	0.421
QND22	16.252	20.380	0.165	17.375	0.525	15.278	19.021	0.154	16.736	0.475
QND23	4.115	4.616	0.012	19.420	0.440	3.120	3.616	0.009	14.691	0.560
QND24	7.718	8.254	0.631	15.975	0.569	8.143	8.738	0.663	18.136	0.431
QND25	1.670	2.075	0.265	16.631	0.573	1.745	2.106	0.277	17.480	0.427
QND26	2.868	3.061	0.057	21.722	0.230	1.880	2.115	0.035	12.389	0.770
QND27	63.210	72.371	0.349	4.808	0.422	66.717	78.019	0.359	4.858	0.356
QND28	14.519	17.098	0.176	4.517	0.586	16.302	18.473	0.199	5.150	0.192
QND29	6.469	8.204	0.069	26.699	0.573	6.869	8.624	0.073	27.412	0.427
QND30	73.263	91.341	0.157	23.101	0.579	75.125	92.366	0.161	23.010	0.421

QND31	2.090	2.588	0.021	20.201	0.423	1.901	2.344	0.019	18.799	0.577
QND32	0.248	0.299	0.006	21.161	0.382	0.216	0.266	0.005	17.839	0.618
QND33	927.763	1167.654	0.601	19.418	0.575	959.185	1201.262	0.613	19.582	0.425
QND34	5.322	5.635	0.053	30.346	0.051	3.997	4.457	0.037	15.765	0.949
QND35	23.795	28.175	0.018	23.020	0.245	18.093	23.445	0.014	15.980	0.755
QND36	12.681	16.040	0.163	19.255	0.501	12.913	15.821	0.166	19.745	0.499
QND37	9.982	12.088	0.212	19.652	0.399	9.878	11.985	0.210	19.348	0.601
QND38	12.549	14.239	0.016	22.246	0.355	9.534	11.294	0.012	16.754	0.645
QND39	0.821	1.089	0.219	20.309	0.373	0.695	0.930	0.191	18.691	0.627
MRF1	443346.207	547490.809	0.346	19.500	0.635	465890.340	570002.563	0.363	20.611	0.365
MRM1	5.316	8.500	0.047	56.258	0.375	4.561	7.124	0.040	50.742	0.625
MRM2	114.299	159.941	0.168	63.888	0.486	116.059	163.355	0.173	63.112	0.514
MRM4	587.233	766.238	0.091	34.354	0.565	589.582	761.773	0.091	34.646	0.435
MRM5	2.898	4.378	0.069	62.552	0.569	3.160	4.873	0.076	64.448	0.431
MRM6	1467.796	1752.621	0.567	20.906	0.395	1357.439	1640.749	0.523	19.205	0.605
MRM7	30667.640	37070.908	0.218	20.074	0.458	29893.238	35883.968	0.216	20.037	0.542
MRM8	183.167	247.053	0.178	20.414	0.390	177.847	244.275	0.173	19.697	0.610
MRM9	2645.054	3088.276	0.343	21.492	0.326	2300.043	2869.415	0.301	18.620	0.674
MRM10	1150.538	1467.223	0.200	64.766	0.492	1175.407	1514.367	0.202	65.345	0.508
MRM11	399.702	513.947	0.119	65.729	0.536	400.757	514.429	0.118	64.382	0.464
MRM12	4.220	5.395	0.159	50.864	0.618	4.480	5.702	0.170	52.581	0.382
MRM13	3.678	4.562	0.174	51.038	0.657	3.848	4.776	0.182	52.407	0.343
MRM15	191.982	259.953	0.185	39.286	0.512	185.950	253.625	0.177	37.714	0.488
MRM16	2139.866	3191.747	0.280	55.068	0.528	2188.538	3224.834	0.283	55.043	0.472
MRM17	9.897	12.597	0.081	46.915	0.405	9.061	11.704	0.074	42.085	0.595
MRM18	4.114	4.995	0.129	44.654	0.408	3.886	4.751	0.122	42.346	0.592
MRB1	866.334	1153.623	0.342	49.324	0.644	900.309	1198.742	0.355	50.787	0.356
MRB2	2006.161	2963.976	0.305	33.506	0.691	2173.197	3167.983	0.330	35.494	0.309
MRB3	1847.118	2991.425	0.296	33.970	0.629	1964.812	3134.624	0.317	35.030	0.371
MRB4	2128.474	3447.893	0.297	33.877	0.574	2258.048	3603.346	0.318	35.123	0.426
MRB5	971.276	1137.102	0.409	27.834	0.543	1013.743	1210.582	0.432	28.277	0.457
MRB6	2.738	3.430	0.073	25.107	0.640	2.965	3.747	0.079	27.005	0.360
MRB7	15.376	19.952	0.021	42.208	0.305	13.295	17.321	0.018	37.903	0.695
MRB8	388.286	496.867	0.362	38.364	0.374	378.229	490.267	0.353	37.748	0.626
MRB9	1078.136	1325.419	0.443	33.541	0.399	1025.433	1284.286	0.409	30.570	0.601
MRB10	384.145	486.867	0.132	32.765	0.564	381.982	477.292	0.128	31.346	0.436
MRB11	382.623	453.835	0.216	32.584	0.482	384.142	457.392	0.216	31.527	0.518
MRB12	43.342	56.474	0.200	31.709	0.604	45.092	58.713	0.209	32.403	0.396
MRB13	6.403	8.669	0.161	30.549	0.528	6.408	8.766	0.162	29.562	0.472
MRB14	304.040	403.120	0.237	31.368	0.539	306.282	411.769	0.243	29.632	0.461
MRB15	446.454	575.336	0.232	31.541	0.551	444.277	579.266	0.233	29.459	0.449
MRB16	407.972	501.248	0.171	25.830	0.492	417.580	513.070	0.177	26.281	0.508
MRB17	57.416	74.007	0.162	29.817	0.602	60.885	78.195	0.171	31.183	0.398
MRB18	79.036	95.647	0.116	29.093	0.628	84.372	100.354	0.124	31.018	0.372
MRB19	29.425	38.689	0.145	30.180	0.596	30.818	39.868	0.152	30.820	0.404
MRB20	105.396	135.236	0.116	29.139	0.681	111.887	142.015	0.124	30.972	0.319
MRB21	127.570	172.189	0.149	29.428	0.527	131.796	179.309	0.155	29.572	0.473
MRB22	87.795	115.168	0.151	30.258	0.562	91.454	122.048	0.160	30.742	0.438
MRB23	75.985	103.751	0.219	31.299	0.383	74.346	101.801	0.215	29.701	0.617
MRB24	41.519	53.274	0.173	30.357	0.578	43.106	54.511	0.180	30.643	0.422
MRB25	2658.678	3044.586	0.113	52.556	0.388	2575.661	2978.344	0.109	50.888	0.612
MRB26	2651.806	3034.691	0.112	52.573	0.381	2567.084	2968.179	0.108	50.872	0.619
MRB27	1534.486	1739.287	0.098	53.427	0.358	1455.396	1670.744	0.092	50.018	0.642
MRB28	1505.710	1735.706	0.112	33.167	0.394	1431.324	1665.301	0.106	30.944	0.606
MRB29	5.188	6.784	0.033	38.827	0.494	5.093	6.767	0.032	37.284	0.506
MRB30	1403.426	1797.427	0.233	18.997	0.404	1408.456	1793.500	0.230	18.003	0.596
MRB31	1212.852	1602.658	0.278	18.821	0.410	1222.827	1590.282	0.276	18.179	0.590
MRB32	0.412	0.474	0.059	19.019	0.389	0.395	0.456	0.057	17.981	0.611
MNF1	6279.594	8731.739	0.198	50.540	0.557	6424.209	8762.345	0.205	51.571	0.443
MNF2	169.837	194.231	0.097	33.046	0.450	163.283	187.606	0.093	31.065	0.550
MNF3	78.115	94.066	0.025	55.071	0.318	63.797	80.193	0.019	43.929	0.682
MNF4	5.713	6.548	0.105	32.563	0.455	5.558	6.371	0.102	31.548	0.545
MNF5	5103.885	6530.185	0.124	32.104	0.405	4871.576	6380.438	0.118	30.007	0.595
MNF6	2159.712	3441.056	0.218	50.461	0.438	2176.214	3519.601	0.225	48.539	0.562
MNF7	46.431	56.798	0.149	32.307	0.450	44.202	56.189	0.142	29.804	0.550
MNF8	131.028	176.610	0.233	39.645	0.461	133.152	179.775	0.241	39.355	0.539
MNF9	1712.675	1957.498	0.144	21.296	0.292	1566.603	1812.015	0.131	18.815	0.708
MNM1	6.852	8.198	0.078	21.625	0.280	5.423	6.346	0.061	18.486	0.720
MNM5	3.820	4.615	0.111	31.374	0.566	3.949	4.787	0.115	32.737	0.434
MNM6	13451.089	17881.565	0.150	36.511	0.460	13900.325	18460.310	0.157	36.933	0.540
MNM7	364.235	463.471	0.111	39.907	0.574	380.168	480.909	0.116	41.093	0.426
MNM8	26.234	40.631	0.053	53.430	0.239	21.241	32.657	0.041	46.681	0.761
MNM9	186.794	243.002	0.068	61.610	0.584	191.515	246.433	0.070	62.501	0.416
MNM10	1365.098	1865.739	0.157	63.714	0.475	1361.274	1892.402	0.158	60.397	0.525
MNM11	612.516	809.310	0.075	58.518	0.530	617.374	816.897	0.075	57.593	0.470
MNM12	3449.818	4328.073	0.178	33.580	0.439	3383.985	4233.228	0.175	33.420	0.561
MNM13	73.012	92.619	0.116	38.181	0.701	79.176	98.392	0.125	40.819	0.299

MNM14	696.953	1001.179	0.112	60.552	0.553	727.238	1044.077	0.118	60.448	0.447
MNM15	2834.723	3492.261	0.307	49.762	0.517	2839.847	3502.641	0.311	49.238	0.483
MNM16	4892.915	6245.197	0.090	58.740	0.538	5062.307	6413.445	0.094	60.260	0.462
MNM17	190.191	259.034	0.270	41.696	0.622	198.841	266.087	0.285	42.415	0.378
MNM18	4717.514	7237.808	0.208	29.857	0.571	4925.971	7527.747	0.221	30.254	0.429
MNM19	3770.380	5340.899	0.220	54.724	0.474	3767.323	5334.684	0.227	54.276	0.526
MNM20	11.008	14.425	0.062	59.115	0.564	11.268	14.619	0.064	59.885	0.436
MNM21	174.042	240.547	0.120	37.987	0.580	182.465	249.191	0.127	39.013	0.420
MNM22	687.221	956.133	0.113	39.911	0.575	728.256	992.761	0.120	41.089	0.425
MNM23	177.077	229.323	0.460	27.665	0.579	183.015	232.202	0.485	29.335	0.421
MNM24	2789.124	4026.189	0.177	62.168	0.451	2819.483	4127.728	0.182	59.943	0.549
MNM25	2445.065	3803.290	0.223	50.329	0.457	2470.815	3887.583	0.231	48.671	0.543
MNM26	1297.053	1827.663	0.198	61.242	0.500	1339.006	1881.841	0.207	60.869	0.500
MNM27	27331.933	40237.872	0.214	61.414	0.513	28706.434	42396.045	0.229	62.697	0.487
MNM28	138.860	182.887	0.061	59.310	0.557	139.751	181.055	0.061	59.690	0.443
MNM29	1561.845	2034.197	0.077	55.478	0.497	1551.710	2042.001	0.077	53.522	0.503
MNM30	922.706	1365.240	0.130	44.498	0.601	983.660	1459.945	0.140	44.502	0.399
MNM31	174.064	218.907	0.123	37.686	0.627	183.942	230.479	0.130	39.314	0.373
MNM32	18519.118	21344.741	0.413	49.007	0.473	18569.713	21266.086	0.422	49.993	0.527
MNM33	381.995	530.688	0.163	39.550	0.477	390.063	539.269	0.168	39.450	0.523
MNM34	2206.528	2843.552	0.185	56.120	0.606	2233.109	2894.936	0.187	54.880	0.394
MNM35	650.974	867.691	0.226	46.940	0.518	669.151	892.471	0.237	46.505	0.482
MNM37	13376.475	16947.241	0.126	65.021	0.564	13584.226	17062.921	0.129	65.090	0.436
MNM38	1262.101	1602.951	0.144	64.805	0.534	1282.816	1619.623	0.147	65.306	0.466
MNM39	182.832	223.240	0.166	27.859	0.539	182.204	227.826	0.165	26.252	0.461
MNM40	48.361	57.607	0.085	28.458	0.436	44.045	54.150	0.075	23.653	0.564
MNM41	88.466	121.620	0.179	26.858	0.589	93.604	126.959	0.189	27.253	0.411
MNM42	312.614	381.161	0.160	27.452	0.530	316.848	389.606	0.162	26.659	0.470
MNM43	32.386	38.715	0.261	26.761	0.595	33.679	40.107	0.273	27.350	0.405
MNM44	73.610	102.108	0.104	49.035	0.329	62.164	89.875	0.087	43.076	0.671
MNM45	73.072	101.427	0.103	53.351	0.298	61.506	88.757	0.085	46.760	0.702
MNM46	44.010	53.831	0.087	59.336	0.275	36.490	45.856	0.071	49.664	0.725
MNM47	0.434	0.551	0.030	32.252	0.452	0.432	0.553	0.030	31.859	0.548
MNM48	2767.088	3441.280	0.232	30.086	0.413	2627.855	3311.347	0.222	28.914	0.587
MNM49	105.669	123.812	0.241	29.378	0.503	106.076	125.130	0.244	29.622	0.497
MNM50	1264.989	1480.552	0.160	29.273	0.508	1265.810	1471.182	0.161	29.727	0.492
MNM51	50.777	60.781	0.149	38.746	0.594	53.761	64.809	0.156	40.254	0.406
MNM52	36.187	43.241	0.144	38.908	0.608	38.261	46.175	0.152	40.092	0.392
MNM53	5.413	6.782	0.190	39.378	0.636	5.530	6.943	0.195	39.622	0.364
MNM54	13.364	15.829	0.166	38.760	0.599	14.155	16.907	0.175	40.240	0.401
MNM55	616.023	730.994	0.171	25.679	0.409	547.865	671.676	0.152	23.321	0.591
MNM56	25418.706	32821.214	0.224	30.163	0.563	25779.313	32905.115	0.226	29.948	0.437
MNM57	37642.252	47896.860	0.089	53.578	0.472	36643.274	46734.869	0.087	52.533	0.528
MNM58	106.037	129.582	0.161	62.690	0.430	103.330	129.333	0.157	60.754	0.570
MNM59	1547.553	1950.179	0.083	54.101	0.497	1502.049	1915.337	0.079	49.343	0.503
MNM60	1973.252	2484.550	0.092	55.891	0.458	1860.868	2396.199	0.082	47.554	0.542
MNM61	711.205	927.779	0.119	55.826	0.429	669.678	893.110	0.105	47.619	0.571
MNM62	96.291	120.181	0.118	48.349	0.554	89.525	109.518	0.112	45.762	0.446
MNM63	151.834	191.709	0.088	52.478	0.553	151.106	192.529	0.087	50.966	0.447
MNM64	104.693	128.825	0.138	51.953	0.583	105.534	129.164	0.138	51.492	0.417
MNM65	65.192	84.006	0.111	53.058	0.434	63.109	81.283	0.107	51.053	0.566
MNM66	1718.097	2201.558	0.080	60.501	0.492	1673.143	2160.720	0.076	54.499	0.508
MNM67	567.127	690.589	0.127	45.488	0.562	525.827	647.653	0.106	40.623	0.438
MNM68	5876.981	7295.330	0.092	56.342	0.444	5478.779	7040.705	0.081	47.103	0.556
MNM69	903.781	1070.834	0.095	53.811	0.537	889.243	1067.440	0.092	49.633	0.463
MNM70	5876.981	7295.330	0.092	56.342	0.444	5478.779	7040.705	0.081	47.103	0.556
MNM71	520.385	630.135	0.108	56.118	0.419	472.850	597.846	0.085	42.882	0.581
MNM72	520.211	664.709	0.098	51.006	0.634	539.394	679.568	0.101	52.438	0.366
MNM73	248.211	328.987	0.097	52.281	0.525	248.990	330.867	0.097	51.163	0.475
MNM74	232.297	282.404	0.097	52.040	0.591	230.480	275.050	0.096	51.404	0.409
MNM75	1208.950	1498.854	0.104	48.905	0.482	1119.005	1419.819	0.089	42.095	0.518
MNM76	1016.160	1291.711	0.148	47.279	0.451	918.237	1215.215	0.115	38.832	0.549
MNM77	345.425	425.057	0.140	45.750	0.437	309.050	390.591	0.120	40.361	0.563
MNB1	11.252	13.350	0.132	33.381	0.327	10.255	12.211	0.121	30.730	0.673
MNB2	1800.527	2294.030	0.201	14.468	0.530	1854.266	2397.061	0.206	14.532	0.470
MNB3	1184.733	1395.819	0.309	14.649	0.410	1181.495	1425.018	0.311	14.351	0.590
MNB4	2133.754	2483.608	0.268	14.531	0.471	2216.104	2553.795	0.275	14.469	0.529
MNB5	2693.055	4441.516	0.219	60.802	0.585	2778.108	4657.531	0.229	58.198	0.415
MNB6	8005.515	10095.838	0.185	36.845	0.482	8179.242	10276.213	0.192	37.266	0.518
MNB7	212.441	293.702	0.140	37.014	0.382	214.584	300.105	0.144	36.430	0.618
MNB8	608.821	803.342	0.107	33.573	0.579	647.740	841.267	0.114	35.427	0.421
MNB9	3712.954	4867.368	0.126	34.426	0.436	3689.046	4930.521	0.126	32.574	0.564
MNB10	479.084	558.915	0.200	40.184	0.574	489.490	571.901	0.204	40.816	0.426
MNB11	230.026	301.288	0.108	37.800	0.603	242.525	314.674	0.114	39.200	0.397
MNB12	3629.532	4577.484	0.192	37.562	0.431	3594.742	4555.820	0.195	36.549	0.569
MNB13	102.753	133.143	0.053	58.934	0.590	104.863	133.405	0.054	60.066	0.410
MNB14	2601.974	4131.053	0.204	60.493	0.560	2680.736	4326.847	0.213	58.507	0.440

MNB15	725.397	880.173	0.286	25.407	0.706	771.751	927.992	0.305	26.704	0.294
MNB16	162.213	196.915	0.193	27.297	0.510	164.660	202.531	0.195	26.814	0.490
MNB17	88.045	112.738	0.119	22.288	0.243	65.532	88.589	0.089	17.823	0.757
MNB18	6.679	8.109	0.129	33.317	0.418	6.295	7.735	0.122	30.794	0.582
MNB19	43.736	53.279	0.197	26.335	0.631	46.387	55.889	0.210	27.776	0.369
MNB20	1.454	1.771	0.224	26.640	0.459	1.381	1.739	0.214	25.471	0.541
MNB21	29.703	36.020	0.099	31.608	0.550	30.622	37.231	0.102	32.503	0.450
MNB22	27.631	32.172	0.109	32.582	0.449	26.871	31.211	0.106	31.529	0.551
MNB23	4.027	5.056	0.073	28.659	0.396	3.618	4.503	0.066	26.341	0.604
MNB24	9.130	10.639	0.055	30.894	0.257	7.304	8.693	0.042	24.106	0.743
MNB25	5.074	6.050	0.043	30.858	0.414	3.772	4.684	0.030	24.142	0.586
MNB26	13.191	16.332	0.058	29.084	0.277	11.694	14.474	0.051	25.916	0.723
MNB27	3.776	4.565	0.042	28.727	0.437	3.414	4.150	0.038	26.273	0.563
MNB28	16.093	18.144	0.068	33.683	0.262	11.840	14.139	0.046	21.317	0.738
MNB29	4.590	5.566	0.030	29.515	0.416	4.018	4.950	0.026	25.485	0.584
MNB30	9.545	11.573	0.033	28.738	0.392	8.639	10.640	0.030	26.262	0.608
MNB31	5.185	6.260	0.030	29.607	0.492	4.548	5.640	0.026	25.393	0.508
MNB32	12.571	14.633	0.041	30.260	0.291	10.623	12.555	0.034	24.740	0.709
MNB33	458.673	620.354	0.107	39.402	0.610	471.785	630.499	0.110	40.709	0.390
MNB34	197.926	245.910	0.107	36.641	0.698	212.471	259.603	0.115	39.470	0.302
MNB35	3038.303	3968.692	0.424	14.815	0.408	2878.291	3757.359	0.406	14.185	0.592
MNB36	1129.218	1424.508	0.159	37.088	0.583	1180.058	1501.344	0.168	37.023	0.417
MNB37	1201.641	1485.521	0.174	14.495	0.412	1190.756	1452.939	0.174	14.505	0.588
MNB38	287.810	327.472	0.277	16.106	0.228	266.325	307.452	0.253	14.005	0.772
MNB39	125792.086	169154.466	0.482	20.635	0.484	121374.672	169889.626	0.464	19.476	0.516
MNB40	775.146	1012.952	0.231	39.619	0.542	779.251	1019.456	0.233	39.381	0.458
MNB41	7.296	9.965	0.169	25.457	0.568	7.787	10.554	0.182	26.654	0.432
MNB42	1227.136	1503.987	0.089	17.713	0.526	1208.298	1461.110	0.087	17.287	0.474
MNB43	27.017	37.462	0.060	39.624	0.651	28.772	40.276	0.064	40.487	0.349
MNB44	269.426	330.416	0.146	34.948	0.477	267.411	331.697	0.141	34.052	0.523
MNB45	4.803	6.066	0.061	40.910	0.366	4.178	5.190	0.053	38.090	0.634
MNB46	1.661	2.315	0.207	44.439	0.440	1.632	2.260	0.205	44.561	0.560
MNB47	1.244	1.510	0.203	39.150	0.573	1.264	1.540	0.208	39.850	0.427
MNB48	3.390	4.188	0.156	39.910	0.506	3.381	4.203	0.157	39.090	0.494
MNB49	26693.177	31605.941	0.097	57.566	0.251	22735.440	27939.697	0.081	48.545	0.749
MNB50	7220.048	9134.441	0.209	31.349	0.505	7097.507	9046.982	0.204	30.763	0.495
MNB51	191.479	221.054	0.489	25.018	0.622	200.067	231.390	0.510	25.982	0.378
MNB52	572.025	761.119	0.105	39.502	0.575	606.257	792.958	0.112	41.498	0.425
MNB53	3.671	4.567	0.137	39.756	0.523	3.733	4.645	0.138	39.244	0.477
MNB54	98.826	130.711	0.143	39.592	0.660	107.556	142.103	0.155	41.408	0.340
MNB55	2.314	3.012	0.039	38.317	0.385	2.143	2.843	0.036	35.794	0.615
MNB56	4589.371	6156.958	0.126	32.941	0.272	4166.891	5971.520	0.114	29.170	0.728
MNB57	583.110	736.132	0.107	36.447	0.653	617.052	782.467	0.113	37.664	0.347
MNB58	1774.087	2131.339	0.168	28.006	0.322	1664.724	2028.544	0.159	26.105	0.678
MNB59	2065.915	2678.639	0.155	57.092	0.612	2211.402	2858.094	0.165	59.908	0.388
MNB60	3927.624	5235.157	0.245	54.580	0.462	3904.970	5207.659	0.249	54.420	0.538
MNB61	10486.288	15371.329	0.249	54.272	0.515	10820.778	15843.241	0.262	54.728	0.485
MNB62	467.522	641.240	0.167	40.489	0.446	479.005	655.370	0.173	40.511	0.554
MNB63	3335.155	4007.887	0.233	26.139	0.501	3364.296	3990.844	0.234	25.972	0.499
MNB64	206.331	262.475	0.209	30.504	0.566	216.961	271.817	0.222	31.607	0.434
MNB65	120.836	149.348	0.010	26.607	0.188	105.540	133.920	0.009	23.504	0.812
MNB66	2960.494	3671.465	0.387	29.444	0.533	2996.414	3693.743	0.398	29.556	0.467
MNB67	5593.208	6938.390	0.374	33.609	0.417	5493.138	6853.265	0.371	33.391	0.583
MNB68	47.139	56.424	0.135	38.486	0.700	49.995	59.669	0.143	40.514	0.300
MNB69	249.051	306.782	0.107	37.263	0.631	266.549	323.195	0.115	39.737	0.369
MNB70	340.640	417.259	0.217	42.063	0.509	349.943	424.353	0.224	42.048	0.491
MNB71	13.752	17.793	0.016	60.558	0.479	13.202	17.135	0.016	58.442	0.521
MNB72	11.812	14.441	0.152	19.081	0.297	10.469	13.289	0.135	17.030	0.703
MRI1	50.438	74.544	0.276	64.401	0.518	51.623	78.436	0.290	59.710	0.482
MRI2	259.374	344.731	0.056	28.163	0.221	222.117	314.063	0.048	23.948	0.779
MRI3	148.793	180.364	0.114	47.642	0.523	149.589	183.553	0.115	47.358	0.477
MRI4	2.513	3.306	0.442	42.517	0.468	2.471	3.315	0.436	42.483	0.532
MRI5	2.640	3.533	0.112	62.896	0.478	2.674	3.625	0.114	61.215	0.522
MRI6	6.785	8.427	0.149	60.938	0.629	7.235	9.102	0.157	63.174	0.371
MRI7	13.253	16.573	0.145	60.644	0.682	14.303	17.855	0.156	63.467	0.318
MRI8	36.141	46.264	0.128	60.971	0.641	38.856	49.858	0.138	63.140	0.359
MRI9	7.674	9.572	0.067	62.580	0.487	7.626	9.512	0.066	61.532	0.513
MRI10	6.738	8.125	0.065	62.017	0.532	6.775	8.075	0.065	62.094	0.468
MRI11	7.982	10.241	0.054	41.576	0.410	8.049	10.429	0.054	40.535	0.590
MRI12	0.198	0.244	0.280	40.834	0.601	0.203	0.251	0.288	41.277	0.399
MRI13	4.200	5.284	0.061	42.778	0.481	4.064	5.268	0.058	39.333	0.519
MRI14	1.690	2.407	0.140	41.366	0.532	1.771	2.531	0.149	40.745	0.468
MRI15	0.385	0.469	0.128	36.342	0.506	0.388	0.475	0.129	35.769	0.494
MRI16	46.159	60.450	0.104	40.872	0.533	47.237	62.897	0.107	41.239	0.467
MNI1	4.582	6.169	0.040	41.512	0.341	3.871	5.640	0.034	34.599	0.659
MNI2	8.866	13.783	0.097	15.368	0.351	8.753	14.431	0.098	13.632	0.649
MNI3	9.338	13.445	0.083	15.370	0.360	8.962	13.719	0.082	13.630	0.640

MNI4	8.200	10.627	0.085	14.859	0.493	8.037	10.586	0.084	14.141	0.507
MNI5	8.306	12.160	0.082	14.460	0.462	8.599	12.557	0.086	14.540	0.538
MNI6	39.835	45.536	0.035	14.410	0.642	40.505	46.030	0.036	14.590	0.358
MNI7	374.324	450.170	0.064	14.736	0.506	354.799	427.723	0.061	14.264	0.494
MNI8	153.879	198.366	0.056	14.950	0.500	150.186	201.738	0.055	14.050	0.500
MNI9	558.512	705.656	0.139	15.590	0.295	465.214	590.441	0.119	13.410	0.705
MNI10	4.194	5.417	0.039	14.301	0.459	4.343	5.512	0.040	14.699	0.541
MNI11	5.117	5.996	0.046	14.224	0.536	5.344	6.227	0.048	14.776	0.464
MNI12	2723.001	3147.878	0.039	14.172	0.569	2839.220	3258.244	0.041	14.828	0.431
MNI13	211.318	250.812	0.101	61.103	0.441	203.214	244.084	0.096	57.897	0.559
MNI14	263.468	307.263	0.101	60.901	0.357	252.815	297.468	0.097	58.099	0.643
MNI15	117.539	150.336	0.077	58.616	0.549	122.321	155.467	0.080	60.384	0.451
MNI16	559.447	667.998	0.111	64.481	0.440	537.619	668.046	0.106	59.630	0.560
MNI17	2006.928	3255.463	0.212	53.426	0.542	2045.937	3398.281	0.219	50.018	0.458
MNI18	2890.123	4329.795	0.213	29.561	0.623	3053.870	4535.312	0.227	30.550	0.377
MNI19	2691.368	3671.324	0.201	59.619	0.526	2725.554	3755.597	0.207	59.381	0.474
MNI20	205.204	244.126	0.517	28.148	0.464	204.282	240.120	0.526	28.852	0.536
MNI21	193.774	294.765	0.173	63.888	0.528	197.597	304.300	0.179	63.112	0.472
MNI22	425.113	577.420	0.160	16.596	0.555	451.748	608.100	0.172	17.515	0.445
MNI23	15.155	21.154	0.141	16.997	0.484	15.592	22.062	0.147	17.114	0.516
MNI24	41.403	50.157	0.087	51.313	0.515	42.294	51.461	0.089	50.798	0.485
MNI25	3.935	4.513	0.034	15.590	0.387	3.745	4.524	0.032	13.410	0.613
MNI26	6.860	8.835	0.054	14.856	0.395	6.533	8.414	0.052	14.144	0.605
MNI27	7.522	9.509	0.062	15.081	0.372	7.260	9.862	0.059	13.919	0.628
MNI28	6.440	8.505	0.054	14.970	0.398	6.493	8.764	0.055	14.030	0.602
MNI29	1431.025	1866.292	0.085	66.617	0.410	1384.666	1849.570	0.082	63.494	0.590
MNI30	942.925	1170.490	0.098	42.313	0.485	915.310	1126.398	0.095	41.798	0.515
MNI31	1533.499	1990.558	0.164	42.276	0.590	1599.876	2111.126	0.173	42.724	0.410
MNI32	303.510	405.817	0.593	49.458	0.397	288.902	394.241	0.564	46.653	0.603
MNI33	564.476	676.356	0.266	47.427	0.595	589.645	707.357	0.278	48.684	0.405
MNI34	322.330	404.399	0.251	40.885	0.578	347.750	436.163	0.271	43.226	0.422
MNI35	508.150	614.750	0.182	24.767	0.509	519.013	652.260	0.184	24.233	0.491
MNI36	222.320	282.879	0.208	40.620	0.586	240.880	303.415	0.224	43.491	0.414
MNI37	19549.990	23969.041	0.256	33.068	0.531	19662.821	23996.754	0.259	33.043	0.469
MNI38	36301.692	44477.247	0.294	43.710	0.542	36682.623	44760.287	0.299	43.290	0.458
MNI39	22.819	29.072	0.135	44.099	0.644	24.185	30.569	0.143	46.012	0.356
MNI40	922.496	1092.029	0.166	31.028	0.501	929.906	1110.788	0.168	31.083	0.499
MNI41	185.053	231.959	0.116	32.317	0.400	179.551	226.404	0.113	31.128	0.600
MNI42	126.952	158.920	0.054	31.442	0.599	135.399	171.509	0.058	32.669	0.401
MNI43	13.342	16.291	0.052	32.346	0.541	13.756	16.997	0.054	32.654	0.459
MNI44	109.582	142.089	0.067	32.635	0.558	102.821	131.557	0.064	31.476	0.442
MNI45	73.598	90.216	0.056	32.240	0.551	72.456	89.862	0.054	31.205	0.449
MNI46	1.189	1.555	0.064	31.999	0.509	1.147	1.472	0.062	31.445	0.491
MNI47	6.956	8.333	0.111	31.314	0.602	7.398	8.887	0.118	32.797	0.398
MNI48	0.364	0.497	0.051	32.261	0.628	0.350	0.467	0.050	31.850	0.372
MNI49	0.416	0.542	0.183	31.596	0.595	0.437	0.552	0.193	33.404	0.405
MNI50	0.219	0.273	0.122	30.277	0.372	0.208	0.263	0.117	28.723	0.628
MNI51	1.181	1.412	0.122	32.181	0.468	1.149	1.387	0.119	31.931	0.532
MNI52	4.186	5.476	0.112	31.237	0.546	4.314	5.584	0.116	32.208	0.454
MNI53	0.205	0.306	0.118	31.575	0.462	0.200	0.314	0.112	29.425	0.538
MNI54	1.384	1.656	0.065	32.029	0.622	1.420	1.708	0.067	32.082	0.378
MNI55	0.332	0.416	0.083	33.034	0.444	0.313	0.399	0.078	30.410	0.556
MNI56	0.403	0.513	0.200	32.262	0.537	0.416	0.524	0.207	32.738	0.463
MNI57	0.700	0.852	0.081	31.369	0.594	0.731	0.890	0.085	32.742	0.406
MNI58	0.370	0.517	0.203	31.604	0.475	0.379	0.524	0.213	32.507	0.525
MNI59	0.251	0.334	0.161	30.663	0.565	0.262	0.354	0.167	31.448	0.435
MNI60	1.167	1.663	0.120	31.857	0.682	1.238	1.780	0.128	32.254	0.318
MNI61	0.280	0.337	0.057	31.553	0.634	0.304	0.370	0.062	33.447	0.366
MNI62	3.580	4.600	0.043	33.155	0.468	3.440	4.605	0.042	30.956	0.532
MNI63	0.148	0.179	0.086	25.557	0.627	0.153	0.182	0.089	26.554	0.373
MNI64	0.273	0.373	0.164	31.597	0.542	0.274	0.374	0.167	32.514	0.458
MNI65	0.117	0.151	0.154	30.945	0.562	0.119	0.154	0.157	31.166	0.438
MNI66	0.057	0.073	0.065	31.974	0.607	0.059	0.075	0.068	33.026	0.393
MNI67	0.153	0.227	0.205	31.850	0.538	0.154	0.232	0.211	31.595	0.462
MNI68	0.395	0.508	0.046	31.520	0.551	0.423	0.534	0.050	33.480	0.449
MNI69	0.291	0.389	0.085	31.557	0.584	0.304	0.401	0.089	32.554	0.416
MNI70	110.579	160.703	0.068	32.099	0.568	113.087	164.670	0.070	32.012	0.432
MNI71	64.245	92.216	0.113	31.890	0.478	61.156	87.858	0.108	31.554	0.522
MNI72	17.351	23.611	0.203	31.708	0.543	18.141	24.370	0.213	32.403	0.457
MNI73	4.035	4.875	0.205	30.354	0.566	4.118	5.018	0.209	31.758	0.434
MNI74	5.617	7.075	0.030	32.919	0.371	5.356	6.902	0.029	31.192	0.629
MNI75	0.757	0.978	0.062	32.943	0.554	0.732	0.951	0.059	31.168	0.446
MNI76	22.676	27.230	0.170	33.746	0.325	20.235	25.003	0.151	30.366	0.675
MNI77	6.821	8.214	0.102	32.707	0.582	6.813	8.226	0.102	32.293	0.418
MNI78	7.798	9.178	0.076	31.502	0.583	7.992	9.414	0.079	32.609	0.417
MNI79	8.660	10.917	0.104	31.871	0.532	8.961	11.304	0.108	32.240	0.468
MNI80	3.923	5.063	0.077	32.371	0.523	3.967	5.111	0.077	32.629	0.477

MNI81	23.445	29.798	0.045	31.963	0.506	23.089	28.434	0.044	32.149	0.494
MNI82	5.202	6.720	0.177	32.436	0.419	5.334	6.937	0.184	32.564	0.581
MNI83	43.295	62.605	0.141	31.443	0.536	42.192	61.904	0.136	30.668	0.464
MNI84	33.389	48.731	0.084	31.659	0.552	34.993	50.382	0.088	32.453	0.448
MNI85	95.077	120.577	0.213	32.226	0.425	88.184	111.891	0.201	31.219	0.575
MNI86	20.588	25.446	0.057	31.537	0.626	22.046	26.983	0.061	33.463	0.374
MNI87	167.597	199.631	0.208	33.030	0.452	153.743	184.637	0.192	31.081	0.548
MNI88	9.739	12.223	0.185	33.795	0.342	8.847	11.312	0.167	31.205	0.658
MNI89	48.915	60.852	0.064	33.568	0.412	45.489	58.837	0.060	30.543	0.588
MNI90	21.606	27.036	0.112	32.902	0.473	21.381	26.729	0.111	32.098	0.527
MNI91	50.048	61.239	0.078	32.975	0.599	50.172	62.593	0.079	32.025	0.401
MNI92	29.022	37.119	0.074	32.393	0.520	29.594	37.060	0.076	32.607	0.480
MNI93	107.644	144.229	0.110	33.337	0.459	104.311	139.553	0.108	31.663	0.541
MNI94	37.450	52.002	0.031	32.298	0.587	38.878	55.224	0.033	31.813	0.413
MNI95	17.640	22.708	0.138	33.073	0.508	17.275	22.440	0.135	31.927	0.492
MNI96	45.981	56.476	0.070	33.744	0.347	43.892	55.309	0.067	31.256	0.653
MNI97	173.459	211.678	0.093	33.240	0.544	171.620	214.972	0.092	31.760	0.456
MNI98	37.492	53.229	0.098	33.279	0.461	37.432	53.507	0.099	32.832	0.539
MNI99	21.464	26.408	0.052	32.793	0.622	21.458	26.873	0.052	31.318	0.378
MNI100	0.659	0.806	0.036	30.388	0.559	0.662	0.802	0.036	30.612	0.441
MNI101	0.139	0.168	0.024	31.291	0.685	0.153	0.186	0.026	33.709	0.315
MNI102	1.244	1.485	0.079	33.200	0.338	1.053	1.312	0.065	27.800	0.662
MNI103	0.929	1.196	0.047	33.654	0.554	0.793	1.026	0.039	29.791	0.446
MNI104	1.026	1.256	0.089	35.164	0.409	0.853	1.101	0.070	28.947	0.591
MNI105	1.669	2.205	0.124	30.132	0.593	1.770	2.304	0.132	30.868	0.407
MNI106	0.132	0.164	0.056	32.142	0.419	0.131	0.162	0.056	31.303	0.581
MNI107	2.856	3.508	0.066	31.727	0.560	2.928	3.599	0.068	32.384	0.440
MNI108	0.973	1.162	0.085	32.464	0.479	0.955	1.130	0.084	31.648	0.521
MNI109	4.820	5.907	0.089	30.026	0.538	4.972	6.155	0.092	30.085	0.462
MNI110	0.162	0.201	0.206	31.671	0.480	0.165	0.210	0.209	31.774	0.520
MNI111	1.216	1.460	0.133	32.150	0.380	1.090	1.357	0.120	28.850	0.620
MNI112	3.772	5.263	0.376	32.716	0.442	3.627	5.226	0.373	31.395	0.558
MNI114	0.893	1.179	0.153	30.051	0.496	0.871	1.158	0.151	28.949	0.504
MNI115	1.297	1.662	0.128	31.488	0.558	1.352	1.741	0.133	31.957	0.442
MNI116	117.919	152.933	0.237	30.283	0.648	127.631	165.808	0.256	31.828	0.352
MNI117	43.173	51.493	0.099	31.139	0.393	41.585	49.885	0.095	29.861	0.607
MNI118	268.694	369.218	0.172	29.283	0.533	273.455	370.407	0.177	29.717	0.467
MNI119	1058.598	1296.246	0.160	27.991	0.696	1108.871	1355.295	0.167	29.009	0.304
MNI120	123.512	167.420	0.350	29.628	0.589	128.459	175.948	0.365	29.372	0.411
MNI121	178.219	241.972	0.299	29.996	0.486	175.835	243.486	0.294	29.004	0.514
MNI122	224.953	275.080	0.144	30.000	0.560	231.259	287.512	0.148	30.111	0.440
MNI123	2.076	2.844	0.107	31.117	0.474	2.073	2.845	0.107	30.994	0.526
MNI124	1.935	2.491	0.092	33.250	0.569	1.811	2.294	0.086	31.750	0.431
MNI125	1.668	2.208	0.111	30.725	0.567	1.679	2.226	0.112	30.275	0.433
MNI126	0.712	0.954	0.126	32.358	0.513	0.710	0.960	0.125	31.754	0.487
MNI127	1.082	1.588	0.101	30.545	0.405	1.031	1.549	0.096	28.455	0.595
MNI128	1.600	2.160	0.184	32.560	0.485	1.585	2.167	0.182	31.552	0.515
MNI129	5.124	7.028	0.184	31.394	0.570	5.308	7.215	0.194	32.717	0.430
MNI130	3.649	4.507	0.082	29.484	0.535	3.751	4.659	0.084	29.516	0.465
MNI131	18.521	23.486	0.213	32.385	0.600	18.791	24.210	0.218	31.726	0.400
MNI132	2.727	3.284	0.096	30.553	0.499	2.605	3.175	0.089	28.447	0.501
MNI133	6.313	7.688	0.183	32.276	0.591	6.421	7.839	0.187	31.835	0.409
MNI134	1.143	1.424	0.224	31.628	0.556	1.170	1.460	0.231	31.816	0.444
MNI135	389.737	466.010	0.061	33.288	0.334	357.806	428.507	0.056	30.823	0.666
MNI136	158.141	188.254	0.055	31.230	0.546	156.705	185.712	0.055	30.881	0.454
MNI137	252.563	322.883	0.071	32.654	0.408	236.674	302.941	0.066	30.791	0.592
MNI138	142.399	190.328	0.064	32.951	0.424	137.779	184.386	0.062	32.049	0.576
MNI139	1656.635	1978.758	0.071	32.659	0.418	1545.624	1854.225	0.066	30.785	0.582
MNI140	367.533	421.240	0.074	33.578	0.342	339.200	390.862	0.068	30.533	0.658
MNI141	196.713	237.247	0.136	31.311	0.421	194.312	234.946	0.135	30.800	0.579
MNI142	300.902	360.467	0.131	33.080	0.410	282.215	344.650	0.123	31.031	0.590
MNI143	35.401	43.985	0.117	32.019	0.442	34.917	44.395	0.115	30.092	0.558
MNI144	117.341	140.466	0.140	32.128	0.402	107.699	130.925	0.128	28.872	0.598
MNI145	37.354	44.590	0.157	33.271	0.314	33.707	40.753	0.141	30.174	0.686
MNI146	76.540	88.280	0.125	32.866	0.327	70.359	83.554	0.114	29.245	0.673
MNI147	32.009	39.562	0.110	34.245	0.363	28.963	36.491	0.093	29.200	0.637
MNI148	1079.159	1317.385	0.088	31.564	0.534	1039.143	1250.710	0.083	30.547	0.466
MNI149	1786.383	2232.848	0.089	30.707	0.484	1782.606	2222.329	0.088	30.293	0.516
MNI150	1048.628	1272.715	0.081	31.765	0.491	1050.298	1257.038	0.081	31.679	0.509
MNI151	1585.542	2039.491	0.063	32.476	0.449	1477.090	1966.413	0.059	29.635	0.551
MNI152	956.468	1274.196	0.141	34.990	0.359	830.070	1163.390	0.110	28.454	0.641
MNI153	148.949	173.175	0.175	31.215	0.635	157.636	179.796	0.184	32.896	0.365
MNI154	8.410	9.875	0.156	34.202	0.332	7.445	9.099	0.136	29.243	0.668
MNI155	55.358	67.210	0.173	31.804	0.427	53.077	64.665	0.167	30.307	0.573
MNI156	26.924	35.281	0.079	30.244	0.443	25.459	33.266	0.074	28.756	0.557
MNI157	155.264	182.049	0.175	30.177	0.570	154.782	178.200	0.176	30.823	0.430
MNI158	3580.964	4554.605	0.169	31.091	0.684	3889.087	4853.507	0.184	33.020	0.316

MNI159	79.237	98.393	0.116	33.220	0.458	75.757	96.919	0.107	30.224	0.542
MNI160	1573.728	1976.214	0.065	31.510	0.452	1543.020	1957.801	0.064	30.601	0.548
MNI161	3703.674	4585.569	0.105	31.333	0.437	3429.463	4350.817	0.095	27.667	0.563
MNI162	5586.968	7381.284	0.119	30.789	0.500	5633.833	7619.086	0.121	30.211	0.500
MNI163	0.163	0.200	0.032	44.556	0.395	0.157	0.198	0.031	42.444	0.605
MNI164	34.119	43.082	0.051	59.172	0.527	34.905	43.753	0.052	59.828	0.473
MNI165	119.912	155.453	0.056	56.835	0.578	122.007	155.463	0.057	58.165	0.422
MNI166	25.397	31.487	0.105	42.403	0.344	24.039	29.871	0.098	39.708	0.656
MNI167	92.416	112.377	0.123	31.540	0.562	94.407	114.518	0.126	32.572	0.438
MNI168	318.482	400.148	0.103	61.863	0.466	322.582	404.822	0.103	62.248	0.534
MRG1	10.182	15.055	0.105	65.352	0.363	9.793	15.395	0.103	58.759	0.637
MRG2	5.018	5.813	0.011	64.960	0.204	3.464	4.224	0.007	47.152	0.796
MRG3	222.182	329.938	0.061	65.543	0.310	211.658	331.962	0.058	58.568	0.690
MRG4	196.909	258.053	0.055	67.401	0.351	176.795	244.686	0.047	56.710	0.649
MRG5	0.013	0.016	0.007	60.514	0.241	0.011	0.014	0.006	51.597	0.759
MRG6	2.215	2.675	0.019	22.823	0.323	1.609	2.083	0.013	16.177	0.677
MRG7	2.522	3.322	0.020	23.189	0.306	1.930	2.844	0.015	15.811	0.694
MRG8	3.924	4.649	0.030	21.818	0.316	3.142	3.938	0.024	17.182	0.684
MRG9	1.421	1.589	0.011	23.249	0.145	0.955	1.126	0.008	15.751	0.855
MRG10	5.629	7.326	0.047	58.022	0.388	5.340	7.073	0.045	54.089	0.612
MRG11	3.144	3.654	0.024	22.284	0.283	2.217	2.660	0.017	16.716	0.717
MRG12	2.450	2.838	0.021	22.486	0.289	1.621	1.966	0.014	16.514	0.711
MRG13	7.107	8.804	0.053	47.653	0.353	6.495	8.355	0.047	41.347	0.647
MRG14	3.384	4.196	0.032	57.353	0.431	3.261	4.090	0.031	54.758	0.569
MRG15	7.766	10.915	0.070	59.243	0.354	7.460	10.917	0.068	52.868	0.646
MRG16	6.292	7.575	0.056	57.146	0.404	6.152	7.494	0.055	54.965	0.596
MRG17	8.508	12.192	0.078	58.874	0.363	8.148	12.403	0.075	50.126	0.637
MRG18	2.890	3.287	0.028	60.777	0.276	2.356	2.813	0.022	48.223	0.724
MRG19	7.162	8.979	0.062	54.732	0.553	7.489	9.165	0.065	57.379	0.447
MRG20	12.075	15.886	0.107	56.040	0.561	12.344	16.558	0.110	56.072	0.439
MRG21	10.902	13.114	0.083	56.919	0.498	10.932	13.441	0.083	55.192	0.502
MRG22	15.890	21.541	0.151	56.347	0.566	16.246	22.485	0.156	55.764	0.434
MRG23	7.496	9.627	0.061	43.534	0.623	7.966	10.061	0.065	45.466	0.377
MRG24	6.985	8.969	0.064	44.049	0.499	7.175	9.145	0.066	44.951	0.501
MRG25	13.594	16.871	0.062	35.462	0.422	11.160	14.484	0.047	28.649	0.578
MRG26	0.491	0.747	0.293	56.292	0.548	0.514	0.801	0.299	55.819	0.452
MRC1	10.018	11.480	0.011	66.217	0.135	6.949	8.777	0.008	45.895	0.865
MRC2	7.262	9.992	0.081	62.127	0.518	7.281	10.250	0.082	61.984	0.482
MRC3	10.812	16.162	0.112	65.782	0.365	10.490	16.641	0.111	58.329	0.635
MRC4	11.220	16.019	0.124	64.420	0.385	10.929	16.359	0.123	59.691	0.615
MRC5	11.002	15.238	0.122	64.125	0.399	10.703	15.505	0.120	59.986	0.601
MRC6	15.761	22.411	0.160	63.167	0.409	15.805	23.139	0.164	60.944	0.591
MRC7	15.975	18.835	0.097	23.606	0.425	15.045	17.787	0.090	21.394	0.575
MRC8	848.006	1006.378	0.656	22.487	0.608	903.137	1074.778	0.689	23.624	0.392
MRC9	3168.289	3741.571	0.025	63.617	0.077	2526.887	3219.894	0.019	48.494	0.923
MRC10	580.267	716.528	0.629	23.049	0.574	593.222	763.166	0.638	23.062	0.426
MRC11	2.250	2.709	0.019	22.797	0.327	1.720	2.210	0.015	16.203	0.673
MRC12	6.238	8.463	0.050	20.568	0.395	5.698	8.069	0.046	18.432	0.605
MRC13	8.314	11.372	0.077	20.159	0.391	7.804	11.015	0.073	18.841	0.609
MRC14	5.536	6.352	0.036	20.763	0.453	4.872	5.647	0.032	18.237	0.547
MRC15	5.114	6.597	0.038	20.514	0.498	4.448	5.791	0.033	18.486	0.502
MRC16	4.003	4.568	0.029	23.407	0.241	2.727	3.302	0.019	15.593	0.759
MRC17	2.440	2.782	0.022	20.700	0.244	1.927	2.265	0.017	15.411	0.756
MRC18	1.269	1.526	0.010	22.511	0.260	0.866	1.107	0.007	16.489	0.740
MRC19	1.411	1.631	0.012	22.495	0.277	1.074	1.318	0.009	16.505	0.723
MRC20	2.857	3.343	0.025	23.219	0.129	1.857	2.262	0.016	15.781	0.871
MRC21	3.077	3.634	0.027	22.583	0.122	2.099	2.548	0.018	16.417	0.878
MRC22	3.736	4.159	0.032	23.170	0.125	2.768	3.180	0.023	15.830	0.875
MRC23	3.724	4.230	0.035	23.087	0.092	2.533	2.893	0.024	15.913	0.908
MRC24	2.807	3.201	0.022	23.138	0.229	1.851	2.201	0.014	15.862	0.771
MRC25	2.514	3.364	0.024	21.030	0.457	1.997	2.739	0.019	17.970	0.543
MRC26	8.004	11.054	0.079	64.482	0.437	7.874	11.269	0.077	59.629	0.563
MRC27	2.353	2.823	0.011	62.940	0.222	1.737	2.219	0.008	49.171	0.778
MRC28	4.736	6.307	0.046	64.200	0.415	4.516	6.235	0.044	59.911	0.585
MRC29	2.944	3.585	0.029	61.776	0.467	2.949	3.585	0.029	62.335	0.533
MRC30	10.369	12.698	0.096	62.957	0.436	10.075	12.490	0.093	61.154	0.564
MRC31	61.157	71.946	0.018	73.766	0.122	44.029	57.379	0.013	50.345	0.878
MRC32	342.877	438.401	0.030	68.610	0.222	270.902	370.991	0.022	55.501	0.778
MRC33	2826.131	3115.904	0.025	67.713	0.019	2092.016	2509.518	0.017	44.398	0.981
MRC34	191.960	205.075	0.022	76.933	0.042	139.032	162.269	0.015	47.179	0.958
MRC35	40.926	45.678	0.019	72.922	0.096	29.950	36.309	0.013	51.189	0.904
MRC36	4.385	4.986	0.023	68.668	0.026	3.301	4.222	0.016	43.443	0.974
MRC37	2.954	3.922	0.032	69.359	0.102	2.442	3.536	0.025	54.752	0.898
MRC38	4.146	5.222	0.034	70.687	0.081	3.291	4.571	0.025	53.424	0.919
MRC39	43.666	57.562	0.243	61.636	0.557	45.121	59.155	0.251	62.476	0.443
MRC40	131.760	161.084	0.076	65.087	0.378	120.254	148.527	0.069	59.024	0.622
MRC41	3.365	4.279	0.102	64.987	0.369	3.043	3.941	0.089	59.124	0.631

MRC42	3.536	4.540	0.066	64.155	0.433	3.281	4.263	0.061	59.956	0.567
MRC43	2582.615	3242.346	0.028	63.646	0.124	1960.680	2737.253	0.020	48.465	0.876
MRC44	59.494	72.526	0.067	59.535	0.368	54.611	67.840	0.060	52.577	0.632
MNG1	0.501	0.681	0.129	15.301	0.727	0.550	0.737	0.141	16.810	0.273
MNG2	0.640	0.763	0.198	16.943	0.553	0.644	0.791	0.201	16.502	0.447
MNG3	1.668	2.103	0.076	19.092	0.233	1.287	1.569	0.057	15.908	0.767
MNG4	2.933	3.827	0.032	21.023	0.388	2.448	3.051	0.027	19.088	0.612
MNG5	4.924	6.193	0.056	21.234	0.297	4.020	4.879	0.045	18.877	0.703
MNG6	3.654	4.681	0.040	20.881	0.352	3.036	3.821	0.033	19.230	0.648
MNG7	8.787	13.171	0.081	21.328	0.434	8.657	13.341	0.081	20.784	0.566
MNG8	5.782	10.061	0.037	22.755	0.306	5.824	10.427	0.037	20.689	0.694
MNG9	6.915	8.246	0.047	24.290	0.203	5.127	5.888	0.035	19.154	0.797
MNG10	28.193	37.012	0.177	18.131	0.529	29.405	38.350	0.183	18.869	0.471
MNG11	127.351	160.036	0.106	57.055	0.471	126.394	160.006	0.104	55.056	0.529
MNG12	123.426	159.964	0.111	56.979	0.532	125.429	163.128	0.113	55.132	0.468
MNG13	11.812	15.257	0.094	57.586	0.450	11.656	15.569	0.093	54.525	0.550
MNG14	168.050	228.020	0.101	57.025	0.537	170.635	233.575	0.103	57.086	0.463
MNG15	8.757	11.758	0.091	17.662	0.403	8.487	11.519	0.090	16.450	0.597
MNG16	45.014	55.034	0.255	16.485	0.572	46.086	56.167	0.263	16.959	0.428
MNG17	7.874	10.956	0.068	21.200	0.398	7.746	10.634	0.068	20.911	0.602
MNG18	4.354	5.099	0.038	24.711	0.275	2.497	2.956	0.022	17.400	0.725
MNG19	0.236	0.324	0.084	14.477	0.567	0.246	0.335	0.088	14.523	0.433
MNG20	4.669	6.557	0.037	21.007	0.456	4.773	6.873	0.038	21.104	0.544
MNG21	176.676	202.812	0.205	21.664	0.262	161.247	191.121	0.187	19.336	0.738
MNG22	12.431	14.403	0.061	21.872	0.323	11.650	13.780	0.057	19.128	0.677
MNG23	15.444	20.262	0.093	22.834	0.430	13.601	18.494	0.083	20.610	0.570
MNG24	5.545	7.009	0.037	20.655	0.557	5.504	6.911	0.036	20.345	0.443
MNG25	20.894	29.054	0.102	20.533	0.604	21.405	29.420	0.103	20.467	0.396
MNG26	6.550	8.475	0.054	21.094	0.379	6.487	8.702	0.054	19.906	0.621
MNG27	4.462	5.298	0.035	22.890	0.287	3.846	4.723	0.030	19.221	0.713
MNG28	8.816	12.241	0.064	20.827	0.546	9.005	12.736	0.066	20.173	0.454
MNG29	4.974	6.132	0.011	17.463	0.295	4.532	5.711	0.010	15.981	0.705
MNG30	0.294	0.380	0.275	21.902	0.490	0.291	0.380	0.276	21.542	0.510
MNG31	268.385	331.584	0.125	17.358	0.537	270.322	330.122	0.124	16.753	0.463
MNG32	293.197	368.396	0.120	17.366	0.418	291.405	367.883	0.119	16.745	0.582
MNG33	4.356	5.361	0.033	65.755	0.382	4.078	5.152	0.030	58.356	0.618
MNG34	0.214	0.262	0.073	14.557	0.615	0.211	0.257	0.072	14.443	0.385
MNG35	4.805	5.854	0.049	54.019	0.436	4.301	5.371	0.042	46.092	0.564
MNG36	7.351	8.898	0.072	53.637	0.460	6.783	8.367	0.063	46.474	0.540
MNG37	8.436	10.863	0.082	50.254	0.451	8.600	11.247	0.083	49.857	0.549
MNG38	5.000	5.894	0.049	51.147	0.396	4.863	5.782	0.048	48.964	0.604
MNC1	10.400	15.189	0.085	46.264	0.410	10.100	15.394	0.084	42.736	0.590
MNC2	3.666	4.196	0.030	21.728	0.312	2.996	3.394	0.024	18.384	0.688
MNC3	2.734	3.896	0.032	20.847	0.496	2.133	2.916	0.025	19.264	0.504
MNC4	2.831	3.445	0.031	21.243	0.279	2.417	2.870	0.027	18.868	0.721
MNC5	3.860	4.904	0.046	21.387	0.414	3.036	3.859	0.037	18.724	0.586
MNC6	4.155	5.423	0.044	21.401	0.378	3.220	4.111	0.034	18.710	0.622
MNC7	4.412	5.734	0.047	20.323	0.348	3.828	5.085	0.041	18.677	0.652
MNC8	6.658	7.653	0.077	22.608	0.196	4.972	5.794	0.058	17.503	0.804
MNC9	5.221	6.389	0.063	21.615	0.307	4.161	5.123	0.050	18.496	0.693
MNC10	4.550	5.408	0.048	21.637	0.358	3.687	4.390	0.039	18.474	0.642
MNC11	4.697	6.168	0.054	20.979	0.425	3.746	4.799	0.043	19.132	0.575
MNC12	4.613	5.674	0.044	21.211	0.392	3.784	4.521	0.036	18.900	0.608
MNC13	4.047	4.776	0.040	20.332	0.390	3.941	4.654	0.039	19.779	0.610
MNC14	5.633	7.483	0.050	20.620	0.453	5.156	6.954	0.046	19.491	0.547
MNC15	4.770	6.221	0.058	20.712	0.359	3.991	5.013	0.048	19.399	0.641
MNC16	4.137	5.198	0.039	21.096	0.346	3.649	4.644	0.034	19.015	0.654
MNC17	4.020	5.171	0.050	21.902	0.304	2.762	3.672	0.035	18.209	0.696
MNC18	5.693	6.983	0.059	21.056	0.342	4.784	5.791	0.049	19.055	0.658
MNC19	418.017	535.425	0.097	21.679	0.362	403.443	534.042	0.093	20.432	0.638
MNC20	3.329	3.897	0.025	46.695	0.283	2.955	3.541	0.022	40.305	0.717
MNC21	19.508	22.856	0.055	28.100	0.206	15.622	18.776	0.043	22.012	0.794
MNC22	30.091	38.964	0.050	27.412	0.358	22.906	31.624	0.037	22.699	0.642
MNC23	0.393	0.495	0.093	25.314	0.518	0.393	0.488	0.092	24.797	0.482
MNC24	37.952	47.817	0.113	26.137	0.374	34.705	45.611	0.102	22.863	0.626
MNC25	6.850	8.018	0.048	46.272	0.427	6.532	7.827	0.046	42.728	0.573
MNC26	9.407	13.618	0.060	49.128	0.315	8.678	13.712	0.055	39.872	0.685
MNC27	5.536	6.790	0.039	47.475	0.315	4.971	6.346	0.034	41.525	0.685
MNC28	6.857	8.801	0.052	45.995	0.457	6.668	8.885	0.050	43.005	0.543
MNC29	3.641	4.462	0.031	45.865	0.452	3.438	4.254	0.029	43.135	0.548
MNC30	6.911	8.331	0.057	44.680	0.529	6.909	8.470	0.058	44.320	0.471
MNC31	5.182	6.200	0.039	65.224	0.398	4.933	6.022	0.037	58.888	0.602
MNC32	6.541	8.115	0.049	57.958	0.383	6.232	7.973	0.046	54.154	0.617
MNC33	4.877	5.857	0.038	64.579	0.365	4.587	5.632	0.035	59.532	0.635
MNC34	85.508	91.325	0.052	31.572	0.059	59.998	68.561	0.034	17.428	0.941
MNC35	0.643	0.839	0.255	25.573	0.407	0.596	0.790	0.233	23.427	0.593
MNC36	1.960	2.353	0.043	25.910	0.411	1.731	2.108	0.038	23.090	0.589

MNC37	15.217	21.611	0.277	25.155	0.468	14.933	21.050	0.259	23.845	0.532
MNC38	22.087	26.704	0.077	27.643	0.178	18.273	23.263	0.060	21.357	0.822
MNC39	2.008	2.413	0.020	56.774	0.170	1.440	1.836	0.014	43.337	0.830
MNC40	154.035	209.130	0.040	53.291	0.374	123.798	171.093	0.032	46.820	0.626
MNC41	461.843	514.312	0.006	59.127	0.209	314.143	374.281	0.004	40.984	0.791
MNC42	4.112	5.130	0.040	66.218	0.335	3.478	4.461	0.034	57.893	0.665
MNC43	493.171	539.764	0.006	59.577	0.156	358.338	420.753	0.004	40.534	0.844
MNC44	108.511	132.029	0.067	64.667	0.361	100.016	122.795	0.061	59.445	0.639
MNC45	0.266	0.330	0.048	34.050	0.423	0.242	0.308	0.043	30.061	0.577
MNC46	5.299	6.307	0.005	57.120	0.211	3.964	5.152	0.004	42.991	0.789
MNC47	599.511	700.660	0.019	57.694	0.227	463.652	585.276	0.014	42.417	0.773
MNC48	167.597	197.885	0.296	60.213	0.667	180.449	214.936	0.320	63.898	0.333
MND1	0.403	0.481	0.168	58.052	0.313	0.357	0.423	0.150	54.059	0.687
MND2	8.353	10.627	0.051	61.767	0.161	6.847	9.282	0.040	50.344	0.839
MND3	3.034	4.270	0.098	27.765	0.357	2.527	3.651	0.084	24.346	0.643
MND4	2.469	2.650	0.018	25.983	0.073	1.557	1.813	0.011	14.128	0.927
MND5	10835.316	12794.583	0.387	20.055	0.566	11141.219	13211.144	0.395	20.056	0.434
MND6	1.143	1.406	0.059	20.670	0.360	1.093	1.357	0.056	19.441	0.640
MND7	0.572	0.684	0.053	19.177	0.301	0.524	0.627	0.048	17.823	0.699
MND8	0.698	0.844	0.083	20.739	0.493	0.670	0.809	0.080	19.372	0.507
MND9	0.739	0.977	0.057	18.402	0.523	0.740	0.955	0.057	18.598	0.477
MND10	18.517	23.585	0.093	20.343	0.538	18.707	23.700	0.095	19.768	0.462
MND11	13.039	18.108	0.262	20.346	0.426	12.704	17.959	0.254	19.765	0.574
MND12	8.810	11.414	0.231	20.206	0.474	8.767	11.546	0.230	19.905	0.526
MND13	18.983	24.907	0.375	20.245	0.438	18.548	24.965	0.360	19.866	0.562
MND14	12.682	16.465	0.318	20.235	0.465	12.613	16.530	0.310	19.876	0.535
MND15	0.917	1.241	0.256	27.197	0.417	0.667	0.915	0.201	23.803	0.583
MND16	0.060	0.075	0.381	27.181	0.337	0.041	0.053	0.331	23.819	0.663
MND17	0.218	0.286	0.354	27.586	0.421	0.164	0.220	0.290	23.414	0.579
MND18	0.237	0.314	0.282	26.995	0.444	0.184	0.248	0.243	24.005	0.556
MND19	0.220	0.348	0.433	27.481	0.427	0.157	0.272	0.334	22.630	0.573
MND20	0.172	0.239	0.659	27.436	0.402	0.117	0.180	0.549	23.564	0.598
MND21	64.160	91.628	0.429	26.953	0.394	52.766	81.681	0.363	24.047	0.606
MND22	130.748	191.413	0.325	26.699	0.412	103.782	155.196	0.270	24.301	0.588
MND23	312.306	429.107	0.332	27.746	0.355	208.918	298.926	0.247	23.254	0.645
MND24	148.707	205.741	0.376	27.522	0.362	115.333	168.581	0.306	23.478	0.638
MND25	813.270	1023.388	0.171	25.546	0.558	818.574	1012.193	0.176	25.454	0.442
MND26	11.449	19.321	0.975	25.933	0.390	11.546	20.247	0.923	25.067	0.610
MND27	24794.312	33445.471	0.163	19.970	0.452	25069.710	33315.785	0.163	20.142	0.548
MND28	833.676	1227.880	0.009	40.427	0.302	719.108	1093.716	0.008	35.684	0.698
MND29	1028.121	1238.420	0.012	40.156	0.326	908.309	1095.674	0.011	35.956	0.674
MND30	293.387	340.266	0.087	27.246	0.283	266.382	310.612	0.079	24.865	0.717
MND31	866.244	1017.555	0.011	28.058	0.343	742.456	884.082	0.009	24.053	0.657
MND32	630.434	805.533	0.096	27.227	0.374	570.099	732.941	0.086	24.885	0.626
MND33	558.131	625.084	0.006	30.695	0.212	405.545	475.269	0.004	21.416	0.788
MND34	254.565	327.417	0.134	28.538	0.254	212.965	275.353	0.106	23.573	0.746
MND35	0.405	0.542	0.057	28.041	0.261	0.323	0.437	0.045	24.071	0.739
MND36	0.447	0.574	0.084	28.361	0.263	0.365	0.472	0.067	23.750	0.737
MND37	0.395	0.549	0.057	27.333	0.383	0.332	0.457	0.048	24.779	0.617
MND38	0.846	1.084	0.047	27.100	0.424	0.776	1.005	0.042	25.011	0.576
MND39	0.392	0.518	0.061	28.353	0.256	0.315	0.422	0.048	23.758	0.744
MND40	0.749	0.934	0.062	26.826	0.464	0.667	0.807	0.055	25.285	0.536
MND41	0.378	0.502	0.095	28.232	0.281	0.314	0.418	0.077	23.879	0.719
MND42	0.238	0.316	0.059	27.281	0.486	0.210	0.279	0.052	24.830	0.514
MND43	0.756	1.028	0.083	28.562	0.220	0.602	0.842	0.065	23.550	0.780
MND44	0.488	0.657	0.065	28.128	0.211	0.388	0.525	0.051	23.983	0.789
MND45	1.476	1.837	0.099	27.483	0.348	1.287	1.582	0.087	24.628	0.652
MND46	0.875	1.133	0.109	28.321	0.270	0.714	0.933	0.087	23.790	0.730
MND47	0.987	1.283	0.124	28.236	0.285	0.802	1.064	0.099	23.875	0.715
MND48	15.336	26.494	0.026	14.565	0.416	14.712	26.741	0.025	14.435	0.584
MND49	7.980	8.982	0.038	18.046	0.149	4.026	4.664	0.020	10.954	0.851
MND50	6.405	7.285	0.011	16.486	0.233	4.721	5.670	0.008	12.514	0.767
MND51	6.482	7.598	0.010	15.751	0.293	5.515	6.758	0.009	13.249	0.707
MND52	36.481	54.012	0.122	59.868	0.238	31.074	47.642	0.103	52.243	0.762
MND53	31.106	40.117	0.074	60.356	0.166	25.308	34.064	0.061	51.755	0.834
MND54	45.267	62.120	0.092	59.673	0.245	38.314	53.249	0.077	52.438	0.755
MND55	37.120	46.638	0.090	60.040	0.242	30.675	38.855	0.074	52.072	0.758
MND56	30.564	38.013	0.105	60.327	0.238	25.176	31.657	0.086	51.784	0.762
MND57	62.150	90.704	0.425	20.081	0.488	64.512	95.523	0.429	20.030	0.512
MND58	13142.590	17371.805	0.412	20.198	0.570	13514.841	18256.363	0.425	19.913	0.430
MND59	53.562	71.747	0.392	19.348	0.681	58.390	76.795	0.431	20.764	0.319
MND60	1862.023	2499.230	0.220	20.985	0.434	1805.502	2533.675	0.211	19.126	0.566
MND61	4.543	5.478	0.351	14.224	0.625	4.841	5.908	0.374	14.776	0.375
MND62	87.910	106.870	0.131	19.314	0.638	94.319	113.392	0.141	20.798	0.362
MND63	304.178	375.336	0.074	20.614	0.506	288.398	361.281	0.070	19.497	0.494
MND64	528.757	916.803	0.113	19.229	0.608	580.238	972.225	0.124	20.883	0.392
MND65	1461.081	1745.337	0.192	20.630	0.336	1341.825	1591.619	0.177	19.481	0.664

MND66	1031.488	1250.184	0.347	19.900	0.449	1056.120	1294.989	0.349	20.211	0.551
MND67	2657.049	3184.389	0.254	19.707	0.546	2773.324	3282.286	0.265	20.405	0.454
MND68	8958.984	10992.251	0.221	20.455	0.451	8943.202	11163.431	0.219	19.656	0.549
MND69	326.106	367.778	0.184	20.505	0.434	313.028	355.794	0.178	19.606	0.566
MND71	2832.844	3898.711	0.447	19.601	0.563	3030.651	4123.523	0.478	20.510	0.437
MND72	1935.202	2272.879	0.270	20.135	0.501	1949.955	2302.677	0.271	19.977	0.499
MND73	10.153	13.063	0.287	19.928	0.648	10.678	13.890	0.297	20.183	0.352
MND74	2.103	2.716	0.071	38.510	0.479	2.033	2.643	0.069	37.602	0.521
MND75	0.299	0.363	0.005	59.797	0.365	0.257	0.318	0.005	52.314	0.635
MND76	9.994	12.098	0.307	19.406	0.645	10.612	12.657	0.327	20.705	0.355
pBetter	0.29	0.33	0.30	0.21	0.30	0.71	0.67	0.70	0.79	0.70

APPENDIX C

Table 8.1 Accuracy Measures for all time series in M-Competition

	Simple Exponential Smoothing					Modified Simple Exponential Smoothing				
Series	MAE	rMSE	sMAPE	rARsAPE	pBetter	MAE	rMSE	sMAPE	rARsAPE	pBetter
YAF2	291402.01	319133.54	0.36	7.67	0.02	239082.11	261186.26	0.28	5.33	0.98
YAF3	101915.98	112792.10	0.20	7.24	0.17	79339.24	90405.06	0.15	5.76	0.83
YAF4	125140.23	130004.04	0.26	7.63	0.09	97453.62	103325.04	0.20	5.37	0.91
YAF5	97893.79	103732.92	0.24	7.43	0.19	82012.04	86894.17	0.19	5.57	0.82
YAF6	8277127.45	9138882.74	0.27	7.09	0.20	7452194.29	8294921.33	0.24	5.91	0.80
YAF7	4909.87	5216.84	0.25	7.61	0.04	3991.51	4303.40	0.20	5.39	0.96
YAF8	379390.93	387929.89	0.32	7.70	0.13	283846.06	295774.21	0.23	5.30	0.87
YAF9	255961.46	290634.61	0.28	7.83	0.11	199062.10	227310.02	0.21	5.17	0.89
YAF10	271384.78	287155.69	0.24	7.82	0.20	323351.46	337951.50	0.38	5.19	0.80
YAF11	3.74	4.24	0.07	6.74	0.37	3.28	3.80	0.06	6.26	0.63
YAF12	1326.37	1457.04	0.16	7.13	0.33	1092.33	1213.18	0.12	5.87	0.67
YAF13	672782.95	710930.00	0.31	7.87	0.00	561563.47	592366.12	0.25	5.13	1.00
YAF14	13380.45	15094.29	0.24	6.91	0.32	12208.91	13720.56	0.21	6.09	0.69
YAF15	111010.25	138220.19	0.15	6.93	0.32	96817.46	121546.71	0.13	6.07	0.69
YAF16	326.71	356.44	0.24	7.33	0.22	253.69	285.46	0.18	5.67	0.78
YAF17	0.45	0.47	0.05	7.78	0.11	0.28	0.31	0.03	5.22	0.89
YAM1	15460.27	18363.74	0.18	7.19	0.17	12142.28	15050.71	0.13	5.82	0.83
YAM2	215060.48	226771.18	0.27	7.80	0.04	167346.59	177941.70	0.20	5.20	0.96
YAM3	1736.82	1901.27	0.20	7.44	0.09	1331.21	1515.10	0.15	5.56	0.91
YAM4	2835.81	3751.26	0.19	6.61	0.56	2721.96	3761.24	0.18	6.39	0.44
YAM5	9.38	9.96	0.52	7.20	0.11	6.47	7.11	0.42	5.80	0.89
YAM6	0.03	0.03	0.01	7.72	0.13	0.02	0.02	0.01	5.28	0.87
YAM7	452.46	482.38	0.39	7.43	0.20	395.97	433.76	0.33	5.57	0.80
YAM8	14.86	15.10	0.25	8.04	0.11	10.15	10.57	0.18	4.96	0.89
YAM10	12.31	13.67	0.20	6.96	0.39	9.21	10.71	0.16	6.04	0.61
YAM11	1988186.30	2598622.05	0.10	6.44	0.56	1991270.30	2663023.61	0.10	6.56	0.44
YAM12	1374422.12	1802528.36	0.10	6.57	0.48	1376405.69	1842883.07	0.10	6.43	0.52
YAM13	1578.26	2260.95	0.44	6.35	0.67	1603.29	2297.60	0.44	6.65	0.33
YAM14	31.33	36.44	0.04	6.94	0.35	24.23	29.46	0.03	6.06	0.65
YAM15	53.37	59.93	0.07	6.41	0.57	54.00	60.70	0.07	6.59	0.43
YAM16	16.76	20.96	0.14	6.70	0.43	15.43	19.76	0.13	6.30	0.57
YAM17	32.15	38.26	0.15	6.93	0.39	28.69	35.15	0.13	6.07	0.61
YAM18	822.48	879.26	0.14	7.28	0.26	693.84	751.98	0.12	5.72	0.74
YAM19	14.46	20.12	0.12	6.82	0.33	12.53	18.52	0.10	6.19	0.67
YAM20	552.46	638.43	0.06	6.63	0.54	523.92	605.82	0.06	6.37	0.46
YAM21	26.34	29.63	0.11	7.15	0.17	22.35	25.57	0.10	5.85	0.83
YAM22	10.64	12.53	0.10	6.78	0.37	9.43	11.13	0.09	6.22	0.63
YAM23	1392.35	1439.38	0.12	7.82	0.07	917.73	985.14	0.07	5.19	0.93
YAM24	1702.59	1830.29	0.17	7.26	0.33	1457.75	1580.98	0.14	5.74	0.67
YAM25	1340.23	1584.83	0.11	6.98	0.35	1207.26	1461.77	0.10	6.02	0.65
YAM26	5162.50	5567.45	0.18	7.04	0.35	4829.19	5187.68	0.16	5.96	0.65
YAM27	237.81	254.71	0.32	7.93	0.02	187.24	199.62	0.24	5.07	0.98
YAM28	333.91	360.13	0.23	7.52	0.19	260.49	287.52	0.17	5.48	0.82
YAM29	400.68	472.14	0.05	6.44	0.48	405.31	476.41	0.06	6.56	0.52
YAM30	15077.32	16668.49	0.20	7.22	0.19	12923.53	14409.40	0.17	5.78	0.82
YAB1	16450.62	18440.10	0.36	7.61	0.07	13635.83	15189.01	0.28	5.39	0.93
YAB2	16356.75	18238.15	0.65	7.44	0.00	13781.05	15623.24	0.54	5.56	1.00
YAB3	142110.50	162515.52	0.24	7.20	0.26	111923.74	130890.94	0.18	5.80	0.74
YAB4	9719.45	13606.93	0.13	6.89	0.30	7651.63	11971.87	0.10	6.11	0.70
YAB5	1450.53	1650.83	0.14	6.91	0.41	1272.50	1484.36	0.12	6.09	0.59
YAB6	148.12	193.06	0.18	6.54	0.57	139.45	184.23	0.17	6.46	0.43
YAB7	131969.43	145398.38	0.18	7.00	0.33	121020.97	134354.33	0.16	6.00	0.67
YAB8	16251.22	18789.88	0.11	6.39	0.50	16698.48	18741.04	0.12	6.61	0.50
YAB9	77702.07	82212.73	0.32	7.11	0.32	65845.82	69758.55	0.26	5.89	0.69
YAB10	2965.08	3327.06	0.08	7.06	0.44	1688.86	2086.53	0.04	5.94	0.56
YAB11	23341.97	28991.14	0.17	6.85	0.43	21809.39	28561.70	0.16	6.15	0.57
YAB12	1340.17	1581.57	0.05	6.44	0.57	1323.01	1573.80	0.05	6.56	0.43
YAI1	215.66	226.95	0.18	7.65	0.11	150.45	165.65	0.12	5.35	0.89
YAI2	7869.99	9450.50	0.24	6.37	0.61	7941.37	9603.65	0.25	6.63	0.39
YAI3	288.78	336.34	0.51	6.67	0.32	291.77	334.37	0.51	6.33	0.69
YAI4	523.92	712.09	0.32	6.52	0.52	512.66	716.18	0.31	6.48	0.48
YAI5	124.40	162.68	0.21	6.43	0.63	123.87	164.29	0.21	6.57	0.37

YAI6	270231.97	275415.23	0.14	8.15	0.00	208948.42	213978.82	0.10	4.85	1.00
YAI7	3282506.65	3408598.63	0.14	8.07	0.06	2637140.16	2753263.76	0.11	4.93	0.94
YAI8	1402.16	1522.63	0.15	7.26	0.20	1090.98	1248.97	0.11	5.74	0.80
YAI9	122.43	127.96	0.32	8.22	0.13	89.46	92.73	0.22	4.78	0.87
YAI10	27611.20	27768.43	0.12	8.44	0.11	19735.66	19818.25	0.08	4.56	0.89
YAI11	125.14	131.66	0.18	7.52	0.13	93.51	103.09	0.13	5.48	0.87
YAI12	278.85	324.67	0.19	7.07	0.32	209.85	263.05	0.13	5.93	0.69
YAI13	227.85	238.59	0.25	7.80	0.13	160.16	172.99	0.17	5.20	0.87
YAI14	660.48	691.89	0.49	7.96	0.11	518.80	534.74	0.37	5.04	0.89
YAI15	42.63	48.68	0.18	6.67	0.48	38.84	44.59	0.16	6.33	0.52
YAI16	25.67	27.32	0.18	7.67	0.11	18.07	20.15	0.12	5.33	0.89
YAI17	179.18	220.34	0.15	7.02	0.35	128.89	179.88	0.10	5.98	0.65
YAI18	19.94	20.95	0.23	7.69	0.11	14.98	15.99	0.18	5.32	0.89
YAI19	63.41	80.57	0.52	7.09	0.22	51.84	67.43	0.43	5.91	0.78
YAI20	2.97	3.28	0.33	7.06	0.13	2.39	2.63	0.28	5.94	0.87
YAI21	333.91	360.13	0.23	7.52	0.19	260.49	287.52	0.17	5.48	0.82
YAI22	1589.62	1761.45	0.30	7.26	0.15	1344.98	1529.32	0.25	5.74	0.85
YAI23	2.05	2.67	0.09	6.57	0.43	1.98	2.61	0.09	6.43	0.57
YAI24	38546.81	43268.80	0.23	7.54	0.06	32083.66	36401.97	0.19	5.46	0.94
YAI25	7.77	8.74	0.15	6.33	0.61	8.17	9.12	0.16	6.67	0.39
YAI26	193.95	234.65	0.23	6.74	0.44	180.57	221.11	0.22	6.26	0.56
YAI27	1038.39	1123.70	0.26	7.04	0.37	904.74	986.83	0.21	5.96	0.63
YAI28	27.35	30.13	0.08	7.09	0.35	18.99	22.69	0.05	5.91	0.65
YAI29	26.34	31.61	0.17	7.06	0.30	21.37	26.61	0.13	5.94	0.70
YAI30	2.13	2.45	0.14	6.98	0.33	1.69	1.96	0.11	6.02	0.67
YAI31	0.72	0.90	0.10	6.87	0.41	0.59	0.76	0.08	6.13	0.59
YAI32	0.63	0.78	0.05	6.54	0.50	0.63	0.77	0.05	6.46	0.50
YAI33	0.55	0.72	0.07	6.61	0.54	0.53	0.71	0.07	6.39	0.46
YAI34	0.62	0.69	0.16	7.80	0.11	0.42	0.51	0.11	5.20	0.89
YAI35	0.29	0.34	0.09	6.44	0.56	0.29	0.34	0.09	6.56	0.44
YAG1	36.51	36.62	0.14	8.15	0.11	25.76	25.99	0.10	4.85	0.89
YAG2	4.48	4.58	0.08	8.22	0.11	3.17	3.23	0.06	4.78	0.89
YAG3	21.78	21.96	0.22	8.09	0.11	15.36	15.60	0.15	4.91	0.89
YAG4	1.82	2.34	0.21	6.61	0.61	1.81	2.39	0.21	6.39	0.39
YAG5	16.30	16.50	0.13	7.98	0.11	11.60	11.92	0.09	5.02	0.89
YAG6	30.55	32.64	0.23	7.96	0.15	23.44	25.20	0.17	5.04	0.85
YAG7	8.11	9.64	0.07	7.19	0.15	7.00	8.57	0.06	5.82	0.85
YAG8	36.23	36.74	0.17	7.85	0.00	30.25	30.71	0.14	5.15	1.00
YAG9	17.15	17.28	0.13	8.06	0.02	14.26	14.39	0.11	4.94	0.98
YAG10	11.22	11.24	0.12	8.43	0.11	8.27	8.33	0.08	4.57	0.89
YAG11	68082.06	69572.15	0.17	8.28	0.11	49600.46	50206.99	0.12	4.72	0.89
YAG12	27500.44	29616.91	0.21	7.89	0.11	20672.81	22142.98	0.15	5.11	0.89
YAG13	19436.08	19966.41	0.18	8.00	0.11	14312.95	14665.19	0.13	5.00	0.89
YAG14	2486.82	3170.61	0.33	6.37	0.52	2581.53	3160.13	0.34	6.63	0.48
YAG15	7462.64	7637.63	0.20	8.20	0.11	5524.69	5614.10	0.15	4.80	0.89
YAG16	94525.77	97348.99	0.17	8.17	0.11	69860.31	71170.20	0.13	4.83	0.89
YAG17	6.77	7.65	0.15	7.15	0.24	5.29	6.21	0.11	5.85	0.76
YAG18	228.27	249.52	0.29	7.82	0.13	173.83	189.04	0.21	5.19	0.87
YAG19	240.78	267.79	0.30	7.67	0.13	185.36	207.51	0.22	5.33	0.87
YAG20	49.49	49.64	0.06	8.19	0.00	38.81	39.28	0.04	4.82	1.00
YAG21	1.03	1.04	0.16	8.06	0.11	0.77	0.78	0.12	4.94	0.89
YAG22	1.33	1.36	0.12	8.00	0.11	0.95	0.97	0.09	5.00	0.89
YAG23	18.84	19.52	0.14	7.83	0.11	13.12	13.91	0.09	5.17	0.89
YAG24	10.02	10.16	0.15	8.19	0.11	7.25	7.31	0.10	4.82	0.89
YAG25	3.32	3.36	0.14	8.20	0.11	2.43	2.46	0.10	4.80	0.89
YAG26	1.46	1.49	0.12	7.83	0.11	1.06	1.10	0.09	5.17	0.89
YAG27	1.24	1.25	0.18	8.19	0.11	0.92	0.93	0.13	4.82	0.89
YAG28	0.97	1.01	0.12	7.80	0.11	0.70	0.74	0.09	5.20	0.89
YAG29	1.05	1.05	0.13	8.07	0.11	0.76	0.77	0.09	4.93	0.89
YAG30	0.77	0.79	0.16	8.07	0.11	0.58	0.59	0.12	4.93	0.89
YAC1	7.66	7.67	0.10	8.43	0.11	5.26	5.30	0.07	4.57	0.89
YAC2	3.94	4.12	0.13	7.65	0.11	2.70	3.01	0.09	5.35	0.89
YAC3	3.06	3.06	0.16	8.41	0.11	2.12	2.13	0.11	4.59	0.89
YAC4	5.93	6.02	0.24	7.72	0.11	4.11	4.31	0.16	5.28	0.89
YAC5	15.87	15.99	0.15	8.52	0.11	11.52	11.54	0.10	4.48	0.89
YAC6	0.79	0.94	0.04	6.70	0.43	0.73	0.85	0.04	6.30	0.57
YAC7	4.18	4.23	0.12	7.85	0.11	3.03	3.12	0.08	5.15	0.89
YAC8	6.91	7.04	0.23	8.20	0.11	4.99	5.09	0.16	4.80	0.89
YAC9	8.92	9.01	0.21	8.04	0.11	6.23	6.35	0.14	4.96	0.89
YAC10	9085.83	9424.74	0.11	7.82	0.11	6759.43	6985.75	0.08	5.19	0.89
YAC11	6352.04	6656.06	0.17	8.00	0.11	4821.57	4990.19	0.12	5.00	0.89
YAC12	10067.22	10149.15	0.17	8.65	0.11	7071.16	7097.74	0.12	4.35	0.89

YAC13	9445.82	9833.28	0.19	7.93	0.11	7134.73	7495.17	0.14	5.07	0.89
YAC14	9197.89	11655.46	0.15	7.15	0.19	7103.03	9357.13	0.11	5.85	0.82
YAC15	17981.20	18454.97	0.26	8.59	0.11	13371.35	13535.67	0.19	4.41	0.89
YAC16	2400.58	2920.43	0.09	6.89	0.33	2045.85	2583.61	0.07	6.11	0.67
YAC17	9752.95	10180.25	0.23	7.85	0.11	7380.26	7672.81	0.17	5.15	0.89
YAC18	7.70	7.73	0.13	8.35	0.11	5.35	5.37	0.09	4.65	0.89
YAC19	3238941.45	3477943.18	0.10	7.61	0.09	2439100.45	2676360.08	0.08	5.39	0.91
YAC20	571.43	574.34	0.11	8.41	0.11	377.44	380.06	0.07	4.59	0.89
YAC21	265.63	269.60	0.12	7.93	0.11	182.66	188.21	0.08	5.07	0.89
YAC22	522.38	526.73	0.22	8.32	0.11	377.49	378.47	0.16	4.69	0.89
YAC23	327.63	341.35	0.17	7.61	0.15	224.61	245.06	0.11	5.39	0.85
YAC24	243.15	250.55	0.12	8.11	0.11	171.92	178.05	0.09	4.89	0.89
YAC25	864.05	922.18	0.22	7.93	0.11	630.49	681.14	0.16	5.07	0.89
YAC26	262.94	274.59	0.23	7.94	0.11	193.61	205.68	0.17	5.06	0.89
YAC27	388.50	404.99	0.22	7.94	0.11	270.60	287.36	0.15	5.06	0.89
YAC28	556.23	573.22	0.20	7.87	0.15	396.24	408.02	0.14	5.13	0.85
YAC29	154.91	161.13	0.07	7.63	0.15	97.89	108.12	0.05	5.37	0.85
YAD1	63.18	70.67	0.31	7.37	0.17	51.34	58.27	0.24	5.63	0.83
YAD2	635.76	700.43	0.02	7.52	0.00	521.56	591.32	0.01	5.48	1.00
YAD3	6.06	7.77	0.02	6.70	0.43	5.27	7.12	0.02	6.30	0.57
YAD4	272.63	307.88	0.20	6.78	0.33	318.44	363.26	0.36	6.22	0.67
YAD5	10.57	13.20	0.02	6.69	0.39	9.78	12.67	0.02	6.32	0.61
YAD6	26.55	34.79	0.06	6.39	0.63	27.01	35.24	0.06	6.61	0.37
YAD7	25.01	34.27	0.06	6.28	0.67	25.57	34.84	0.06	6.72	0.33
YAD8	51.21	68.57	0.06	6.30	0.65	52.22	69.62	0.06	6.70	0.35
YAD9	17.44	21.68	0.02	6.74	0.37	16.07	20.68	0.02	6.26	0.63
YAD10	20.43	25.56	0.02	6.74	0.37	18.83	24.45	0.02	6.26	0.63
YAD11	1314.95	1612.21	0.24	7.06	0.28	1154.09	1438.11	0.21	5.94	0.72
YAD12	0.69	0.75	0.02	7.43	0.22	0.44	0.54	0.01	5.57	0.78
YAD13	0.51	0.56	0.01	6.20	0.56	0.54	0.59	0.01	6.80	0.44
YAD14	578.72	775.65	0.29	6.44	0.56	583.58	768.72	0.30	6.56	0.44
YAD15	1.90	1.98	0.09	7.48	0.20	3.53	3.58	0.29	5.52	0.80
YAD16	0.10	0.11	0.01	5.59	0.67	1.14	1.15	0.23	7.41	0.33
YAD17	44729.02	49478.94	0.10	7.20	0.24	41811.63	46056.46	0.09	5.80	0.76
YAD18	0.41	0.51	0.15	6.80	0.37	0.40	0.49	0.15	6.20	0.63
YAD19	146338.83	153376.97	0.08	7.72	0.13	122535.06	126320.92	0.07	5.28	0.87
YAD20	155.07	156.14	0.20	8.00	0.13	115.65	116.63	0.15	5.00	0.87
YAD21	425.00	438.89	0.02	7.59	0.17	267.01	296.23	0.01	5.41	0.83
YAD22	24.62	26.48	0.05	7.32	0.22	19.57	22.05	0.04	5.69	0.78
YAD23	23.42	25.07	0.05	7.41	0.20	18.57	20.76	0.04	5.59	0.80
YAD24	6885.81	8290.06	0.02	6.96	0.39	5532.55	7158.25	0.02	6.04	0.61
YAD25	391.75	403.60	0.01	7.67	0.15	254.20	279.11	0.01	5.33	0.85
YAD26	7742.90	9109.07	0.02	7.32	0.26	5494.54	7210.67	0.02	5.69	0.74
YAD27	978.89	1051.93	0.10	7.56	0.11	732.64	791.52	0.08	5.44	0.89
YAD28	780.88	811.44	0.11	7.54	0.11	595.07	620.08	0.09	5.46	0.89
YAD29	0.71	0.85	0.01	6.57	0.46	0.70	0.84	0.01	6.43	0.54
YAD30	259.87	297.01	0.19	6.94	0.37	223.81	267.90	0.16	6.06	0.63
QRF1	1.15	1.37	0.50	8.56	0.42	1.12	1.35	0.49	8.44	0.58
QRF2	25.79	32.05	0.18	9.07	0.11	23.93	29.58	0.16	7.93	0.89
QRM1	64.79	72.68	0.27	8.54	0.49	64.31	73.04	0.26	8.46	0.51
QNF1	5801.30	6443.57	0.16	8.43	0.53	5865.17	6494.46	0.16	8.57	0.47
QNF2	47048.92	52357.38	0.07	9.11	0.26	40709.18	46147.06	0.06	7.89	0.74
QNF3	60.84	67.78	0.10	8.79	0.40	56.86	62.38	0.09	8.21	0.60
QNM1	12.11	14.76	0.37	8.08	0.63	12.61	15.14	0.39	8.92	0.38
QNM2	14.24	17.96	0.09	8.78	0.43	13.58	17.56	0.08	8.22	0.57
QNM3	866.07	1091.77	0.34	8.40	0.54	886.85	1114.03	0.34	8.60	0.46
QNM4	2057.85	2236.59	0.17	8.60	0.36	2062.20	2199.82	0.17	8.40	0.64
QNM5	13.68	17.25	0.09	8.78	0.43	13.04	16.87	0.08	8.22	0.57
QNM6	50.02	58.67	0.17	8.56	0.51	49.69	59.55	0.17	8.44	0.49
QNM7	98.51	110.08	0.16	9.06	0.17	91.99	102.07	0.15	7.94	0.83
QNM8	1940.79	2224.25	0.07	8.58	0.50	1889.71	2159.44	0.07	8.42	0.50
QNM9	9984.59	11734.49	0.08	8.33	0.71	9908.72	11662.58	0.08	8.67	0.29
QNM10	6318.17	7295.37	0.24	8.38	0.54	6517.55	7440.28	0.25	8.63	0.46
QNM11	35340.44	39263.79	0.06	9.33	0.21	30358.43	34431.42	0.05	7.67	0.79
QNM12	10203.06	12993.36	0.08	8.71	0.42	9867.98	12810.46	0.07	8.29	0.58
QNM13	6340.00	7045.94	0.24	8.53	0.46	6411.98	7157.89	0.25	8.47	0.54
QNM14	60836.77	67774.20	0.10	8.78	0.40	56863.16	62378.07	0.09	8.22	0.60
QNM15	3183.74	3906.60	0.03	9.03	0.33	2961.05	3628.74	0.02	7.97	0.67
QNM16	6769.54	8757.69	0.05	8.83	0.33	6510.84	8647.93	0.05	8.17	0.67
QNM17	14.96	17.86	0.05	8.92	0.44	12.56	15.86	0.04	8.08	0.56
QNM18	192.22	240.67	0.18	8.46	0.60	187.70	235.63	0.18	8.54	0.40
QNM19	198.50	246.35	0.16	8.31	0.68	201.72	249.47	0.16	8.69	0.32

QNM20	198.46	246.32	0.16	8.31	0.68	201.72	249.46	0.16	8.69	0.32
QNB1	35.16	39.45	0.13	8.43	0.51	35.34	39.69	0.13	8.57	0.49
QNB2	5.75	6.91	0.58	8.44	0.61	5.64	6.84	0.58	8.56	0.39
QNB3	11314.97	13874.08	0.15	8.47	0.58	11398.89	14191.69	0.15	8.53	0.42
QNB4	210.68	256.32	0.28	7.97	0.86	218.87	262.19	0.29	9.03	0.14
QNB5	68.44	78.09	0.22	8.47	0.57	68.37	78.24	0.22	8.53	0.43
QNB6	53.27	61.85	0.12	8.49	0.51	53.79	62.98	0.12	8.51	0.49
QNB7	27357.60	32965.72	0.27	8.38	0.63	27766.62	33657.84	0.27	8.63	0.38
QNB8	18.89	23.26	0.02	8.65	0.38	17.95	22.16	0.02	8.35	0.63
QNB10	636.07	843.58	0.60	9.10	0.19	595.80	783.60	0.57	7.90	0.81
QNB11	1920.62	2041.09	0.08	9.47	0.24	1663.64	1779.18	0.07	7.53	0.76
QNB12	55.90	76.16	0.17	8.71	0.36	53.13	73.36	0.16	8.29	0.64
QNB13	9739.01	11602.04	0.37	9.04	0.31	8489.94	10533.91	0.33	7.96	0.69
QNB14	1875.70	2223.53	0.25	8.65	0.44	1806.78	2212.75	0.24	8.35	0.56
QNB15	17986.64	19944.08	0.10	8.63	0.46	16890.86	18396.69	0.09	8.38	0.54
QNB16	2705.37	3317.37	0.17	8.36	0.65	2757.02	3372.26	0.18	8.64	0.35
QNB17	3045.27	3531.00	0.33	8.82	0.26	2829.90	3328.52	0.31	8.18	0.74
QRI1	228.39	256.18	0.11	8.38	0.53	227.88	253.70	0.11	8.63	0.47
QRI2	9.73	11.35	0.08	8.56	0.38	9.79	11.31	0.08	8.44	0.63
QRI3	7.82	9.16	0.10	8.72	0.42	7.31	8.63	0.09	8.28	0.58
QRI4	0.17	0.19	0.09	9.71	0.07	0.13	0.15	0.06	7.29	0.93
QRI5	9.21	10.12	0.09	7.99	0.86	9.40	10.32	0.10	9.01	0.14
QNI1	17.28	19.92	0.16	8.61	0.46	17.27	20.21	0.16	8.39	0.54
QNI2	15.72	19.38	0.13	8.89	0.49	14.31	18.29	0.12	8.11	0.51
QNI3	3.91	4.47	0.19	8.42	0.56	3.93	4.55	0.19	8.58	0.44
QNI4	16.00	19.77	0.09	8.54	0.47	15.79	19.87	0.09	8.46	0.53
QNI5	2.25	3.10	0.10	8.60	0.51	2.27	3.16	0.11	8.40	0.49
QNI6	3.82	4.60	0.10	8.60	0.51	3.54	4.34	0.09	8.40	0.49
QNI7	6.17	7.17	0.09	8.36	0.64	6.09	7.09	0.09	8.64	0.36
QNI8	13.47	15.78	0.11	8.53	0.56	12.52	14.75	0.11	8.47	0.44
QNI9	73.79	94.05	0.08	8.56	0.50	69.41	90.76	0.08	8.44	0.50
QNI10	6.74	9.14	0.06	8.69	0.46	6.68	9.06	0.06	8.31	0.54
QNI11	268.82	298.66	0.06	9.33	0.21	230.92	261.91	0.05	7.67	0.79
QNI12	96.06	107.72	0.12	8.53	0.49	95.77	108.31	0.12	8.47	0.51
QNI13	6769.32	8758.67	0.05	8.83	0.33	6510.43	8648.98	0.05	8.17	0.67
QNG1	82.68	87.78	0.28	9.56	0.00	71.05	76.96	0.24	7.44	1.00
QNG2	4.08	4.46	0.04	8.78	0.33	4.03	4.36	0.04	8.22	0.67
QNG3	4.80	5.35	0.05	8.69	0.35	4.67	5.22	0.05	8.31	0.65
QNG4	0.48	0.54	0.03	9.07	0.26	0.44	0.52	0.03	7.93	0.74
QNG5	3.94	4.60	0.03	8.83	0.33	3.74	4.33	0.03	8.17	0.67
QNG6	3.87	4.52	0.02	9.14	0.36	3.12	3.68	0.02	7.86	0.64
QNG7	2.96	3.43	0.04	8.86	0.35	2.59	3.11	0.03	8.14	0.65
QNG8	17.22	17.49	0.09	10.86	0.11	11.17	11.34	0.06	6.14	0.89
QNG9	1.46	1.87	0.05	8.36	0.58	1.54	2.00	0.05	8.64	0.42
QNG10	6.13	8.28	0.09	8.31	0.51	6.56	8.69	0.10	8.69	0.49
QNG11	3.84	4.66	0.04	8.86	0.39	3.49	4.34	0.04	8.14	0.61
QNG12	4.71	5.58	0.03	8.85	0.32	4.04	4.99	0.02	8.15	0.68
QNG13	5.77	5.79	0.05	10.49	0.15	3.60	3.75	0.03	6.51	0.85
QNG14	5.69	5.71	0.04	10.60	0.15	3.55	3.68	0.03	6.40	0.85
QNG15	6.70	6.75	0.05	10.50	0.18	4.08	4.30	0.03	6.50	0.82
QNG16	6.28	6.30	0.05	10.78	0.15	3.94	4.07	0.03	6.22	0.85
QNG17	91.48	92.98	0.07	10.54	0.14	64.61	65.99	0.05	6.46	0.86
QNG18	329.90	365.06	0.03	9.15	0.31	274.83	308.69	0.02	7.85	0.69
QNG19	595.22	622.89	0.05	9.76	0.00	502.46	529.45	0.04	7.24	1.00
QNG20	5161.55	5254.03	0.06	10.00	0.00	4258.12	4344.50	0.05	7.00	1.00
QNG21	1528.16	1548.60	0.06	10.18	0.00	1235.07	1265.47	0.04	6.82	1.00
QNG22	621.84	675.73	0.07	9.61	0.06	523.22	572.73	0.06	7.39	0.94
QNG23	6834.82	6919.40	0.10	9.76	0.00	5656.99	5810.94	0.08	7.24	1.00
QNG24	1065.68	1169.06	0.07	9.15	0.17	824.28	973.81	0.05	7.85	0.83
QNG25	15.90	18.24	0.08	9.28	0.28	12.28	14.74	0.06	7.72	0.72
QNG26	12.55	14.12	0.09	8.54	0.50	12.15	13.83	0.08	8.46	0.50
QNG27	126.45	155.82	0.33	9.26	0.13	113.69	140.36	0.29	7.74	0.88
QNC1	1195.54	1286.83	0.03	9.46	0.08	974.48	1069.26	0.03	7.54	0.92
QNC2	14.06	15.78	0.12	8.72	0.49	13.76	15.51	0.12	8.28	0.51
QNC3	0.91	1.00	0.05	8.32	0.64	0.93	1.03	0.05	8.68	0.36
QNC4	1.18	1.40	0.07	8.58	0.49	1.15	1.37	0.06	8.42	0.51
QNC5	2.16	2.59	0.28	8.39	0.56	2.27	2.61	0.29	8.61	0.44
QNC6	11.46	13.18	0.25	9.49	0.25	8.37	10.58	0.18	7.51	0.75
QNC7	41.64	51.45	0.29	8.61	0.39	39.48	48.22	0.27	8.39	0.61
QNC8	6.99	8.34	0.16	8.99	0.47	6.09	7.51	0.14	8.01	0.53
QNC9	9.17	10.92	0.14	9.51	0.29	7.16	9.20	0.11	7.49	0.71
QNC10	45.83	51.47	0.11	9.03	0.49	37.62	43.96	0.09	7.97	0.51

QNC11	162.04	182.95	0.14	9.35	0.35	109.33	133.50	0.09	7.65	0.65
QNC12	71.43	82.44	0.16	9.35	0.36	54.26	65.21	0.12	7.65	0.64
QNC13	2.44	3.16	0.04	8.69	0.39	2.25	2.97	0.04	8.31	0.61
QNC14	228.30	295.43	0.44	8.67	0.42	222.66	292.10	0.43	8.33	0.58
QNC15	11.76	11.94	0.07	9.69	0.00	10.08	10.35	0.06	7.31	1.00
QNC16	957.43	1014.68	0.06	9.61	0.03	769.31	849.57	0.05	7.39	0.97
QNC17	16.15	17.66	0.08	8.86	0.46	13.54	15.32	0.07	8.14	0.54
QNC18	73.73	80.05	0.13	8.86	0.33	66.68	73.60	0.11	8.14	0.67
QNC19	11.09	12.53	0.06	8.75	0.42	9.84	11.35	0.05	8.25	0.58
QNC20	44.71	49.04	0.30	8.10	0.75	46.54	50.54	0.31	8.90	0.25
QNC21	8.31	9.76	0.06	8.54	0.46	8.40	9.79	0.07	8.46	0.54
QNC22	1084.06	1192.50	0.18	9.47	0.17	917.05	1024.80	0.15	7.53	0.83
QNC23	5812.42	6530.11	0.31	9.63	0.06	5110.79	5888.43	0.28	7.38	0.94
QNC24	13.10	17.68	0.13	8.51	0.53	12.77	17.51	0.13	8.49	0.47
QNC25	301.73	358.93	0.09	9.14	0.39	244.76	312.64	0.07	7.86	0.61
QNC26	22.38	27.40	0.05	8.49	0.51	22.42	27.34	0.05	8.51	0.49
QNC27	39.93	46.13	0.14	8.99	0.39	33.63	39.75	0.11	8.01	0.61
QNC28	970.66	1096.83	0.09	9.01	0.40	800.37	933.01	0.07	7.99	0.60
QNC29	10.27	11.51	0.07	8.79	0.46	9.28	10.53	0.06	8.21	0.54
QRG1	17.21	19.83	0.03	8.85	0.33	14.32	17.27	0.02	8.15	0.67
QRG2	14.34	15.70	0.03	9.58	0.06	11.19	12.67	0.03	7.42	0.94
QRG3	4.92	5.82	0.03	8.96	0.31	4.17	5.12	0.02	8.04	0.69
QRG4	3.96	5.12	0.04	8.57	0.51	3.89	5.05	0.04	8.43	0.49
QRG5	22.97	25.60	0.08	9.07	0.28	21.09	23.79	0.08	7.93	0.72
QRG6	0.91	0.95	0.05	10.26	0.00	0.69	0.74	0.04	6.74	1.00
QRG7	49.62	49.83	0.06	10.61	0.00	37.05	37.56	0.04	6.39	1.00
QRG8	4.72	5.41	0.03	9.31	0.17	3.25	4.16	0.02	7.69	0.83
QRG9	1.28	1.44	0.03	9.04	0.35	1.03	1.17	0.02	7.96	0.65
QRG10	1.88	2.10	0.11	8.83	0.35	1.71	1.91	0.10	8.17	0.65
QRG11	5.40	6.66	0.05	8.40	0.51	5.27	6.50	0.05	8.60	0.49
QRG12	71.94	72.75	0.06	10.15	0.00	58.99	59.84	0.05	6.85	1.00
QRG13	367.08	382.94	0.06	9.90	0.03	287.14	304.88	0.04	7.10	0.97
QRG14	13.46	16.24	0.07	8.71	0.50	13.06	16.00	0.07	8.29	0.50
QRG15	14.69	14.80	0.11	10.60	0.00	12.17	12.20	0.09	6.40	1.00
QRG16	394.22	394.33	0.03	12.50	0.00	304.67	305.88	0.02	4.50	1.00
QRG17	1642.40	1716.02	0.05	9.88	0.08	1245.14	1328.18	0.03	7.13	0.92
QRG18	399.54	476.01	0.02	9.21	0.36	321.03	413.04	0.01	7.79	0.64
QRC1	913.38	1077.42	0.86	8.64	0.40	907.26	1073.93	0.84	8.36	0.60
QRC2	49.84	56.18	0.12	9.78	0.08	40.24	46.45	0.09	7.22	0.92
QRC3	4.94	5.31	0.04	9.31	0.32	3.81	4.25	0.03	7.69	0.68
QRC4	6.24	7.92	0.07	8.57	0.42	6.26	7.92	0.07	8.43	0.58
QRC5	2.89	3.60	0.10	8.78	0.35	2.79	3.54	0.10	8.22	0.65
QRC6	5.87	6.43	0.13	8.79	0.28	5.65	6.23	0.13	8.21	0.72
QRC7	14.41	19.17	0.14	8.33	0.64	14.72	19.44	0.15	8.67	0.36
QRC8	10.41	13.28	0.09	8.54	0.43	10.54	13.33	0.09	8.46	0.57
QRC9	1.75	1.98	0.02	8.61	0.43	1.75	1.95	0.02	8.39	0.57
QRC10	4.40	5.72	0.04	8.56	0.49	4.33	5.67	0.04	8.44	0.51
QRC11	9.13	10.21	0.09	8.85	0.28	8.90	9.86	0.09	8.15	0.72
QRC12	3.61	4.12	0.01	8.96	0.36	3.04	3.57	0.01	8.04	0.64
QRC13	4.93	5.30	0.04	9.31	0.32	3.80	4.24	0.03	7.69	0.68
QRC14	4.65	4.94	0.04	9.83	0.11	3.36	3.71	0.03	7.17	0.89
QRC15	4.00	4.20	0.03	10.01	0.07	2.77	3.04	0.02	6.99	0.93
QRC16	4.29	4.63	0.03	9.58	0.22	2.70	3.17	0.02	7.42	0.78
QRC17	3.94	4.25	0.03	9.67	0.13	2.90	3.27	0.02	7.33	0.88
QRC18	5.03	5.42	0.04	9.65	0.13	3.71	4.17	0.03	7.35	0.88
QRC19	0.24	0.28	0.10	8.57	0.46	0.24	0.28	0.10	8.43	0.54
QRC20	0.68	0.84	0.13	8.53	0.51	0.65	0.80	0.12	8.47	0.49
QRC21	9.62	11.88	0.09	8.36	0.61	9.66	11.95	0.09	8.64	0.39
QRC22	8.05	9.04	0.07	8.39	0.61	7.96	8.85	0.07	8.61	0.39
QRC23	5.40	6.66	0.05	8.40	0.51	5.27	6.50	0.05	8.60	0.49
QRC24	88.20	102.85	0.13	8.76	0.38	85.63	100.27	0.13	8.24	0.63
QRC25	7.14	9.22	0.07	8.51	0.50	7.17	9.21	0.07	8.49	0.50
QRC26	92.98	93.73	0.07	10.63	0.00	73.74	74.51	0.05	6.38	1.00
QRC27	4.69	6.05	0.04	8.64	0.49	4.61	5.98	0.04	8.36	0.51
QRC28	6.75	7.71	0.03	8.90	0.35	5.21	6.33	0.03	8.10	0.65
QRC29	18.89	21.41	0.14	8.54	0.47	18.65	21.18	0.14	8.46	0.53
QRC30	22.77	26.16	0.16	8.51	0.56	22.62	26.09	0.16	8.49	0.44
QND1	21.80	27.03	0.26	8.64	0.42	21.12	26.90	0.25	8.36	0.58
QND2	22.10	35.90	0.11	8.71	0.40	20.76	34.53	0.10	8.29	0.60
QND3	4.77	5.91	0.10	8.68	0.38	4.76	6.12	0.10	8.32	0.63
QND4	77.45	81.82	0.20	9.56	0.06	62.79	68.65	0.16	7.44	0.94
QND5	0.06	0.07	0.01	8.81	0.26	0.06	0.07	0.01	8.19	0.74

QND6	0.88	1.08	0.01	8.35	0.60	0.93	1.12	0.01	8.65	0.40
QND7	5.29	5.58	0.04	10.07	0.17	3.20	3.58	0.03	6.93	0.83
QND8	2.26	2.28	0.02	10.74	0.11	1.35	1.39	0.01	6.26	0.89
QND9	5.45	5.63	0.04	10.40	0.14	3.31	3.61	0.03	6.60	0.86
QND10	117.83	143.92	0.20	9.60	0.00	104.06	126.83	0.17	7.40	1.00
QND11	65.59	77.76	0.27	9.29	0.11	56.95	69.64	0.23	7.71	0.89
QND12	4.63	5.98	0.15	8.53	0.40	4.76	6.19	0.15	8.47	0.60
QND13	22.20	27.92	0.26	8.71	0.35	21.66	27.58	0.25	8.29	0.65
QND14	77.61	85.07	0.25	9.18	0.15	68.59	76.79	0.22	7.82	0.85
QND15	0.33	0.36	0.02	9.46	0.26	0.24	0.26	0.01	7.54	0.74
QND16	0.20	0.23	0.07	8.54	0.58	0.18	0.22	0.07	8.46	0.42
QND17	15.29	19.34	0.04	8.75	0.54	13.45	17.56	0.04	8.25	0.46
QND18	0.97	1.17	0.28	8.56	0.49	0.95	1.16	0.27	8.44	0.51
QND19	168.18	184.44	0.02	8.99	0.25	160.36	173.12	0.02	8.01	0.75
QND20	0.01	0.01	0.01	8.60	0.42	0.01	0.01	0.01	8.40	0.58
QND21	14.90	18.43	0.23	8.38	0.57	15.15	18.59	0.24	8.63	0.43
QND22	13.22	16.52	0.15	8.64	0.40	12.89	16.28	0.15	8.36	0.60
QND23	3.39	3.93	0.01	8.90	0.42	2.90	3.40	0.01	8.10	0.58
QND24	7.66	8.29	0.48	8.26	0.67	7.88	8.47	0.50	8.74	0.33
QND25	1.71	2.01	0.30	8.40	0.58	1.74	2.07	0.31	8.60	0.42
QND26	3.77	4.29	0.06	9.42	0.14	2.96	3.44	0.04	7.58	0.86
QND27	86.49	101.92	0.51	8.43	0.58	91.35	107.66	0.54	8.57	0.42
QND28	18.84	22.61	0.21	8.15	0.60	20.20	24.25	0.22	8.85	0.40
QND29	8.07	9.77	0.10	8.47	0.51	7.86	9.44	0.10	8.53	0.49
QND30	100.23	140.56	0.16	8.39	0.67	98.92	139.21	0.16	8.61	0.33
QND31	2.62	3.23	0.03	8.69	0.36	2.60	3.19	0.02	8.31	0.64
QND32	0.37	0.46	0.01	9.14	0.17	0.32	0.42	0.01	7.86	0.83
QND33	1123.37	1411.03	0.46	8.40	0.63	1111.06	1392.89	0.45	8.60	0.38
QND34	13.59	13.83	0.09	10.17	0.00	11.21	11.37	0.08	6.83	1.00
QND35	35.18	40.99	0.03	8.96	0.26	32.00	37.66	0.03	8.04	0.74
QND36	56.71	73.89	0.34	8.82	0.39	50.85	68.09	0.30	8.18	0.61
QND37	15.35	17.55	0.31	8.82	0.32	14.90	17.32	0.30	8.18	0.68
QND38	17.63	19.99	0.02	9.19	0.24	14.32	17.23	0.02	7.81	0.76
QND39	0.90	1.07	0.30	8.94	0.25	0.85	1.02	0.28	8.06	0.75
MRF1	396881.50	481947.31	0.38	18.44	0.61	398225.51	487006.92	0.38	18.56	0.39
MRM1	27.96	37.53	0.13	19.15	0.27	24.66	34.37	0.11	17.85	0.73
MRM2	115.83	181.14	0.16	18.50	0.46	114.98	181.64	0.16	18.50	0.54
MRM4	660.13	780.54	0.12	18.99	0.36	615.05	717.00	0.11	18.01	0.64
MRM5	3.07	3.81	0.07	18.30	0.56	3.08	3.79	0.07	18.70	0.44
MRM6	1319.73	1516.27	0.51	19.25	0.28	1211.59	1395.95	0.48	17.75	0.72
MRM7	29550.39	34981.86	0.20	18.44	0.47	29623.63	34702.86	0.21	18.56	0.53
MRM8	140.32	184.87	0.19	18.74	0.51	132.68	178.65	0.18	18.27	0.49
MRM9	2511.37	2967.89	0.35	19.48	0.29	2322.64	2881.75	0.32	17.53	0.71
MRM10	1216.48	1621.30	0.23	18.43	0.48	1218.23	1621.53	0.23	18.57	0.53
MRM11	626.87	829.09	0.16	18.77	0.40	611.17	820.16	0.15	18.23	0.60
MRM12	4.10	5.09	0.15	18.25	0.59	4.16	5.13	0.15	18.75	0.41
MRM13	3.21	4.12	0.16	18.38	0.61	3.25	4.18	0.16	18.62	0.40
MRM15	361.07	481.82	0.25	18.88	0.36	352.86	473.85	0.25	18.12	0.64
MRM16	2655.80	3194.45	0.36	18.46	0.40	2643.35	3168.39	0.36	18.54	0.61
MRM17	7.39	8.87	0.07	18.86	0.41	6.89	8.40	0.07	18.14	0.59
MRM18	2.79	3.49	0.09	18.21	0.64	2.85	3.54	0.09	18.79	0.36
MRB1	957.21	1147.88	0.29	18.25	0.70	974.75	1167.68	0.30	18.75	0.30
MRB2	1318.06	1847.76	0.24	18.22	0.57	1338.30	1851.03	0.24	18.78	0.43
MRB3	1424.86	1957.80	0.27	18.40	0.53	1431.11	1944.86	0.28	18.60	0.48
MRB4	1583.44	2579.56	0.22	18.20	0.64	1638.83	2626.61	0.23	18.80	0.36
MRB5	339.65	518.32	0.16	18.69	0.52	330.60	510.06	0.16	18.32	0.48
MRB6	5.15	7.26	0.14	18.15	0.69	5.31	7.53	0.15	18.85	0.32
MRB7	11.48	14.73	0.02	18.34	0.65	11.37	14.57	0.02	18.66	0.35
MRB8	334.19	469.56	0.26	18.53	0.51	334.42	471.21	0.26	18.47	0.49
MRB9	1482.08	1841.75	0.41	18.52	0.54	1496.99	1876.05	0.41	18.48	0.46
MRB10	924.77	1235.10	0.28	18.33	0.58	934.26	1245.02	0.28	18.67	0.42
MRB11	378.49	479.69	0.23	18.59	0.52	372.02	472.60	0.23	18.41	0.48
MRB12	28.87	35.84	0.19	18.55	0.42	28.02	34.86	0.19	18.45	0.58
MRB13	9.46	13.71	0.23	18.61	0.49	9.47	13.79	0.23	18.40	0.51
MRB14	345.05	520.02	0.36	18.22	0.73	354.51	532.59	0.37	18.78	0.27
MRB15	437.92	636.62	0.27	18.59	0.57	434.11	642.10	0.27	18.41	0.43
MRB16	515.57	608.95	0.21	18.30	0.56	521.34	614.93	0.22	18.70	0.44
MRB17	42.94	56.42	0.16	18.24	0.67	43.24	56.38	0.16	18.76	0.33
MRB18	63.57	81.43	0.11	18.36	0.65	62.98	80.53	0.11	18.64	0.35
MRB19	44.44	51.50	0.21	18.29	0.58	45.24	52.39	0.21	18.71	0.42
MRB20	104.29	134.11	0.13	18.04	0.63	107.35	136.38	0.13	18.96	0.37
MRB21	116.16	183.89	0.13	18.79	0.54	115.64	185.55	0.13	18.21	0.46

MRB22	79.79	122.08	0.19	18.65	0.48	79.02	121.53	0.19	18.35	0.52
MRB23	127.06	185.42	0.31	18.67	0.50	124.78	185.56	0.31	18.33	0.50
MRB24	52.14	60.09	0.24	18.51	0.45	50.88	57.91	0.23	18.49	0.55
MRB25	2758.28	3301.80	0.11	18.43	0.53	2772.53	3300.82	0.11	18.57	0.48
MRB26	2794.46	3342.39	0.11	18.41	0.53	2811.32	3342.33	0.11	18.59	0.47
MRB27	1562.96	1865.45	0.09	18.44	0.48	1564.51	1868.26	0.09	18.56	0.52
MRB28	1396.39	1652.18	0.09	18.87	0.35	1358.42	1604.31	0.09	18.13	0.65
MRB29	4.63	5.91	0.03	18.54	0.44	4.57	5.83	0.03	18.46	0.56
MRB30	1542.50	1747.72	0.24	18.17	0.62	1584.17	1793.59	0.25	18.83	0.38
MRB31	1389.82	1680.81	0.21	18.92	0.48	1332.20	1631.16	0.20	18.08	0.53
MRB32	0.29	0.35	0.04	18.78	0.53	0.26	0.31	0.03	18.22	0.47
MNF1	4491.47	6445.82	0.15	18.20	0.59	4608.68	6547.54	0.16	18.80	0.41
MNF2	166.64	192.15	0.09	18.57	0.43	167.62	190.90	0.09	18.43	0.57
MNF3	61.57	71.59	0.02	19.36	0.42	53.18	63.66	0.01	17.64	0.58
MNF4	5.75	6.90	0.10	18.61	0.44	5.74	6.88	0.10	18.40	0.56
MNF5	8051.36	10702.44	0.17	18.83	0.48	8040.11	10930.64	0.17	18.17	0.52
MNF6	2652.97	3929.14	0.25	18.38	0.57	2700.87	3993.67	0.26	18.62	0.43
MNF7	65.59	84.12	0.19	18.58	0.56	65.81	85.77	0.19	18.42	0.44
MNF8	125.47	159.56	0.18	18.96	0.37	121.99	156.81	0.18	18.04	0.63
MNF9	1534.29	1727.94	0.14	19.07	0.35	1487.75	1662.53	0.13	17.93	0.65
MNM1	5.78	6.67	0.07	19.07	0.29	5.21	5.93	0.06	17.93	0.71
MNM5	3.09	3.83	0.09	18.27	0.55	3.15	3.87	0.09	18.74	0.45
MNM6	16481.01	21881.71	0.17	18.31	0.60	16899.93	22221.63	0.18	18.69	0.40
MNM7	291.99	384.78	0.08	18.40	0.52	290.95	378.73	0.08	18.61	0.48
MNM8	97.53	145.65	0.11	19.19	0.26	82.89	127.09	0.09	17.81	0.74
MNM9	151.17	193.15	0.05	18.61	0.43	149.28	191.56	0.05	18.39	0.57
MNM10	1982.88	2440.56	0.23	18.54	0.52	1976.20	2448.90	0.23	18.46	0.48
MNM11	705.28	812.70	0.08	18.62	0.44	700.50	808.73	0.08	18.38	0.56
MNM12	3015.40	3813.23	0.13	18.79	0.53	2944.43	3748.37	0.13	18.21	0.48
MNM13	60.92	74.71	0.12	18.29	0.59	61.66	75.31	0.12	18.71	0.41
MNM14	918.21	1246.91	0.14	18.40	0.55	930.43	1266.02	0.14	18.60	0.45
MNM15	4595.88	5513.67	0.35	18.63	0.48	4565.32	5544.40	0.35	18.37	0.53
MNM16	5026.19	6124.50	0.09	18.50	0.58	5016.47	6160.59	0.09	18.50	0.42
MNM17	223.44	284.54	0.22	18.68	0.58	219.77	284.98	0.21	18.32	0.42
MNM18	4596.84	7136.34	0.19	18.56	0.49	4623.81	7195.69	0.19	18.44	0.51
MNM19	3073.85	4413.67	0.20	18.13	0.53	3146.28	4452.39	0.21	18.87	0.47
MNM20	11.74	16.22	0.07	18.38	0.60	11.82	16.31	0.07	18.62	0.40
MNM21	247.30	325.69	0.14	18.96	0.36	240.96	324.77	0.14	18.04	0.64
MNM22	573.75	749.94	0.09	18.45	0.53	575.75	753.91	0.09	18.55	0.48
MNM23	146.89	184.24	0.36	18.47	0.52	148.55	186.42	0.37	18.53	0.48
MNM24	3348.86	4320.72	0.19	18.48	0.51	3365.94	4361.54	0.20	18.53	0.49
MNM25	3100.62	4361.36	0.26	18.28	0.57	3167.98	4428.84	0.27	18.72	0.43
MNM26	1548.34	1904.20	0.22	18.58	0.46	1551.55	1917.53	0.22	18.42	0.54
MNM27	36367.52	51572.34	0.27	18.35	0.59	36421.66	51634.95	0.27	18.65	0.41
MNM28	146.00	206.31	0.05	18.79	0.53	140.61	201.88	0.05	18.21	0.47
MNM29	1862.01	2237.52	0.08	18.46	0.49	1860.93	2224.63	0.08	18.54	0.51
MNM30	1482.28	2202.23	0.21	18.40	0.57	1505.19	2237.09	0.22	18.60	0.43
MNM31	169.02	210.88	0.11	18.39	0.51	171.59	213.12	0.11	18.61	0.49
MNM32	29601.19	33243.86	0.49	18.49	0.51	29557.44	33255.68	0.49	18.51	0.49
MNM33	383.40	483.10	0.15	18.70	0.45	378.15	481.35	0.14	18.30	0.55
MNM34	2931.92	3832.27	0.29	18.59	0.48	2877.25	3791.71	0.28	18.41	0.52
MNM35	419.26	607.54	0.16	18.38	0.46	424.24	608.61	0.16	18.62	0.54
MNM37	14411.86	15919.01	0.12	18.44	0.54	14414.23	15905.47	0.12	18.56	0.46
MNM38	937.68	1093.66	0.12	18.49	0.52	936.91	1086.21	0.12	18.51	0.48
MNM39	180.46	219.53	0.11	18.94	0.43	172.93	211.49	0.11	18.06	0.57
MNM40	47.08	62.39	0.08	18.84	0.40	45.34	60.57	0.08	18.16	0.60
MNM41	81.73	111.41	0.12	18.41	0.53	81.63	110.22	0.12	18.59	0.47
MNM42	286.22	335.55	0.11	18.59	0.44	281.35	324.10	0.11	18.41	0.56
MNM43	24.14	30.24	0.17	18.32	0.61	24.51	30.49	0.17	18.68	0.39
MNM44	57.12	75.84	0.08	18.91	0.33	53.25	71.73	0.07	18.09	0.67
MNM45	47.71	56.33	0.06	18.87	0.35	44.98	53.98	0.06	18.13	0.65
MNM46	48.80	73.88	0.08	18.90	0.36	43.87	66.27	0.08	18.11	0.64
MNM47	0.30	0.36	0.02	19.08	0.34	0.29	0.35	0.02	17.92	0.66
MNM48	1921.29	2717.04	0.14	18.97	0.46	1836.74	2678.63	0.13	18.03	0.54
MNM49	124.11	165.60	0.25	18.67	0.45	120.27	163.60	0.24	18.33	0.55
MNM50	1370.84	1829.37	0.14	18.67	0.44	1344.76	1817.71	0.14	18.33	0.56
MNM51	44.87	60.06	0.13	18.32	0.62	45.62	60.85	0.13	18.69	0.38
MNM52	32.06	42.55	0.12	18.36	0.60	32.60	43.17	0.13	18.64	0.40
MNM53	4.03	5.29	0.17	18.41	0.58	4.09	5.36	0.17	18.59	0.42
MNM54	10.46	14.10	0.13	18.24	0.68	10.64	14.34	0.13	18.77	0.32
MNM55	531.01	631.70	0.16	18.96	0.43	506.13	611.48	0.15	18.04	0.57
MNM56	28712.70	35933.77	0.25	18.24	0.59	29379.20	36659.22	0.26	18.76	0.41

MNM57	24887.30	34115.73	0.05	18.70	0.53	23975.41	33396.16	0.05	18.30	0.48
MNM58	130.03	159.73	0.14	18.69	0.46	127.18	157.39	0.13	18.31	0.54
MNM59	1302.93	1639.52	0.06	18.41	0.54	1310.65	1653.00	0.06	18.59	0.46
MNM60	2496.35	3106.50	0.07	19.22	0.34	2313.18	2924.53	0.07	17.78	0.66
MNM61	789.58	977.59	0.10	18.72	0.40	761.77	945.34	0.10	18.28	0.60
MNM62	133.24	161.40	0.11	19.09	0.44	124.81	152.49	0.10	17.91	0.56
MNM63	116.29	132.10	0.10	19.15	0.34	104.18	120.26	0.09	17.85	0.66
MNM64	74.84	90.70	0.09	18.22	0.63	76.09	92.10	0.09	18.78	0.37
MNM65	94.70	115.90	0.08	18.99	0.48	88.03	111.18	0.08	18.01	0.52
MNM66	1735.93	2164.30	0.06	18.75	0.50	1680.71	2128.89	0.06	18.25	0.50
MNM67	586.19	731.43	0.08	18.90	0.44	554.78	699.66	0.07	18.11	0.56
MNM68	6720.51	8352.97	0.07	19.28	0.38	6223.92	7870.50	0.06	17.72	0.62
MNM69	670.88	795.40	0.06	18.35	0.67	677.37	802.21	0.06	18.65	0.33
MNM70	6720.51	8352.97	0.07	19.28	0.38	6223.92	7870.50	0.06	17.72	0.62
MNM71	552.66	721.71	0.06	19.02	0.48	513.69	688.90	0.06	17.98	0.52
MNM72	368.52	431.54	0.07	18.40	0.58	375.09	440.72	0.07	18.60	0.42
MNM73	228.46	288.13	0.08	18.44	0.61	230.10	292.06	0.08	18.56	0.40
MNM74	181.64	214.00	0.11	18.70	0.53	171.64	204.69	0.10	18.30	0.48
MNM75	1236.05	1603.54	0.07	18.77	0.52	1185.29	1556.74	0.07	18.24	0.48
MNM76	879.62	1120.63	0.07	18.69	0.53	857.10	1099.53	0.07	18.32	0.47
MNM77	172.06	211.86	0.11	18.74	0.54	150.08	193.51	0.10	18.26	0.46
MNB1	12.95	16.49	0.14	18.62	0.48	12.94	16.46	0.14	18.38	0.53
MNB2	2440.44	2848.82	0.28	18.47	0.56	2448.86	2866.11	0.28	18.53	0.44
MNB3	969.28	1247.22	0.33	18.68	0.50	932.45	1197.33	0.33	18.32	0.50
MNB4	3335.34	4427.97	0.43	18.04	0.57	3507.62	4539.30	0.45	18.96	0.43
MNB5	2413.20	4120.38	0.18	18.57	0.51	2420.61	4162.66	0.18	18.43	0.49
MNB6	11023.51	13869.63	0.25	18.52	0.52	11068.93	13920.73	0.25	18.48	0.48
MNB7	261.21	370.12	0.16	18.59	0.48	257.58	366.67	0.16	18.41	0.53
MNB8	584.74	747.31	0.09	18.43	0.61	587.91	756.99	0.09	18.57	0.40
MNB9	3892.02	4773.66	0.11	19.15	0.36	3660.12	4599.71	0.10	17.85	0.64
MNB10	442.92	508.89	0.17	18.37	0.55	446.82	510.20	0.17	18.63	0.45
MNB11	287.68	356.77	0.12	18.61	0.46	285.31	357.72	0.12	18.39	0.54
MNB12	5008.80	6306.11	0.25	18.49	0.50	5015.89	6325.09	0.25	18.51	0.50
MNB13	119.88	158.11	0.05	18.57	0.56	117.46	156.11	0.05	18.43	0.44
MNB14	1932.04	3457.78	0.14	18.62	0.51	1936.00	3494.98	0.14	18.38	0.49
MNB15	521.76	659.50	0.24	18.78	0.43	491.74	631.39	0.23	18.22	0.57
MNB16	142.77	177.66	0.15	18.46	0.52	142.98	175.85	0.15	18.54	0.48
MNB17	47.67	56.29	0.06	19.14	0.34	42.78	51.80	0.06	17.86	0.66
MNB18	6.16	7.40	0.11	18.59	0.46	6.12	7.42	0.11	18.41	0.54
MNB19	51.01	64.11	0.17	18.50	0.51	50.55	63.72	0.17	18.50	0.49
MNB20	1.64	1.94	0.27	18.01	0.65	1.68	1.96	0.27	18.99	0.35
MNB21	28.21	34.00	0.09	18.36	0.54	28.53	34.53	0.09	18.64	0.46
MNB22	27.69	32.09	0.10	18.48	0.46	27.70	31.91	0.10	18.52	0.54
MNB23	2.87	3.45	0.06	19.08	0.40	2.56	3.16	0.06	17.92	0.61
MNB24	10.58	12.64	0.05	19.73	0.38	8.11	10.20	0.03	17.27	0.62
MNB25	6.80	7.60	0.04	20.11	0.25	5.53	6.30	0.04	16.90	0.75
MNB26	13.50	16.91	0.05	19.49	0.31	10.87	14.12	0.04	17.51	0.69
MNB27	5.56	7.30	0.06	18.78	0.44	5.39	7.23	0.06	18.22	0.56
MNB28	25.03	27.51	0.06	21.50	0.06	18.24	20.82	0.04	15.50	0.94
MNB29	4.56	5.80	0.03	19.07	0.43	3.98	5.01	0.02	17.93	0.57
MNB30	8.43	10.25	0.03	18.62	0.44	8.28	10.07	0.03	18.38	0.56
MNB31	5.56	6.52	0.03	19.70	0.36	4.61	5.58	0.02	17.30	0.64
MNB32	19.81	22.70	0.05	19.55	0.34	16.69	19.33	0.04	17.45	0.66
MNB33	333.97	413.17	0.07	18.22	0.59	341.64	414.01	0.08	18.78	0.41
MNB34	259.24	299.38	0.11	18.96	0.49	244.25	281.98	0.10	18.04	0.51
MNB35	3201.62	3897.34	0.40	18.86	0.41	3096.54	3844.75	0.39	18.14	0.59
MNB36	948.37	1220.31	0.18	18.92	0.38	889.78	1162.69	0.17	18.08	0.62
MNB37	1928.90	2242.99	0.21	18.94	0.40	1862.49	2180.99	0.21	18.06	0.60
MNB38	347.47	404.55	0.27	19.38	0.40	324.68	379.41	0.25	17.62	0.60
MNB39	78571.76	106665.85	0.49	18.45	0.53	77852.06	107273.44	0.49	18.55	0.48
MNB40	1328.65	1614.23	0.33	18.46	0.56	1335.10	1632.51	0.33	18.54	0.44
MNB41	10.13	11.58	0.23	18.03	0.67	10.45	11.84	0.24	18.97	0.33
MNB42	1747.02	2214.60	0.14	19.53	0.35	1560.28	2076.11	0.12	17.47	0.65
MNB43	19.79	22.40	0.04	18.59	0.56	19.71	22.38	0.04	18.41	0.44
MNB44	267.42	319.04	0.13	18.36	0.60	269.53	317.26	0.14	18.64	0.40
MNB45	2.38	3.02	0.03	18.48	0.49	2.38	3.02	0.03	18.53	0.51
MNB46	1.04	1.42	0.21	18.57	0.49	1.04	1.44	0.21	18.43	0.51
MNB47	1.02	1.23	0.13	18.33	0.52	1.03	1.23	0.13	18.67	0.48
MNB48	3.10	3.94	0.12	18.26	0.59	3.13	3.95	0.12	18.74	0.41
MNB49	14872.81	18262.46	0.04	18.99	0.30	13828.05	16836.72	0.04	18.01	0.70
MNB50	5669.65	7293.56	0.14	18.37	0.58	5728.37	7417.98	0.15	18.63	0.42
MNB51	153.28	224.31	0.34	18.29	0.69	158.04	230.72	0.35	18.71	0.32

MNB52	558.50	713.76	0.09	18.46	0.60	560.77	721.65	0.09	18.54	0.40
MNB53	4.58	6.36	0.16	18.46	0.52	4.62	6.44	0.16	18.54	0.48
MNB54	126.55	151.13	0.20	18.20	0.67	129.84	154.75	0.21	18.80	0.33
MNB55	1.39	1.65	0.02	18.59	0.44	1.36	1.60	0.02	18.41	0.56
MNB56	7870.68	10710.62	0.18	19.03	0.40	7685.76	10823.93	0.18	17.98	0.61
MNB57	510.08	630.01	0.10	18.25	0.66	519.96	647.55	0.10	18.75	0.34
MNB58	1555.01	1970.83	0.17	18.62	0.38	1512.81	1896.32	0.17	18.38	0.62
MNB59	1394.99	1848.83	0.13	18.45	0.58	1383.32	1834.07	0.13	18.55	0.42
MNB60	3209.17	4377.35	0.23	18.30	0.49	3273.37	4409.30	0.24	18.70	0.51
MNB61	7098.99	10027.22	0.19	18.31	0.56	7222.41	10128.33	0.19	18.69	0.44
MNB62	445.87	569.15	0.13	18.86	0.41	432.33	560.01	0.13	18.14	0.59
MNB63	3348.27	4112.28	0.17	18.77	0.50	3274.76	4059.49	0.17	18.23	0.50
MNB64	281.29	341.25	0.27	18.33	0.52	286.45	345.00	0.28	18.67	0.48
MNB65	178.34	216.20	0.02	19.72	0.26	152.64	192.28	0.01	17.28	0.74
MNB66	3902.46	4876.58	0.37	18.47	0.59	3960.06	5004.47	0.37	18.53	0.41
MNB67	2530.80	3352.76	0.13	18.41	0.49	2553.36	3346.32	0.13	18.59	0.51
MNB68	52.86	62.97	0.13	18.40	0.62	53.27	63.67	0.14	18.60	0.38
MNB69	253.44	359.29	0.13	18.33	0.65	256.33	362.69	0.14	18.67	0.35
MNB70	505.52	690.61	0.24	18.67	0.51	498.19	689.01	0.23	18.33	0.49
MNB71	14.68	18.06	0.02	18.42	0.57	14.54	17.72	0.02	18.58	0.43
MNB72	20.82	23.90	0.21	18.87	0.43	19.94	23.00	0.20	18.13	0.57
MRI1	68.55	103.49	0.36	18.26	0.70	69.92	104.83	0.37	18.74	0.30
MRI2	703.49	828.52	0.10	19.80	0.17	610.70	718.00	0.09	17.20	0.83
MRI3	181.01	240.85	0.15	18.42	0.54	181.53	241.15	0.15	18.58	0.46
MRI4	2.01	2.71	0.39	18.51	0.48	2.02	2.73	0.39	18.49	0.52
MRI5	4.82	5.86	0.14	18.65	0.51	4.77	5.86	0.13	18.35	0.49
MRI6	5.20	6.39	0.20	18.36	0.56	5.21	6.35	0.20	18.64	0.44
MRI7	12.81	16.76	0.17	18.45	0.54	12.68	16.56	0.16	18.55	0.46
MRI8	33.89	42.39	0.14	18.49	0.53	33.78	42.21	0.14	18.51	0.48
MRI9	9.86	12.62	0.08	18.54	0.52	9.74	12.57	0.08	18.46	0.48
MRI10	9.41	11.21	0.09	18.34	0.58	9.54	11.35	0.09	18.66	0.42
MRI11	11.33	13.63	0.10	19.12	0.28	10.67	12.89	0.10	17.88	0.72
MRI12	0.10	0.13	0.11	18.56	0.58	0.09	0.12	0.11	18.44	0.42
MRI13	4.48	5.69	0.06	18.78	0.46	4.21	5.43	0.06	18.22	0.54
MRI14	1.98	2.46	0.15	18.38	0.56	2.00	2.49	0.15	18.62	0.44
MRI15	0.50	0.60	0.18	18.51	0.52	0.49	0.60	0.18	18.49	0.48
MRI16	68.12	84.25	0.17	18.38	0.56	68.69	84.74	0.17	18.62	0.44
MNI1	4.39	5.28	0.04	18.51	0.51	4.35	5.23	0.04	18.49	0.49
MNI2	15.51	23.79	0.18	18.51	0.49	15.88	24.58	0.18	18.49	0.51
MNI3	17.38	25.16	0.15	18.89	0.37	17.34	25.82	0.15	18.11	0.63
MNI4	13.26	16.56	0.14	18.44	0.53	13.28	16.62	0.14	18.56	0.48
MNI5	15.30	19.18	0.14	18.59	0.49	15.22	19.31	0.14	18.41	0.51
MNI6	37.53	46.35	0.03	18.51	0.51	37.38	46.59	0.03	18.49	0.49
MNI7	576.80	660.86	0.09	18.96	0.39	551.96	624.60	0.08	18.04	0.61
MNI8	187.11	233.21	0.06	18.93	0.46	175.35	223.14	0.05	18.07	0.54
MNI9	328.82	399.61	0.08	19.44	0.31	283.00	355.50	0.07	17.56	0.69
MNI10	6.08	7.92	0.05	18.90	0.49	5.93	8.02	0.05	18.11	0.51
MNI11	7.05	8.60	0.06	18.74	0.48	6.91	8.66	0.06	18.27	0.52
MNI12	3389.53	3938.80	0.04	18.55	0.50	3322.39	3857.79	0.04	18.45	0.50
MNI13	222.05	280.52	0.10	18.43	0.50	224.68	283.04	0.10	18.57	0.50
MNI14	317.20	359.76	0.10	18.79	0.36	313.00	352.77	0.10	18.21	0.64
MNI15	104.22	139.65	0.08	18.35	0.64	104.84	140.59	0.08	18.65	0.36
MNI16	564.46	675.81	0.12	18.48	0.53	567.40	680.50	0.12	18.53	0.47
MNI17	1616.79	2550.63	0.15	18.61	0.49	1614.61	2586.47	0.15	18.40	0.51
MNI18	2407.34	3393.72	0.17	18.38	0.57	2452.27	3426.74	0.17	18.62	0.43
MNI19	2735.97	3620.60	0.18	18.69	0.48	2702.81	3618.68	0.18	18.31	0.52
MNI20	235.36	272.43	0.46	18.56	0.52	234.80	273.45	0.46	18.44	0.48
MNI21	188.99	305.45	0.16	18.67	0.43	185.76	304.66	0.16	18.33	0.57
MNI22	522.97	631.75	0.16	18.44	0.53	527.07	639.17	0.16	18.56	0.48
MNI23	16.76	22.18	0.13	18.78	0.51	16.26	22.17	0.12	18.22	0.49
MNI24	52.60	64.39	0.09	18.33	0.58	53.40	65.18	0.09	18.67	0.42
MNI25	3.16	3.73	0.03	18.06	0.64	3.30	3.88	0.03	18.94	0.36
MNI26	10.97	13.53	0.08	18.99	0.44	10.71	13.61	0.08	18.01	0.56
MNI27	9.24	11.74	0.08	18.15	0.65	9.60	12.05	0.08	18.85	0.35
MNI28	10.09	13.31	0.08	18.50	0.57	10.13	13.34	0.08	18.50	0.43
MNI29	1944.33	3261.39	0.12	18.61	0.49	1958.39	3303.11	0.12	18.40	0.51
MNI30	1024.21	1583.21	0.12	18.72	0.49	1018.85	1610.68	0.12	18.28	0.51
MNI31	2222.08	2711.61	0.23	18.15	0.71	2268.07	2758.16	0.23	18.85	0.29
MNI32	238.85	325.08	0.78	18.60	0.46	237.41	327.17	0.78	18.40	0.54
MNI33	479.35	591.11	0.20	18.33	0.60	485.30	593.99	0.21	18.67	0.40
MNI34	115.92	150.48	0.09	18.27	0.71	117.48	152.92	0.09	18.74	0.29
MNI35	386.43	461.61	0.14	18.31	0.59	391.69	468.53	0.14	18.69	0.41

MNI36	146.18	180.18	0.18	18.28	0.59	147.65	180.40	0.18	18.72	0.41
MNI37	12699.05	15616.33	0.32	18.63	0.53	12163.42	15068.65	0.31	18.37	0.48
MNI38	38103.51	47154.30	0.23	18.49	0.61	38093.93	47334.11	0.23	18.51	0.40
MNI39	18.86	23.27	0.12	18.39	0.59	18.86	23.39	0.12	18.61	0.41
MNI40	965.32	1214.73	0.16	18.55	0.53	967.92	1228.40	0.16	18.45	0.48
MNI41	150.28	185.77	0.08	18.84	0.39	145.77	183.24	0.08	18.16	0.61
MNI42	118.62	143.26	0.05	18.04	0.65	122.47	146.49	0.05	18.96	0.35
MNI43	16.78	20.94	0.07	18.06	0.70	17.31	21.39	0.07	18.94	0.30
MNI44	86.54	102.36	0.06	18.24	0.57	87.72	103.13	0.06	18.77	0.43
MNI45	84.26	111.40	0.06	18.51	0.56	84.92	113.41	0.06	18.49	0.44
MNI46	1.35	1.57	0.08	18.53	0.38	1.36	1.58	0.08	18.48	0.62
MNI47	6.54	8.69	0.10	18.30	0.67	6.63	8.81	0.10	18.70	0.33
MNI48	0.29	0.34	0.04	18.33	0.54	0.30	0.34	0.04	18.67	0.46
MNI49	0.48	0.66	0.23	18.30	0.64	0.49	0.66	0.23	18.70	0.36
MNI50	0.22	0.29	0.14	18.51	0.57	0.22	0.29	0.14	18.49	0.43
MNI51	0.74	0.92	0.08	18.36	0.55	0.75	0.92	0.08	18.64	0.45
MNI52	6.94	8.29	0.19	18.25	0.59	7.07	8.39	0.19	18.75	0.41
MNI53	0.24	0.33	0.10	18.74	0.53	0.22	0.31	0.10	18.26	0.47
MNI54	1.47	1.85	0.07	18.51	0.61	1.48	1.88	0.07	18.49	0.39
MNI55	0.35	0.41	0.06	19.16	0.40	0.31	0.37	0.06	17.84	0.60
MNI56	0.60	0.71	0.26	18.03	0.70	0.61	0.73	0.26	18.97	0.30
MNI57	0.60	0.78	0.07	18.39	0.57	0.60	0.79	0.07	18.61	0.43
MNI58	0.39	0.49	0.25	18.25	0.51	0.40	0.50	0.26	18.75	0.49
MNI59	0.16	0.21	0.10	18.25	0.70	0.16	0.21	0.10	18.75	0.30
MNI60	0.98	1.55	0.10	18.46	0.62	0.99	1.58	0.10	18.54	0.38
MNI61	0.30	0.41	0.06	18.17	0.64	0.31	0.42	0.06	18.83	0.36
MNI62	4.11	4.78	0.06	19.25	0.33	3.88	4.57	0.05	17.75	0.67
MNI63	0.18	0.23	0.10	18.20	0.56	0.19	0.23	0.10	18.80	0.44
MNI64	0.35	0.44	0.25	18.41	0.52	0.36	0.45	0.25	18.59	0.48
MNI65	0.12	0.15	0.17	18.56	0.44	0.12	0.15	0.17	18.44	0.56
MNI66	0.07	0.08	0.08	18.30	0.64	0.07	0.08	0.08	18.70	0.36
MNI67	0.13	0.19	0.16	18.23	0.61	0.13	0.19	0.16	18.77	0.40
MNI68	0.43	0.50	0.05	18.01	0.80	0.44	0.51	0.05	18.99	0.20
MNI69	0.31	0.44	0.08	18.67	0.48	0.31	0.44	0.08	18.33	0.52
MNI70	84.82	124.07	0.05	18.65	0.44	85.12	125.07	0.05	18.35	0.56
MNI71	46.41	57.17	0.07	18.44	0.57	45.67	55.69	0.07	18.56	0.43
MNI72	11.33	15.43	0.14	18.80	0.47	11.02	15.24	0.14	18.20	0.53
MNI73	2.57	3.41	0.13	18.20	0.68	2.64	3.48	0.14	18.80	0.32
MNI74	7.46	8.97	0.04	18.61	0.53	7.43	8.97	0.04	18.40	0.47
MNI75	1.32	1.74	0.08	19.30	0.41	1.17	1.61	0.07	17.70	0.59
MNI76	18.39	23.46	0.12	18.83	0.43	17.94	23.25	0.12	18.17	0.57
MNI77	8.14	9.86	0.11	18.54	0.57	8.08	9.86	0.11	18.46	0.43
MNI78	9.20	12.60	0.09	18.38	0.61	9.32	12.83	0.09	18.62	0.39
MNI79	8.56	10.94	0.11	18.67	0.47	8.30	10.63	0.11	18.33	0.53
MNI80	5.20	6.33	0.10	18.33	0.58	5.27	6.41	0.10	18.67	0.42
MNI81	19.47	25.64	0.04	18.24	0.60	19.96	26.01	0.04	18.77	0.40
MNI82	4.72	5.98	0.16	18.36	0.57	4.82	6.09	0.16	18.64	0.43
MNI83	60.27	73.40	0.15	18.33	0.46	61.27	73.92	0.15	18.67	0.54
MNI84	38.34	58.28	0.10	18.24	0.54	39.60	59.30	0.10	18.76	0.46
MNI85	130.42	154.63	0.32	18.56	0.40	127.50	152.29	0.31	18.44	0.60
MNI86	31.16	39.90	0.08	18.35	0.59	31.50	40.56	0.08	18.65	0.41
MNI87	211.17	260.12	0.29	18.75	0.35	204.56	254.47	0.29	18.25	0.65
MNI88	10.29	12.98	0.12	18.35	0.62	10.28	12.96	0.12	18.65	0.38
MNI89	67.50	89.19	0.09	18.64	0.46	66.72	89.05	0.09	18.36	0.54
MNI90	25.94	31.76	0.12	18.88	0.38	25.38	31.48	0.12	18.12	0.62
MNI91	44.91	52.93	0.07	18.19	0.63	45.98	54.12	0.07	18.82	0.37
MNI92	33.44	40.42	0.09	18.39	0.48	33.50	40.34	0.09	18.61	0.52
MNI93	84.41	103.03	0.09	18.83	0.47	82.17	102.39	0.09	18.17	0.53
MNI94	39.53	55.23	0.03	18.46	0.62	39.91	56.01	0.03	18.54	0.38
MNI95	21.56	26.54	0.12	19.15	0.40	20.72	25.81	0.11	17.85	0.60
MNI96	44.14	53.30	0.06	18.54	0.51	43.80	52.91	0.06	18.46	0.49
MNI97	108.42	157.96	0.06	18.53	0.60	108.47	159.78	0.06	18.48	0.40
MNI98	30.20	37.34	0.08	18.55	0.55	30.13	37.09	0.08	18.45	0.45
MNI99	25.87	32.68	0.05	19.19	0.43	22.76	29.22	0.05	17.82	0.57
MNI100	0.85	1.04	0.04	19.06	0.48	0.80	1.00	0.04	17.94	0.52
MNI101	0.18	0.23	0.03	18.06	0.76	0.19	0.24	0.03	18.94	0.24
MNI102	1.35	1.62	0.06	19.21	0.34	1.22	1.52	0.06	17.79	0.66
MNI103	1.77	2.55	0.09	18.74	0.46	1.74	2.53	0.09	18.27	0.54
MNI104	0.92	1.18	0.06	18.35	0.61	0.94	1.20	0.06	18.65	0.40
MNI105	1.72	2.04	0.14	18.24	0.62	1.76	2.09	0.14	18.76	0.38
MNI106	0.24	0.32	0.09	18.49	0.62	0.24	0.32	0.09	18.51	0.38
MNI107	5.07	6.27	0.12	18.16	0.64	5.21	6.37	0.13	18.84	0.36

MNI108	1.68	2.07	0.16	18.35	0.62	1.69	2.10	0.16	18.65	0.38
MNI109	3.69	4.68	0.07	18.56	0.53	3.72	4.75	0.07	18.44	0.48
MNI110	0.21	0.25	0.27	18.28	0.57	0.21	0.26	0.28	18.72	0.43
MNI111	1.25	1.63	0.12	19.05	0.37	1.17	1.56	0.12	17.95	0.63
MNI112	1.90	2.94	0.14	18.51	0.47	1.91	2.97	0.14	18.49	0.53
MNI114	1.07	1.35	0.15	18.68	0.54	1.05	1.34	0.15	18.32	0.46
MNI115	1.25	1.75	0.12	18.22	0.67	1.28	1.78	0.12	18.78	0.33
MNI116	103.35	139.83	0.24	18.28	0.66	105.53	142.67	0.24	18.72	0.34
MNI117	75.17	106.30	0.17	18.56	0.48	75.56	109.45	0.17	18.44	0.53
MNI118	212.56	273.62	0.11	18.82	0.44	203.88	268.37	0.11	18.18	0.56
MNI119	559.12	885.36	0.09	18.88	0.53	528.35	870.32	0.08	18.12	0.47
MNI120	94.35	119.96	0.34	18.25	0.65	96.30	122.04	0.35	18.75	0.35
MNI121	121.40	165.44	0.28	18.71	0.44	119.56	165.97	0.27	18.29	0.56
MNI122	446.39	549.10	0.23	18.73	0.39	438.68	534.40	0.22	18.27	0.61
MNI123	1.33	1.62	0.07	18.46	0.57	1.33	1.65	0.07	18.54	0.43
MNI124	0.97	1.27	0.04	18.83	0.48	0.92	1.23	0.04	18.17	0.52
MNI125	1.61	2.02	0.11	18.53	0.48	1.60	2.02	0.10	18.47	0.52
MNI126	0.40	0.56	0.07	18.50	0.59	0.40	0.56	0.07	18.50	0.41
MNI127	1.91	2.58	0.16	18.87	0.46	1.80	2.52	0.15	18.13	0.54
MNI128	0.73	0.95	0.09	18.82	0.48	0.73	0.96	0.09	18.19	0.53
MNI129	5.26	7.15	0.22	18.28	0.55	5.41	7.28	0.22	18.72	0.45
MNI130	8.83	13.96	0.17	18.75	0.52	8.49	13.95	0.16	18.25	0.48
MNI131	16.40	22.30	0.18	18.86	0.40	16.18	22.31	0.18	18.14	0.61
MNI132	3.97	4.69	0.11	18.24	0.62	4.01	4.75	0.11	18.77	0.38
MNI133	9.17	11.92	0.19	19.24	0.35	8.79	11.75	0.19	17.76	0.65
MNI134	0.76	1.12	0.12	18.69	0.56	0.75	1.13	0.12	18.32	0.44
MNI135	465.66	557.46	0.07	18.67	0.40	455.97	542.44	0.06	18.33	0.60
MNI136	153.18	184.03	0.05	18.30	0.62	153.88	183.50	0.05	18.70	0.38
MNI137	299.37	344.45	0.08	18.60	0.45	298.97	339.14	0.08	18.40	0.55
MNI138	185.65	228.25	0.07	18.68	0.44	180.32	219.61	0.07	18.32	0.56
MNI139	2435.47	2964.28	0.09	18.81	0.41	2368.79	2871.21	0.09	18.19	0.59
MNI140	408.25	469.73	0.07	18.93	0.38	399.69	455.22	0.07	18.07	0.62
MNI141	246.62	321.48	0.14	18.69	0.43	243.35	320.67	0.14	18.31	0.57
MNI142	352.23	396.02	0.14	18.86	0.33	344.24	385.84	0.13	18.14	0.67
MNI143	47.68	60.99	0.13	18.65	0.49	47.24	61.03	0.13	18.35	0.51
MNI144	159.38	200.73	0.16	18.72	0.41	156.49	198.38	0.16	18.28	0.59
MNI145	40.73	50.46	0.15	18.69	0.46	39.81	49.55	0.15	18.31	0.54
MNI146	73.34	89.76	0.10	19.06	0.36	70.03	87.84	0.10	17.94	0.64
MNI147	32.41	39.28	0.10	18.85	0.39	31.14	38.00	0.10	18.15	0.61
MNI148	1514.90	1811.70	0.10	18.67	0.52	1459.06	1731.95	0.10	18.33	0.48
MNI149	2702.40	3258.34	0.10	18.82	0.53	2509.84	3002.04	0.09	18.19	0.48
MNI150	1524.05	1851.35	0.10	18.47	0.52	1504.20	1814.90	0.10	18.53	0.48
MNI151	2420.32	3075.30	0.08	18.46	0.57	2372.10	3001.99	0.08	18.54	0.43
MNI152	1218.08	1865.06	0.12	18.46	0.56	1232.64	1874.70	0.12	18.54	0.44
MNI153	166.10	201.11	0.17	18.08	0.64	170.82	205.93	0.17	18.92	0.36
MNI154	9.99	11.63	0.14	18.83	0.36	9.54	11.34	0.13	18.17	0.64
MNI155	43.37	53.60	0.13	18.63	0.44	42.89	52.96	0.13	18.37	0.56
MNI156	29.04	38.18	0.08	18.57	0.47	28.98	38.56	0.08	18.43	0.53
MNI157	226.03	270.51	0.22	18.03	0.69	233.16	273.96	0.23	18.97	0.31
MNI158	4734.55	6086.62	0.18	18.17	0.69	4867.69	6232.57	0.19	18.83	0.31
MNI159	110.00	131.66	0.12	18.57	0.44	109.71	130.20	0.12	18.43	0.56
MNI160	2455.76	3200.72	0.08	18.51	0.48	2443.06	3167.93	0.08	18.49	0.53
MNI161	3418.56	4694.53	0.09	18.51	0.49	3423.12	4710.53	0.09	18.49	0.51
MNI162	5357.08	6969.89	0.11	18.64	0.42	5325.11	6965.39	0.11	18.36	0.58
MNI163	0.14	0.17	0.03	18.83	0.45	0.14	0.17	0.03	18.17	0.55
MNI164	49.63	60.72	0.06	18.37	0.62	49.39	60.20	0.06	18.63	0.38
MNI165	116.45	155.50	0.05	18.44	0.64	114.58	153.70	0.05	18.56	0.36
MNI166	32.15	40.67	0.10	18.71	0.43	31.38	39.55	0.10	18.29	0.57
MNI167	102.55	122.86	0.14	18.44	0.55	102.74	122.81	0.14	18.56	0.45
MNI168	300.71	370.90	0.10	18.45	0.53	301.20	371.64	0.10	18.55	0.47
MRG1	12.63	17.99	0.12	18.34	0.47	12.79	18.05	0.12	18.66	0.53
MRG2	3.10	3.87	0.01	18.93	0.32	2.98	3.71	0.01	18.07	0.69
MRG3	560.76	593.90	0.08	20.33	0.07	462.73	501.23	0.07	16.67	0.93
MRG4	612.26	695.09	0.09	19.84	0.19	515.61	595.01	0.07	17.16	0.82
MRG5	0.01	0.01	0.01	18.75	0.36	0.01	0.01	0.01	18.25	0.64
MRG6	3.94	4.71	0.03	19.07	0.43	3.69	4.48	0.03	17.93	0.57
MRG7	5.01	6.22	0.04	19.08	0.43	4.61	5.89	0.04	17.92	0.57
MRG8	5.03	6.83	0.04	19.01	0.30	4.38	5.85	0.04	17.99	0.70
MRG9	1.25	1.54	0.01	19.20	0.34	1.11	1.39	0.01	17.80	0.66
MRG10	10.80	13.24	0.07	19.09	0.36	10.18	12.66	0.07	17.91	0.64
MRG11	4.53	6.02	0.04	19.10	0.32	3.90	5.19	0.03	17.90	0.68
MRG12	3.64	4.45	0.03	19.84	0.30	3.02	3.84	0.02	17.16	0.70

MRG13	13.55	16.87	0.08	19.14	0.41	12.78	16.44	0.07	17.86	0.59
MRG14	5.15	6.01	0.04	19.12	0.32	4.80	5.67	0.04	17.88	0.68
MRG15	13.99	17.75	0.11	19.43	0.28	13.62	17.57	0.10	17.57	0.72
MRG16	9.86	11.43	0.07	18.92	0.40	9.48	10.98	0.07	18.08	0.60
MRG17	11.45	17.30	0.09	19.05	0.35	11.23	17.40	0.09	17.95	0.65
MRG18	4.23	5.06	0.03	19.13	0.40	3.87	4.70	0.03	17.87	0.60
MRG19	8.76	10.72	0.06	18.51	0.51	8.72	10.58	0.06	18.49	0.49
MRG20	16.99	21.50	0.13	18.33	0.54	17.10	21.68	0.13	18.67	0.46
MRG21	14.92	17.95	0.09	18.51	0.56	14.88	17.97	0.09	18.49	0.44
MRG22	22.60	29.42	0.21	18.38	0.56	22.85	29.75	0.21	18.62	0.44
MRG23	9.47	10.75	0.07	18.28	0.61	9.56	10.86	0.07	18.72	0.39
MRG24	7.80	9.94	0.06	18.85	0.41	7.35	9.47	0.06	18.15	0.59
MRG25	17.35	20.86	0.05	19.60	0.33	14.75	18.44	0.04	17.40	0.67
MRG26	0.55	0.93	0.22	18.77	0.53	0.55	0.93	0.21	18.24	0.48
MRC1	6.41	8.03	0.01	19.09	0.27	6.03	7.59	0.01	17.91	0.74
MRC2	7.24	9.95	0.09	18.25	0.51	7.35	9.96	0.09	18.75	0.49
MRC3	13.21	19.25	0.13	18.35	0.49	13.39	19.34	0.13	18.65	0.51
MRC4	14.28	19.40	0.16	18.41	0.45	14.39	19.36	0.16	18.59	0.55
MRC5	14.21	18.42	0.16	18.43	0.43	14.30	18.35	0.16	18.57	0.57
MRC6	21.02	28.12	0.17	18.45	0.54	21.15	28.28	0.17	18.55	0.46
MRC7	14.63	18.71	0.11	19.07	0.38	13.04	16.98	0.10	17.93	0.62
MRC8	734.82	881.00	0.66	18.17	0.68	748.93	896.75	0.67	18.83	0.32
MRC9	4018.47	4584.97	0.02	19.49	0.24	3385.96	4031.52	0.02	17.51	0.76
MRC10	261.25	335.34	0.51	18.48	0.59	256.90	333.05	0.51	18.53	0.41
MRC11	3.80	4.58	0.03	19.21	0.38	3.55	4.38	0.03	17.79	0.62
MRC12	7.29	9.83	0.07	18.93	0.38	6.53	8.73	0.07	18.07	0.62
MRC13	9.20	11.99	0.11	18.89	0.35	8.47	10.95	0.10	18.11	0.65
MRC14	6.18	8.04	0.05	19.46	0.35	5.10	6.82	0.04	17.54	0.65
MRC15	8.16	10.92	0.07	19.01	0.32	6.99	9.26	0.06	17.99	0.69
MRC16	4.52	6.04	0.03	19.27	0.32	3.73	5.12	0.03	17.73	0.69
MRC17	4.02	4.81	0.04	19.55	0.22	3.45	4.12	0.03	17.45	0.78
MRC18	1.11	1.25	0.01	19.94	0.20	0.95	1.06	0.01	17.06	0.80
MRC19	1.09	1.37	0.01	19.41	0.40	0.95	1.26	0.01	17.59	0.60
MRC20	3.06	3.74	0.03	19.80	0.26	2.39	3.09	0.02	17.20	0.74
MRC21	4.08	4.86	0.03	20.10	0.23	3.51	4.38	0.03	16.90	0.77
MRC22	2.86	3.54	0.02	19.34	0.36	2.34	2.93	0.02	17.66	0.64
MRC23	3.28	4.00	0.03	19.94	0.34	2.48	3.24	0.02	17.06	0.66
MRC24	4.41	5.34	0.03	19.66	0.32	3.65	4.60	0.03	17.34	0.68
MRC25	3.83	5.42	0.04	18.54	0.37	3.57	4.97	0.04	18.46	0.63
MRC26	6.75	10.27	0.06	18.66	0.46	6.72	10.31	0.06	18.34	0.54
MRC27	3.90	4.86	0.02	19.38	0.17	3.43	4.35	0.02	17.62	0.83
MRC28	6.97	8.43	0.06	18.51	0.49	6.97	8.45	0.06	18.49	0.51
MRC29	3.21	4.00	0.03	18.65	0.42	3.15	3.94	0.03	18.35	0.58
MRC30	9.52	11.55	0.08	18.54	0.47	9.53	11.51	0.08	18.46	0.53
MRC31	158.56	186.24	0.04	19.75	0.14	129.38	161.91	0.03	17.25	0.86
MRC32	296.14	363.06	0.02	19.21	0.32	252.90	324.82	0.02	17.79	0.69
MRC33	2056.34	2379.41	0.01	19.72	0.19	1549.98	1937.29	0.01	17.28	0.82
MRC34	273.69	289.20	0.02	20.78	0.00	219.90	237.55	0.02	16.22	1.00
MRC35	44.67	51.86	0.02	19.28	0.22	41.16	47.36	0.02	17.72	0.78
MRC36	6.96	8.54	0.03	19.60	0.20	5.48	7.35	0.02	17.40	0.80
MRC37	4.03	5.10	0.03	19.08	0.21	3.67	4.64	0.03	17.92	0.79
MRC38	5.31	6.51	0.03	19.15	0.17	4.89	5.96	0.03	17.85	0.83
MRC39	61.88	78.07	0.24	18.65	0.51	60.88	77.50	0.24	18.35	0.49
MRC40	138.95	165.73	0.11	19.08	0.25	127.58	152.61	0.11	17.92	0.75
MRC41	5.62	6.94	0.16	18.81	0.24	5.44	6.70	0.15	18.19	0.76
MRC42	6.14	7.32	0.16	18.91	0.32	5.72	6.77	0.15	18.09	0.68
MRC43	3315.23	3987.32	0.03	19.14	0.23	3046.01	3607.59	0.02	17.86	0.77
MRC44	75.53	86.11	0.06	18.99	0.36	71.78	82.20	0.06	18.01	0.64
MNG1	1.58	1.98	0.29	18.48	0.49	1.60	2.00	0.29	18.52	0.51
MNG2	0.97	1.48	0.19	18.82	0.51	0.96	1.49	0.19	18.19	0.49
MNG3	1.00	1.25	0.05	19.81	0.30	0.82	1.09	0.04	17.19	0.70
MNG4	3.26	3.73	0.04	19.24	0.29	2.94	3.31	0.04	17.77	0.71
MNG5	5.00	5.99	0.07	19.33	0.35	4.33	5.23	0.06	17.67	0.65
MNG6	1.77	2.15	0.02	19.23	0.41	1.52	1.92	0.02	17.77	0.59
MNG7	14.13	19.51	0.13	18.70	0.44	14.05	19.68	0.13	18.30	0.56
MNG8	3.30	4.41	0.02	19.60	0.36	2.45	3.76	0.01	17.40	0.64
MNG9	4.27	5.53	0.03	19.17	0.36	3.68	5.01	0.02	17.83	0.64
MNG10	17.82	29.33	0.11	18.48	0.50	18.45	30.16	0.11	18.52	0.50
MNG11	182.17	214.16	0.11	18.63	0.50	179.17	211.64	0.11	18.37	0.50
MNG12	168.69	203.71	0.11	18.91	0.46	162.19	198.71	0.10	18.09	0.54
MNG13	13.92	18.60	0.10	18.40	0.54	14.04	18.83	0.11	18.60	0.46
MNG14	202.25	253.26	0.11	18.49	0.50	202.22	254.12	0.11	18.51	0.50

MNG15	9.41	11.97	0.10	18.07	0.61	9.79	12.34	0.10	18.93	0.39
MNG16	38.41	47.17	0.22	18.69	0.50	36.96	46.30	0.21	18.32	0.50
MNG17	8.46	10.44	0.07	18.62	0.43	8.32	10.29	0.07	18.38	0.57
MNG18	2.29	2.76	0.02	19.12	0.31	2.10	2.61	0.02	17.88	0.69
MNG19	0.31	0.38	0.09	19.02	0.48	0.29	0.38	0.09	17.98	0.52
MNG20	6.38	9.94	0.05	18.22	0.54	6.55	10.04	0.05	18.78	0.46
MNG21	198.58	236.67	0.20	18.49	0.51	198.37	237.67	0.20	18.51	0.49
MNG22	17.86	23.83	0.07	19.77	0.33	15.21	21.67	0.06	17.24	0.67
MNG23	24.70	27.86	0.10	18.94	0.46	22.56	25.64	0.09	18.06	0.54
MNG24	7.69	10.62	0.05	18.64	0.52	7.41	10.41	0.04	18.36	0.48
MNG25	24.61	37.76	0.09	19.21	0.30	22.61	35.54	0.08	17.79	0.70
MNG26	7.38	8.67	0.06	18.75	0.41	7.17	8.58	0.06	18.25	0.59
MNG27	4.94	5.79	0.03	19.19	0.43	4.39	5.21	0.03	17.81	0.57
MNG28	14.01	18.76	0.09	19.19	0.43	13.40	18.83	0.09	17.81	0.57
MNG29	7.70	9.11	0.02	20.42	0.21	5.44	6.73	0.01	16.58	0.79
MNG30	0.19	0.23	0.24	18.19	0.61	0.20	0.22	0.24	18.81	0.39
MNG31	415.77	535.52	0.13	19.11	0.42	397.33	529.83	0.13	17.89	0.58
MNG32	477.71	576.21	0.14	18.44	0.51	482.58	582.92	0.14	18.56	0.49
MNG33	5.77	7.08	0.04	18.64	0.49	5.66	6.98	0.04	18.36	0.51
MNG34	0.31	0.44	0.09	18.97	0.41	0.30	0.44	0.09	18.03	0.59
MNG35	5.61	6.85	0.04	19.38	0.34	5.00	6.15	0.04	17.62	0.66
MNG36	7.19	9.47	0.05	19.00	0.44	6.55	8.87	0.05	18.00	0.56
MNG37	9.03	11.25	0.08	18.55	0.47	9.04	11.22	0.08	18.45	0.53
MNG38	6.23	7.18	0.05	18.62	0.44	6.14	7.10	0.05	18.38	0.56
MNC1	17.16	22.86	0.13	18.75	0.36	17.00	22.98	0.13	18.25	0.64
MNC2	5.08	6.39	0.04	19.19	0.33	4.51	5.85	0.04	17.81	0.67
MNC3	2.19	2.77	0.03	19.00	0.35	1.98	2.51	0.03	18.00	0.65
MNC4	3.71	4.41	0.05	19.45	0.27	3.11	3.68	0.04	17.55	0.73
MNC5	1.66	2.07	0.02	19.02	0.40	1.50	1.87	0.02	17.98	0.60
MNC6	4.50	5.20	0.06	19.79	0.22	3.59	4.13	0.05	17.21	0.78
MNC7	4.50	5.19	0.06	19.82	0.22	3.57	4.11	0.05	17.19	0.78
MNC8	3.95	4.61	0.05	19.43	0.32	3.42	4.16	0.04	17.57	0.68
MNC9	4.91	5.81	0.07	19.64	0.25	3.97	4.80	0.06	17.36	0.75
MNC10	3.69	4.34	0.04	19.12	0.33	3.29	3.82	0.04	17.88	0.67
MNC11	4.53	5.13	0.06	19.86	0.20	3.66	4.24	0.05	17.14	0.80
MNC12	4.25	5.34	0.05	19.21	0.40	3.59	4.64	0.04	17.79	0.60
MNC13	9.26	10.33	0.15	20.78	0.14	6.66	8.04	0.11	16.22	0.86
MNC14	7.15	8.26	0.07	19.86	0.29	6.01	7.26	0.06	17.14	0.71
MNC15	4.29	4.99	0.06	19.42	0.29	3.66	4.29	0.05	17.58	0.71
MNC16	6.43	7.88	0.08	19.57	0.20	5.22	6.70	0.06	17.43	0.80
MNC17	4.56	5.51	0.05	19.12	0.36	4.08	4.83	0.05	17.88	0.64
MNC18	3.84	4.58	0.04	18.82	0.35	3.72	4.39	0.04	18.18	0.65
MNC19	540.91	766.95	0.10	18.88	0.41	537.13	783.50	0.10	18.12	0.59
MNC20	4.98	5.67	0.03	19.48	0.30	4.30	4.98	0.03	17.52	0.70
MNC21	41.21	52.28	0.08	19.03	0.31	36.56	46.57	0.07	17.97	0.69
MNC22	87.90	110.45	0.09	19.14	0.33	79.18	101.08	0.08	17.86	0.67
MNC23	0.42	0.50	0.08	18.70	0.50	0.41	0.50	0.08	18.30	0.50
MNC24	54.00	67.32	0.17	18.42	0.51	54.17	67.70	0.17	18.58	0.49
MNC25	8.98	10.49	0.06	18.56	0.48	8.97	10.52	0.06	18.44	0.52
MNC26	14.70	19.90	0.08	19.38	0.32	14.01	19.65	0.08	17.62	0.68
MNC27	9.89	12.42	0.06	19.19	0.38	9.37	12.09	0.05	17.81	0.62
MNC28	10.07	14.26	0.07	18.77	0.46	9.97	14.32	0.07	18.23	0.54
MNC29	3.62	4.56	0.03	18.28	0.56	3.65	4.57	0.03	18.72	0.44
MNC30	8.18	9.89	0.06	18.42	0.52	8.23	9.94	0.06	18.58	0.48
MNC31	7.01	8.51	0.05	18.56	0.49	6.97	8.50	0.05	18.44	0.51
MNC32	7.46	9.56	0.05	18.90	0.42	7.18	9.36	0.04	18.10	0.58
MNC33	4.24	5.10	0.03	19.32	0.36	3.69	4.65	0.02	17.69	0.64
MNC34	141.70	152.02	0.06	21.71	0.01	95.79	106.12	0.04	15.29	0.99
MNC35	0.49	0.65	0.24	19.22	0.35	0.43	0.60	0.22	17.78	0.65
MNC36	1.91	2.13	0.04	18.99	0.40	1.80	1.98	0.03	18.01	0.60
MNC37	15.217	21.611	0.277	25.155	0.468	14.933	21.050	0.259	23.845	0.532
MNC38	22.087	26.704	0.077	27.643	0.178	18.273	23.263	0.060	21.357	0.822
MNC39	2.008	2.413	0.020	56.774	0.170	1.440	1.836	0.014	43.337	0.830
MNC40	154.035	209.130	0.040	53.291	0.374	123.798	171.093	0.032	46.820	0.626
MNC41	461.843	514.312	0.006	59.127	0.209	314.143	374.281	0.004	40.984	0.791
MNC42	4.112	5.130	0.040	66.218	0.335	3.478	4.461	0.034	57.893	0.665
MNC43	493.171	539.764	0.006	59.577	0.156	358.338	420.753	0.004	40.534	0.844
MNC44	108.511	132.029	0.067	64.667	0.361	100.016	122.795	0.061	59.445	0.639
MNC45	0.266	0.330	0.048	34.050	0.423	0.242	0.308	0.043	30.061	0.577
MNC46	5.299	6.307	0.005	57.120	0.211	3.964	5.152	0.004	42.991	0.789
MNC47	599.511	700.660	0.019	57.694	0.227	463.652	585.276	0.014	42.417	0.773
MNC48	167.597	197.885	0.296	60.213	0.667	180.449	214.936	0.320	63.898	0.333
MND1	0.403	0.481	0.168	58.052	0.313	0.357	0.423	0.150	54.059	0.687

MND2	8.353	10.627	0.051	61.767	0.161	6.847	9.282	0.040	50.344	0.839
MND3	3.034	4.270	0.098	27.765	0.357	2.527	3.651	0.084	24.346	0.643
MND4	2.469	2.650	0.018	25.983	0.073	1.557	1.813	0.011	14.128	0.927
MND5	10835.316	12794.583	0.387	20.055	0.566	11141.219	13211.144	0.395	20.056	0.434
MND6	1.143	1.406	0.059	20.670	0.360	1.093	1.357	0.056	19.441	0.640
MND7	0.572	0.684	0.053	19.177	0.301	0.524	0.627	0.048	17.823	0.699
MND8	0.698	0.844	0.083	20.739	0.493	0.670	0.809	0.080	19.372	0.507
MND9	0.739	0.977	0.057	18.402	0.523	0.740	0.955	0.057	18.598	0.477
MND10	18.517	23.585	0.093	20.343	0.538	18.707	23.700	0.095	19.768	0.462
MND11	13.039	18.108	0.262	20.346	0.426	12.704	17.959	0.254	19.765	0.574
MND12	8.810	11.414	0.231	20.206	0.474	8.767	11.546	0.230	19.905	0.526
MND13	18.983	24.907	0.375	20.245	0.438	18.548	24.965	0.360	19.866	0.562
MND14	12.682	16.465	0.318	20.235	0.465	12.613	16.530	0.310	19.876	0.535
MND15	0.917	1.241	0.256	27.197	0.417	0.667	0.915	0.201	23.803	0.583
MND16	0.060	0.075	0.381	27.181	0.337	0.041	0.053	0.331	23.819	0.663
MND17	0.218	0.286	0.354	27.586	0.421	0.164	0.220	0.290	23.414	0.579
MND18	0.237	0.314	0.282	26.995	0.444	0.184	0.248	0.243	24.005	0.556
MND19	0.220	0.348	0.433	27.481	0.427	0.157	0.272	0.334	22.630	0.573
MND20	0.172	0.239	0.659	27.436	0.402	0.117	0.180	0.549	23.564	0.598
MND21	64.160	91.628	0.429	26.953	0.394	52.766	81.681	0.363	24.047	0.606
MND22	130.748	191.413	0.325	26.699	0.412	103.782	155.196	0.270	24.301	0.588
MND23	312.306	429.107	0.332	27.746	0.355	208.918	298.926	0.247	23.254	0.645
MND24	148.707	205.741	0.376	27.522	0.362	115.333	168.581	0.306	23.478	0.638
MND25	813.270	1023.388	0.171	25.546	0.558	818.574	1012.193	0.176	25.454	0.442
MND26	11.449	19.321	0.975	25.933	0.390	11.546	20.247	0.923	25.067	0.610
MND27	24794.312	33445.471	0.163	19.970	0.452	25069.710	33315.785	0.163	20.142	0.548
MND28	833.676	1227.880	0.009	40.427	0.302	719.108	1093.716	0.008	35.684	0.698
MND29	1028.121	1238.420	0.012	40.156	0.326	908.309	1095.674	0.011	35.956	0.674
MND30	293.387	340.266	0.087	27.246	0.283	266.382	310.612	0.079	24.865	0.717
MND31	866.244	1017.555	0.011	28.058	0.343	742.456	884.082	0.009	24.053	0.657
MND32	630.434	805.533	0.096	27.227	0.374	570.099	732.941	0.086	24.885	0.626
MND33	558.131	625.084	0.006	30.695	0.212	405.545	475.269	0.004	21.416	0.788
MND34	254.565	327.417	0.134	28.538	0.254	212.965	275.353	0.106	23.573	0.746
MND35	0.405	0.542	0.057	28.041	0.261	0.323	0.437	0.045	24.071	0.739
MND36	0.447	0.574	0.084	28.361	0.263	0.365	0.472	0.067	23.750	0.737
MND37	0.395	0.549	0.057	27.333	0.383	0.332	0.457	0.048	24.779	0.617
MND38	0.846	1.084	0.047	27.100	0.424	0.776	1.005	0.042	25.011	0.576
MND39	0.392	0.518	0.061	28.353	0.256	0.315	0.422	0.048	23.758	0.744
MND40	0.749	0.934	0.062	26.826	0.464	0.667	0.807	0.055	25.285	0.536
MND41	0.378	0.502	0.095	28.232	0.281	0.314	0.418	0.077	23.879	0.719
MND42	0.238	0.316	0.059	27.281	0.486	0.210	0.279	0.052	24.830	0.514
MND43	0.756	1.028	0.083	28.562	0.220	0.602	0.842	0.065	23.550	0.780
MND44	0.488	0.657	0.065	28.128	0.211	0.388	0.525	0.051	23.983	0.789
MND45	1.476	1.837	0.099	27.483	0.348	1.287	1.582	0.087	24.628	0.652
MND46	0.875	1.133	0.109	28.321	0.270	0.714	0.933	0.087	23.790	0.730
MND47	0.987	1.283	0.124	28.236	0.285	0.802	1.064	0.099	23.875	0.715
MND48	15.336	26.494	0.026	14.565	0.416	14.712	26.741	0.025	14.435	0.584
MND49	7.980	8.982	0.038	18.046	0.149	4.026	4.664	0.020	10.954	0.851
MND50	6.405	7.285	0.011	16.486	0.233	4.721	5.670	0.008	12.514	0.767
MND51	6.482	7.598	0.010	15.751	0.293	5.515	6.758	0.009	13.249	0.707
MND52	36.481	54.012	0.122	59.868	0.238	31.074	47.642	0.103	52.243	0.762
MND53	31.106	40.117	0.074	60.356	0.166	25.308	34.064	0.061	51.755	0.834
MND54	45.267	62.120	0.092	59.673	0.245	38.314	53.249	0.077	52.438	0.755
MND55	37.120	46.638	0.090	60.040	0.242	30.675	38.855	0.074	52.072	0.758
MND56	30.564	38.013	0.105	60.327	0.238	25.176	31.657	0.086	51.784	0.762
MND57	62.150	90.704	0.425	20.081	0.488	64.512	95.523	0.429	20.030	0.512
MND58	13142.590	17371.805	0.412	20.198	0.570	13514.841	18256.363	0.425	19.913	0.430
MND59	53.562	71.747	0.392	19.348	0.681	58.390	76.795	0.431	20.764	0.319
MND60	1862.023	2499.230	0.220	20.985	0.434	1805.502	2533.675	0.211	19.126	0.566
MND61	4.543	5.478	0.351	14.224	0.625	4.841	5.908	0.374	14.776	0.375
MND62	87.910	106.870	0.131	19.314	0.638	94.319	113.392	0.141	20.798	0.362
MND63	304.178	375.336	0.074	20.614	0.506	288.398	361.281	0.070	19.497	0.494
MND64	528.757	916.803	0.113	19.229	0.608	580.238	972.225	0.124	20.883	0.392
MND65	1461.081	1745.337	0.192	20.630	0.336	1341.825	1591.619	0.177	19.481	0.664
MND66	1031.488	1250.184	0.347	19.900	0.449	1056.120	1294.989	0.349	20.211	0.551
MND67	2657.049	3184.389	0.254	19.707	0.546	2773.324	3282.286	0.265	20.405	0.454
MND68	8958.984	10992.251	0.221	20.455	0.451	8943.202	11163.431	0.219	19.656	0.549
MND69	326.106	367.778	0.184	20.505	0.434	313.028	355.794	0.178	19.606	0.566
MND71	2832.844	3898.711	0.447	19.601	0.563	3030.651	4123.523	0.478	20.510	0.437
MND72	1935.202	2272.879	0.270	20.135	0.501	1949.955	2302.677	0.271	19.977	0.499
MND73	10.153	13.063	0.287	19.928	0.648	10.678	13.890	0.297	20.183	0.352
MND74	2.103	2.716	0.071	38.510	0.479	2.033	2.643	0.069	37.602	0.521
MND75	0.299	0.363	0.005	59.797	0.365	0.257	0.318	0.005	52.314	0.635
MND76	9.994	12.098	0.307	19.406	0.645	10.612	12.657	0.327	20.705	0.355
pBetter	0.29	0.33	0.30	0.21	0.30	0.71	0.67	0.70	0.79	0.70

APPENDIX D

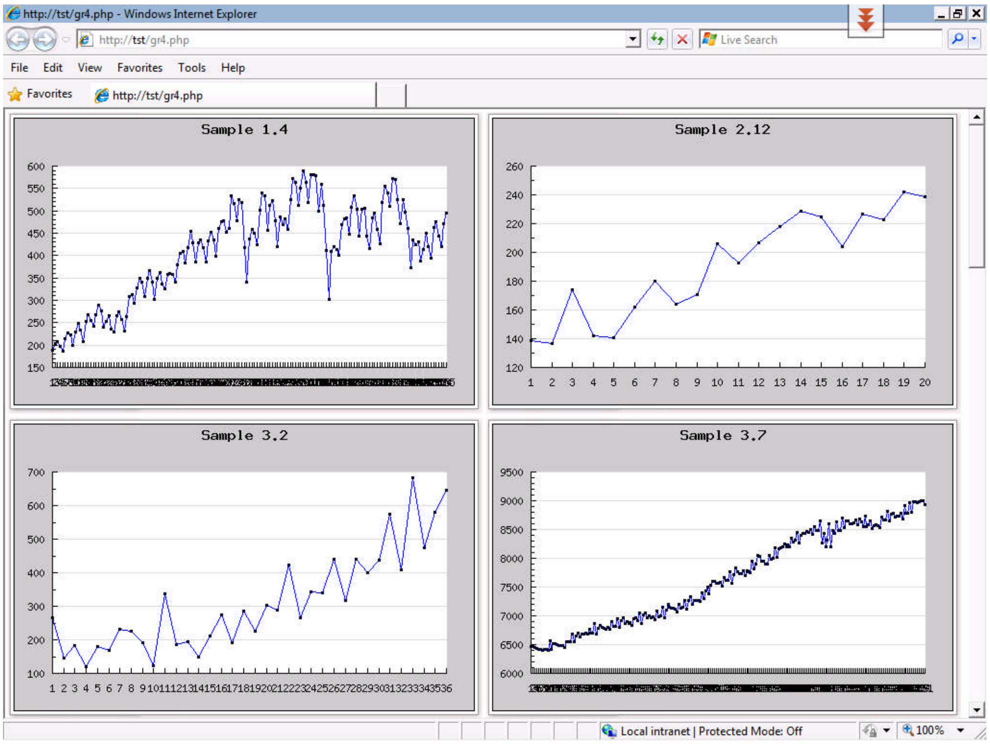

Figure 8.1 Time series plot of Sample 1.4, Sample 2.12, Sample 3.2, Sample 3.7

Figure 8.2 Time series plot of Sample 4.2, Sample 4.4, Sample 4.7, Sample 5.4

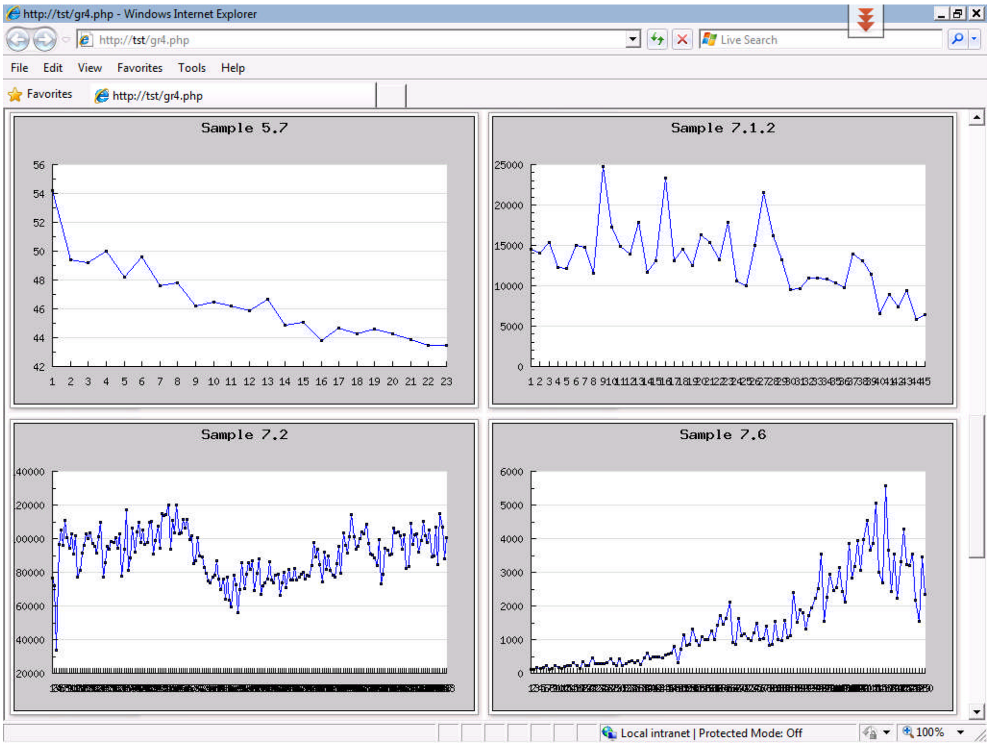

Figure 8.3 Time series plot of Sample 5.7, Sample 7.1.2, Sample 7.2, Sample 7.6

Figure 8.4 Time series plot of Sample 8.7, Sample 8.10, Sample 10.1, Sample 11.1

APPENDIX E

Table 10.1 Results for out-of-sample performance for 1001 time series

	Double Exponential Smoothing					Modified Double Exponential Smoothing				
Time Series	MAE	rMSE	sMAPE	rARsAPE	pB	MAE	rMSE	sMAPE	rARsAPE	pB
YAF2	375273.70	406171.83	0.48	8.13	0.00	290123.13	311353.41	0.35	4.87	1.00
YAF3	130996.91	143765.10	0.27	7.73	0.07	91894.25	105309.78	0.18	5.27	0.93
YAF4	167985.40	172573.87	0.36	8.23	0.00	119746.02	126933.55	0.25	4.77	1.00
YAF5	123388.61	129704.25	0.31	7.83	0.13	96455.54	100375.21	0.23	5.17	0.87
YAF6	9890992.45	10758564.10	0.34	7.50	0.03	8431780.28	9294830.33	0.28	5.50	0.97
YAF7	6531.29	6757.51	0.35	8.13	0.00	4969.27	5186.08	0.25	4.87	1.00
YAF8	508315.20	514314.85	0.44	8.40	0.00	340333.29	351614.45	0.29	4.60	1.00
YAF9	319566.47	356347.61	0.36	8.53	0.00	222490.23	248811.48	0.24	4.47	1.00
YAF10	358231.95	372889.68	0.33	8.90	0.00	230720.94	242081.36	0.20	4.10	1.00
YAF11	4.67	5.28	0.09	7.00	0.27	3.82	4.51	0.07	6.00	0.73
YAF12	1612.06	1716.31	0.20	7.67	0.17	1180.78	1259.19	0.14	5.33	0.83
YAF13	888465.68	924246.23	0.42	8.50	0.00	703056.13	725062.18	0.32	4.50	1.00
YAF14	15483.80	17761.15	0.28	6.93	0.33	13528.45	15457.56	0.23	6.07	0.67
YAF15	137143.86	164482.00	0.18	7.00	0.33	114178.39	136819.08	0.15	6.00	0.67
YAF16	403.29	435.63	0.31	7.93	0.07	269.18	307.05	0.20	5.07	0.93
YAF17	0.67	0.69	0.08	8.53	0.00	0.37	0.41	0.04	4.47	1.00
YAM1	20153.91	22804.03	0.23	7.53	0.07	14592.53	17148.96	0.16	5.47	0.93
YAM2	289444.47	299342.89	0.37	8.33	0.00	210222.95	217449.76	0.26	4.67	1.00
YAM3	2314.93	2443.90	0.26	7.97	0.00	1628.77	1783.07	0.18	5.03	1.00
YAM4	2990.61	3768.89	0.20	6.60	0.63	2800.46	3775.50	0.19	6.40	0.37
YAM5	13.04	13.44	0.66	7.53	0.00	7.89	8.41	0.49	5.47	1.00
YAM6	0.04	0.04	0.02	8.53	0.00	0.02	0.03	0.01	4.47	1.00
YAM7	576.04	599.23	0.49	7.63	0.27	495.09	531.19	0.41	5.37	0.73
YAM8	20.64	20.81	0.34	8.93	0.00	12.45	12.89	0.22	4.07	1.00
YAM10	16.46	17.70	0.25	7.43	0.27	10.90	12.32	0.18	5.57	0.73
YAM11	2050394.86	2550365.43	0.10	6.47	0.53	2031141.02	2649009.63	0.10	6.53	0.47
YAM12	1421044.53	1784294.55	0.10	6.53	0.50	1437692.09	1837070.74	0.10	6.47	0.50
YAM13	1481.06	2147.24	0.41	6.37	0.63	1515.76	2193.74	0.42	6.63	0.37
YAM14	40.01	44.91	0.05	7.30	0.20	27.66	32.61	0.03	5.70	0.80
YAM15	49.71	55.70	0.06	6.37	0.63	49.85	55.74	0.06	6.63	0.37
YAM16	18.64	23.37	0.16	6.90	0.33	16.42	21.51	0.14	6.10	0.67
YAM17	37.03	41.24	0.17	7.20	0.27	30.67	35.43	0.14	5.80	0.73
YAM18	993.65	1033.26	0.18	7.73	0.17	763.32	796.10	0.13	5.27	0.83
YAM19	17.45	22.93	0.14	7.20	0.17	13.99	20.27	0.11	5.80	0.83
YAM20	579.03	652.40	0.06	6.90	0.40	519.85	581.00	0.06	6.10	0.60
YAM21	33.19	36.31	0.14	7.53	0.03	26.07	29.43	0.11	5.47	0.97
YAM22	11.95	14.30	0.11	7.10	0.20	9.73	11.84	0.09	5.90	0.80
YAM23	2069.36	2091.83	0.18	8.50	0.00	1252.77	1305.89	0.10	4.50	1.00
YAM24	2036.33	2134.05	0.21	7.73	0.23	1589.69	1666.01	0.16	5.27	0.77
YAM25	1510.71	1687.28	0.13	7.33	0.27	1255.85	1439.02	0.11	5.67	0.73
YAM26	5575.69	6031.71	0.19	7.30	0.30	4933.01	5287.79	0.17	5.70	0.70
YAM27	312.17	331.34	0.44	8.60	0.00	227.46	239.10	0.30	4.40	1.00
YAM28	432.37	457.08	0.32	8.20	0.03	301.32	329.04	0.21	4.80	0.97
YAM29	424.92	526.20	0.06	6.37	0.57	441.75	540.54	0.06	6.63	0.43
YAM30	19946.57	21521.71	0.27	7.63	0.07	16250.25	17629.65	0.21	5.37	0.93
YAB1	20759.58	23108.13	0.47	8.17	0.00	16118.84	17775.52	0.34	4.83	1.00
YAB2	20908.27	22593.90	0.85	7.73	0.00	16840.42	18317.30	0.68	5.27	1.00
YAB3	178842.92	200267.71	0.31	7.83	0.07	125214.36	144264.87	0.20	5.17	0.93
YAB4	12813.66	16029.88	0.18	7.33	0.13	9123.61	13053.78	0.12	5.67	0.87
YAB5	1664.79	1804.68	0.16	7.27	0.27	1323.16	1461.82	0.12	5.73	0.73
YAB6	150.34	199.45	0.19	6.77	0.43	132.12	182.38	0.16	6.23	0.57
YAB7	147560.92	158318.05	0.21	7.37	0.27	125308.72	135446.95	0.17	5.63	0.73
YAB8	15765.81	19638.08	0.11	6.20	0.57	16340.05	19455.87	0.11	6.80	0.43
YAB9	93291.19	97392.13	0.41	7.60	0.20	71269.95	73938.62	0.29	5.40	0.80
YAB10	4031.96	4515.52	0.11	7.57	0.30	1671.87	2222.43	0.04	5.43	0.70
YAB11	25601.41	29320.40	0.19	7.07	0.37	22076.34	27608.90	0.16	5.93	0.63
YAB12	1285.51	1493.90	0.05	6.57	0.47	1238.47	1466.06	0.05	6.43	0.53
YAI1	314.59	319.63	0.28	8.47	0.00	196.77	208.55	0.16	4.53	1.00
YAI2	7510.50	8694.45	0.24	6.53	0.47	7559.49	8829.40	0.24	6.47	0.53
YAI3	301.44	354.65	0.57	6.53	0.43	309.71	351.62	0.58	6.47	0.57
YAI4	546.10	690.21	0.35	6.70	0.40	523.57	695.02	0.33	6.30	0.60
YAI5	135.26	166.08	0.24	6.70	0.43	132.69	168.05	0.23	6.30	0.57

YAI6	383875.36	386925.21	0.20	8.80	0.00	279008.15	281591.40	0.14	4.20	1.00
YAI7	4602812.61	4689836.16	0.20	8.67	0.00	3493575.56	3560885.27	0.15	4.33	1.00
YAI8	1849.40	1963.93	0.20	7.70	0.07	1305.64	1473.66	0.14	5.30	0.93
YAI9	159.40	165.84	0.44	9.17	0.00	102.45	105.12	0.26	3.83	1.00
YAI10	37638.48	37870.84	0.16	9.47	0.00	23955.32	24055.27	0.10	3.53	1.00
YAI11	172.92	176.83	0.25	8.13	0.00	117.47	126.35	0.16	4.87	1.00
YAI12	368.61	407.56	0.25	7.63	0.10	240.51	293.36	0.15	5.37	0.90
YAI13	331.77	337.28	0.37	8.67	0.00	210.56	220.04	0.22	4.33	1.00
YAI14	855.06	895.08	0.66	8.73	0.00	618.04	632.23	0.45	4.27	1.00
YAI15	47.67	56.19	0.21	6.83	0.50	40.77	48.99	0.17	6.17	0.50
YAI16	36.92	37.84	0.27	8.50	0.00	23.06	24.81	0.16	4.50	1.00
YAI17	251.08	294.61	0.21	7.43	0.20	162.02	223.07	0.13	5.57	0.80
YAI18	26.39	27.25	0.29	8.17	0.00	17.96	18.77	0.21	4.83	1.00
YAI19	77.20	96.52	0.63	7.23	0.17	59.59	75.83	0.48	5.77	0.83
YAI20	3.69	4.05	0.39	7.27	0.00	2.73	2.96	0.31	5.73	1.00
YAI21	432.37	457.08	0.32	8.20	0.03	301.32	329.04	0.21	4.80	0.97
YAI22	2021.94	2163.30	0.38	7.67	0.00	1612.77	1771.07	0.30	5.33	1.00
YAI23	2.19	2.83	0.10	6.60	0.33	2.09	2.73	0.09	6.40	0.67
YAI24	50077.48	54244.58	0.31	8.07	0.00	39127.76	42530.35	0.23	4.93	1.00
YAI25	7.09	8.31	0.14	6.37	0.57	7.66	8.87	0.15	6.63	0.43
YAI26	205.99	240.45	0.25	7.07	0.23	179.10	212.41	0.21	5.93	0.77
YAI27	1251.67	1340.30	0.32	7.53	0.23	995.95	1073.67	0.24	5.47	0.77
YAI28	37.02	39.44	0.11	7.63	0.20	21.72	25.75	0.06	5.37	0.80
YAI29	32.65	38.41	0.21	7.60	0.13	23.58	29.63	0.15	5.40	0.87
YAI30	2.77	3.15	0.19	7.30	0.30	2.00	2.29	0.13	5.70	0.70
YAI31	0.84	1.03	0.12	7.13	0.33	0.62	0.79	0.09	5.87	0.67
YAI32	0.61	0.79	0.05	6.37	0.60	0.63	0.78	0.05	6.63	0.40
YAI33	0.53	0.70	0.07	6.90	0.47	0.47	0.66	0.06	6.10	0.53
YAI34	0.85	0.90	0.23	8.53	0.00	0.50	0.57	0.13	4.47	1.00
YAI35	0.27	0.35	0.09	6.53	0.57	0.27	0.34	0.09	6.47	0.43
YAG1	50.16	50.28	0.20	9.00	0.00	31.42	31.75	0.12	4.00	1.00
YAG2	6.11	6.20	0.11	9.23	0.00	3.82	3.85	0.07	3.77	1.00
YAG3	29.97	30.15	0.31	8.97	0.00	18.81	19.06	0.19	4.03	1.00
YAG4	1.78	2.22	0.20	6.77	0.60	1.68	2.24	0.19	6.23	0.40
YAG5	22.90	23.02	0.19	8.83	0.00	14.57	14.89	0.12	4.17	1.00
YAG6	40.22	42.06	0.32	8.90	0.00	27.60	28.94	0.21	4.10	1.00
YAG7	10.41	11.88	0.09	7.53	0.07	8.46	10.04	0.07	5.47	0.93
YAG8	49.95	50.34	0.25	8.47	0.00	39.87	40.15	0.19	4.53	1.00
YAG9	24.34	24.43	0.19	8.63	0.03	19.51	19.61	0.15	4.37	0.97
YAG10	15.80	15.82	0.17	9.23	0.00	10.68	10.77	0.11	3.77	1.00
YAG11	90953.32	92845.94	0.23	9.37	0.00	58944.61	59372.16	0.14	3.63	1.00
YAG12	36102.95	38404.90	0.29	8.63	0.00	24486.12	25798.26	0.19	4.37	1.00
YAG13	25802.22	26411.48	0.24	8.87	0.00	17017.23	17298.99	0.15	4.13	1.00
YAG14	2451.32	3216.63	0.33	6.47	0.43	2529.35	3124.53	0.35	6.53	0.57
YAG15	9902.28	10113.70	0.27	9.10	0.00	6576.23	6635.68	0.18	3.90	1.00
YAG16	125104.66	128715.02	0.24	9.07	0.00	82774.90	83849.32	0.15	3.93	1.00
YAG17	8.94	9.85	0.20	7.50	0.17	6.44	7.39	0.14	5.50	0.83
YAG18	294.41	317.43	0.38	8.60	0.00	202.41	215.51	0.25	4.40	1.00
YAG19	308.09	335.17	0.40	8.47	0.00	214.24	232.65	0.26	4.53	1.00
YAG20	71.38	71.47	0.08	8.70	0.00	53.00	53.64	0.06	4.30	1.00
YAG21	1.39	1.41	0.22	9.03	0.00	0.94	0.95	0.14	3.97	1.00
YAG22	1.85	1.87	0.18	9.07	0.00	1.17	1.18	0.11	3.93	1.00
YAG23	26.54	27.00	0.20	8.67	0.00	16.22	16.93	0.11	4.33	1.00
YAG24	13.81	13.97	0.20	9.23	0.00	8.87	8.91	0.13	3.77	1.00
YAG25	4.58	4.62	0.20	9.20	0.00	3.01	3.03	0.12	3.80	1.00
YAG26	2.03	2.05	0.17	8.73	0.00	1.32	1.35	0.11	4.27	1.00
YAG27	1.69	1.70	0.26	9.17	0.00	1.13	1.14	0.16	3.83	1.00
YAG28	1.35	1.37	0.17	8.63	0.00	0.86	0.89	0.11	4.37	1.00
YAG29	1.46	1.46	0.18	9.10	0.00	0.95	0.96	0.11	3.90	1.00
YAG30	1.05	1.07	0.23	9.07	0.00	0.71	0.72	0.15	3.93	1.00
YAC1	10.64	10.66	0.14	9.30	0.00	6.43	6.50	0.08	3.70	1.00
YAC2	5.55	5.66	0.19	8.40	0.00	3.37	3.72	0.11	4.60	1.00
YAC3	4.24	4.26	0.22	9.40	0.00	2.59	2.62	0.13	3.60	1.00
YAC4	8.27	8.33	0.34	8.47	0.00	5.06	5.31	0.20	4.53	1.00
YAC5	21.38	21.58	0.20	9.50	0.00	13.90	13.92	0.13	3.50	1.00
YAC6	0.86	1.01	0.05	6.70	0.47	0.77	0.88	0.04	6.30	0.53
YAC7	5.67	5.70	0.16	8.77	0.00	3.68	3.77	0.10	4.23	1.00
YAC8	9.40	9.54	0.32	9.10	0.00	6.11	6.19	0.20	3.90	1.00
YAC9	12.37	12.43	0.29	8.90	0.00	7.64	7.76	0.17	4.10	1.00
YAC10	12037.16	12412.50	0.15	8.70	0.00	8063.25	8235.67	0.10	4.30	1.00
YAC11	8279.93	8658.62	0.22	8.67	0.00	5692.62	5842.16	0.15	4.33	1.00

YAC12	13754.69	13863.81	0.24	9.50	0.00	8502.04	8521.46	0.14	3.50	1.00
YAC13	12384.82	12724.27	0.26	8.73	0.00	8432.57	8690.63	0.17	4.27	1.00
YAC14	11663.57	14191.23	0.19	7.63	0.00	8182.88	10449.73	0.13	5.37	1.00
YAC15	23791.73	24432.23	0.35	9.50	0.00	15892.77	16026.59	0.22	3.50	1.00
YAC16	2910.24	3335.83	0.11	7.10	0.30	2295.11	2701.40	0.08	5.90	0.70
YAC17	12740.06	13267.35	0.31	8.53	0.00	8770.20	9061.48	0.20	4.47	1.00
YAC18	10.60	10.64	0.19	9.47	0.00	6.49	6.52	0.11	3.53	1.00
YAC19	4634904.72	4776697.58	0.15	8.20	0.00	3243090.04	3380677.19	0.10	4.80	1.00
YAC20	801.70	804.73	0.15	9.43	0.00	457.74	460.41	0.08	3.57	1.00
YAC21	367.25	369.94	0.17	8.97	0.00	220.44	225.62	0.10	4.03	1.00
YAC22	706.20	712.98	0.31	9.33	0.00	455.99	456.95	0.19	3.67	1.00
YAC23	452.37	459.86	0.25	8.33	0.00	268.38	287.38	0.14	4.67	1.00
YAC24	332.48	338.93	0.17	9.10	0.00	210.16	213.90	0.11	3.90	1.00
YAC25	1155.53	1208.46	0.31	8.80	0.00	757.32	795.41	0.19	4.20	1.00
YAC26	350.90	359.87	0.32	8.73	0.00	232.24	241.03	0.20	4.27	1.00
YAC27	536.19	547.10	0.31	8.83	0.00	330.88	340.84	0.18	4.17	1.00
YAC28	748.17	766.80	0.28	8.83	0.00	469.16	479.20	0.16	4.17	1.00
YAC29	222.87	226.76	0.11	8.50	0.00	119.81	130.58	0.06	4.50	1.00
YAD1	76.98	84.67	0.38	7.83	0.03	56.01	63.44	0.27	5.17	0.97
YAD2	870.74	913.04	0.02	7.77	0.00	678.81	725.99	0.02	5.23	1.00
YAD3	6.81	8.36	0.02	6.97	0.33	5.36	7.11	0.02	6.03	0.67
YAD4	355.95	387.21	0.25	7.63	0.10	225.92	280.94	0.16	5.37	0.90
YAD5	11.49	13.11	0.02	7.07	0.17	9.93	11.95	0.02	5.93	0.83
YAD6	22.71	30.44	0.05	6.40	0.63	23.17	30.89	0.05	6.60	0.37
YAD7	20.98	29.52	0.05	6.23	0.70	21.59	30.15	0.05	6.77	0.30
YAD8	43.32	59.48	0.05	6.23	0.67	44.38	60.57	0.05	6.77	0.33
YAD9	19.40	22.35	0.02	7.03	0.17	16.70	20.25	0.02	5.97	0.83
YAD10	22.25	25.58	0.02	7.10	0.13	19.06	23.19	0.02	5.90	0.87
YAD11	1563.34	1856.63	0.29	7.33	0.20	1310.48	1568.09	0.24	5.67	0.80
YAD12	1.02	1.07	0.03	8.27	0.00	0.57	0.68	0.02	4.73	1.00
YAD13	0.49	0.53	0.01	5.87	0.63	0.53	0.56	0.01	7.13	0.37
YAD14	577.54	790.33	0.29	6.43	0.57	587.14	780.78	0.30	6.57	0.43
YAD15	2.48	2.57	0.12	8.40	0.00	1.66	1.69	0.08	4.60	1.00
YAD16	0.09	0.10	0.01	5.80	0.60	0.10	0.10	0.01	7.20	0.40
YAD17	50752.09	54535.52	0.11	7.40	0.17	46133.69	48449.48	0.10	5.60	0.83
YAD18	0.44	0.53	0.16	6.87	0.37	0.42	0.49	0.15	6.13	0.63
YAD19	182310.87	191398.51	0.10	8.17	0.10	144277.66	147359.27	0.08	4.83	0.90
YAD20	208.84	210.49	0.28	9.00	0.00	139.65	141.03	0.18	4.00	1.00
YAD21	633.60	649.32	0.02	8.40	0.03	346.01	388.70	0.01	4.60	0.97
YAD22	33.23	35.53	0.07	7.63	0.13	24.51	28.05	0.05	5.37	0.87
YAD23	31.71	33.77	0.07	7.90	0.10	23.37	26.53	0.05	5.10	0.90
YAD24	8294.82	9590.11	0.03	7.43	0.23	5765.42	7425.75	0.02	5.57	0.77
YAD25	577.89	588.93	0.02	8.60	0.00	328.81	362.98	0.01	4.40	1.00
YAD26	10427.12	11348.84	0.03	7.77	0.10	6563.25	7880.81	0.02	5.23	0.90
YAD27	1310.61	1373.01	0.14	8.10	0.00	896.17	933.91	0.09	4.90	1.00
YAD28	1027.24	1056.36	0.14	8.20	0.00	713.86	733.77	0.10	4.80	1.00
YAD29	0.72	0.83	0.01	6.70	0.37	0.69	0.82	0.01	6.30	0.63
YAD30	312.30	344.60	0.23	7.43	0.13	247.41	294.14	0.18	5.57	0.87
QRF1	1.42	1.60	0.61	8.68	0.35	1.37	1.59	0.60	8.33	0.65
QRF2	31.46	39.03	0.22	9.28	0.03	28.42	34.98	0.19	7.73	0.98
QRM1	65.28	69.64	0.26	8.63	0.43	64.71	69.90	0.26	8.38	0.58
QNF1	5561.66	6427.90	0.15	8.33	0.63	5666.63	6510.70	0.15	8.68	0.38
QNF2	57811.24	63124.41	0.08	9.55	0.10	46459.10	52286.64	0.06	7.45	0.90
QNF3	63.98	75.20	0.10	9.08	0.28	56.77	65.50	0.09	7.93	0.73
QNM1	11.32	13.94	0.35	7.88	0.65	12.09	14.50	0.37	9.13	0.35
QNM2	15.73	18.25	0.10	9.08	0.33	14.44	17.40	0.09	7.93	0.68
QNM3	810.94	1040.35	0.31	8.30	0.58	843.52	1073.19	0.32	8.70	0.43
QNM4	2269.31	2519.64	0.19	8.48	0.45	2297.91	2467.57	0.19	8.53	0.55
QNM5	15.11	17.53	0.10	9.08	0.33	13.87	16.72	0.09	7.93	0.68
QNM6	50.32	58.48	0.17	8.80	0.43	48.90	59.04	0.16	8.20	0.58
QNM7	122.50	135.86	0.20	9.18	0.13	111.72	122.52	0.19	7.83	0.88
QNM8	1990.08	2234.75	0.07	8.75	0.38	1872.81	2090.19	0.07	8.25	0.63
QNM9	9202.32	10999.18	0.07	8.50	0.58	8886.69	10675.67	0.07	8.50	0.43
QNM10	6205.93	7383.46	0.24	8.20	0.65	6538.30	7646.44	0.25	8.80	0.35
QNM11	44894.80	48107.09	0.08	9.78	0.13	36359.51	39615.53	0.06	7.23	0.88
QNM12	10430.58	12586.67	0.08	9.00	0.23	9672.41	11990.59	0.07	8.00	0.78
QNM13	6672.72	7316.76	0.25	8.38	0.58	6882.88	7561.25	0.26	8.63	0.43
QNM14	63975.63	75195.36	0.10	9.08	0.28	56767.93	65495.84	0.09	7.93	0.73
QNM15	3452.21	4230.63	0.03	9.10	0.35	3099.80	3761.16	0.03	7.90	0.65
QNM16	7728.03	9391.62	0.05	9.00	0.33	7264.16	9242.53	0.05	8.00	0.68
QNM17	18.00	20.23	0.06	9.28	0.40	13.65	16.61	0.04	7.73	0.60

QNM18	185.09	236.60	0.18	8.55	0.53	176.10	226.44	0.17	8.45	0.48
QNM19	178.25	223.57	0.14	8.28	0.70	181.85	227.81	0.15	8.73	0.30
QNM20	178.18	223.53	0.14	8.28	0.70	181.84	227.80	0.15	8.73	0.30
QNB1	35.10	38.85	0.13	8.33	0.55	35.50	39.03	0.14	8.68	0.45
QNB2	5.71	6.88	0.56	8.50	0.63	5.54	6.67	0.55	8.50	0.38
QNB3	10452.30	12577.21	0.14	8.63	0.48	10422.49	12929.94	0.14	8.38	0.53
QNB4	184.13	234.13	0.24	7.93	0.88	194.90	240.94	0.25	9.08	0.13
QNB5	65.04	72.92	0.21	8.63	0.45	64.58	72.70	0.21	8.38	0.55
QNB6	52.56	60.25	0.12	8.53	0.53	52.75	61.20	0.12	8.48	0.48
QNB7	24854.71	30538.79	0.24	8.50	0.53	25262.59	31493.57	0.25	8.50	0.48
QNB8	19.82	23.41	0.02	8.98	0.23	17.96	21.34	0.02	8.03	0.78
QNB10	752.63	987.13	0.72	9.23	0.25	697.22	904.67	0.68	7.78	0.75
QNB11	2496.90	2645.62	0.11	10.13	0.08	2043.60	2183.70	0.09	6.88	0.93
QNB12	63.07	83.53	0.19	9.00	0.13	58.08	78.56	0.17	8.00	0.88
QNB13	11842.23	13205.78	0.43	9.40	0.15	9761.25	11356.54	0.36	7.60	0.85
QNB14	2095.64	2315.03	0.28	8.75	0.40	1986.04	2300.55	0.26	8.25	0.60
QNB15	19210.93	21838.60	0.11	8.83	0.40	17291.88	19075.50	0.10	8.18	0.60
QNB16	2529.86	3149.77	0.16	8.38	0.70	2592.68	3234.86	0.17	8.63	0.30
QNB17	3569.23	4193.41	0.37	8.95	0.20	3201.25	3859.31	0.34	8.05	0.80
QRI1	230.02	269.83	0.11	8.48	0.50	227.95	265.80	0.11	8.53	0.50
QRI2	10.41	12.13	0.09	8.48	0.40	10.55	12.03	0.09	8.53	0.60
QRI3	8.10	9.44	0.10	8.98	0.30	7.14	8.41	0.09	8.03	0.70
QRI4	0.24	0.25	0.12	10.35	0.00	0.17	0.18	0.08	6.65	1.00
QRI5	8.00	8.94	0.08	7.93	0.88	8.21	9.15	0.08	9.08	0.13
QNI1	17.01	18.72	0.15	8.75	0.43	16.78	18.89	0.15	8.25	0.58
QNI2	16.80	19.51	0.14	9.45	0.28	14.12	17.37	0.12	7.55	0.73
QNI3	3.83	4.20	0.19	8.50	0.53	3.81	4.26	0.18	8.50	0.48
QNI4	16.94	19.38	0.10	8.50	0.48	16.60	19.44	0.10	8.50	0.53
QNI5	2.47	3.20	0.11	8.73	0.48	2.49	3.31	0.11	8.28	0.53
QNI6	4.15	4.94	0.11	8.85	0.43	3.58	4.41	0.10	8.15	0.58
QNI7	5.47	6.44	0.08	8.50	0.53	5.17	6.16	0.08	8.50	0.48
QNI8	13.13	15.67	0.11	8.95	0.35	11.25	13.66	0.10	8.05	0.65
QNI9	78.44	98.02	0.09	8.88	0.25	70.08	91.68	0.08	8.13	0.75
QNI10	6.62	9.06	0.06	8.95	0.33	6.43	8.84	0.06	8.05	0.68
QNI11	341.50	365.93	0.08	9.78	0.13	276.57	301.34	0.06	7.23	0.88
QNI12	95.13	103.18	0.11	8.45	0.55	94.72	103.25	0.11	8.55	0.45
QNI13	7727.91	9392.28	0.05	9.00	0.33	7263.74	9243.25	0.05	8.00	0.68
QNG1	112.64	116.81	0.38	9.88	0.00	93.20	98.62	0.31	7.13	1.00
QNG2	4.64	5.07	0.04	8.68	0.48	4.63	4.95	0.04	8.33	0.53
QNG3	5.33	5.76	0.05	8.65	0.43	5.15	5.57	0.05	8.35	0.58
QNG4	0.58	0.65	0.04	9.25	0.25	0.52	0.61	0.03	7.75	0.75
QNG5	4.65	5.26	0.04	8.78	0.43	4.36	4.84	0.04	8.23	0.58
QNG6	4.75	5.43	0.03	9.53	0.33	3.57	4.12	0.02	7.48	0.68
QNG7	3.55	3.94	0.04	9.00	0.38	3.03	3.52	0.04	8.00	0.63
QNG8	23.78	24.08	0.13	12.15	0.00	13.30	13.40	0.07	4.85	1.00
QNG9	1.38	1.73	0.05	8.53	0.53	1.45	1.89	0.05	8.48	0.48
QNG10	5.53	7.87	0.08	8.10	0.60	6.27	8.57	0.09	8.90	0.40
QNG11	4.18	4.99	0.04	9.13	0.30	3.58	4.46	0.04	7.88	0.70
QNG12	5.83	6.68	0.04	8.93	0.33	4.68	5.66	0.03	8.08	0.68
QNG13	8.30	8.31	0.07	11.98	0.00	4.35	4.61	0.03	5.03	1.00
QNG14	8.16	8.18	0.06	12.13	0.00	4.27	4.50	0.03	4.88	1.00
QNG15	9.78	9.81	0.07	12.13	0.00	5.01	5.35	0.04	4.88	1.00
QNG16	8.97	8.98	0.07	12.38	0.00	4.75	4.95	0.04	4.63	1.00
QNG17	122.19	123.89	0.09	11.85	0.00	75.10	76.54	0.06	5.15	1.00
QNG18	423.05	461.69	0.04	9.65	0.10	325.36	362.50	0.03	7.35	0.90
QNG19	823.83	842.76	0.07	10.28	0.00	662.76	680.01	0.05	6.73	1.00
QNG20	7376.14	7452.97	0.09	10.75	0.00	5799.81	5870.83	0.07	6.25	1.00
QNG21	2236.89	2245.69	0.08	11.00	0.00	1723.36	1749.30	0.06	6.00	1.00
QNG22	852.13	906.29	0.10	10.15	0.03	681.73	727.80	0.08	6.85	0.98
QNG23	9932.00	9987.34	0.15	10.33	0.00	7875.81	8049.03	0.12	6.68	1.00
QNG24	1650.03	1777.60	0.11	9.53	0.05	1219.36	1431.28	0.08	7.48	0.95
QNG25	20.81	22.95	0.11	10.05	0.05	14.27	16.78	0.07	6.95	0.95
QNG26	12.38	13.70	0.09	8.78	0.33	11.58	13.08	0.08	8.23	0.68
QNG27	157.28	187.27	0.43	9.58	0.08	135.98	161.28	0.36	7.43	0.93
QNC1	1654.99	1740.31	0.04	9.90	0.03	1265.90	1358.35	0.03	7.10	0.98
QNC2	14.06	15.25	0.12	9.10	0.38	13.38	14.45	0.11	7.90	0.63
QNC3	0.79	0.88	0.05	8.33	0.60	0.82	0.91	0.05	8.68	0.40
QNC4	1.24	1.47	0.07	8.70	0.45	1.19	1.41	0.07	8.30	0.55
QNC5	1.99	2.53	0.26	8.30	0.60	2.12	2.53	0.27	8.70	0.40
QNC6	14.24	15.65	0.31	10.25	0.05	8.69	10.87	0.18	6.75	0.95
QNC7	45.30	55.13	0.31	8.58	0.40	42.22	50.63	0.29	8.43	0.60

QNC8	7.59	8.85	0.17	9.43	0.33	5.92	7.26	0.13	7.58	0.68
QNC9	11.19	12.53	0.17	10.30	0.10	7.60	9.41	0.11	6.70	0.90
QNC10	50.14	55.62	0.12	9.80	0.25	32.22	38.73	0.07	7.20	0.75
QNC11	211.97	231.36	0.19	10.45	0.10	110.57	138.04	0.09	6.55	0.90
QNC12	87.18	98.07	0.20	10.15	0.18	55.74	65.95	0.12	6.85	0.83
QNC13	3.05	3.90	0.05	8.78	0.38	2.74	3.58	0.04	8.23	0.63
QNC14	240.63	302.09	0.48	8.90	0.33	230.37	298.32	0.44	8.10	0.68
QNC15	16.97	17.10	0.11	10.23	0.00	14.07	14.35	0.09	6.78	1.00
QNC16	1422.23	1464.54	0.09	10.15	0.00	1091.10	1172.48	0.07	6.85	1.00
QNC17	19.08	21.03	0.10	9.35	0.25	14.25	16.67	0.07	7.65	0.75
QNC18	87.40	97.06	0.15	9.10	0.25	74.68	85.50	0.13	7.90	0.75
QNC19	12.72	14.27	0.07	9.18	0.25	10.39	12.10	0.06	7.83	0.75
QNC20	40.55	45.09	0.27	8.25	0.68	41.85	45.77	0.28	8.75	0.33
QNC21	8.52	10.15	0.07	8.58	0.43	8.64	10.20	0.07	8.43	0.58
QNC22	1409.79	1504.08	0.23	10.10	0.03	1115.18	1209.74	0.18	6.90	0.98
QNC23	7263.47	7461.59	0.38	10.23	0.00	6080.36	6346.81	0.32	6.78	1.00
QNC24	13.88	17.25	0.14	8.58	0.43	13.17	16.73	0.13	8.43	0.58
QNC25	366.00	424.71	0.11	9.85	0.13	261.16	339.69	0.08	7.15	0.88
QNC26	23.89	28.58	0.05	8.50	0.53	23.87	28.37	0.05	8.50	0.48
QNC27	45.76	53.99	0.17	9.40	0.25	34.13	42.48	0.12	7.60	0.75
QNC28	1179.90	1307.43	0.11	9.55	0.23	862.83	999.76	0.08	7.45	0.78
QNC29	10.93	12.04	0.07	9.20	0.28	9.10	10.24	0.06	7.80	0.73
QRG1	22.29	25.37	0.03	9.00	0.30	17.15	20.80	0.03	8.00	0.70
QRG2	20.57	21.66	0.05	10.13	0.00	15.04	16.39	0.04	6.88	1.00
QRG3	6.44	7.27	0.03	9.15	0.28	5.13	6.03	0.03	7.85	0.73
QRG4	4.41	5.61	0.04	8.70	0.40	4.29	5.52	0.04	8.30	0.60
QRG5	27.96	29.89	0.10	9.33	0.23	24.59	26.57	0.09	7.68	0.78
QRG6	1.26	1.29	0.07	10.95	0.00	0.89	0.92	0.05	6.05	1.00
QRG7	70.64	70.78	0.08	11.45	0.00	49.07	49.69	0.06	5.55	1.00
QRG8	7.06	7.89	0.05	9.63	0.18	4.48	5.69	0.03	7.38	0.83
QRG9	1.54	1.68	0.03	9.40	0.28	1.11	1.21	0.02	7.60	0.73
QRG10	1.95	2.21	0.11	9.08	0.23	1.65	1.86	0.09	7.93	0.78
QRG11	5.53	6.95	0.05	8.43	0.53	5.29	6.66	0.05	8.58	0.48
QRG12	100.42	101.20	0.09	10.85	0.00	78.32	79.12	0.07	6.15	1.00
QRG13	526.33	537.01	0.08	10.60	0.00	387.46	401.68	0.06	6.40	1.00
QRG14	14.07	16.59	0.07	8.73	0.58	13.44	16.17	0.07	8.28	0.43
QRG15	20.30	20.47	0.15	11.50	0.00	16.02	16.06	0.12	5.50	1.00
QRG16	567.22	567.38	0.04	12.50	0.00	411.98	414.16	0.03	4.50	1.00
QRG17	2255.32	2309.32	0.06	10.63	0.00	1558.76	1634.31	0.04	6.38	1.00
QRG18	472.25	555.40	0.02	9.78	0.20	329.62	439.93	0.02	7.23	0.80
QRC1	987.34	1121.87	0.95	8.65	0.38	984.02	1118.04	0.93	8.35	0.63
QRC2	66.38	71.08	0.16	10.43	0.00	49.77	54.14	0.12	6.58	1.00
QRC3	6.18	6.60	0.05	9.90	0.18	4.14	4.68	0.03	7.10	0.83
QRC4	6.77	8.81	0.07	8.38	0.55	6.86	8.88	0.07	8.63	0.45
QRC5	3.57	4.13	0.12	8.85	0.30	3.43	4.06	0.12	8.15	0.70
QRC6	7.40	8.14	0.16	8.75	0.35	7.07	7.85	0.16	8.25	0.65
QRC7	12.96	17.82	0.13	8.33	0.63	13.32	18.12	0.13	8.68	0.38
QRC8	10.05	13.11	0.09	8.53	0.43	10.18	13.10	0.09	8.48	0.58
QRC9	1.80	2.07	0.02	8.60	0.40	1.79	2.02	0.02	8.40	0.60
QRC10	4.81	6.22	0.04	8.63	0.43	4.69	6.16	0.04	8.38	0.58
QRC11	10.85	11.95	0.10	8.83	0.30	10.56	11.46	0.10	8.18	0.70
QRC12	4.28	4.67	0.01	9.20	0.38	3.31	3.69	0.01	7.80	0.63
QRC13	6.17	6.59	0.05	9.90	0.18	4.13	4.67	0.03	7.10	0.83
QRC14	6.68	6.86	0.05	10.68	0.00	4.44	4.71	0.03	6.33	1.00
QRC15	5.79	5.96	0.05	10.75	0.03	3.64	3.92	0.03	6.25	0.98
QRC16	6.30	6.61	0.04	10.33	0.10	3.47	4.01	0.02	6.68	0.90
QRC17	5.56	5.80	0.05	10.40	0.03	3.73	4.09	0.03	6.60	0.98
QRC18	6.93	7.25	0.05	10.43	0.00	4.59	5.04	0.03	6.58	1.00
QRC19	0.25	0.27	0.11	8.55	0.45	0.24	0.27	0.11	8.45	0.55
QRC20	0.70	0.87	0.13	8.73	0.38	0.64	0.80	0.12	8.28	0.63
QRC21	9.14	11.43	0.08	8.48	0.53	9.06	11.42	0.08	8.53	0.48
QRC22	7.73	8.87	0.06	8.55	0.48	7.48	8.44	0.06	8.45	0.53
QRC23	5.53	6.95	0.05	8.43	0.53	5.29	6.66	0.05	8.58	0.48
QRC24	96.21	109.83	0.14	8.88	0.35	91.52	105.18	0.14	8.13	0.65
QRC25	7.49	9.79	0.08	8.48	0.48	7.57	9.82	0.08	8.53	0.53
QRC26	131.84	132.44	0.10	11.53	0.00	98.62	99.29	0.07	5.48	1.00
QRC27	5.04	6.28	0.05	8.63	0.55	4.93	6.18	0.04	8.38	0.45
QRC28	9.11	10.16	0.05	9.10	0.38	6.38	7.71	0.03	7.90	0.63
QRC29	18.91	20.45	0.14	8.73	0.38	18.27	19.64	0.13	8.28	0.63
QRC30	21.85	24.58	0.15	8.70	0.45	21.28	23.94	0.15	8.30	0.55
QND1	28.11	34.83	0.32	8.60	0.48	27.03	34.77	0.31	8.40	0.53

QND2	23.17	37.74	0.12	8.85	0.38	20.84	35.46	0.10	8.15	0.63
QND3	6.04	7.02	0.13	8.65	0.35	6.08	7.46	0.13	8.35	0.65
QND4	109.36	112.74	0.28	10.05	0.00	84.18	90.24	0.21	6.95	1.00
QND5	0.08	0.09	0.01	8.75	0.30	0.07	0.08	0.01	8.25	0.70
QND6	0.84	1.05	0.01	8.28	0.65	0.92	1.13	0.01	8.73	0.35
QND7	7.51	7.70	0.06	11.20	0.00	3.79	4.13	0.03	5.80	1.00
QND8	3.24	3.25	0.03	12.28	0.00	1.61	1.65	0.01	4.73	1.00
QND9	7.79	7.89	0.06	11.65	0.00	3.96	4.25	0.03	5.35	1.00
QND10	148.58	180.61	0.26	9.93	0.00	125.84	152.56	0.21	7.08	1.00
QND11	84.32	94.38	0.34	9.73	0.00	69.52	80.30	0.28	7.28	1.00
QND12	5.48	6.79	0.17	8.28	0.58	5.78	7.24	0.18	8.73	0.43
QND13	29.05	35.72	0.33	8.55	0.45	28.48	35.48	0.32	8.45	0.55
QND14	98.88	107.25	0.32	9.40	0.15	83.67	93.29	0.27	7.60	0.85
QND15	0.46	0.48	0.02	10.35	0.08	0.28	0.31	0.01	6.65	0.93
QND16	0.20	0.23	0.07	8.88	0.43	0.17	0.20	0.06	8.13	0.58
QND17	16.45	21.00	0.05	9.08	0.45	13.12	17.86	0.04	7.93	0.55
QND18	1.02	1.28	0.31	8.63	0.45	0.99	1.25	0.30	8.38	0.55
QND19	201.90	222.85	0.03	8.90	0.33	192.47	207.49	0.03	8.10	0.68
QND20	0.01	0.01	0.01	8.78	0.35	0.01	0.01	0.01	8.23	0.65
QND21	14.71	18.53	0.23	8.40	0.58	15.14	18.71	0.24	8.60	0.43
QND22	14.69	18.20	0.16	8.70	0.43	14.11	17.90	0.16	8.30	0.58
QND23	3.92	4.51	0.01	9.15	0.35	3.08	3.59	0.01	7.85	0.65
QND24	7.03	7.81	0.45	8.10	0.78	7.36	8.06	0.47	8.90	0.23
QND25	1.67	1.91	0.30	8.43	0.55	1.71	1.99	0.30	8.58	0.45
QND26	4.94	5.45	0.07	9.95	0.03	3.52	3.98	0.05	7.05	0.98
QND27	78.60	93.81	0.47	8.38	0.65	85.40	101.12	0.51	8.63	0.35
QND28	17.73	20.99	0.20	7.98	0.60	19.64	22.92	0.22	9.03	0.40
QND29	7.91	10.00	0.10	8.58	0.43	7.47	9.36	0.09	8.43	0.58
QND30	96.56	138.73	0.16	8.38	0.68	93.41	135.76	0.15	8.63	0.33
QND31	3.01	3.56	0.03	8.75	0.33	2.99	3.49	0.03	8.25	0.68
QND32	0.50	0.57	0.01	9.38	0.13	0.41	0.49	0.01	7.63	0.88
QND33	1136.15	1412.11	0.46	8.48	0.60	1116.10	1379.80	0.45	8.53	0.40
QND34	18.70	19.00	0.13	10.93	0.00	14.66	14.81	0.10	6.08	1.00
QND35	43.84	49.70	0.04	9.05	0.33	38.80	44.29	0.03	7.95	0.68
QND36	68.50	86.73	0.39	9.20	0.20	58.06	76.83	0.34	7.80	0.80
QND37	18.28	19.99	0.38	8.85	0.35	17.69	19.71	0.36	8.15	0.65
QND38	23.15	25.67	0.03	9.63	0.15	17.21	20.72	0.02	7.38	0.85
QND39	1.11	1.23	0.37	8.93	0.33	1.02	1.15	0.34	8.08	0.68
MRF1	381431.07	449548.18	0.37	18.64	0.52	378838.54	451940.32	0.37	18.36	0.48
MRM1	35.44	47.00	0.17	19.52	0.18	29.71	41.63	0.14	17.48	0.82
MRM2	116.16	177.48	0.16	18.50	0.47	113.91	177.30	0.16	18.50	0.53
MRM4	768.80	906.33	0.14	19.13	0.36	693.23	796.18	0.13	17.87	0.64
MRM5	2.99	3.76	0.07	18.38	0.43	2.98	3.69	0.07	18.62	0.57
MRM6	1557.87	1780.25	0.58	19.21	0.39	1412.71	1615.82	0.55	17.79	0.61
MRM7	29229.86	36057.95	0.20	18.39	0.53	29317.04	35669.09	0.20	18.61	0.47
MRM8	142.26	181.22	0.19	19.03	0.47	127.50	168.48	0.18	17.97	0.53
MRM9	2955.23	3189.23	0.41	19.69	0.29	2698.80	3071.23	0.37	17.31	0.71
MRM10	1185.83	1620.98	0.23	18.37	0.51	1189.54	1621.70	0.23	18.63	0.49
MRM11	671.04	839.01	0.17	19.01	0.30	641.43	820.83	0.16	17.99	0.70
MRM12	3.96	4.86	0.14	18.18	0.54	4.04	4.90	0.14	18.82	0.46
MRM13	3.02	3.86	0.15	18.42	0.60	3.07	3.95	0.15	18.58	0.40
MRM15	386.05	504.63	0.27	19.09	0.33	374.96	495.76	0.26	17.91	0.67
MRM16	2827.03	3253.50	0.38	18.31	0.41	2816.32	3202.61	0.38	18.69	0.59
MRM17	8.85	10.71	0.09	19.13	0.34	7.95	9.86	0.08	17.87	0.66
MRM18	2.55	3.37	0.08	18.22	0.58	2.62	3.44	0.08	18.78	0.42
MRB1	870.72	1036.74	0.27	18.24	0.69	892.65	1058.27	0.28	18.76	0.31
MRB2	1239.08	1789.71	0.22	18.14	0.53	1258.89	1780.03	0.22	18.86	0.47
MRB3	1414.07	1958.44	0.26	18.37	0.50	1416.88	1922.84	0.26	18.63	0.50
MRB4	1495.96	2450.50	0.20	18.02	0.64	1590.40	2514.39	0.21	18.98	0.36
MRB5	339.34	516.94	0.16	18.98	0.37	318.79	495.90	0.15	18.02	0.63
MRB6	4.69	6.55	0.13	18.24	0.60	4.85	6.89	0.13	18.76	0.40
MRB7	10.95	14.30	0.02	18.44	0.61	10.60	13.87	0.02	18.56	0.39
MRB8	339.92	475.76	0.27	18.54	0.51	340.48	478.75	0.27	18.46	0.49
MRB9	1420.22	1721.97	0.39	18.63	0.49	1435.69	1764.31	0.40	18.37	0.51
MRB10	887.15	1191.01	0.26	18.42	0.54	892.05	1201.60	0.26	18.58	0.46
MRB11	367.57	449.99	0.23	18.61	0.53	355.09	434.20	0.22	18.39	0.47
MRB12	29.61	37.01	0.19	18.54	0.40	28.03	35.13	0.18	18.46	0.60
MRB13	9.04	13.17	0.22	18.77	0.43	9.00	13.22	0.21	18.23	0.57
MRB14	309.38	476.26	0.32	18.30	0.63	319.97	489.92	0.33	18.70	0.37
MRB15	417.80	603.65	0.26	18.81	0.53	404.98	604.65	0.25	18.19	0.47
MRB16	492.06	581.12	0.20	18.18	0.60	502.15	587.27	0.21	18.82	0.40

MRB17	38.24	53.52	0.14	18.51	0.57	37.75	52.59	0.14	18.49	0.43
MRB18	59.24	78.51	0.10	18.68	0.50	56.76	75.78	0.10	18.32	0.50
MRB19	42.42	48.64	0.20	18.09	0.61	43.71	49.76	0.20	18.91	0.39
MRB20	95.79	124.40	0.11	17.79	0.67	100.16	126.30	0.12	19.21	0.33
MRB21	111.55	174.37	0.13	19.03	0.47	109.22	175.38	0.12	17.97	0.53
MRB22	77.12	120.79	0.18	18.82	0.44	74.28	118.32	0.17	18.18	0.56
MRB23	126.30	177.76	0.31	19.08	0.32	119.94	176.03	0.29	17.92	0.68
MRB24	53.46	62.48	0.24	18.38	0.49	51.46	58.76	0.23	18.62	0.51
MRB25	2748.90	3347.41	0.11	18.42	0.52	2772.71	3342.13	0.11	18.58	0.48
MRB26	2778.71	3382.43	0.11	18.40	0.52	2805.44	3377.70	0.11	18.60	0.48
MRB27	1590.75	1900.41	0.09	18.41	0.50	1592.66	1901.11	0.09	18.59	0.50
MRB28	1546.27	1804.47	0.10	18.88	0.40	1501.61	1729.64	0.09	18.12	0.60
MRB29	4.85	6.35	0.03	18.49	0.44	4.74	6.19	0.03	18.51	0.56
MRB30	1436.26	1630.98	0.23	18.06	0.58	1490.72	1677.08	0.24	18.94	0.42
MRB31	1452.74	1699.92	0.22	19.16	0.39	1348.83	1587.34	0.20	17.84	0.61
MRB32	0.33	0.40	0.04	19.32	0.41	0.27	0.34	0.03	17.68	0.59
MNF1	4004.10	5948.42	0.13	18.03	0.60	4178.49	6078.72	0.14	18.97	0.40
MNF2	174.83	204.54	0.09	18.43	0.44	177.84	203.23	0.09	18.57	0.56
MNF3	72.29	81.66	0.02	20.09	0.30	57.36	67.41	0.02	16.91	0.70
MNF4	6.01	7.24	0.10	18.60	0.44	6.01	7.22	0.10	18.40	0.56
MNF5	8066.16	10003.30	0.17	19.01	0.41	8054.06	10298.75	0.17	17.99	0.59
MNF6	2404.65	3654.75	0.23	18.38	0.58	2472.53	3744.31	0.23	18.62	0.42
MNF7	63.79	78.82	0.18	18.73	0.43	63.97	80.83	0.18	18.27	0.57
MNF8	133.22	163.06	0.19	19.04	0.42	127.95	157.83	0.18	17.96	0.58
MNF9	1744.65	1961.74	0.16	18.84	0.46	1709.21	1887.77	0.15	18.16	0.54
MNM1	6.75	7.93	0.08	19.34	0.30	5.80	6.73	0.07	17.66	0.70
MNM5	2.92	3.65	0.08	18.01	0.57	3.02	3.70	0.08	18.99	0.43
MNM6	15077.23	20628.50	0.16	18.28	0.59	15700.97	21065.71	0.16	18.72	0.41
MNM7	285.73	394.39	0.08	18.30	0.56	282.59	382.61	0.08	18.70	0.44
MNM8	126.76	182.43	0.14	19.48	0.28	101.74	150.96	0.11	17.52	0.72
MNM9	173.43	217.76	0.06	18.71	0.41	169.64	215.18	0.06	18.29	0.59
MNM10	1954.66	2431.09	0.23	18.66	0.47	1931.71	2434.13	0.22	18.34	0.53
MNM11	722.61	832.33	0.08	18.71	0.40	713.94	822.84	0.08	18.29	0.60
MNM12	3047.14	3851.75	0.13	19.19	0.41	2897.30	3721.70	0.13	17.81	0.59
MNM13	56.49	70.47	0.11	18.22	0.57	57.37	70.92	0.11	18.78	0.43
MNM14	862.61	1154.66	0.13	18.46	0.52	878.94	1178.21	0.13	18.54	0.48
MNM15	4723.78	5418.37	0.35	18.83	0.44	4682.67	5467.49	0.35	18.17	0.56
MNM16	4921.57	5825.12	0.09	18.59	0.52	4899.17	5873.08	0.09	18.41	0.48
MNM17	211.80	265.96	0.20	19.02	0.44	201.71	263.17	0.20	17.98	0.56
MNM18	4497.92	6953.99	0.18	18.76	0.41	4527.99	7044.74	0.18	18.24	0.59
MNM19	2863.15	4192.58	0.19	17.81	0.57	2977.79	4233.76	0.19	19.19	0.43
MNM20	11.32	15.95	0.07	18.44	0.54	11.44	16.12	0.07	18.56	0.46
MNM21	257.24	313.92	0.14	19.17	0.32	245.85	309.88	0.14	17.83	0.68
MNM22	565.45	718.74	0.08	18.52	0.46	567.14	719.79	0.09	18.48	0.54
MNM23	144.96	180.20	0.35	18.48	0.52	147.46	184.18	0.36	18.52	0.48
MNM24	3306.47	4126.10	0.19	18.40	0.54	3341.00	4182.49	0.19	18.60	0.46
MNM25	2813.32	4076.94	0.24	18.14	0.60	2916.14	4172.38	0.24	18.86	0.40
MNM26	1572.28	1863.69	0.22	18.54	0.52	1582.35	1882.55	0.22	18.46	0.48
MNM27	35500.33	50708.58	0.25	18.27	0.63	35582.79	50760.20	0.25	18.73	0.37
MNM28	151.39	209.04	0.06	19.19	0.41	140.86	200.49	0.05	17.81	0.59
MNM29	1857.13	2259.12	0.08	18.42	0.50	1856.83	2236.03	0.08	18.58	0.50
MNM30	1347.02	2001.01	0.19	18.39	0.57	1379.06	2047.30	0.20	18.61	0.43
MNM31	162.79	207.94	0.11	18.34	0.51	166.37	211.14	0.11	18.66	0.49
MNM32	29937.45	33557.88	0.48	18.41	0.59	30051.16	33696.47	0.49	18.59	0.41
MNM33	381.69	470.65	0.14	18.70	0.41	373.14	466.15	0.14	18.30	0.59
MNM34	3003.94	3916.80	0.29	18.76	0.40	2902.49	3848.32	0.28	18.24	0.60
MNM35	419.69	599.89	0.16	18.26	0.43	428.11	598.30	0.16	18.74	0.57
MNM37	14091.38	15782.40	0.12	18.40	0.56	14097.91	15743.95	0.12	18.60	0.44
MNM38	885.77	1072.36	0.11	18.47	0.52	882.49	1056.34	0.11	18.53	0.48
MNM39	191.52	226.51	0.12	19.53	0.32	176.03	210.62	0.11	17.47	0.68
MNM40	52.98	68.83	0.09	18.89	0.37	50.56	66.21	0.09	18.11	0.63
MNM41	77.47	111.51	0.12	18.59	0.44	75.87	108.32	0.11	18.41	0.56
MNM42	296.38	347.95	0.11	18.52	0.44	290.20	327.87	0.11	18.48	0.56
MNM43	23.48	28.89	0.16	18.34	0.58	23.88	29.07	0.16	18.66	0.42
MNM44	67.62	91.20	0.09	19.07	0.36	61.20	84.52	0.08	17.93	0.64
MNM45	55.87	67.84	0.07	19.11	0.38	51.29	64.00	0.07	17.89	0.62
MNM46	60.03	91.11	0.10	19.11	0.33	51.76	78.45	0.09	17.89	0.67
MNM47	0.34	0.39	0.02	19.42	0.29	0.31	0.37	0.02	17.58	0.71
MNM48	2096.97	2853.25	0.15	19.50	0.38	1935.09	2789.62	0.14	17.50	0.62
MNM49	128.62	171.09	0.26	18.70	0.43	122.75	167.85	0.25	18.30	0.57
MNM50	1458.70	1893.68	0.15	18.89	0.37	1406.44	1868.70	0.14	18.11	0.63

MNM51	40.93	54.89	0.12	18.31	0.57	41.98	55.92	0.12	18.69	0.43
MNM52	29.39	38.80	0.11	18.37	0.59	30.20	39.61	0.12	18.63	0.41
MNM53	3.62	4.78	0.15	18.36	0.59	3.69	4.86	0.15	18.64	0.41
MNM54	9.30	12.70	0.11	18.26	0.60	9.56	13.01	0.12	18.74	0.40
MNM55	606.72	702.60	0.18	19.12	0.43	570.31	673.86	0.17	17.88	0.57
MNM56	28194.16	34277.60	0.24	18.22	0.52	28920.55	35112.22	0.25	18.78	0.48
MNM57	24875.96	33447.26	0.05	18.97	0.47	23065.76	31975.68	0.05	18.03	0.53
MNM58	133.01	160.74	0.14	18.92	0.42	127.42	156.27	0.13	18.08	0.58
MNM59	1298.54	1610.32	0.06	18.39	0.52	1310.65	1626.43	0.06	18.61	0.48
MNM60	2887.79	3377.50	0.08	19.74	0.28	2565.25	3040.87	0.07	17.26	0.72
MNM61	891.77	1070.97	0.11	18.84	0.33	844.45	1013.00	0.11	18.16	0.67
MNM62	144.92	171.54	0.12	19.64	0.29	128.97	154.28	0.11	17.36	0.71
MNM63	136.70	151.92	0.12	19.69	0.19	114.97	130.60	0.10	17.31	0.81
MNM64	70.77	84.25	0.08	18.18	0.66	72.52	86.10	0.08	18.82	0.34
MNM65	99.17	118.35	0.09	19.57	0.34	86.34	108.50	0.08	17.43	0.66
MNM66	1832.05	2175.82	0.06	18.96	0.46	1730.04	2100.08	0.06	18.04	0.54
MNM67	633.06	757.57	0.09	19.30	0.33	573.67	695.01	0.08	17.70	0.67
MNM68	7631.57	8825.99	0.08	19.83	0.29	6741.38	7915.52	0.07	17.17	0.71
MNM69	616.67	736.05	0.06	18.52	0.56	622.54	743.51	0.06	18.48	0.44
MNM70	7631.57	8825.99	0.08	19.83	0.29	6741.38	7915.52	0.07	17.17	0.71
MNM71	567.46	724.48	0.07	19.63	0.36	490.59	658.25	0.06	17.37	0.64
MNM72	341.53	393.61	0.06	18.40	0.56	350.79	405.47	0.06	18.60	0.44
MNM73	225.67	271.84	0.08	18.46	0.58	228.98	277.43	0.08	18.54	0.42
MNM74	185.71	217.23	0.11	19.12	0.40	166.15	198.58	0.10	17.88	0.60
MNM75	1317.68	1613.55	0.07	19.17	0.38	1221.76	1517.71	0.07	17.83	0.62
MNM76	870.45	1096.05	0.07	19.00	0.43	819.50	1048.00	0.07	18.00	0.57
MNM77	196.29	238.40	0.13	19.12	0.41	155.37	203.65	0.10	17.88	0.59
MNB1	12.92	16.69	0.14	18.59	0.50	13.04	16.73	0.14	18.41	0.50
MNB2	2406.26	2764.49	0.28	18.56	0.57	2401.55	2764.62	0.27	18.44	0.43
MNB3	959.83	1245.39	0.32	19.06	0.37	881.99	1147.57	0.30	17.94	0.63
MNB4	3187.92	4301.34	0.41	17.88	0.58	3433.57	4429.93	0.44	19.12	0.42
MNB5	2352.60	3815.77	0.17	18.74	0.42	2353.08	3867.22	0.17	18.26	0.58
MNB6	10827.07	13911.80	0.24	18.53	0.51	10905.90	14014.76	0.24	18.47	0.49
MNB7	258.93	374.78	0.15	18.74	0.43	250.62	367.61	0.15	18.26	0.57
MNB8	559.41	710.09	0.09	18.56	0.53	559.28	721.03	0.09	18.44	0.47
MNB9	4085.79	4891.68	0.11	19.72	0.26	3646.63	4544.70	0.10	17.28	0.74
MNB10	418.12	488.28	0.16	18.37	0.54	422.12	487.76	0.16	18.63	0.46
MNB11	290.68	346.40	0.12	18.73	0.41	285.25	345.91	0.12	18.27	0.59
MNB12	4945.71	6367.52	0.24	18.58	0.48	4956.53	6411.55	0.24	18.42	0.52
MNB13	116.58	155.49	0.05	18.87	0.43	111.14	151.25	0.05	18.13	0.57
MNB14	1863.27	3190.22	0.14	18.78	0.46	1860.03	3236.06	0.14	18.22	0.54
MNB15	561.42	694.40	0.26	19.22	0.32	504.11	643.65	0.24	17.78	0.68
MNB16	140.74	180.67	0.15	18.53	0.49	141.42	178.68	0.15	18.47	0.51
MNB17	55.81	67.76	0.07	19.54	0.37	47.66	60.50	0.06	17.46	0.63
MNB18	6.33	7.39	0.12	18.52	0.50	6.34	7.43	0.12	18.48	0.50
MNB19	49.57	61.65	0.17	18.59	0.49	48.27	60.42	0.16	18.41	0.51
MNB20	1.51	1.80	0.25	17.69	0.68	1.58	1.82	0.26	19.31	0.32
MNB21	26.62	32.16	0.09	18.18	0.57	27.11	32.91	0.09	18.82	0.43
MNB22	29.18	34.16	0.10	18.34	0.46	29.40	33.97	0.10	18.66	0.54
MNB23	3.40	4.12	0.07	19.48	0.33	2.85	3.61	0.06	17.52	0.67
MNB24	13.37	15.87	0.06	20.83	0.23	8.94	11.56	0.04	16.17	0.77
MNB25	8.40	9.30	0.05	21.14	0.14	6.20	7.03	0.04	15.86	0.86
MNB26	16.92	20.94	0.06	20.11	0.24	12.26	16.07	0.04	16.89	0.76
MNB27	5.76	7.23	0.06	18.93	0.39	5.48	7.08	0.06	18.07	0.61
MNB28	34.58	36.52	0.09	23.20	0.01	22.79	24.85	0.06	13.80	0.99
MNB29	5.28	6.76	0.03	19.57	0.31	4.26	5.37	0.03	17.43	0.69
MNB30	9.14	10.93	0.03	18.74	0.39	8.87	10.67	0.03	18.26	0.61
MNB31	6.68	7.68	0.03	20.74	0.20	4.97	6.00	0.03	16.26	0.80
MNB32	23.61	26.99	0.06	20.30	0.23	18.07	21.00	0.05	16.70	0.77
MNB33	310.42	407.70	0.07	18.01	0.61	323.84	407.85	0.07	18.99	0.39
MNB34	266.57	306.40	0.11	19.52	0.34	238.16	272.74	0.10	17.48	0.66
MNB35	3347.27	4047.76	0.41	19.09	0.40	3200.60	4002.49	0.40	17.91	0.60
MNB36	1046.00	1288.55	0.20	19.26	0.28	943.70	1185.71	0.18	17.74	0.72
MNB37	2058.24	2349.34	0.22	19.13	0.40	1951.57	2244.47	0.21	17.87	0.60
MNB38	370.80	436.08	0.28	19.59	0.42	336.89	398.59	0.26	17.41	0.58
MNB39	77650.68	105072.84	0.48	18.63	0.46	75344.23	105071.77	0.47	18.37	0.54
MNB40	1312.95	1550.06	0.34	18.63	0.49	1309.91	1560.88	0.33	18.37	0.51
MNB41	9.15	10.54	0.21	17.79	0.74	9.67	10.88	0.22	19.21	0.26
MNB42	1926.79	2319.04	0.15	20.13	0.31	1601.47	2054.71	0.13	16.87	0.69
MNB43	19.65	22.19	0.04	18.83	0.49	19.35	21.93	0.04	18.17	0.51
MNB44	251.49	310.30	0.13	18.49	0.51	251.31	304.69	0.13	18.51	0.49

MNB45	2.38	3.06	0.03	18.39	0.52	2.38	3.05	0.03	18.61	0.48
MNB46	1.00	1.33	0.20	18.70	0.44	0.99	1.34	0.20	18.30	0.56
MNB47	1.01	1.25	0.13	18.28	0.46	1.02	1.25	0.13	18.72	0.54
MNB48	2.92	3.82	0.11	18.32	0.54	2.95	3.82	0.11	18.68	0.46
MNB49	18082.72	22023.44	0.05	19.22	0.24	16334.03	19590.10	0.04	17.78	0.76
MNB50	5591.13	6934.24	0.14	18.29	0.57	5690.31	7106.57	0.14	18.71	0.43
MNB51	135.17	201.39	0.30	18.37	0.64	140.16	208.98	0.31	18.63	0.36
MNB52	534.30	678.22	0.09	18.61	0.52	533.05	686.54	0.09	18.39	0.48
MNB53	4.32	5.91	0.16	18.50	0.48	4.37	6.02	0.16	18.50	0.52
MNB54	112.20	138.10	0.18	18.23	0.68	116.38	143.14	0.19	18.77	0.32
MNB55	1.46	1.75	0.02	18.47	0.50	1.41	1.67	0.02	18.53	0.50
MNB56	8365.25	10417.33	0.19	19.32	0.32	8117.71	10594.26	0.19	17.68	0.68
MNB57	464.07	568.06	0.09	18.32	0.57	472.78	587.11	0.09	18.68	0.43
MNB58	1634.94	2113.94	0.18	18.60	0.41	1567.40	1996.20	0.17	18.40	0.59
MNB59	1338.62	1798.00	0.13	18.56	0.53	1307.59	1760.05	0.12	18.44	0.47
MNB60	2986.81	4202.04	0.21	17.99	0.56	3087.06	4234.70	0.22	19.01	0.44
MNB61	6565.78	9297.52	0.17	18.20	0.53	6744.16	9403.93	0.18	18.80	0.47
MNB62	468.62	579.56	0.14	18.98	0.38	445.25	561.63	0.13	18.02	0.62
MNB63	3390.48	4156.35	0.17	18.89	0.49	3272.95	4058.81	0.16	18.11	0.51
MNB64	272.04	334.87	0.26	18.23	0.53	279.75	339.86	0.27	18.77	0.47
MNB65	217.94	249.27	0.02	20.34	0.24	175.14	208.98	0.02	16.66	0.76
MNB66	3730.29	4595.37	0.35	18.48	0.58	3814.94	4769.80	0.35	18.52	0.42
MNB67	2437.30	3288.53	0.13	18.36	0.49	2468.35	3265.77	0.13	18.64	0.51
MNB68	49.06	58.94	0.13	18.57	0.57	49.10	59.70	0.13	18.43	0.43
MNB69	226.75	337.21	0.12	18.33	0.70	228.14	340.26	0.12	18.67	0.30
MNB70	500.22	680.20	0.23	18.91	0.40	484.90	676.39	0.23	18.09	0.60
MNB71	15.10	18.61	0.02	18.44	0.51	14.83	17.93	0.02	18.56	0.49
MNB72	22.79	26.27	0.23	19.11	0.39	21.27	24.77	0.21	17.89	0.61
MRI1	59.93	95.48	0.31	18.23	0.68	61.80	97.21	0.32	18.77	0.32
MRI2	885.43	1022.71	0.13	20.39	0.17	736.23	845.13	0.11	16.61	0.83
MRI3	173.59	232.59	0.14	18.61	0.43	172.63	230.83	0.14	18.39	0.57
MRI4	2.03	2.67	0.38	18.58	0.42	2.05	2.70	0.39	18.42	0.58
MRI5	4.79	5.71	0.14	18.86	0.42	4.70	5.68	0.13	18.14	0.58
MRI6	4.97	6.20	0.19	18.42	0.47	4.98	6.10	0.19	18.58	0.53
MRI7	12.72	16.19	0.16	18.53	0.44	12.42	15.75	0.16	18.47	0.56
MRI8	32.72	40.35	0.14	18.59	0.46	32.35	39.78	0.14	18.41	0.54
MRI9	10.28	12.85	0.08	18.66	0.44	10.03	12.72	0.08	18.34	0.56
MRI10	8.79	10.61	0.09	18.28	0.62	8.96	10.78	0.09	18.72	0.38
MRI11	13.82	16.41	0.12	19.31	0.24	12.70	15.10	0.11	17.69	0.76
MRI12	0.10	0.12	0.11	18.76	0.52	0.09	0.12	0.11	18.24	0.48
MRI13	4.97	6.34	0.07	19.11	0.39	4.47	5.89	0.06	17.89	0.61
MRI14	1.93	2.38	0.14	18.39	0.53	1.96	2.42	0.14	18.61	0.47
MRI15	0.50	0.62	0.18	18.68	0.44	0.49	0.61	0.18	18.32	0.56
MRI16	64.11	81.19	0.16	18.62	0.47	64.12	81.22	0.16	18.38	0.53
MNI1	4.66	5.55	0.04	18.62	0.44	4.58	5.45	0.04	18.38	0.56
MNI2	14.87	22.47	0.17	18.38	0.52	15.52	23.53	0.18	18.62	0.48
MNI3	17.53	24.19	0.15	18.90	0.41	17.57	25.08	0.15	18.10	0.59
MNI4	13.18	16.47	0.14	18.34	0.56	13.27	16.60	0.14	18.66	0.44
MNI5	15.20	18.95	0.14	18.50	0.52	15.19	19.11	0.14	18.50	0.48
MNI6	38.33	46.03	0.03	18.54	0.51	38.08	46.29	0.03	18.46	0.49
MNI7	612.02	705.56	0.09	19.01	0.43	576.95	645.81	0.09	17.99	0.57
MNI8	203.51	243.72	0.06	19.34	0.34	183.04	223.03	0.06	17.66	0.66
MNI9	402.43	474.88	0.09	20.19	0.28	324.22	404.73	0.08	16.81	0.72
MNI10	6.09	7.54	0.05	19.31	0.40	5.76	7.58	0.05	17.69	0.60
MNI11	6.98	8.22	0.06	19.06	0.41	6.68	8.26	0.06	17.94	0.59
MNI12	3396.07	3974.20	0.04	18.82	0.46	3220.13	3755.16	0.04	18.18	0.54
MNI13	218.34	275.17	0.10	18.40	0.50	222.14	278.23	0.10	18.60	0.50
MNI14	340.70	395.49	0.11	18.70	0.43	335.91	385.92	0.11	18.30	0.57
MNI15	98.14	132.73	0.07	18.30	0.60	98.96	133.94	0.07	18.70	0.40
MNI16	547.46	657.00	0.11	18.43	0.58	551.82	663.88	0.11	18.57	0.42
MNI17	1630.63	2399.85	0.15	18.81	0.41	1616.66	2442.37	0.15	18.19	0.59
MNI18	2310.01	3290.10	0.16	18.38	0.50	2379.63	3340.82	0.16	18.62	0.50
MNI19	2816.31	3576.63	0.18	18.83	0.47	2756.20	3566.16	0.18	18.17	0.53
MNI20	235.24	273.78	0.45	18.40	0.59	236.57	277.45	0.45	18.60	0.41
MNI21	189.54	302.08	0.15	18.73	0.42	182.76	298.73	0.15	18.27	0.58
MNI22	501.64	602.99	0.15	18.53	0.46	505.13	605.55	0.15	18.47	0.54
MNI23	16.80	21.68	0.13	19.12	0.38	15.84	21.39	0.12	17.88	0.62
MNI24	47.90	59.47	0.08	18.37	0.50	48.91	60.27	0.09	18.63	0.50
MNI25	2.96	3.47	0.03	17.92	0.62	3.13	3.64	0.03	19.08	0.38
MNI26	10.98	13.24	0.08	19.24	0.46	10.49	13.24	0.08	17.76	0.54
MNI27	8.69	11.38	0.07	18.12	0.69	9.20	11.90	0.08	18.88	0.31

MNI28	9.67	12.92	0.08	18.54	0.54	9.68	12.92	0.08	18.46	0.46
MNI29	1820.38	3037.76	0.11	18.78	0.41	1824.16	3072.95	0.11	18.22	0.59
MNI30	1005.22	1483.75	0.12	19.10	0.36	980.16	1505.70	0.12	17.90	0.64
MNI31	2045.41	2508.62	0.21	18.10	0.70	2105.36	2572.47	0.22	18.90	0.30
MNI32	247.98	320.56	0.80	18.71	0.39	245.36	322.77	0.79	18.29	0.61
MNI33	442.69	550.80	0.19	18.37	0.57	449.70	551.42	0.19	18.63	0.43
MNI34	104.54	135.80	0.08	18.42	0.62	105.74	138.47	0.08	18.58	0.38
MNI35	364.33	426.31	0.13	18.37	0.51	367.97	432.02	0.13	18.63	0.49
MNI36	136.92	170.27	0.17	18.11	0.62	139.19	169.72	0.17	18.89	0.38
MNI37	12960.02	15667.66	0.32	18.91	0.41	11865.28	14525.04	0.30	18.09	0.59
MNI38	37163.76	45786.62	0.23	18.53	0.58	37021.43	45782.12	0.23	18.47	0.42
MNI39	17.85	21.86	0.12	18.50	0.53	17.71	21.90	0.12	18.50	0.47
MNI40	939.54	1163.43	0.16	18.70	0.48	937.92	1180.65	0.16	18.30	0.52
MNI41	157.29	189.87	0.08	19.10	0.30	149.55	184.75	0.08	17.90	0.70
MNI42	108.25	133.35	0.05	17.87	0.64	113.48	136.99	0.05	19.13	0.36
MNI43	15.03	18.89	0.06	18.01	0.63	15.70	19.43	0.07	18.99	0.37
MNI44	83.51	98.87	0.05	18.10	0.58	85.42	99.32	0.06	18.90	0.42
MNI45	78.46	103.98	0.05	18.69	0.49	78.00	105.99	0.05	18.31	0.51
MNI46	1.40	1.58	0.08	18.38	0.43	1.42	1.59	0.08	18.62	0.57
MNI47	6.05	7.89	0.10	18.44	0.58	6.13	8.02	0.10	18.56	0.42
MNI48	0.28	0.33	0.04	18.37	0.46	0.28	0.33	0.04	18.63	0.54
MNI49	0.45	0.63	0.21	18.34	0.58	0.46	0.64	0.22	18.66	0.42
MNI50	0.22	0.28	0.14	18.60	0.51	0.22	0.27	0.14	18.40	0.49
MNI51	0.72	0.90	0.07	18.40	0.50	0.73	0.92	0.08	18.60	0.50
MNI52	6.55	8.00	0.18	18.16	0.61	6.73	8.11	0.18	18.84	0.39
MNI53	0.24	0.34	0.10	19.08	0.44	0.22	0.31	0.09	17.92	0.56
MNI54	1.42	1.74	0.06	18.72	0.52	1.42	1.77	0.06	18.28	0.48
MNI55	0.41	0.47	0.07	19.68	0.33	0.34	0.40	0.06	17.32	0.67
MNI56	0.56	0.67	0.24	17.94	0.70	0.58	0.69	0.25	19.06	0.30
MNI57	0.56	0.72	0.06	18.39	0.56	0.56	0.73	0.06	18.61	0.44
MNI58	0.37	0.48	0.24	18.07	0.54	0.39	0.49	0.24	18.93	0.46
MNI59	0.15	0.20	0.09	18.29	0.64	0.15	0.20	0.09	18.71	0.36
MNI60	0.91	1.42	0.09	18.69	0.50	0.91	1.46	0.09	18.31	0.50
MNI61	0.26	0.37	0.05	18.11	0.62	0.27	0.38	0.05	18.89	0.38
MNI62	4.73	5.30	0.07	19.57	0.30	4.35	4.90	0.06	17.43	0.70
MNI63	0.17	0.23	0.09	18.13	0.52	0.18	0.23	0.10	18.87	0.48
MNI64	0.33	0.42	0.23	18.20	0.57	0.34	0.43	0.24	18.80	0.43
MNI65	0.12	0.15	0.18	18.50	0.42	0.12	0.15	0.18	18.50	0.58
MNI66	0.07	0.08	0.07	18.46	0.51	0.07	0.08	0.07	18.54	0.49
MNI67	0.11	0.18	0.14	18.11	0.60	0.12	0.18	0.15	18.89	0.40
MNI68	0.39	0.45	0.04	17.97	0.77	0.40	0.46	0.05	19.03	0.23
MNI69	0.30	0.42	0.08	18.86	0.46	0.29	0.42	0.08	18.14	0.54
MNI70	81.15	118.22	0.05	18.62	0.42	81.48	119.65	0.05	18.38	0.58
MNI71	46.47	57.58	0.07	18.48	0.58	45.13	54.65	0.06	18.52	0.42
MNI72	12.14	15.89	0.15	18.99	0.41	11.60	15.54	0.15	18.01	0.59
MNI73	2.38	3.14	0.12	18.12	0.68	2.47	3.22	0.13	18.88	0.32
MNI74	7.22	8.48	0.04	18.63	0.56	7.17	8.43	0.04	18.37	0.44
MNI75	1.52	1.90	0.09	20.10	0.23	1.25	1.66	0.07	16.90	0.77
MNI76	19.05	23.64	0.13	19.10	0.39	18.26	23.24	0.12	17.90	0.61
MNI77	7.72	9.31	0.11	18.86	0.43	7.47	9.18	0.10	18.14	0.57
MNI78	8.75	11.97	0.08	18.41	0.56	8.92	12.29	0.09	18.59	0.44
MNI79	8.80	11.16	0.12	18.93	0.36	8.28	10.59	0.11	18.07	0.64
MNI80	4.92	6.12	0.09	18.39	0.51	5.01	6.20	0.10	18.61	0.49
MNI81	18.77	24.79	0.04	18.04	0.61	19.58	25.26	0.04	18.96	0.39
MNI82	4.45	5.69	0.15	18.34	0.53	4.60	5.83	0.15	18.66	0.47
MNI83	61.30	74.22	0.15	18.16	0.46	63.01	74.77	0.15	18.84	0.54
MNI84	35.08	55.45	0.09	17.94	0.61	37.17	56.82	0.10	19.06	0.39
MNI85	146.29	169.43	0.35	18.48	0.41	143.25	167.20	0.34	18.52	0.59
MNI86	29.16	37.63	0.07	18.44	0.53	29.28	38.19	0.07	18.56	0.47
MNI87	239.13	290.01	0.33	18.73	0.42	230.76	284.32	0.32	18.27	0.58
MNI88	9.66	12.41	0.11	18.44	0.56	9.49	12.22	0.11	18.56	0.44
MNI89	72.31	92.20	0.09	18.62	0.50	71.39	92.11	0.09	18.38	0.50
MNI90	28.38	33.26	0.13	19.00	0.38	27.57	32.83	0.13	18.00	0.62
MNI91	41.52	48.79	0.07	18.08	0.61	42.82	50.04	0.07	18.92	0.39
MNI92	33.85	40.66	0.09	18.20	0.52	34.16	40.68	0.09	18.80	0.48
MNI93	89.22	103.34	0.09	19.08	0.40	85.85	102.41	0.09	17.92	0.60
MNI94	35.94	50.14	0.03	18.64	0.58	35.92	50.76	0.03	18.36	0.42
MNI95	22.87	26.64	0.13	19.60	0.31	21.19	25.06	0.12	17.40	0.69
MNI96	42.26	50.28	0.05	18.62	0.46	41.47	49.25	0.05	18.38	0.54
MNI97	101.02	146.09	0.05	18.69	0.52	100.04	147.47	0.05	18.31	0.48
MNI98	29.06	36.46	0.08	18.64	0.52	28.92	35.93	0.08	18.36	0.48

MNI99	29.91	37.32	0.06	19.87	0.31	24.30	31.13	0.05	17.13	0.69
MNI100	0.88	1.06	0.04	19.74	0.30	0.77	0.97	0.04	17.26	0.70
MNI101	0.16	0.20	0.03	18.16	0.68	0.16	0.21	0.03	18.84	0.32
MNI102	1.56	1.78	0.08	19.73	0.23	1.32	1.60	0.06	17.27	0.77
MNI103	1.89	2.66	0.10	18.81	0.42	1.85	2.63	0.10	18.19	0.58
MNI104	0.85	1.11	0.05	18.43	0.57	0.86	1.12	0.05	18.57	0.43
MNI105	1.62	1.91	0.13	18.21	0.61	1.68	1.97	0.14	18.79	0.39
MNI106	0.23	0.30	0.08	18.73	0.58	0.22	0.30	0.08	18.27	0.42
MNI107	4.73	5.78	0.12	18.18	0.57	4.91	5.88	0.12	18.82	0.43
MNI108	1.62	2.00	0.15	18.42	0.59	1.62	2.04	0.15	18.58	0.41
MNI109	3.62	4.53	0.07	18.48	0.57	3.69	4.63	0.07	18.52	0.43
MNI110	0.20	0.23	0.26	18.22	0.56	0.20	0.24	0.26	18.78	0.44
MNI111	1.41	1.80	0.14	19.36	0.33	1.28	1.70	0.13	17.64	0.67
MNI112	1.86	2.88	0.13	18.68	0.40	1.85	2.90	0.13	18.32	0.60
MNI114	1.07	1.33	0.15	18.90	0.50	1.03	1.32	0.15	18.10	0.50
MNI115	1.15	1.64	0.11	18.12	0.70	1.19	1.68	0.12	18.88	0.30
MNI116	92.89	131.96	0.21	18.43	0.62	94.50	135.30	0.22	18.57	0.38
MNI117	74.25	100.78	0.17	18.73	0.47	74.02	104.77	0.17	18.27	0.53
MNI118	224.81	281.08	0.12	19.17	0.37	207.81	271.41	0.11	17.83	0.63
MNI119	557.15	853.09	0.09	19.37	0.43	494.90	820.97	0.08	17.63	0.57
MNI120	85.40	108.80	0.31	18.27	0.61	87.65	111.23	0.32	18.73	0.39
MNI121	129.71	167.23	0.30	18.89	0.36	126.22	167.45	0.29	18.11	0.64
MNI122	469.46	586.47	0.24	18.73	0.43	457.55	563.92	0.23	18.27	0.57
MNI123	1.30	1.55	0.06	18.52	0.54	1.30	1.59	0.06	18.48	0.46
MNI124	1.07	1.34	0.05	19.34	0.34	0.97	1.26	0.04	17.66	0.66
MNI125	1.66	2.07	0.11	18.68	0.44	1.63	2.07	0.11	18.32	0.56
MNI126	0.36	0.49	0.06	18.72	0.54	0.36	0.50	0.06	18.28	0.46
MNI127	2.12	2.75	0.17	19.27	0.33	1.95	2.66	0.16	17.73	0.67
MNI128	0.78	0.97	0.09	18.92	0.41	0.78	0.99	0.09	18.08	0.59
MNI129	4.89	6.69	0.20	18.31	0.47	5.07	6.81	0.21	18.69	0.53
MNI130	9.71	14.03	0.19	19.02	0.46	9.17	14.00	0.18	17.98	0.54
MNI131	16.77	22.45	0.18	19.11	0.36	16.41	22.46	0.18	17.89	0.64
MNI132	3.76	4.42	0.10	18.24	0.58	3.79	4.49	0.10	18.76	0.42
MNI133	9.76	11.99	0.20	19.73	0.28	9.09	11.65	0.19	17.27	0.72
MNI134	0.73	1.07	0.11	18.98	0.51	0.70	1.08	0.11	18.02	0.49
MNI135	512.61	611.77	0.07	18.61	0.42	500.28	591.00	0.07	18.39	0.58
MNI136	149.36	182.23	0.05	18.46	0.51	148.42	179.75	0.05	18.54	0.49
MNI137	310.56	359.30	0.08	18.60	0.47	311.39	350.64	0.08	18.40	0.53
MNI138	197.68	244.02	0.08	18.74	0.41	189.73	230.45	0.07	18.26	0.59
MNI139	2672.93	3293.58	0.10	18.87	0.42	2581.35	3157.91	0.09	18.13	0.58
MNI140	444.13	517.17	0.08	18.91	0.43	434.34	496.69	0.08	18.09	0.57
MNI141	269.57	346.94	0.16	18.90	0.40	264.42	347.19	0.15	18.10	0.60
MNI142	391.84	436.44	0.15	18.90	0.38	382.19	422.99	0.15	18.10	0.62
MNI143	48.30	59.08	0.13	18.81	0.44	47.35	58.70	0.13	18.19	0.56
MNI144	170.15	211.93	0.17	18.89	0.39	164.57	208.39	0.16	18.11	0.61
MNI145	44.43	53.35	0.16	18.67	0.50	43.43	52.03	0.16	18.33	0.50
MNI146	84.56	96.70	0.11	19.29	0.30	79.55	93.67	0.11	17.71	0.70
MNI147	36.42	43.43	0.12	19.07	0.37	34.21	41.18	0.11	17.93	0.63
MNI148	1524.00	1827.58	0.10	18.89	0.44	1421.31	1678.28	0.10	18.11	0.56
MNI149	2850.53	3525.92	0.10	19.37	0.37	2490.06	3062.72	0.09	17.63	0.63
MNI150	1577.11	1906.96	0.10	18.74	0.40	1534.46	1846.71	0.10	18.26	0.60
MNI151	2438.52	3112.32	0.08	18.60	0.49	2352.57	2978.27	0.08	18.40	0.51
MNI152	1175.11	1798.56	0.12	18.41	0.56	1196.87	1809.91	0.12	18.59	0.44
MNI153	152.00	182.08	0.16	17.96	0.63	158.09	188.21	0.16	19.04	0.37
MNI154	11.35	12.66	0.16	18.99	0.33	10.66	12.23	0.15	18.01	0.67
MNI155	47.23	57.79	0.14	18.50	0.48	46.83	57.13	0.14	18.50	0.52
MNI156	30.05	37.86	0.09	18.66	0.48	29.86	38.47	0.09	18.34	0.52
MNI157	207.71	259.91	0.20	17.84	0.72	218.40	264.23	0.21	19.16	0.28
MNI158	4187.28	5517.16	0.16	18.30	0.60	4325.95	5676.11	0.17	18.70	0.40
MNI159	109.09	132.06	0.12	18.51	0.44	108.95	129.06	0.12	18.49	0.56
MNI160	2513.51	3248.36	0.09	18.50	0.44	2489.46	3198.17	0.09	18.50	0.56
MNI161	3320.20	4636.13	0.09	18.40	0.53	3326.89	4659.02	0.09	18.60	0.47
MNI162	5410.51	6872.79	0.11	18.62	0.41	5370.87	6842.89	0.11	18.38	0.59
MNI163	0.15	0.18	0.03	19.16	0.41	0.14	0.17	0.03	17.84	0.59
MNI164	46.49	57.40	0.06	18.54	0.51	45.66	56.03	0.06	18.46	0.49
MNI165	112.20	151.13	0.05	18.83	0.46	107.46	146.75	0.04	18.17	0.54
MNI166	34.41	44.21	0.11	18.73	0.41	33.26	42.48	0.10	18.27	0.59
MNI167	99.06	119.62	0.13	18.49	0.52	98.57	118.93	0.13	18.51	0.48
MNI168	301.46	360.26	0.10	18.49	0.49	301.98	360.00	0.10	18.51	0.51
MRG1	12.15	17.60	0.11	18.11	0.52	12.49	17.69	0.12	18.89	0.48
MRG2	4.00	4.99	0.01	18.98	0.32	3.82	4.72	0.01	18.02	0.68

MRG3	785.24	811.47	0.11	21.46	0.02	612.74	647.83	0.09	15.54	0.98
MRG4	805.25	906.52	0.11	20.69	0.07	635.14	731.26	0.09	16.31	0.93
MRG5	0.01	0.02	0.01	18.88	0.32	0.01	0.02	0.01	18.12	0.68
MRG6	4.36	5.14	0.04	19.44	0.34	3.93	4.76	0.03	17.56	0.66
MRG7	5.57	6.74	0.04	19.49	0.39	4.86	6.22	0.04	17.51	0.61
MRG8	6.10	8.45	0.05	19.02	0.36	5.09	6.86	0.04	17.98	0.64
MRG9	1.45	1.79	0.01	19.42	0.36	1.24	1.57	0.01	17.58	0.64
MRG10	11.93	14.32	0.08	19.40	0.29	10.87	13.33	0.07	17.60	0.71
MRG11	5.61	7.49	0.04	19.46	0.33	4.57	6.13	0.04	17.54	0.67
MRG12	4.50	5.36	0.04	20.67	0.24	3.46	4.35	0.03	16.33	0.76
MRG13	14.65	17.11	0.08	19.57	0.34	13.22	16.27	0.08	17.43	0.66
MRG14	5.69	6.42	0.05	19.50	0.28	5.07	5.79	0.04	17.50	0.72
MRG15	14.91	18.07	0.11	19.80	0.36	14.34	17.75	0.11	17.20	0.64
MRG16	10.33	11.92	0.08	19.23	0.36	9.65	11.12	0.07	17.77	0.64
MRG17	11.69	16.55	0.09	19.36	0.32	11.24	16.63	0.09	17.64	0.68
MRG18	4.77	5.61	0.04	19.70	0.27	4.12	4.98	0.03	17.30	0.73
MRG19	8.50	10.78	0.06	18.52	0.53	8.42	10.53	0.06	18.48	0.47
MRG20	16.39	20.21	0.13	18.26	0.53	16.60	20.41	0.13	18.74	0.47
MRG21	14.25	16.80	0.09	18.58	0.53	14.11	16.73	0.09	18.42	0.47
MRG22	21.58	27.49	0.20	18.27	0.58	21.99	27.91	0.20	18.73	0.42
MRG23	8.58	9.67	0.06	18.37	0.56	8.65	9.76	0.06	18.63	0.44
MRG24	8.13	10.38	0.06	19.03	0.39	7.31	9.53	0.06	17.97	0.61
MRG25	19.99	23.51	0.06	20.59	0.14	15.20	19.05	0.05	16.41	0.86
MRG26	0.54	0.90	0.21	19.16	0.38	0.53	0.90	0.21	17.84	0.62
MRC1	7.60	9.27	0.01	19.36	0.22	6.97	8.53	0.01	17.64	0.78
MRC2	7.21	9.96	0.09	18.03	0.56	7.42	9.97	0.09	18.97	0.44
MRC3	12.63	18.61	0.12	18.13	0.51	12.99	18.72	0.12	18.87	0.49
MRC4	13.87	18.95	0.15	18.18	0.52	14.08	18.82	0.15	18.82	0.48
MRC5	14.00	18.14	0.15	18.26	0.50	14.16	17.96	0.15	18.74	0.50
MRC6	20.54	27.47	0.17	18.46	0.54	20.80	27.71	0.17	18.54	0.46
MRC7	17.29	21.49	0.13	19.50	0.28	14.51	18.54	0.11	17.50	0.72
MRC8	660.59	797.88	0.60	18.10	0.68	676.23	814.03	0.61	18.90	0.32
MRC9	5316.73	6039.37	0.03	20.04	0.22	4211.32	5075.20	0.03	16.96	0.78
MRC10	254.56	319.38	0.48	18.80	0.47	242.45	311.46	0.47	18.20	0.53
MRC11	4.24	4.94	0.04	19.67	0.31	3.80	4.61	0.03	17.33	0.69
MRC12	8.49	11.57	0.09	19.04	0.38	7.30	9.79	0.08	17.96	0.62
MRC13	10.52	13.76	0.12	18.86	0.38	9.46	12.11	0.11	18.14	0.62
MRC14	7.66	9.65	0.06	20.02	0.26	5.79	7.52	0.05	16.98	0.74
MRC15	9.99	13.63	0.09	19.04	0.36	8.10	10.88	0.07	17.96	0.64
MRC16	5.78	7.52	0.04	19.73	0.27	4.46	6.01	0.03	17.27	0.73
MRC17	4.99	5.86	0.05	19.87	0.21	4.10	4.72	0.04	17.13	0.79
MRC18	1.38	1.53	0.01	20.52	0.22	1.11	1.22	0.01	16.48	0.78
MRC19	1.24	1.51	0.01	19.96	0.37	1.00	1.33	0.01	17.04	0.63
MRC20	3.96	4.71	0.03	20.57	0.24	2.83	3.63	0.02	16.43	0.76
MRC21	5.01	5.61	0.04	20.74	0.21	4.13	4.83	0.03	16.26	0.79
MRC22	3.62	4.46	0.03	19.88	0.33	2.73	3.41	0.02	17.12	0.67
MRC23	4.27	5.11	0.04	20.98	0.21	2.89	3.85	0.03	16.02	0.79
MRC24	5.34	6.25	0.04	20.38	0.28	4.04	5.00	0.03	16.62	0.72
MRC25	4.35	6.24	0.04	18.39	0.40	3.96	5.53	0.04	18.61	0.60
MRC26	6.73	10.24	0.06	18.72	0.48	6.69	10.29	0.06	18.28	0.52
MRC27	5.22	6.39	0.02	19.63	0.21	4.42	5.52	0.02	17.37	0.79
MRC28	7.26	8.39	0.06	18.47	0.50	7.28	8.40	0.06	18.53	0.50
MRC29	3.72	4.53	0.04	18.82	0.37	3.62	4.42	0.03	18.18	0.63
MRC30	9.91	12.06	0.08	18.43	0.50	9.98	12.03	0.08	18.57	0.50
MRC31	229.21	262.19	0.05	20.41	0.08	177.81	219.69	0.04	16.59	0.92
MRC32	386.58	472.29	0.02	19.72	0.26	309.27	404.51	0.02	17.28	0.74
MRC33	2983.49	3403.48	0.02	20.44	0.13	2089.00	2632.59	0.01	16.56	0.87
MRC34	395.02	407.21	0.03	21.98	0.00	301.33	317.13	0.03	15.02	1.00
MRC35	57.09	66.66	0.02	19.42	0.29	51.34	59.19	0.02	17.58	0.71
MRC36	10.15	12.26	0.04	20.26	0.18	7.54	10.16	0.03	16.74	0.82
MRC37	5.74	7.25	0.04	19.13	0.23	5.14	6.47	0.04	17.87	0.77
MRC38	7.36	9.11	0.04	19.23	0.23	6.66	8.18	0.04	17.77	0.77
MRC39	63.65	78.79	0.24	18.88	0.42	61.67	77.59	0.24	18.12	0.58
MRC40	182.41	214.62	0.15	19.32	0.21	162.77	191.89	0.13	17.68	0.79
MRC41	6.40	7.86	0.18	18.84	0.26	6.08	7.45	0.17	18.16	0.74
MRC42	7.54	9.02	0.19	19.11	0.28	6.80	8.09	0.18	17.89	0.72
MRC43	4482.35	5475.90	0.04	19.21	0.28	4031.52	4826.57	0.03	17.79	0.72
MRC44	86.56	96.70	0.07	19.30	0.31	80.09	90.09	0.06	17.70	0.69
MNG1	1.60	1.96	0.30	18.38	0.46	1.64	1.98	0.30	18.62	0.54
MNG2	0.92	1.43	0.19	19.30	0.49	0.89	1.44	0.18	17.70	0.51
MNG3	1.25	1.50	0.06	20.84	0.21	0.94	1.22	0.05	16.16	0.79

MNG4	3.81	4.41	0.05	19.49	0.27	3.30	3.72	0.04	17.51	0.73
MNG5	6.08	7.25	0.08	19.92	0.30	4.92	5.95	0.07	17.08	0.70
MNG6	2.05	2.45	0.02	19.84	0.34	1.61	2.04	0.02	17.16	0.66
MNG7	14.43	19.03	0.13	18.79	0.46	14.34	19.23	0.13	18.21	0.54
MNG8	4.47	5.82	0.03	20.59	0.21	2.93	4.66	0.02	16.41	0.79
MNG9	5.43	6.75	0.03	19.60	0.34	4.38	5.79	0.03	17.40	0.66
MNG10	17.18	27.94	0.10	18.57	0.51	17.98	28.95	0.11	18.43	0.49
MNG11	176.63	207.73	0.11	18.79	0.47	170.47	202.18	0.10	18.21	0.53
MNG12	170.52	201.95	0.11	19.31	0.37	158.14	192.22	0.10	17.69	0.63
MNG13	13.05	17.33	0.10	18.34	0.60	13.24	17.64	0.10	18.66	0.40
MNG14	201.36	249.11	0.11	18.42	0.51	201.65	250.53	0.11	18.58	0.49
MNG15	8.75	11.24	0.09	17.91	0.64	9.22	11.71	0.10	19.09	0.36
MNG16	39.62	48.23	0.23	18.97	0.48	37.00	46.83	0.22	18.03	0.52
MNG17	8.83	10.85	0.07	18.67	0.42	8.66	10.67	0.07	18.33	0.58
MNG18	2.75	3.25	0.03	19.41	0.29	2.46	3.03	0.02	17.59	0.71
MNG19	0.32	0.38	0.09	19.63	0.36	0.28	0.37	0.08	17.37	0.64
MNG20	5.94	9.51	0.04	17.89	0.60	6.22	9.57	0.05	19.11	0.40
MNG21	200.59	238.19	0.21	18.52	0.50	200.14	239.81	0.20	18.48	0.50
MNG22	20.20	25.23	0.08	20.66	0.23	15.48	21.18	0.06	16.34	0.77
MNG23	26.22	30.13	0.11	19.56	0.33	22.03	25.79	0.09	17.44	0.67
MNG24	8.15	10.71	0.05	18.97	0.43	7.58	10.23	0.05	18.03	0.57
MNG25	26.63	39.55	0.10	19.57	0.24	23.19	35.50	0.09	17.43	0.76
MNG26	7.78	8.67	0.06	18.77	0.42	7.49	8.52	0.06	18.23	0.58
MNG27	5.61	6.37	0.04	19.73	0.33	4.63	5.27	0.03	17.27	0.67
MNG28	14.55	18.19	0.10	19.84	0.34	13.40	18.08	0.09	17.16	0.66
MNG29	10.20	11.74	0.03	21.46	0.16	6.35	7.66	0.02	15.54	0.84
MNG30	0.18	0.21	0.22	18.18	0.52	0.18	0.21	0.22	18.82	0.48
MNG31	427.95	526.64	0.14	19.59	0.33	389.10	505.18	0.12	17.41	0.67
MNG32	469.90	560.99	0.14	18.54	0.49	470.32	559.08	0.14	18.46	0.51
MNG33	5.80	6.94	0.04	18.78	0.47	5.60	6.73	0.04	18.22	0.53
MNG34	0.32	0.42	0.10	19.29	0.39	0.30	0.42	0.09	17.71	0.61
MNG35	6.37	7.77	0.05	20.06	0.22	5.29	6.53	0.04	16.94	0.78
MNG36	7.87	10.06	0.06	19.47	0.33	6.68	8.95	0.05	17.53	0.67
MNG37	8.99	11.21	0.08	18.46	0.54	9.04	11.19	0.08	18.54	0.46
MNG38	6.37	7.20	0.06	18.69	0.43	6.24	7.06	0.05	18.31	0.57
MNC1	17.57	22.40	0.13	18.74	0.40	17.35	22.56	0.13	18.26	0.60
MNC2	5.94	7.31	0.05	19.46	0.33	5.05	6.47	0.04	17.54	0.67
MNC3	2.50	3.14	0.03	19.36	0.30	2.14	2.72	0.03	17.64	0.70
MNC4	4.68	5.51	0.06	19.98	0.24	3.64	4.28	0.05	17.02	0.76
MNC5	1.87	2.32	0.03	19.30	0.33	1.58	1.97	0.02	17.70	0.67
MNC6	5.83	6.70	0.08	20.44	0.18	4.27	4.89	0.06	16.56	0.82
MNC7	5.82	6.69	0.08	20.49	0.18	4.22	4.84	0.06	16.51	0.82
MNC8	4.85	5.65	0.06	19.94	0.29	3.93	4.87	0.05	17.06	0.71
MNC9	6.24	7.34	0.09	20.07	0.28	4.65	5.64	0.07	16.93	0.72
MNC10	4.26	5.16	0.05	19.33	0.37	3.61	4.29	0.04	17.67	0.63
MNC11	5.81	6.60	0.08	20.62	0.17	4.31	5.07	0.06	16.38	0.83
MNC12	5.11	6.40	0.05	19.76	0.30	3.97	5.20	0.04	17.24	0.70
MNC13	12.69	13.72	0.20	22.31	0.02	8.17	9.75	0.13	14.69	0.98
MNC14	8.75	9.90	0.08	20.84	0.18	6.77	8.23	0.06	16.16	0.82
MNC15	5.26	6.17	0.07	19.89	0.33	4.19	4.99	0.06	17.11	0.67
MNC16	8.25	9.97	0.10	20.17	0.16	6.15	7.94	0.07	16.83	0.84
MNC17	5.25	6.37	0.06	19.26	0.41	4.52	5.28	0.05	17.74	0.59
MNC18	4.21	5.06	0.04	18.67	0.42	4.07	4.79	0.04	18.33	0.58
MNC19	531.18	726.97	0.10	19.18	0.36	520.86	743.99	0.10	17.82	0.64
MNC20	6.01	6.68	0.04	20.26	0.19	4.78	5.45	0.03	16.74	0.81
MNC21	50.22	63.97	0.10	19.16	0.32	42.51	54.49	0.08	17.84	0.68
MNC22	106.47	131.76	0.11	19.54	0.27	91.61	115.94	0.10	17.46	0.73
MNC23	0.41	0.49	0.08	18.96	0.47	0.39	0.48	0.08	18.04	0.53
MNC24	53.83	68.88	0.16	18.46	0.46	53.69	69.34	0.16	18.54	0.54
MNC25	8.93	10.25	0.06	18.56	0.52	8.94	10.29	0.06	18.44	0.48
MNC26	15.65	19.29	0.08	19.93	0.28	14.42	18.74	0.08	17.07	0.72
MNC27	10.94	12.90	0.06	19.70	0.32	10.04	12.32	0.06	17.30	0.68
MNC28	10.18	13.97	0.07	18.97	0.43	9.98	14.05	0.07	18.03	0.57
MNC29	3.41	4.45	0.03	18.12	0.61	3.47	4.46	0.03	18.88	0.39
MNC30	8.23	9.85	0.06	18.34	0.53	8.32	9.93	0.06	18.66	0.47
MNC31	7.07	8.19	0.05	18.56	0.50	7.00	8.14	0.05	18.44	0.50
MNC32	7.96	9.68	0.05	19.11	0.39	7.47	9.32	0.05	17.89	0.61
MNC33	5.27	6.10	0.03	19.99	0.20	4.29	5.28	0.03	17.01	0.80
MNC34	202.73	211.14	0.08	23.61	0.00	123.44	131.50	0.05	13.39	1.00
MNC35	0.58	0.72	0.28	19.88	0.23	0.47	0.62	0.23	17.12	0.77
MNC36	2.01	2.26	0.04	19.07	0.41	1.81	1.98	0.03	17.93	0.59

MNC37	50.15	59.36	0.38	20.48	0.29	38.33	45.20	0.31	16.52	0.71
MNC38	37.15	41.29	0.08	22.80	0.02	22.91	27.57	0.05	14.20	0.98
MNC39	4.54	4.73	0.04	21.54	0.00	3.37	3.67	0.03	15.46	1.00
MNC40	154.95	197.13	0.03	19.46	0.30	134.25	179.72	0.03	17.54	0.70
MNC41	947.88	991.72	0.01	22.30	0.00	690.87	737.73	0.01	14.70	1.00
MNC42	5.40	6.21	0.05	19.40	0.28	4.82	5.57	0.05	17.60	0.72
MNC43	865.44	910.44	0.01	21.88	0.03	634.70	683.88	0.01	15.12	0.97
MNC44	165.10	203.22	0.08	19.00	0.29	149.26	182.60	0.07	18.00	0.71
MNC45	0.69	1.00	0.09	18.82	0.38	0.60	0.89	0.08	18.18	0.62
MNC46	6.97	8.07	0.01	19.81	0.27	5.92	6.90	0.01	17.19	0.73
MNC47	1556.44	1690.12	0.04	21.11	0.08	1162.68	1322.63	0.03	15.89	0.92
MNC48	191.34	233.79	0.33	18.21	0.71	194.73	237.86	0.34	18.79	0.29
MND1	0.31	0.37	0.13	18.60	0.44	0.31	0.37	0.13	18.40	0.56
MND2	10.09	12.17	0.04	19.37	0.28	8.99	10.95	0.04	17.63	0.72
MND3	12.66	13.92	0.22	21.18	0.17	8.92	10.11	0.16	15.82	0.83
MND4	3.09	3.21	0.02	23.61	0.00	1.71	1.85	0.01	13.39	1.00
MND5	9181.55	11741.53	0.32	18.08	0.62	9698.39	12083.13	0.34	18.92	0.38
MND6	1.05	1.33	0.06	19.33	0.32	0.98	1.28	0.05	17.67	0.68
MND7	0.57	0.67	0.06	19.09	0.42	0.52	0.63	0.05	17.91	0.58
MND8	0.59	0.72	0.08	18.70	0.42	0.56	0.68	0.07	18.30	0.58
MND9	0.73	0.87	0.06	19.42	0.38	0.67	0.84	0.06	17.58	0.62
MND10	15.41	19.63	0.10	18.59	0.43	15.04	18.97	0.09	18.41	0.57
MND11	20.65	31.22	0.30	18.51	0.50	21.11	31.27	0.31	18.49	0.50
MND12	12.83	18.43	0.26	18.62	0.54	13.08	18.58	0.26	18.38	0.46
MND13	26.38	37.07	0.37	18.33	0.50	26.79	37.44	0.37	18.67	0.50
MND14	16.71	21.79	0.32	18.16	0.59	17.21	21.98	0.33	18.84	0.41
MND15	0.26	0.30	0.20	19.57	0.36	0.21	0.25	0.16	17.43	0.64
MND16	0.02	0.03	0.38	19.27	0.34	0.02	0.03	0.35	17.73	0.60
MND17	0.07	0.07	0.51	20.01	0.28	0.05	0.05	0.42	16.99	0.72
MND18	0.10	0.11	0.42	19.83	0.20	0.07	0.08	0.33	17.17	0.80
MND19	0.03	0.03	0.44	21.12	0.16	0.01	0.01	0.27	15.88	0.84
MND20	0.02	0.02	0.58	19.87	0.40	0.01	0.01	0.41	17.13	0.54
MND21	9.37	11.00	0.44	20.11	0.41	5.26	6.68	0.33	16.89	0.59
MND22	28.94	31.90	0.47	20.62	0.20	15.08	18.23	0.32	16.38	0.80
MND23	59.31	65.58	0.39	20.72	0.31	31.73	37.96	0.26	16.28	0.69
MND24	53.01	79.39	0.25	18.46	0.57	52.59	81.10	0.25	18.54	0.43
MND25	531.79	663.91	0.12	18.13	0.58	541.28	665.94	0.12	18.87	0.42
MND26	13.39	23.89	0.91	18.64	0.52	13.90	24.63	0.89	18.36	0.48
MND27	24448.33	32762.22	0.15	18.18	0.50	24867.18	32964.97	0.15	18.82	0.50
MND28	1213.46	1594.83	0.01	19.96	0.27	964.12	1384.71	0.01	17.04	0.73
MND29	1453.71	1708.31	0.02	19.94	0.23	1184.26	1439.10	0.01	17.06	0.77
MND30	336.01	384.86	0.10	18.68	0.44	328.37	373.20	0.10	18.32	0.56
MND31	1363.00	1516.11	0.02	21.00	0.17	1018.32	1161.33	0.01	16.00	0.83
MND32	452.29	552.72	0.07	19.07	0.36	424.51	531.60	0.06	17.93	0.64
MND33	999.63	1053.19	0.01	22.41	0.04	654.44	724.12	0.01	14.59	0.96
MND34	164.06	205.23	0.08	19.58	0.40	135.35	177.69	0.06	17.42	0.60
MND35	0.29	0.33	0.04	20.64	0.23	0.22	0.26	0.03	16.36	0.77
MND36	0.34	0.39	0.06	19.67	0.31	0.28	0.34	0.05	17.33	0.69
MND37	0.24	0.30	0.03	19.03	0.43	0.22	0.29	0.03	17.97	0.57
MND38	0.59	0.80	0.03	18.82	0.41	0.55	0.72	0.03	18.18	0.59
MND39	0.31	0.34	0.05	20.54	0.23	0.24	0.28	0.04	16.46	0.77
MND40	0.50	0.61	0.04	18.38	0.51	0.51	0.63	0.04	18.62	0.49
MND41	0.28	0.32	0.07	20.04	0.34	0.23	0.27	0.06	16.96	0.66
MND42	0.19	0.22	0.04	18.97	0.48	0.18	0.20	0.04	18.03	0.52
MND43	0.50	0.64	0.06	18.80	0.41	0.42	0.53	0.05	18.20	0.59
MND44	0.33	0.41	0.05	19.69	0.33	0.27	0.34	0.04	17.31	0.67
MND45	1.29	1.49	0.10	19.99	0.27	1.03	1.22	0.08	17.01	0.73
MND46	0.54	0.68	0.08	18.96	0.41	0.47	0.60	0.07	18.04	0.59
MND47	0.64	0.78	0.09	19.30	0.38	0.53	0.66	0.08	17.70	0.62
MND48	7.95	10.27	0.01	19.83	0.29	5.65	7.38	0.01	17.17	0.71
MND49	2.94	3.50	0.02	19.57	0.33	2.50	3.08	0.01	17.43	0.67
MND50	7.10	7.59	0.01	22.54	0.08	3.96	4.66	0.01	14.46	0.92
MND51	11.31	11.77	0.02	23.53	0.02	6.43	7.20	0.01	13.47	0.98
MND52	48.85	52.97	0.21	21.00	0.08	38.71	44.60	0.17	16.00	0.92
MND53	82.83	85.94	0.14	21.27	0.03	65.08	69.64	0.11	15.73	0.97
MND54	23.99	29.33	0.04	18.86	0.42	23.23	28.96	0.04	18.14	0.58
MND55	23.01	27.94	0.04	18.94	0.39	22.04	26.94	0.04	18.06	0.61
MND56	19.19	22.18	0.07	18.80	0.44	18.86	21.62	0.07	18.20	0.56
MND57	52.39	81.07	0.33	17.97	0.61	55.13	83.28	0.35	19.03	0.39
MND58	11881.42	15066.83	0.36	18.94	0.40	11741.79	15591.28	0.36	18.06	0.60
MND59	54.25	68.79	0.35	18.72	0.51	55.52	72.07	0.36	18.28	0.49

MND60	2450.64	3782.32	0.24	18.51	0.42	2484.10	3803.90	0.24	18.49	0.58
MND61	6.33	7.90	0.41	18.30	0.59	6.62	8.33	0.43	18.70	0.41
MND62	79.25	102.74	0.13	18.62	0.40	81.24	107.89	0.14	18.38	0.60
MND63	334.99	484.11	0.09	18.42	0.57	309.66	450.71	0.08	18.58	0.43
MND64	678.86	1281.10	0.13	18.42	0.58	704.98	1315.24	0.14	18.58	0.42
MND65	1725.38	2041.12	0.23	18.63	0.44	1697.75	1988.07	0.23	18.37	0.56
MND66	913.08	1075.51	0.27	18.14	0.60	944.20	1089.14	0.28	18.86	0.40
MND67	2431.81	2861.47	0.25	18.06	0.53	2530.42	2917.42	0.26	18.94	0.47
MND68	9939.83	11503.03	0.25	18.39	0.40	10084.95	11777.30	0.25	18.61	0.60
MND69	385.24	434.62	0.22	18.23	0.49	398.58	448.06	0.23	18.77	0.51
MND71	1981.73	2869.82	0.32	18.19	0.57	2054.08	2925.36	0.33	18.81	0.43
MND72	1602.83	1954.55	0.21	19.07	0.43	1529.15	1961.89	0.20	17.93	0.57
MND73	13.84	16.17	0.41	18.04	0.64	14.48	16.74	0.43	18.96	0.36
MND74	2.29	2.64	0.08	18.67	0.39	2.25	2.63	0.08	18.33	0.61
MND75	0.42	0.51	0.01	19.59	0.24	0.36	0.44	0.01	17.41	0.76
MND76	9.65	11.51	0.28	17.84	0.61	10.32	11.98	0.30	19.16	0.39
pBetter	0.26	0.29	0.26	0.24	0.25	0.74	0.71	0.74	0.75	0.72