

**T.C.
BAHÇEŞEHİR ÜNİVERSİTESİ**

**STEPWISE SELECTION OF FORECASTING METHOD TO
REDUCE COST OF FORECASTING ERROR**

Master Thesis

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İSTANBUL, 2012

**T.C.
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GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

INDUSTRIAL ENGINEERING

**STEPWISE SELECTION OF FORECASTING METHOD TO
REDUCE COST OF FORECASTING ERROR**

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FEN BİLİMLERİ ENSTİTÜSÜ
UYGULAMALI MATEMATİK PROGRAMI

Name of the thesis : STEPWISE SELECTION OF FORECASTING METHOD TO REDUCE COST OF FORECASTING ERROR

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Date of Defense of Thesis: 12.06.2012

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ABSTRACT

STEPWISE SELECTION OF FORECASTING METHOD TO REDUCE COST OF FORECASTING ERROR

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Industrial Engineering

Thesis Supervisor: Assist. Prof. Ahmet Beşkese

May 2012, 101 pages

The following work of thesis considers determining appropriate forecasting method for all type of demand by considering forecasting error cost. Accurate forecasting method provides to make ready customer demand in inventory previously. If accuracy of forecasting method decreases, useless inventory and inventory cost increase. In this thesis appropriate forecasting method is determined according to providing minimum forecasting error cost. The statistical error measurement methods factor in size of error which is about just distance of forecasting value to the actual demand. However, if holding cost is less than stock out cost, the forecasting method which over forecasts is better than the others. Similarly, if inventory cost greater than the stock-out cost, then companies bear stock out cost and the forecasting method which under forecasts is better than the others. Forecasting method which superiors according to quantitative error can be inaccurate by considering error cost. The proposed method applied on 2.700 SKUs. Three forecasting methods – CR, SBA, and HWM – and three forecasting error measurements – RMSE, MAE, and RGRMSE – are used. Earning rate of proposed method is greater than 0 percentages for all items and for all error measurement methods. When proposed method is computed with the results of current forecasting method applied in the company, the total earning is calculated as 47 percentages.

Key words: Forecasting, inventory cost, smoothing constant.

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ABBREVIATIONS

AIC	: Akaike' s Information Criterion
ARIMA	: Auto-Regressive Integrated Moving Average
ARMA	: Auto-Regressive Moving Average
AW	: Additive Winters Method
CR	: Croston Method
EWMA	: Exponential Weighted Moving Average
HWM	: Holt-Winters Method
MA	: Mean Average
MAD	: Mean Absolute Deviation
MAPE	: Mean absolute percentage error
ME	: Mean Error
MSE	: Mean Square Error
MW	: Multiplicative Winters Method
PE	: Percentage Error
RGRMSE	: Relative Geometric Root Mean Square Error
RMAE	: Relative Mean Absolute Error
RMSE	: Root Mean Square Error
S-ARIMA	: Seasonal Auto-Regressive Integrated Moving Average
SBA	: Syntetos and Boylan Approximation
SES	: Simple Exponential Smoothing
SKU	: Stock Keeping Unit
S-MAPE	: Symmetrical Mean Absolute Percentage Error
WMA	: Weighted Moving Average

SYMBLOS

Actual demand for term t	: y_t
Basic value for term t	: L_t
Carrying Cost for item i	: CC_i
Cost of error for forecasting method I	: EC_i
Error cost of carrying	: EC_{CC}
Error cost of stock-out	: EC_{SOC}
Error value of term t	: e_t
Forecast of the (t+1)th demand size	: \hat{z}_t
Forecast of the (t+1)th inter-demand interval	: \hat{p}_t
Forecasted value for previous term	: \hat{y}_t
Forecasting method	: F_i
Forecasting value for term t+1	: F_{t+1}
Inter-demand intervals	: p
Length of season	: s
Local trend variable for term t	: b_t
Next forecasting demand value for forecasting method i	: D_i
Number of parameters	: q
Number of term will be forecasted	: m
Percentage of error for term t	: PE_t
Seasonal index for term t	: S_t
Seasonal smoothing constant value	: β
Smoothed series	: \hat{y}_{t+1}
Smoothing Constant Value	: α, γ
Square of coefficient of variation	: CV^2
Stock-out Cost for item i	: SOC_i
Term	: t
Total Error Cost	: TEC
Turkish Lira	: ₺

Undefined : ∞
Weighting coefficient of term i : w_i

1. INTRODUCTION

Changing market conditions, high product variety, short deadline expectation by customer, cost of high and not demanded inventory etc. makes necessary to use an accurate forecasting method not only for manufacturing but also for service sector to satisfy customer different expectations with minimum cost.

Management of production planning, inventory, investment etc is successful if and only if different customer needs are satisfied on time. Having inventory for all products and with high quantity to make customer level 100 percentages is possible with unlimited resources. On the other hand, having inventory for only a product which has the minimum keeping cost reduces carrying cost but also decreased customer service level. Forecasting future demand becomes important at the point of optimizing system between high customer service levels and low inventory cost.

In real world, firms have product variety to satisfy different customer needs. All products do not have the same or similar demand patterns. Some of products have smooth demand pattern, some of others have intermittent and there is no a single accurate forecasting method for all demand types. Hence, using one kind of forecasting method is insufficient. If a forecasting method is superior for smooth product, the method may probably be inappropriate for intermittent product and vice versa. Therefore determining the appropriate forecasting method for each item is important.

The point considered in this thesis is determining accurate forecasting method which minimizes total cost of forecasting error for each item. Forecasting method provides to make probable customer demand ready in inventory previously. If accuracy of forecasting method decreases, useless inventory is increased and customer satisfaction is decreased. Therefore inventory or stock out cost is increased. The present forecasting error measurement methods consider the difference between forecasted and occurred demand size. However, under forecasting and over forecasting demand have different results when carrying and stock out costs are calculated. In this thesis, carrying cost and stock out cost are considered while determining the appropriate forecasting method for

each item. Also, smoothing constant parameter is optimized during forecasting. Moreover, the optimum solution set is updated after the demand occurred for each item.

The following work of thesis considers determining appropriate forecasting method for all type of demand by considering forecasting error cost. Chapter 1 is dedicated to presentation of the necessity of a demand forecasting method and problems of inaccurate forecasting methods.

Chapter 2 includes previous works of forecasting methods. The necessities of previous forecasting methods are told accompanied by strengths and weaknesses. After a general knowledge about forecasting methods, the calculations of forecasting methods are presented. Moreover, formulations of forecasting error measurements with strengths and weaknesses are given. Lastly, relation between forecasting demand and inventory management is told.

Chapter 3 is about methodology of the thesis. Reason and necessity of proposed method and the aim of the thesis are included.

Chapter 4 includes application of proposed method. Firstly, a general knowledge is given about the company which the proposed method is applied. The necessity of proposed method is told. Then, application of methodology is exemplified by real data of two different items. The earnings of the proposed method for the two items are presented at the end of this chapter.

Chapter 5 presents differences between proposed methods and other forecasting methods. Proposed method is compared with original forecasting demand methods and current forecasting method which is applied in the company. The total earnings are calculated and further research is told at the end.

2. DEMAND FORECASTING

Forecasting is an analytical technique used to assist managers to develop a business plan or to proceed with decision-making with uncertainties, and a forecast of the sales volume is closely related to a business' competitive strategy (Shih et al 2012). Accurate forecasting of future demand has an important role in production planning, inventory control management, resource and investment management, increasing customer service level, satisfying customer needs etc. Not only manufacturing but also service sector has been trying to manage uncertainty of future demand. The uncertainty level makes essential appropriate forecasting method according to demand characteristics. This requirement brings about development of forecasting methods and techniques. Classical forecasting methods such as weighted moving average (WMA), exponential smoothing and regression analysis have been used for several decades. But these methodologies are getting inadequate with increasing product range and uncertainty of demand pattern. The naive method which is the simplest forecasting method takes the last actual demand value as the forecasting demand for the next term. This method is inappropriate for demand with fluctuation. Assumption of simple average method is that next demand will occur according to simple average of past demand. Simple average method is appropriate when there isn't sufficient historical data for accurate forecasting. After historical demand data are collected, fluctuation of demand pattern will be more significant, this method will be insufficient. Simple moving average focuses on recent historical data more than oldest data and applicable for slow moving demand. Forecasting value is high if demand has an increasing trend. This method is inadequate for identifying demand characteristic. WMA method recovers disadvantages of simple moving average method. The basic principal is weighting last actual demand higher. Simple exponential smoothing (SES) method is developed by RG Brown in 1959 (Brown 1959). The method is unbiased when demand is smooth. SES method needs less historical data by comparison with WMA method. α , smoothing constant value, is used to compute. α is a coefficient between 0 and 1.

All these classical forecasting methods have been insufficient as a reason of high production range, different customer needs, gain of inventory management etc. Decision

makers need more sensitive and accurate forecasting methods. In other words several of these forecasting methods may perform in a good way when coefficient variation (CV^2) which means the fluctuation of demand pattern is low. But in general when demand for an item is lumpy or erratic or intermittent all these methods are insufficient (Gutierrez et al. 2008).

Holt (1957) developed a procedure appropriate both for seasonal and non-seasonal time series. The method is an extension of SES. Basic principal is determining the direction of demand fluctuation. The method is named as “Double Exponential Smoothing Method”. Winters (1960) contributed Holt’s Method. Method is called Holt-Winters model and appropriate for seasonal fluctuation time series.

When actual demand data are noisy, or demand pattern is erratic, a linear trend is inaccurate (Roberts 1982) especially forecasting several periods ahead. McKenzie (1985) introduced a damped trend procedure which follows closely Holt’s method. The method works particularly well when demand data are noisy or erratic and it is easy to apply in terms of Holt’s method (Syntetos et al 2009).

SES method was commonly used method when Croston (1972) emphasized that SES method causes inappropriate stock levels for lumpy demand pattern. Croston proposed a new method which applies SES both inter-demand intervals and demand sizes separately and then forecasts the next demand. Both forecasted values of inter-demand intervals and demand sizes are updated when non-zero demand occurs.

Over against Willemain et al. (1994) found that there is a correlation in real data and this finding violates Croston’s assumptions. So the authors compared Croston’s method and exponential smoothing method. They compared these two methods by using both theoretical demand data and real world data. Theoretical demand data are generated for different scenarios which violated Croston’s assumption. The forecasting method’s performance is measured by mean absolute percentage error (MAPE). Willemain et al. concluded that Croston’s method is more appropriate than exponential smoothing method. Moreover Croston’s method provides tangible benefits to real world problems of forecasting intermittent demand.

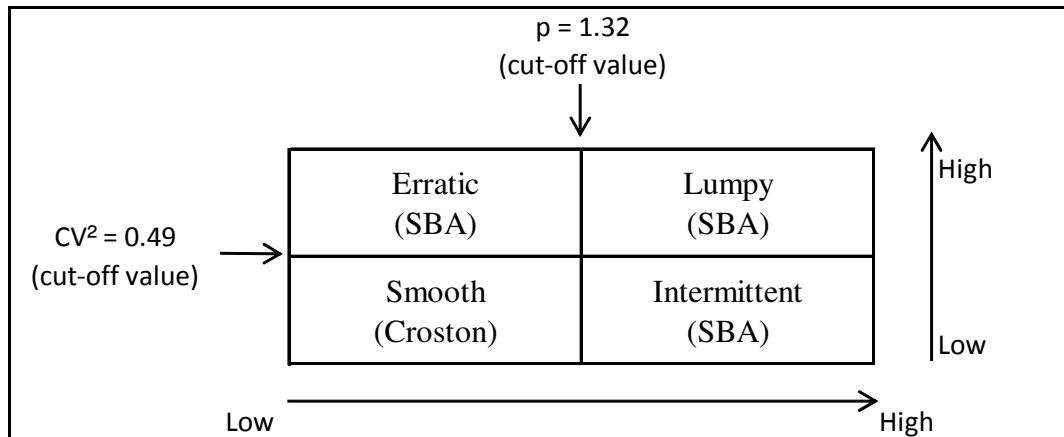
Box and Jenkins (1970) proposed a methodology for managing spare parts forecasts which has sporadic demand pattern. The method bases on Auto-Regressive Moving Average (ARMA), Auto-Regressive Integrated Moving Average (ARIMA) and Seasonal Auto-Regressive Integrated Moving Average (S-ARIMA). Jhonston and Boylan (1996) reassessed forecasting method developed for intermittent demand. The authors considered the aim that satisfying customer's different expectations by having the breadth of range of products and depth of stock for each stock keeping unit (SKUs). They compared Exponential Weighted Moving Average (EWMA) and Croston's Method with real data. Ratio of the mean square of forecasting error is used for comparing. The authors conclude that if average of inter order intervals is greater than 1.25 Croston Method is more appropriate else EWMA should be used.

Sani and Kingsman (1997) compared several forecasting methods according to forecasting method influence on error and inventory. The authors used real data. They concluded the best forecasting method is moving average followed by Croston's method.

Syntetos and Boylan (2001) reported that Croston's method is biased. Syntetos and Boylan (2005, 2006) contributed Croston's Method and they proposed a modified method. Bias of Croston's Method is reduced by multiplying the mathematical model by $(1 - \alpha/2)$. The authors tested these two methods using real intermittent demand data. They tested Syntetos and Boylan Approximation (SBA) in other words modified Croston's method and original Croston's method by using 3.000 SKUs for $\alpha = 0,05, 0,10, 0,15, 0,20$. They concluded SBA is the best method for the intermittent demand. They used Mean Square Error (MSE) as a forecasting error measurement. Another study for intermittent demand is proposed by Syntetos and Boylan (2005). The authors classified the SKUs according to demand patterns. Square of coefficient of variation (CV^2) and average of inter-demand intervals (p) are the parameters to identify brake points of classes. The aim is classifying SKUs and finding the most appropriate forecasting method for each class. The forecasting methods Croston and SBA are tested for 3.000 SKUs. Brake points of classes determined via pattern of forecasting errors of different two forecasting method. Relative Geometric Root Mean Square Error (RGRMSE) is used to measure forecasting accuracy. As can be seen in the Figure 2.1.

The SKUs with the value of $CV^2 \leq 0,49$ and $p \leq 1,32$ are classified as smooth demand pattern and Croston's Method is better than SBA. And SBA is better for the others. The authors recommended smoothing constant value in the literature. The previous studies suggest α value between 0,05 and 0,20. The test is repeated for four α values ($\alpha = 0,05, 0,10, 0,15, 0,20$) and the cut-off value of classes is not change significantly.

Figure 2.1 Demand – based categorization for forecasting



Source: Syntetos et al (2005)

Syntetos and Boylan (2005) compared four forecasting methods which are simple moving average, SES, Croston's method and SBA. Monthly lumpy demand histories of 3.000 SKUs are used. The methods compared via RGRMSE method and they concluded that SBA has superiority.

Ghobbar and Friend (2003) compared and evaluated 13 methods, i.e. additive winter (AW), multiplicative winter (MW), seasonal regression model, component service life, weighted calculation of demand rates, weighted regression demand forecasters, Croston, SES, exponentially weighted moving average, trend adjusted exponential smoothing, weighted moving averages, double exponential smoothing, and adaptive-response-rate SES. They concluded exponential smoothing and Croston's methods outperformed other forecasting methods for intermittent demand. The methods are compared via MAPE.

Hyndman and Khandakar (2008) improved two forecasting algorithms based on exponential smoothing method and ARIMA. The algorithms are applicable both seasonal and non-seasonal demand pattern. The method is also available as a forecast

package. The algorithm applies about 13 forecasting methods for each series and chooses the best one.

Teunter et al. (2010) conducted that Croston’s method and SBA outperform average and exponential smoothing methods. A large data set from UK’s Royal Air Force is used. They compared in a numerical example Croston Method and all his different variation proposed in the years.

Snyder (2002) identifies some contradictions in the original Croston method. Snyder aimed to overcome implementation difficulties and he made corrections to the theory of time-dependent. He developed a simulation procedure that provides a numerical determination of predictive distribution for lead-time demand.

The studies about intermittent demand forecasting are summarized as can be seen in Table 2.1.

Table 2.1 Historical developments of forecasting methods analyzed

Authors	Year	SES	CR	SBA	WMA	AW	MW	Object
Croston	1972		x					C
Rao	1973		x					E
Mckenzie	1986					x		E
Willemain et al.	1994		x					A
Johnston , Boylan	1996		x					E
Sani , Kingsman	1997		x	x				A
Koehler et al.	2001						x	B
Syntetos , Boylan	2001	x	x	x				E
Snyder	2002		x	x				A
Archibald , Koehler	2003					x	x	C-D
Ghobbar A.A., Friend	2003	x	x		x	x	x	A
Willemain et al.	2004	x	x					A
Syntetos , Boylan	2005	x	x	x				D-E
Syntetos et al.	2005		x	x				C-D-E
Hyndman and Khandakar	2008	x	x	x	x	x	x	A
Gutierrez et al.	2008	x		x				A
Teunter, Sani	2009		x	x				C-E

Source: Callegaro (2010)

A refers to “Comparative evaluations based on experimental / simulated data”, B refers to “Individuation of contexts of application”, C refers to “Theoretical explanation”, D

refers to “Proposition of innovative elements”, E refers to “Individuation of errors in the method”.

2.1 FORECASTING METHODS

There are four type of demand category;

- a. Smooth: this items have a behavior which is similar to that of the traditional articles, at low rotation, of a productive system
- b. Intermittent: they are characterized by extremely sporadic demand (therefore a lot of a period with no demand) with a not accentuated variability in the quantity of the single demand
- c. Erratic: the fundamental characteristic is the great variability of the requested quantity, but the demand is approximately constant as distribution in the time
- d. Lumpy: items are characterized by a lot of intervals with zero-demand and a great variability in the quantity

There are several forecasting methods which perform better for one of these demand patterns then the others.

The forecasting methods that are told above can be summarized as in Table 2.2. Inputs, description, mathematical model, innovation features and limits of the forecasting methods are as can be seen below.

Calculations of forecasting methods are as follows.

Table 2.2 Pivot Table of forecasting methods analyzed

Method	Inputs	Description	Mathematical Model	Innovative Features	Limits
Single Exponential Smoothing (SES)	<ul style="list-style-type: none"> Historical data Smoothing constant 	It adopts a smoothing constant α of the real demands	Exponential smoothing	<ul style="list-style-type: none"> Adapt for low period forecasts Easy to compute 	<ul style="list-style-type: none"> Deterministic model Few fields of applicability
Croston's Method (CR)	<ul style="list-style-type: none"> Historical data Smoothing constant Interval between present and last non-zero demand 	Evolution of SES which also looks on intervals of zero demand	Exponential smoothing	Adapt for low period forecasts	Deterministic model
Syntetos & Boylan Approximation (SBA)	<ul style="list-style-type: none"> Historical data Interval between present and last-non zero demand Smoothing constant 	Evolution of Croston in order to decrease the error of the expected estimate of demand per time period	Exponential smoothing	Decrease of the theoretical error of Croston's method	Deterministic model
Moving Average (MA)	<ul style="list-style-type: none"> Historical data Number of data to considerate 	Mean of past n demands	Arithmetic mean	<ul style="list-style-type: none"> Adapt for low period forecasts Easy to compute 	<ul style="list-style-type: none"> Deterministic model Few fields of applicability
Weighted Moving Average (WMA)	<ul style="list-style-type: none"> Historical data Number of data to considerate 	Mean of past n demands with weights	Arithmetic mean	<ul style="list-style-type: none"> More weight applied to last demands Easy to compute 	<ul style="list-style-type: none"> Deterministic model Applicable only with low level of lumpiness
Additive Winter (AW)	<ul style="list-style-type: none"> Historical data Smoothing constant Trend constant β Periodicity constant γ Width of periodicity 	Evolution of SES with the introduction of additive terms on the components	<ul style="list-style-type: none"> Exponential smoothing Sum of components 	It considers the effects of seasonality (in a additive way)	<ul style="list-style-type: none"> Deterministic model Inappropriate for non-seasonal demand
Multiplicative Winter (MW)	<ul style="list-style-type: none"> Historical data Smoothing constant Trend constant β Periodicity constant γ Width of periodicity 	Evolution of SES with the introduction of multiplicative terms on the components	<ul style="list-style-type: none"> Exponential smoothing Product of components 	It considers the effects of seasonality (multiplicative way)	<ul style="list-style-type: none"> Deterministic model Inappropriate for non-seasonal demand

Source: Callegaro (2010)

2.1.1 Simple Average Method

Assumption of simple average method is that next demand will be occur according to past actual demands.

$$F_{t+1} = \frac{1}{t} \sum_{i=1}^t Y_i \quad (2.1)$$

Where,

t= term

F_{t+1} = Forecasting value for term $t+1$

Y_i = Actual demand for term i

Simple average method is inadequate for demand with trend or fluctuation. This method is used when there is inadequate historical demand data.

2.1.2 Simple Moving Average Method

Simple moving average focuses on recent historical demand data more than oldest data.

For k refers to number of term included forecasting computing.

$$F_{t+1} = \frac{1}{k} \sum_{i=t-k+1}^t Y_i \quad (2.2)$$

The method is applicable for slow moving demand. As well as simple average method, simple moving average method is not sufficient to determine demand characteristic.

2.1.3 Weighted Moving Average Method

Weighted moving average method recover some disadvantages of moving average method. The basic principal is weighting last actual demand higher. For w_i refers to weighting coefficient of term i , forecasting by equation 2.3.

$$F_{t+1} = \frac{1}{k} \sum_{i=t-k+1}^t w_i Y_i \quad (2.3)$$

If all terms are weighted equal, weighted moving average method will give the same forecasting value with moving average method.

2.1.4 Simple Exponential Smoothing Method

Simple exponential smoothing method is a time series analysis. The forecast formula is as follows;

$$\hat{y}_{t+1} = \alpha y_t + (1 - \alpha)\hat{y}_t \quad (2.4)$$

Where,

\hat{y}_{t+1} = Smoothed series

y_t = Actual demand at time t

α = Smoothing parameter. ($0 < \alpha < 1$)

\hat{y}_t = Forecasted value for previous term

When moving average method and SES is compared, the most important contribution of SES is that quantity of required data is decreased by using α value. Forecasting data is been able to compute with actual demand value and forecasting value of the previous term. Effect of last actual demand is increased by SES while computing forecasting next demand. α , smoothing constant value, is a determiner of weight of previous actual demand. If α is increased to 1, last observation have greater weight. If α is decreased to zero, the error of previous term is not considered.

If there is no demand fluctuation (seasonal, trend etc) except random variability, demand is settled, α should be close to zero. In other words, α should be close to one, if there is a seasonal or trendy demand pattern.

2.1.5 Holt's Method

Holt (1957) developed a procedure which provides the method appropriate both non-seasonal and seasonal series, also demand with trend. The procedure is a natural extension of SES with two smoothing constant. Holt reprinted his 1957 report to provide greater accessibility in 2004.

Basic principle of the method is determining that the trend is increasing or decreasing thus random fluctuation will be smoothed.

$$L_t = \alpha Y_t + (1 - \alpha)(L_{t-1} + b_{t-1}) \quad (2.5)$$

Where;

t = term

L_t = Basic value for term t

Y_t = Actual demand

α = Smoothed constant value

b_{t-1} = Local trend variable for term $t-1$

By equation 2.5, basic value for term t is closed to last observation demand value. And local trend variable is calculated as follows.

$$b_t = \beta(L_t - L_{t-1}) + (1 - \beta)b_{t-1} \quad (2.6)$$

β is smoothing parameter and take value between 0 and 1.

By equation 2.6, trend is determined according to differences between last two smoothed values. If a smoothed value is less or greater than the previous one, then there is a trend. β is used to reduce effect of random fluctuations. If β value decreases, slope of trend is decrease. If β value increases, forecasted value is affected by previous trend effect.

Forecasting formula is as follows;

$$\tilde{y}_{t+m} = L_t + b_t m \quad (2.7)$$

where m refers to the term will be forecast.

Initial solution for L_1 and b_1 are required for Holt's method. The first two observed demand data are able to use to determine initial solution.

Holt's method in other words Double Exponential Smoothing Method is named as Brown's Double Exponential Smoothing Method when smoothing constant values (α and β) are equal.

2.1.6 Holt-Winters Method

Exponential smoothing methods also is made appropriate for demand with seasonal fluctuation by Winters (1960) and the method is called Holt-Winters Method.

Winters (1960) itemized a good forecasting method characteristic as follows;

1. A forecasting method must have a routine basis for thousands of products.
2. A forecasting method must be easy to calculate and made quickly.
3. A forecasting method must be cheap in terms of both computing time and information storage.

Three forecasting models are compared for three different time series in terms of ability to forecast compares preferably with more traditional methods. And sales data has the characteristics above. The forecasting methods are follows;

1. Simple Exponential Smoothing Model
2. Forecasting with ratio seasonal
3. Forecasting with ratio seasonal and linear trend

The result of comparison of ability to predict for each forecasting method shows that: exponential system calculate better forecasts. Also ES requires less information storage. However, the exponential system requires more time to compute but the difference is not significant with other two methods.

There are three smoothing constant value (basic, trend and seasonality)

Multiplicative Seasonality Formula;

$$\text{Basic} \quad :L_t = \alpha \frac{Y_t}{S_{t-s}} + (1 - \alpha)(L_{t-1} + b_{t-1}) \quad (2.8)$$

$$\text{Trend} \quad :b_t = \beta(L_t - L_{t-1}) + (1 - \beta)b_{t-1} \quad (2.9)$$

$$\text{Seasonal} \quad :S_t = \gamma \frac{Y_t}{L_t} + (1 - \gamma)S_{t-s} \quad (2.10)$$

$$\text{Forecast} \quad : F_{t+m} = (L_t + b_t m) S_{t-s+m} \quad (2.11)$$

where;

s = length of season

S_t = seasonal index for term t

t = term

L_t = Basic value for term t

Y_t = Actual demand observed for term t

α = Seasonal smoothing constant value

β = Seasonal smoothing constant value

γ = Seasonal smoothing constant value

b_t = Trend values for term t

F_{t+m} = Forecasting value for term $t+m$

Formulas for initial solution:

$$L_s = \frac{1}{S} (Y_1 + Y_2 + \dots + Y_s) \quad (2.12)$$

$$b_s = \frac{1}{S} \left[\frac{Y_{s+1} - Y_1}{s} + \frac{Y_{s+2} - Y_2}{s} \dots \frac{Y_{s+s} - Y_s}{s} \right] \quad (2.13)$$

$$S_1 = \frac{Y_1}{L_s} \quad S_2 = \frac{Y_2}{L_s} \quad \dots \quad S_s = \frac{Y_s}{L_s}$$

Additive Seasonality Formula;

$$\text{Basic} \quad : L_t = \alpha(Y_t - S_{t-s}) + (1 - \alpha)(L_{t-1} + b_{t-1}) \quad (2.14)$$

$$\text{Trend} \quad : b_t = \beta(L_t - L_{t-1}) + (1 - \beta)b_{t-1} \quad (2.15)$$

$$\text{Seasonal} \quad : S_t = \gamma(Y_t - L_t) + (1 - \gamma)S_{t-s} \quad (2.16)$$

$$\text{Forecast} \quad : F_{t+m} = (L_t + b_t m) S_{t-s+m} \quad (2.17)$$

Initial solutions are the same with multiplicative seasonality except seasonality index as follows;

$$S_1 = Y_1 - L_s, \quad S_2 = Y_2 - L_s \dots \quad S_s = Y_s - L_s$$

Winter showed that exponential smoothing methods have a good forecasting performance also demand with seasonality pattern. This method is intuitively appealing and natural extension of the Holt's method for trended demand pattern (Syntetos et al. 2009)

2.1.7 Croston's Method

Croston's method is based on traditional exponential smoothing method. Croston modified exponential smoothing method because exponential smoothing method is inadequate for stock control system. Croston advocated that exponential smoothing method is a biased method for intermittent demand pattern. And intermittent demand cause inappropriate stock levels.

Croston Method analyses intermittent time series in two different series. He applied SES for inter-demand intervals and demand sizes separately. He used Mean Absolute Deviation (MAD) method to as a tool to compare SES and Croston's Method.

Assumptions of Croston's Method;

1. A constant mean model for underlying demand pattern
2. Demand size with normal distribution
3. Inter – demand intervals with geometric distribution
4. Demand sizes and inter – demand intervals are independence

Assumption of geometric distribution is appropriate with independent inter-demand intervals because the probability of non-zero demand is depend on the last term of non-zero demand occurrence (Syntetos and Boylan 2010).

As an example, consider a historical demand given by: 9 - 1 - 5 - 0 - 0 - 0 - 0 - 6 - 0 - 4 - 5 - 8 - 0 - 0 - 2 - 3. Croston separates the demand data into size: 9 - 1 - 5 - 6 - 4 - 5 - 8 - 2 - 3 and interval: 1 - 1 - 5 - 2 - 1 - 1 - 3 - 1. If the actual demand of time t is a non-zero demand ($y_t > 0$), then

$$\hat{z}_t = \alpha y_t + (1 - \alpha)\hat{z}_{t-1} \quad (2.18)$$

$$\hat{p}_t = \alpha q_t + (1 - \alpha)\hat{p}_{t-1} \quad (2.19)$$

$$\hat{y}_{t+1} = \hat{z}_t / \hat{p}_t \quad (2.20)$$

\hat{z}_t and \hat{p}_t are used to calculate forecasting the $(t+1)$ th demand. \hat{z}_t is the forecast of the $(t+1)$ th demand size and \hat{p}_t is the forecast of the $(t+1)$ th inter-demand interval. α is smoothing constant value and takes value between 0 and 1. If α is increase, the effect of last actual demand \hat{z}_t / \hat{p}_t of the forecasting data value is increase. For example α value should be higher if demand has a residual trend. q_t is actual demand at time t and the previous non-zero demand. \hat{y}_{t+1} is the forecasting demand value for $(t+1)$ th term.

If the actual demand of time t is zero demand ($y_t = 0$); then

$$\hat{z}_t = \hat{z}_{t-1} \quad (2.21)$$

$$\hat{p}_t = \hat{p}_{t-1} \quad (2.22)$$

As is seen from equation 2.21 and 2.22, if the actual demand is non zero, the forecasting value of demand size and interval are not refreshed until the next non-zero demand. This indicates that forecasts are not updated until non-zero demand occurs. When demand has a lumpy pattern, Croston's method is unable to forecast unbiased. Croston also does not determine α value and users decide α value baseless.

Croston's method is based on following assumptions;

1. Successive intervals are independent
2. Successive demand sizes are independent
3. Normality of demand sizes

Rao (1973) modified Croston's method but forecasting performance did not change. Willemain et al. (1972) compared Croston method to exponential smoothing method. Real world data and simulated data are used for comparison. The authors concluded that Croston method is superior to exponential smoothing. Johnston and Boylan (1996) showed that Croston method superior to exponential smoothing when average of inter-

demand intervals are greater than 1.25. Otherwise exponential smoothing method is superior.

Willemain, Smart and Schwartz (2004) proposed a bootstrap method. The method based approach that allows for a Markov chain development of the probability of an order (Snyder, 2010). They concluded that the proposed method is more appropriate for inventory decisions than both exponential smoothing and Croston method. However, Gardner and Koehler (2005) searched out that Willemain et al. (2004) proposed incorrect methodology because of using incorrect lead-time distribution.

2.1.8 Syntetos and Boylan Approximation

Syntetos and Boylan (2001) reported an error in Croston's mathematical derivation of expected demand size. And they proposed a modified Croston's method: SBA (Syntetos et al 2005)

Bias of Croston's Method is reduced by multiplying coefficient $(1 - \alpha/2)$ with equation 2.20 as follows;

$$\hat{y}_{t+1} = (1 - \alpha/2) \hat{z}_t / \hat{p}_t \quad (2.23)$$

The authors tested these two methods using real intermittent demand data. They tested 3.000 SKUs for $\alpha = 0,05, 0,10, 0,15, 0,20$. They concluded SBA is the best method for the intermittent demand. They used MSE as a forecasting error measurement.

2.1.9 Automatic Time Series Forecasting Method

Hyndman and Khandakar (2008) improved two forecasting algorithms based on exponential smoothing method and ARIMA. The algorithms are applicable both seasonal and non-seasonal demand pattern. The method is also available as a forecast package.

The most useful study is the methodology of identifying initial parameters $x_0, \alpha, \beta, \gamma$. The algorithm finds the most appropriate initial value.

Akaike's Information Criterion (AIC) method is used to measure forecasting accuracy.

$$AIC = L \times (\hat{\theta}, \hat{X}_0) + 2q \quad (2.24)$$

where q is the number of parameters. The forecasting method with the minimum AIC value is selected as the most appropriate method.

The MSE or MAPE are not used as a tool to measure forecasting error because these methods are not able to select the error types but AIC is.

The steps of automatic forecasting algorithm are below.

1. Apply appropriate forecasting methods for each series. Run each method until find the most appropriate initial state variable and smoothing parameters.
2. Apply AIC for selected methods in step 1. And select the best model according the AIC value. (The forecasting with the minimum AIC value is selected.)
3. Calculate the forecast for terms that are needed via selecting model in step 2.

2.2 FORECASTING ERROR MEASUREMENTS

There are great numbers of forecasting method in the literature. Contributing present methods and improving new methodologies are still going on. Several forecasting methods are able to used for several demands pattern and compute different forecasting value. Determining the most appropriate forecasting method is important as calculating forecasting the demand. The forecasting method which computes the most closed value to the actual demand is the most appropriate method in general. In the other words, the method which generates the minimum forecasting error is appropriate.

Error value is the difference between actual demand and forecasting demand value for the same term.

For;

e_t = Error value of term t

y_t = Actual demand of term t

\hat{y}_t = Forecasting demand for term t

$$e_t = y_t - \hat{y}_t \quad (2.25)$$

If there is n number of actual and forecasting demand value then there is n number of error value. There are sort of statistical methods to measure forecasting errors.

2.2.1 Scale – Dependent Error Measures

The forecasting error measures which are based on scale of the data are useful when comparing different methods applied to the same set of data. But these methods should not be used when comparing across data sets that have different scales (Hyndman and Koehler 2006).

2.2.1.1 Mean error (ME)

Mean Error methodology computes the mean of differences between actual and forecasting demand value.

$$ME = \frac{1}{n} \sum_{i=1}^n e_t \quad (2.26)$$

where n refers number of term.

The equation 2.27 does not consider the direction of the deviation, which means is the error is negative or positive. Hence the mean of error will probably lesser. ME is not adequate for typical error types. ME is used when the bias is always positive or negative.

2.2.1.2 Mean absolute error (MAE)

Mean absolute method computes the mean of absolute error. The direction of the deviation is not important in this methodology.

$$MAE = \frac{1}{n} \sum_{i=1}^n |e_t| \quad (2.27)$$

2.2.1.3 Mean square error (MSE)

Mean square error has the same advantage with the mean absolute error. The method incorporates both the variance of the estimator and its bias.

$$MAE = \frac{1}{n} \sum_{t=1}^n |e_t^2| \quad (2.28)$$

2.2.1.4 Root mean square error (RMSE)

Taking the square root of MSE refers to standard deviation of time series and named as Root Mean Square Error.

$$RMSE = \sqrt{\frac{1}{n} \sum_{t=1}^n e_t^2} \quad (2.29)$$

Armstrong and Collopy (1992) concluded that RMSE is not reliable, even though most practitioners prefer RMSE. Because the method describes the magnitude of errors in terms of decision maker (Carbone and Armstrong 1982)

RMSE and MSE are more sensitive to outliers than MAE and ME (Armstrong 2001). RMSE and MSE have more theoretical relevance in statistical.

2.2.2 Measures Based on Percentage Errors

Percentage errors are scale-independent methods. These methods are frequently used to compare forecast performance across different data sets. The methods based on percentage have a disadvantage of being infinite or undefined. If actual demand occurs as zero, then equation 2.30 is undefined.

2.2.2.1 Percentage error (PE)

ME, MAE, MSE and RMSE represent the error different mathematical values according to length of time series. For example ME with the value of 10 and MAE with the value of 10 is different each other. Hence, these error measurement methods are not able to compare with each other. Percentage method is used to compare.

$$PE_t = \left(\frac{y_t - \hat{y}_t}{y_t} \right) \times 100 \quad (2.30)$$

where PE_t refers to percentage of error for term t .

According the equation 2.30 mean percentage error is calculated as follows;

$$MPE = \frac{1}{n} \sum_{i=1}^n PE_t \quad (2.31)$$

2.2.2.2 Mean absolute percentage error (MAPE)

$$MAPE = \frac{1}{n} \sum_{i=1}^n |PE_t| \quad (2.32)$$

The disadvantage of Mean error is received for Mean Percentage Error, too. Hence, MAPE is a common formulation for error measurement.

Although it is easy to imply, MAPE has two main inadequacies. One of them is that when the actual demand (y_t) is zero, percentage calculation will be undefined. As a reason of intermittent demand pattern, percentage methodology is inappropriate to measure forecasting error. The other one is unbounded upper level. In other words, when the forecasted value is equal to actual demand, MAPE equals to zero which means forecasting method has a perfect fit. However, there is no restriction for the upper level to have an idea about performance of the forecasting method. Following measures have been defined to cover this disadvantage.

2.2.2.3 Symmetrical MAPE (S-MAPE)

Symmetrical MAPE has a lower bound and upper bound according to flowing formula;

$$S - MAPE = \frac{1}{n} \times \sum_{i=1}^n \frac{|y_t - \hat{y}_t|}{(y_t + \hat{y}_t)/2} \quad (2.33)$$

When difference between actual and forecasting demand is zero, the lower bound is 0 percentages. When actual demand or forecasting demand is equal to zero and the other is non-zero, the upper bound is computed as 200 percentages. By removing factor 0,5, the range between bounds computed as between 0 – 100 percentages to easy interpret.

Otherwise, two errors with different direction and same deviation value give different S-MAPE value. Goodwin and Lawton (1999) and Koehler (2001) discussed on this point.

Makridakis and Hibon (2000) said “By using symmetric MAPE, the problem of large errors is avoided when the actual demand values are close to zero and the large difference between the absolute percentage errors when actual demand is greater than forecasted demand and vice versa.”

2.2.3 Measures Based on Relative Errors

Another method of determining the better forecasting method is dividing each error by the error obtained using another standard method of forecasting. Index a and b refers to different forecasting methods for equations 2.34 and 2.35. If equations are lower than 1, method “a” performs rather than method “b”.

Measures based on relative errors remove the scale of the data via comparing the forecasts with obtained from some benchmark forecast method. These methods have a problem with statistical distribution with undefined mean and infinite variance (Hyndman and Koehler 2005).

2.2.3.1 Relative mean absolute error (RMAE)

$$RMAE = \frac{\frac{1}{n} \sum_{i=1}^n |e_{a,t}|}{\frac{1}{n} \sum_{i=1}^n |e_{b,t}|} \quad (2.34)$$

2.2.3.2 Relative geometric root mean square error (RGRMSE)

$$RGRMSE = \frac{(\prod_{t=1}^n (y_{a,t} - \hat{y}_{a,t})^2)^{1/2n}}{(\prod_{t=1}^n (y_{b,t} - \hat{y}_{b,t})^2)^{1/2n}} \quad (2.35)$$

2.3 ROLE OF DEMAND FORECASTING IN INVENTORY MANAGEMENT

Changing market conditions, high product variety, short deadline expectation by customer, cost of high and not demanded inventory etc. makes necessary to use an accurate forecasting method not only for manufacturing but also for service sector.

Why do firms make to stock instead of make to order? Reducing setup costs, stock out costs or lost sale costs can be answers of this question. But the main answer is given by

Lode Li (1992). Li said that if firms compete on speed of delivery, then reducing production lead times may necessitate holding inventory. Assume two different firms which produce the same good on the same quality and with the same price. Customers prefer the product on the market. They do not prefer waiting the product to be produced generally. So holding inventory provide facilitate prompt delivery.

Management of production planning, inventory, investment etc is successful if and only if different customer needs are satisfied. Having inventory for all products and with high quantity to make customer level 100 percentages is possible with unlimited resources. However, having inventory for only a product which has the minimum keeping cost reduces cost but also decreased customer service level. Forecasting future demand becomes important at the point of optimizing system between high customer service levels and low cost. Forecasting accuracy is a critical factor for, among other things, reducing cost and providing better customer service (Makridakis and Hibon 2000). Companies manage their resources according to certain and probable customer orders. The objection is satisfying customer needs with a high customer service level and low inventory cost.

Accurate forecasting method provides to make ready customer demand in inventory previously. If accuracy of forecasting method decreases, useless inventory and inventory cost increase. Croston (1972) analyzed that intermittent demands almost always produce inappropriate stock levels because off the difficulty of accurate forecasting. Sani and Kingsman (1997) showed that achieving high customer service levels above 95 percentages is not possible for low and intermittent demand items except by carrying high stocks at a high cost.

Therefore, cost factor of forecasting error should be considered. If stock out cost is less than carrying cost, demand forecasting method which forecasts less than actual demand may be preferred not to increase inventory cost.

3. METHODOLOGY

Several forecasting methods have been developed for decades to meet different needs. Many books have been written and several journals are dedicated to demand forecasting for different demand patterns.

In real world, firms have product variety to satisfy different customer needs. All products do not have the same or similar demand patterns. Some of products have smooth demand pattern, some of others have intermittent. Hence, using one kind of forecasting method is insufficient. If a forecasting method is superior for smooth product, the method may probably be inappropriate for intermittent product and vice versa. It is possible that there may be a single superior method for a kind of demand pattern but there is no a single superior method for companies. Therefore, companies should use different forecasting methods for different demand patterns.

The most common forecasting methods, Croston's original method (CR), SBA and HWM are used in this thesis. In regard to previous analyses, CR is used for smooth demand pattern, SBA is used for intermittent demand pattern and HWM is used for demand with seasonal fluctuation.

Croston (1972), Syntetos and Boylan (2001, 2005) and Winters (1960) take the α – smoothing constant value between 0,05 and 0,2. Moreover, Syntetos and Boylan (2005) classified SKUs for four different groups and propose different forecasting method for each group as can be seen in Figure 2.1. They aimed to make easy to manage inventory and forecasting management.

α takes value between 0,05 and 0,9 in this thesis. Different forecasting methods are superior for several α values. Hence there is no a single superior forecasting method. Besides, classifying SKUs increased the deviation because there isn't sharp contrast between classes. When number of non-zero demand increases or decreases or fluctuation of demand volume increases or decreases by the time, coefficient of variation (CV^2) and average of inter-demand intervals (p) of an item change. Hence, class of item is able to change easily. Otherwise, although having the break point values

of a class does not mean that the forecasting method used for that class superior for the mentioned item. Because break points are determined according to average error of SKUs and in detail different results are obtained. Therefore, determining accurate forecasting method on the basis of SKU is aimed.

The best method, which provides the company with the least total cost, is chosen from the list of forecasting methods told in section 2.2. The error measurement methods which measures bias on the basis of quantity are used. There is a disadvantage of measuring errors for volume of difference equation 2.26. Several measurements methods do not consider the direction of bias (if actual demand less or greater than forecasted value).

Statistically error measurements on the basis of quantity may be sufficient. Otherwise, in terms of inventory management, cost of forecasting should be use to determine forecasting methods. Because the cost of forecasting greater and less than accrual demand are different. If the demand occurs less than forecasted demand, inventory cost increases. In this situation, forecasting error should be measured by holding cost. If the demand occurs greater than forecasted demand, stock-out cost increases. In this situation, forecasting error should be measured by stock-out cost.

When viewed from this aspect, a forecasting method which superior according to quantitative error can be inaccurate according to cost of deviation.

In terms of inventory management, quantitative analysis of forecasting deviation is not reflecting the truth. Better forecasting method should not be determined according to minimum deviation of quantity but minimum holding cost and stock-out cost. In this situation, direction of variation come in to prominence according to unit cost of stock out and inventory. In other words, if holding cost is less than stock out cost, the forecasting method which over forecasts is better than the others. However, if inventory cost greater than the stock-out cost, then companies bear stock out cost and the forecasting method which under forecasts is better than the others.

Forecasting methods are computed for 2.700 SKUs. Historical data set is actual demand occurred in 2009 and 2010. Forecasting demands are produced for 2011 and forecasting

error are measured according to difference between forecasted demand data and actual demand of 2011.

The calculation is repeated for ten different α value and three different forecasting methods. Optimum solution set is determined by the forecasting method and α value which caused the minimum total error cost. By developed algorithm, after a demand occurs for an item the most accurate α value and forecasting method are updated. The methodology is told by flow chart as Figure 3.2.

F_i = Forecasting Method

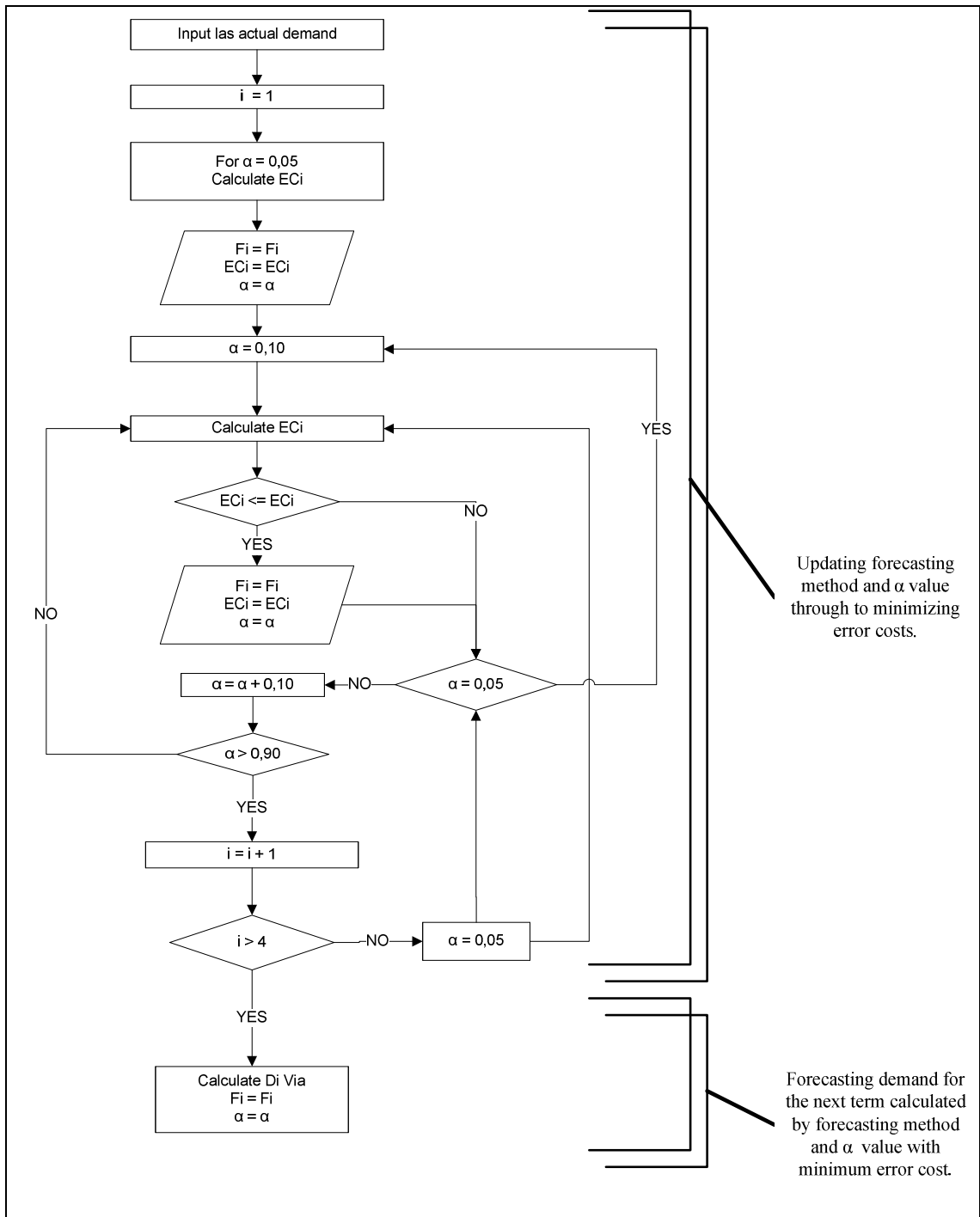
EC_i = Cost of error for forecasting method i

D_i = Next forecasting demand value for forecasting method i

i = 1, 2, 3

α = Smoothing constant value ($0,05 \leq \alpha \leq 0,90$)

Figure 3.1 Flow chart of updating accurate forecasting method



4. APPLICATION OF FORECASTING METHODS

VİKO is a production company with 650 employees located in Sancaktepe, Istanbul that creates solutions for the transmission, use and more convenient supply of electric power. The firm is active in low voltage sector and market leader in Turkey and has a vision of being one of the top 10 companies worldwide in the low voltage sector by 2020.

VİKO's product range includes power switches and socket outlets, group socket outlets, fuse boxes, accessories, low voltage switchgear products, smart meters and building automation systems. While VİKO maintains its leadership in Turkish markets, it also represents Turkey in global markets successfully with 45 percent of its sales consisting of export performed to 70 countries.

There are about 20.000 kinds of product and four main sales channel, named as Export Channel, Dealer Channel, DIY (do it yourself) and Project Production.

Export channel orders have high volume and high variety. One customer approximately orders 11 orders in a year. That can be said, a customer gives order once a month. Dealer channel order once approximately in three days.

Resources are used firstly to meet certain customer demand, than match with safety stock levels after that to meet probable customer demand according to forecasting data. Managing resources gets hard by increasing product variety. Hence, accurate forecasting data comes in to prominence.

Moreover, to meet customer expectations has an important role of being one of the top 10 companies worldwide. Hence, increasing customer satisfaction becomes in prominence. To manage resources and increase customer service level is possible by accurate forecasting method. Accuracy of forecasting method provides being proactive in terms of customer needs.

In VİKO, forecasting data calculated not only according to statistical methods but also is composed of sales target. The data are calculated on the bases of product groups. The

total number of a product group is allocated to products by an allocation key. The performance of forecasting method is computed via MAPE. Cost of inaccuracy of current forecasting method is ₺292 million. Decreasing forecasting error cost in VIKO is aimed.

In this master thesis, sales data of VIKO are used to compare forecasting methods and results are also compared to VIKO's forecasting method.

2.700 SKUs are involved in this study. The SKUs have different demand characteristics. CR, SBA and HWM are applied for each item. Demands are forecasted for 2011 via actual demand value of 2009 and 2010. The forecasting value is calculated for α value between 0,05 and 0,9. Croston (1972) and Syntetos and Boylan (2005) propose α value at least 0,05. 30 different forecasting values are computed for each item. The forecasting values are compared with actual demand occurred in related term.

The data of code 90 and code 92 will be used as an example to show calculations.

Historical demand data of SKUs are in Table 4.1

Table 4.1 Volume of actual demand occurred in 2009 and 2010 for item 90 and 92

Code	Jan 2009	Feb 2009	March 2009	April 2009	May 2009	June 2009	July 2009	Aug 2009	Sep 2009	Oct 2009	Nov 2009	Dec 2009
# 90	24	915	60	132	24	144	181	36	0	240	336	24
# 92	0	0	0	0	0	65	105	30	0	0	24	16

Code	Jan 2010	Feb 2010	March 2010	April 2010	May 2010	June 2010	July 2010	Aug 2010	Sep 2010	Oct 2010	Nov 2010	Dec 2010
# 90	303	132	420	192	200	2064	108	96	168	144	207	276
# 92	160	50	0	3	0	82	10	22	17	40	0	60

Historical demand data is used to compute initial solution for CR, SBA and HWM.

4.1 APPLICATION OF CROSTON METHOD

Simple exponential smoothing method is applied for inter-demand intervals (p) and demand sizes (z) separately. Then, forecasting demand is calculated via p and z.

The Table 4.1 is separated in two as follows.

Demand size for #90 : 24 – 915 – 60 – 132 – 24 – 144 – 181 – 36 – 1 – 240 – 336 – 24 – 303 – 132 – 420 – 192 – 200 – 2064 – 108 – 96 – 168 – 144 – 207 – 276

Intervals for #90 : 1 – 1 – 1 – 1 – 1 – 1 – 2 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1

Demand size for #92 : 65 – 105 – 30 – 24 – 16 – 160 – 50 – 3 – 83 – 10 – 22 – 17 – 40 – 60

Intervals for #91 : 5 – 1 – 1 – 3 – 1 – 1 – 1 – 2 – 2 – 1 – 1 – 1 – 1 – 1 – 2

If last actual demand is greater than zero, forecasting value of demand size and inter – demand intervals are calculated by equation 2.18 and 2.19 respectively.

If last actual demand is zero, forecasting value of demand size and inter – demand intervals are calculated by equation 2.21 and 2.22.

After demand sizes and inter – demand intervals are calculated, forecasting value of next term demand is calculated by equation 2.20.

Table 4.2 Calculated and Actual values for code 90 and 92 ($\alpha = 0,02$)

Code	Term	\hat{p}	\hat{z}	\hat{y}	y	p
#90	Jan 2011	1	279	279	277	1
	Feb 2011	1	277	277	216	1
	March 2011	1	222	222	192	1
	April 2011	1	195	195	35	1
	May 2011	1	51	51	169	1
	June 2011	1	157	157	13	1
	Jly 2011	1	27	27	46	1
	Aug 2011	1	44	44	0	0
	Sep 2011	1	44	44	48	2
	Oct 2011	2	48	25	0	0
	Nov 2011	1	48	25	57	2
	Dec 2011	2	51	26	72	1
#92	Jan 2011	2	49	30	0	0
	Feb 2011	2	49	30	10	1
	March 2011	1	12	11	20	1
	April 2011	1	19	19	0	0
	May 2011	1	19	19	30	2
	June 2011	2	29	15	116	1
	Jly 2011	1	106	97	20	1
	Aug 2011	1	28	27	50	1
	Sep 2011	1	48	48	0	0
	Oct 2011	1	48	48	0	0
	Nov 2011	1	48	48	0	0
	Dec 2011	2	43	21	59	0

The forecasting value (\hat{y}) calculated for $\alpha = 0,02$ in Table 4.2. The forecasting values for ten different α value and actual demands are in Table 4.3. “ i ” refers to month number of the year 2011 for \hat{y}_i .

Table 4.3 Forecasting values for $\alpha = 0,05 \dots 0,90$ calculated via CR

Code	α	\hat{y}_1	\hat{y}_2	\hat{y}_3	\hat{y}_4	\hat{y}_5	\hat{y}_6	\hat{y}_7	\hat{y}_8	\hat{y}_9	\hat{y}_{10}
# 90	0,05	279	279	276	272	260	256	243	234	234	214
	0,1	279	279	273	265	242	235	212	196	196	165
	0,2	279	279	266	251	208	200	163	140	140	101
	0,3	279	279	260	240	178	175	127	102	102	66
	0,4	279	278	253	229	151	158	100	79	79	47
	0,5	279	278	247	220	127	148	81	63	63	37
	0,6	279	278	241	212	106	144	65	54	54	31
	0,7	279	278	235	205	86	144	52	48	48	28
	0,8	279	277	228	199	68	149	40	45	45	26
0,9	279	277	222	195	51	157	27	44	44	25	
# 92	0,05	30	30	18	11	11	8	8	6	5	5
	0,1	30	30	18	12	12	9	13	9	9	9
	0,2	30	30	17	12	12	10	22	16	18	18
	0,3	30	30	16	13	13	12	32	22	26	26
	0,4	30	30	16	14	14	13	41	27	33	33
	0,5	30	30	15	15	15	14	50	31	38	38
	0,6	30	30	14	16	16	15	60	33	41	41
	0,7	30	30	13	17	17	15	71	33	44	44
	0,8	30	30	12	18	18	15	83	31	46	46
0,9	30	30	11	19	19	15	97	27	48	48	

Croston method is applied for 2.700 SKUs and for ten different alpha values.

4.2 APPLICATION OF SBA

Syntetos and Boylan modified Croston method and develop SBA (Syntetos et al 2005). There is no difference of calculation intervals and demand sizes. Forecasting demand value is calculated by equation 2.23. According to equation 2.23, the forecasting data in Table 4.4 are procured.

Table 4.4 Forecasting values for $\alpha = 0,05 \dots 0,90$ calculated via SBA

Code	α	\hat{y}_1	\hat{y}_2	\hat{y}_3	\hat{y}_4	\hat{y}_5	\hat{y}_6	\hat{y}_7	\hat{y}_8	\hat{y}_9	\hat{y}_{10}
# 90	0,05	272	266	257	247	231	222	206	193	193	173
	0,1	265	253	237	221	192	180	155	137	137	111
	0,2	251	231	205	182	138	129	96	77	77	53
	0,3	238	212	181	157	102	104	65	50	50	33
	0,4	224	196	163	140	78	92	48	38	38	24
	0,5	210	182	149	128	61	86	37	31	31	20
	0,6	196	171	139	119	48	84	29	27	27	17
	0,7	182	161	130	113	38	84	22	25	25	16
	0,8	168	153	122	107	30	85	16	24	24	14
	0,9	154	146	115	101	23	85	11	23	23	13
# 92	0,05	29	29	17	11	11	7	8	5	5	5
	0,1	28	28	16	10	10	7	11	8	8	8
	0,2	27	27	14	10	10	8	19	13	14	14
	0,3	25	25	12	9	9	9	25	16	19	19
	0,4	24	24	11	9	9	9	31	18	22	22
	0,5	22	22	9	9	9	9	36	18	24	24
	0,6	21	21	8	10	10	9	41	18	25	25
	0,7	19	19	7	10	10	9	45	17	26	26
	0,8	18	18	6	10	10	9	49	15	26	26
	0,9	16	16	5	10	10	8	53	13	25	25

As application of CR, also SBA is applied to all items for α is between 0,05 and 0,9.

4.3 APPLICATION OF HWM

Holt-Winters method is used to forecast demand with seasonal fluctuation. Determining length of season, period of season and initial solution are important. There are two kind of Holt-Winters Method, multiplicative and additive Holt-Winters Methods. These models are very flexible, because they can also consider non-polynomial trends and non-constant seasonality. Multiplicative Holt-Winters, mathematical model with product of components, is used to consider the effects of seasonality in a multiplicative way. The model is deterministic and is not appropriate for non – seasonal demand. The calculations for code 90 and 92 are as follows.

Initial solutions, Table 4.5, are determined via equations 2.12 and 2.13.

Table 4.5 Initial solution for multiplicative HWM

Code	L_s	b_s	S_1	S_2	S_3	S_4
# 90	424	147,5	0,6	0,3	0,4	2,6
# 92	22	-0,25	0,2	0,6	0,4	2,8

Using initial solutions, forecasting demand is computed via equations 2.8, 2.9, 2.10 and 2.11.

Forecasting demand values for items # 90 and # 92 as can be seen in Table 4.6.

Table 4.6 Forecasting values for $\alpha = 0,05 \dots 0,90$ calculated via multiplicative HWM

Code	α	\hat{y}_1	\hat{y}_2	\hat{y}_3	\hat{y}_4	\hat{y}_5	\hat{y}_6	\hat{y}_7	\hat{y}_8	\hat{y}_9	\hat{y}_{10}	\hat{y}_{11}	\hat{y}_{12}
# 90	0,05	248	1889	507	300	401	1957	469	217	257	892	312	521
	0,1	248	1905	474	262	309	1358	264	88	52	0	0	105
	0,2	248	1935	413	200	181	684	67	0	0	0	0	74
	0,3	248	1961	357	156	107	443	14	0	0	0	0	57
	0,4	248	1983	306	127	69	422	12	0	0	0	0	0
	0,5	248	2003	261	112	55	500	21	0	0	0	0	0
	0,6	248	2018	222	107	54	615	30	1	0	26	71	36
	0,7	248	2030	191	110	60	744	35	8	0	77	346	187
	0,8	248	2039	168	120	72	891	43	19	0	148	204	203
0,9	248	2044	152	135	88	1079	60	39	20	275	263	277	
Code	α	\hat{y}_1	\hat{y}_2	\hat{y}_3	\hat{y}_4	\hat{y}_5	\hat{y}_6	\hat{y}_7	\hat{y}_8	\hat{y}_9	\hat{y}_{10}	\hat{y}_{11}	\hat{y}_{12}
# 92	0,05	8	54	4	12	6	66	13	19	26	153	17	36
	0,1	8	48	3	13	7	88	18	26	35	189	29	49
	0,2	8	38	1	17	8	132	24	34	39	188	33	52
	0,3	8	29	0	23	10	168	24	37	39	159	57	67
	0,4	8	21	0	28	10	196	22	37	38	132	47	63
	0,5	8	14	0	34	10	219	19	37	38	110	47	61
	0,6	8	9	0	39	8	240	17	37	38	90	24	42
	0,7	8	5	0	43	7	255	15	38	38	68	19	37
	0,8	8	2	0	46	4	264	13	39	38	45	12	23
0,9	8	0	0	48	2	268	11	40	36	23	12	14	

4.4 COMPARISON OF FORECASTING METHODS

Three different forecasting methods are applied for ten different α value for each item and consequently 30 forecasted demand value are produced for an item. The best solution for the item is determined by comparing 30 forecasting data.

RMSE, MAE and RGRMSE are used to measure forecasting error. For each statistical error measurement method, the optimum solution is determined. The solution which gives the minimum error value is chosen.

All calculations are recomputed for ten different α value. The solutions are compared on the basis of SKU for CR, SBA and HWM separately.

Otherwise, cost of differences between forecasting demand and actual demand is calculated. If demand occurs more than forecasted demand, there will be stock-out cost and if demand occurs less than forecasted demand, there will be carrying cost. The calculation Total Error Cost (TEC) is shown by equation 4.3.

If $\hat{y}_t > y_t$, error cost calculated by inventory cost;

$$EC_{cc} = \sum_{i=1}^n (\hat{y}_t - y_t)_i \times CC_i \quad (4.1)$$

Else, error cost calculated by stock-out cost;

$$EC_{soc} = \sum_{t=1}^n (y_t - \hat{y}_t)_i \times SOC_i \quad (4.2)$$

where CC_i and SOC_i refer to carrying cost and stock out cost for item i respectively.

$$Total\ Error\ Cost\ (TEC) = EC_{cc} + EC_{soc} \quad (4.3)$$

TEC is calculated for each forecasting method and α value. The notation is as “ $TEC_{c,F,\alpha}$ ”. “F” refers to forecasting method; “ α ” refers to optimum α value used for calculation and “c” refers to code number.

The actual demand of item # 90 and # 92 are in Table 4.7.

Table 4.7 Actual demand of # 90 and # 92 in 2011

Code	y ₁	y ₂	y ₃	y ₄	y ₅	y ₆	y ₇	y ₈	y ₉	y ₁₀	y ₁₁	y ₁₂
# 90	277	216	192	35	169	13	46	0	48	0	57	72
# 92	0	10	20	0	30	116	20	50	0	0	0	59

The first step is selecting the optimum forecasting method and α value via statistical error measurement methods. After that, the forecasting method and α value which gives minimum TEC is determined for all SKU as the second step. The forecasting methods and α values are compared which calculated in step I and II are compared.

Statistical error measurement methods RMSE, MAE and RGRMSE measure errors with different sizes hence it is not possible to compare forecasting methods with error size. The solutions determined according to error sizes are compared by TEC for selected forecasting method and α value.

Forecasted methods are applied for #90 and #92 by 10 different α values.

The Table 4.8 includes RMSE calculates for each forecasting method.

Table 4.8 RMSE calculates for # 90 and # 92

	α	CR	SBA	HW		α	CR	SBA	HW
	#90	0,05	175,5	146,0		887,1	#92	0,05	39,5
0,1		152,5	108,5	697,8	0,1	38,9		39,3	64,0
0,2		120,3	70,3	590,3	0,2	38,3		38,7	62,7
0,3		100,6	57,6	572,6	0,3	38,5		38,5	56,1
0,4		88,9	56,2	576,8	0,4	39,2		38,6	52,2
0,5		82,3	59,1	587,9	0,5	40,3		38,8	51,5
0,6		79,2	63,3	602,8	0,6	41,6		39,1	52,4
0,7		78,5	68,0	620,8	0,7	43,2		39,5	53,4
0,8		79,7	72,6	643,2	0,8	45,2		40,0	53,8
0,9		82,4	77,2	676,5	0,9	48,0		40,5	53,6

If RGRMSE is used to measure forecasting errors, when SBA is used for #90 with α value equals to 0,4, the closest value to actual demand is forecasted. Because minimum RMSE value is calculated with SBA and $\alpha = 0,4$. Similarly, the minimum RMSE value in the other words the closest forecasting value to actual demand is calculated by CR forecasting method with the α value equals to 0,2. The forecasted value can be more or less than actual demand. The costs of these solutions are as follows.

$$TEC_{90,SBA,0,4} = \text{₺}3.784$$

$$TEC_{92,CR,0,2} = \text{₺}6.002$$

The differences between forecasted demand and actual demand are measured by MAE and Table 4.9 shows the solutions.

Table 4.9 MAE calculates for # 90 and # 92

	α	CR	SBA	HW		α	CR	SBA	HW
	#90	0,05	155,1	127,3		619,9	#92	0,05	25,7
0,1		134,5	91,7	402,3	0,1	25,6		25,6	37,7
0,2		103,2	55,8	288,6	0,2	26,0		25,5	35,6
0,3		81,3	43,8	263,2	0,3	27,8		26,3	35,7
0,4		69,4	45,1	259,3	0,4	29,5		27,1	35,3
0,5		63,1	49,4	263,4	0,5	31,1		27,8	35,2
0,6		59,4	53,9	274,2	0,6	32,7		28,3	35,8
0,7		57,3	58,0	290,3	0,7	34,3		28,8	36,3
0,8		58,2	61,7	315,4	0,8	36,1		29,2	35,8
0,9		60,8	65,1	350,2	0,9	38,4		29,6	34,4

For code #90, the selected forecasting method SBA which gives the minimum error value does not change although error measurement method changes. But α value changes as 0,3. For code #92 forecasting method changes. The minimum MAE value is calculated by SBA. α value is 0,2. TEC changes when one of the forecasting method or α change. The TCE values of #90 and #92 which gives min MAE value are as follows.

$$TEC_{90,SBA,0,3} = \text{₹}2.775$$

$$TEC_{92,SBA,0,2} = \text{₹}6.272$$

TEC of #90 decrease by determining optimum solution with MAE instead of RMSE. Similarly TEC of #92 increase by using MAE instead of RMSE.

Table 4.10 includes solutions for RGRMSE.

Table 4.10 RGRMSE calculates for # 90 and # 92

	α	CR	SBA	HW		α	CR	SBA	HW
	#90	0,05	102,2	89,0		1.328,7	#92	0,05	14,5
0,1		90,4	67,9	∞	0,1	15,6		16,0	44,5
0,2		69,8	41,7	∞	0,2	15,8		14,9	43,8
0,3		49,8	25,1	∞	0,3	20,1		18,3	46,9
0,4		44,2	29,3	∞	0,4	22,2		20,2	43,2
0,5		40,1	38,1	∞	0,5	23,7		21,2	34,9
0,6		33,9	43,4	175,6	0,6	24,9		21,7	37,0
0,7		20,0	46,8	162,1	0,7	26,1		22,0	45,9
0,8		27,7	25,1	242,1	0,8	27,4		27,7	48,0
0,9		31,5	51,2	337,1	0,9	29,1		22,0	46,5

If optimum solution is determined by RGRMSE, CR method should be used for both code #90 and #92 as can be seen in Table 4.11. The α values equal to 0,7 and 0,05 respectively. When TEC of items are examine, TEC of code #90 decreases and #92 increases according to both RMSE and MAE.

$$TEC_{90,CR,0,7} = \text{₺}2.737$$

$$TEC_{92,CR,0,05} = \text{₺}6.580$$

Table 4.11 includes the optimum solutions for each error measurement method. Also TEC of optimum methodologies are in the table.

Table 4.11 The optimum statistical solution for each error measurement method

	RMSE			MAE			RGRMSE		
	Method	α	TEC	Method	α	TEC	Method	α	TEC
# 90	SBA	0,4	3.784	SBA	0,3	2.775	CR	0,7	2.737
# 92	CR	0,2	6.002	SBA	0,2	6.272	CR	0,1	6.359

There are three best solutions on the basis of SKUs. The calculations of optimum solutions consider the distance of forecasted value and actual demand value. And there are different optimal solutions for an item. The solution with the minimum TEC can be selected the best solution for relevant item.

Table 4.12 The best solutions according to minimum TEC

	Forecasting Method	α	Error Measurement Method	TEC
# 90	CR	0,7	RGRMSE	2.737
# 92	CR	0,2	RMSE	6.002

Table 4.12 includes the best solutions according to minimum TEC.

Analyzing the results of forecasting methods and error measurement methods just in terms of size of error is not enough to have the most appropriate solution for the company. The methods should be chosen considering carrying cost and stock out cost which occur in consequence of deviation of forecasting methods.

Direction of variation come in to prominence according to unit cost of stock out and inventory. In other words, if holding cost is less than stock out cost, the forecasting method which over forecasts is better than the others. However, if inventory cost greater than the stock-out cost, then companies bear stock out cost and the forecasting method which under forecasts is better than the others. Table 4.14 has the cost of difference between forecasted value and actual demand for all α values. When the optimum solution is determined by minimum TEC directly, the best solutions are as remarked in Table 4.13.

$$TEC_{90,CR,0,4} = \text{₱}2.331$$

$$TEC_{92,HW,0,4} = \text{₱}4.185$$

Table 4.13 Cost of forecasting difference

	α	CR	SBA	HW		α	CR	SBA	HW
	# 90	0,05	4.741	3.947		19.297	#92	0,05	6.580
0,1		4.112	2.942	12.643	0,1	6.359		6.532	5.353
0,2		3.154	2.380	9.736	0,2	6.002		6.272	4.275
0,3		2.486	2.775	10.077	0,3	5.958		6.264	4.217
0,4		2.331	3.784	10.427	0,4	5.943		6.318	4.185
0,5		2.425	4.791	10.612	0,5	5.963		6.385	4.206
0,6		2.566	5.649	10.856	0,6	6.025		6.464	4.361
0,7		2.737	6.386	11.207	0,7	6.138		6.556	4.587
0,8		3.083	7.040	12.025	0,8	6.324		6.660	4.690
0,9		3.521	7.633	12.823	0,9	6.617		6.778	4.687

When the Tables 4.12 and 4.13 are compared, the value of best solutions, parameters and forecasting methods are different for both #90 and #92.

When next demand of #90 is forecasted via CR method with the $\alpha = 0,4$, the forecasted demand is not good enough in terms of statistical calculations. Otherwise, in terms of cost of carrying or stock-out, the best solution which is determined according to statistical methods produces higher cost. Table 4.14 summarizes the selected solutions.

Table 4.14 Comparing the solutions determined by statistical methods and minimum TCE

	According to Statistical Measurements				According to Minimum TEC		
	Forecasting Method	α	Error Measurement Method	TEC	Forecasting Method	α	TEC
# 90	CR	0,7	RGRMSE	2.737	CR	0,4	2331
# 92	CR	0,2	RMSE	6.002	HWM	0,4	4185

If carrying cost of an item is more than stock out cost, TCE is minimized by the solution set which produce forecasted demand less than or equal to actual demand. Otherwise, if stock out cost is more than carrying cost, TCE is minimized by the solution set which produce forecasted demand more than or equal to actual demand. Hence, although the error size is greater, the solution can be determined as optimum solution if and only if the TCE is the minimum.

4.5 FINDINGS

Three forecasting methods are applied for ten different α values for an item. There are 30 different forecasting values. The difference between forecasting value and actual demand is measured by three different error measurement methods. Then, the minimum error measurement value is selected and the optimum forecasting method and α value are determined as the most appropriate solution for each error measurement method. There are three different solutions for an item. The optimum solutions are compared according to TEC value and the solution with the minimum TEC value is selected as the best.

Otherwise, after demands are forecasted, cost of difference between forecasted and actual demand is calculated for each α value. The solution set which produce the minimum TEC is selected as the best solution. All calculated values are in Table 4.15.

Table 4.15 Detail of selecting the most accurate methods for #90 via TEC

# 90	RMSE			MAE			RGRMSE			TEC		
	CR	SBA	HW	CR	SBA	HW	CR	SBA	HW	CR	SBA	HW
0,05	175,5	146,0	887,1	155,1	127,3	619,9	102,2	89,0	1.328,7	4.741	3.947	19.297
0,1	152,5	108,5	697,8	134,5	91,7	402,3	90,4	67,9	0,0	4.112	2.942	12.643
0,2	120,3	70,3	590,3	103,2	55,8	288,6	69,8	41,7	0,0	3.154	2.380	9.736
0,3	100,6	57,6	572,6	81,3	43,8	263,2	49,8	25,1	0,0	2.486	2.775	10.077
0,4	88,9	56,2	576,8	69,4	45,1	259,3	44,2	29,3	0,0	2.331	3.784	10.427
0,5	82,3	59,1	587,9	63,1	49,4	263,4	40,1	38,1	0,0	2.425	4.791	10.612
0,6	79,2	63,3	602,8	59,4	53,9	274,2	33,9	43,4	175,6	2.566	5.649	10.856
0,7	78,5	68,0	620,8	57,3	58,0	290,3	20,0	46,8	162,1	2.737	6.386	11.207
0,8	79,7	72,6	643,2	58,2	61,7	315,4	27,7	25,1	242,1	3.083	7.040	12.025
0,9	82,4	77,2	676,5	60,8	65,1	350,2	31,5	51,2	337,1	3.521	7.633	12.823

The column of RMSE, MAE and RGRMSE includes error measurement values for code #90. TEC column includes the cost of forecasting errors. The cells remarked with grey in column RMSE, MAE and RGRMSE are the optimum solutions. And costs of these solutions are remarked with grey in TEC column. The black cell is the minimum TEC which the proposed method is selected.

The earnings for item #90 and #92 is given in Table 4.16

Table 4.16 Earnings of proposed method for item #90 and #92

	TEC (₹)	RMSE		MAE		RGRMSE	
		Cost (₹)	Earning (%)	Cost (₹)	Earning (%)	Cost (₹)	Earning (%)
# 90	2.331	3.784	38%	2.775	16%	2.737	15%
# 92	4.185	6.002	30%	6.272	33%	6.359	34%

When proposed method is compared with current forecasting method has applied in VIKO the TEC values and earnings are in Table 4.17 for #90 and #92.

Table 4.17 Comparison of proposed and current method for #90 and #92

	Current Method	Proposed Method	Earning
#90	12.329	2.331	81%
#92	6.070	4.185	31%

5. RESULTS AND DISCUSSION

Proposed method are applied 2.700 different SKUs. There are thirty different forecasting demand values (for 10 different α values and three different forecasting methods). The solution set with the minimum TEC is selected for each SKU.

Companies have very high product variety. And all products d not have the same demand pattern. There are several forecasting methods which are appropriate for different demand type. Hence, companies need to apply different appropriate forecasting methods for each demand pattern.

Table 5.1 includes the TEC values which occur when single forecasting method and error measurement method is used. TEC are calculated according to minimum error size calculated by statistical methods and optimum α value is determined as well.

Table 5.1 Cost of application single forecasting and single error measurement methods

Method	RMSE (million)	MAE (million)	RGRMSE (million)
CR	₺240	₺245	₺260
SBA	₺400	₺369	₺354
HWM	₺211	₺212	₺237

When Croston Method is applied, determining optimum α value for all SKUs according to size of RMSE costs ₺240 million, according to size of MAE costs ₺245 million and according to size of RGRMSE costs ₺260 million. Cost of RMSE is less then cost of MAE and RGRMSE for Croston forecasting method.

When SBA is applied, determining optimum α value for all SKUs according to size of RMSE costs ₺400 million, according to size of MAE costs ₺369 million and according to size of RGRMSE costs ₺354 million. Cost of RGRMSE is less then cost of RMSE and MAE for SBA.

When HWM is applied, determining optimum α value for all SKUs according to size of RMSE costs ₺211 million, according to size of MAE costs ₺212 million and according

to size of RGRMSE costs ₺237 million. Cost of RMSE is less than cost of MAE and RGRMSE for HWM.

In this thesis multiple forecasting methods are applied and multiple error measurement methods are used to determine optimum α value for each item. The solution with the minimum cost is determined according to cost of forecasting errors unlike Hyndman and Khandakar method. Selecting optimum forecasting method with optimum α value according to minimum TEC cost ₺154,8 million in total. Total error cost for all each SKU is can be seen in Appendix 1. The earnings according to Table 5.1 are shown in Table 5.2.

Table 5.2 Earnings of proposed method in comparison Table 5.1

Method	RMSE	MAE	RGRMSE
CR	35%	37%	40%
SBA	61%	58%	56%
HWM	27%	27%	35%

The current forecasting method which has been applying in VIKO is a deviant method and the cost of forecasting error is ₺292 million. When proposed selecting method is compared with not only forecasting methods in literature but also the method applies in VIKO, proposed method has cost advantage for all items. TEC of current method is calculated ₺292 million for a year and TEC is decreased 47 percentages by proposed method as can be seen in Table 5.3.

Table 5.3 Earning of developed method

	Cost of Forecasting Error (million)
Current Method	₺292
Developed Method	₺155
Earning	47 %

6. CONCLUSION

Stepwise selection method is proposed by this thesis. The method selects the appropriate forecasting method to minimize the cost of forecasting error.

CR, SBA and HWM are used as forecasting methods and RMSE, MAE and RGRMSE is used to calculate forecasting error to compare. Rather than classifying SKUs according to α value, the optimum α value is determined for each SKU. Because, classification with CV^2 and p values generalizes the differences and so deviation increases. Optimum α value is updated after demand occurs as can be seen in figure 3.1.

Hyndman and Khandakar (2008) developed an automatic forecasting method which forecasts by optimum α value for each item. The algorithm includes several forecasting methods. Also produce optimum initial solution for each item. The forecasting method with the minimum AIC value which considers number of parameters is selected as the most appropriate method. The selected solution is determined according to cost of forecasting errors unlike Hyndman and Khandakar method by this thesis. Forecasting method which involves cost ingredient is more preferable by companies in real world situations.

After all forecasting methods are applied for all α values, TCE is calculated for each item. And the solutions set which is shown as " $TEC_{c,F,\alpha}$ ", is determined according to minimum TEC value. That can be said that earning rate of proposed method is greater than 0 percentages for all items. Total cost of forecasting error is decreased 47 percentages according to current method.

There are several forecasting methods in the literature and most of them produce accurate forecasting data. In this thesis, determining the optimum forecasting method is developed. Optimum α value determined for each item instead of classifying SKUs. Moreover, appropriate forecasting method is selected as providing least TEC instead of according to minimum size of forecasting error. The most accurate forecasting method is not determined by this thesis. The methodology of selecting the accurate forecasting method between using methods which minimizes cost of forecasting error is developed.

Hence the forecasting methods used are able to be change or number of methods is able to be increased or decreased as well.

If carrying cost is greater than stock-out cost, the proposed method chooses the forecasting method which does not forecast more than actual demand. A forecasting method is able to be developed which considers the cost of carrying and stock out cost as a further research. A coefficient may be determined for each SKU and forecasted value is multiplied with this coefficient. Thereby, forecasting values do not exceed the acceptable carrying cost level for the items with higher carrying cost and vice versa.

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APPENDICES

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1	6.348	6.428	7.013	6.002	6.359	6.580	4.206	4.687	4.206	4.185
2	295.340	258.311	253.759	177.426	177.426	205.614	77.271	94.265	121.782	77.271
3	3.784	2.775	2.775	2.737	2.737	2.737	9.736	10.427	12.643	2.331
4	19.096	17.629	15.768	13.942	13.601	13.601	22.972	24.140	33.288	13.601
5	6.303	5.861	5.861	5.539	5.539	5.539	4.838	5.546	5.645	3.512
6	23.761	21.668	21.668	14.487	14.487	13.280	22.072	23.856	23.856	13.280
7	28.286	26.662	26.662	20.072	19.210	19.210	21.513	21.513	21.513	18.982
8	13.451	14.831	16.215	12.488	12.427	12.616	19.030	19.030	21.005	12.427
9	470	483	487	545	545	545	677	679	683	439
10	14.354	13.831	14.555	13.013	13.013	14.133	14.113	14.113	18.287	13.013
11	2.537	2.455	3.383	1.708	1.536	1.536	1.962	1.962	3.824	1.536
12	19.103	19.300	17.252	17.184	17.894	17.894	23.285	23.160	23.994	15.999
13	2.326	2.334	2.508	2.167	2.167	2.552	8.068	6.205	7.875	2.143
14	11.390	10.728	10.728	9.158	9.158	9.158	9.471	9.978	8.550	7.849
15	19.548	19.588	19.588	18.669	18.969	18.969	22.135	19.834	18.943	15.868
16	2.151	2.284	2.182	2.684	2.566	2.369	4.926	4.926	11.949	1.596
17	6.441	5.584	8.501	4.499	4.604	4.604	8.684	8.684	8.684	4.499
18	8.626	8.298	8.298	6.821	6.821	8.203	7.157	7.157	11.003	6.821
19	14.789	14.714	18.209	14.759	14.759	14.759	73.201	69.137	69.137	14.666
20	13.208	12.714	12.523	11.284	11.284	11.497	20.509	20.509	25.686	11.262
21	30.624	27.443	25.604	14.515	14.515	14.515	14.025	14.025	14.025	13.882
22	242.629	204.094	204.094	148.553	148.553	158.002	111.700	109.105	115.146	109.105
23	209.681	187.990	187.990	91.046	91.046	102.825	104.480	104.480	104.480	91.046
24	4.010	3.931	3.931	4.416	4.416	4.109	11.674	11.674	12.822	3.564
25	187.043	168.278	164.151	98.178	98.178	98.178	111.188	111.188	114.410	98.178
26	9.903	9.545	9.785	7.890	7.890	9.420	8.539	8.539	9.135	7.890
27	29.086	22.044	22.044	18.835	18.835	19.915	24.997	24.997	21.304	18.835
28	40.412	33.426	24.747	9.331	7.662	7.662	23.046	19.384	19.384	7.662
29	143.439	128.957	117.931	36.017	36.809	43.763	32.003	32.003	32.849	32.003
30	466	495	495	582	582	582	26	26	226	26
31	48.268	42.732	42.732	19.555	19.555	19.183	29.454	27.293	27.293	19.183
32	103.776	94.902	81.845	61.438	61.438	69.117	65.556	65.556	65.556	60.949
33	62.669	57.008	57.008	45.386	50.869	50.869	68.658	68.658	83.488	45.386
34	19.095	17.901	17.901	11.285	11.285	12.062	12.772	12.772	12.049	10.464
35	80.414	71.260	71.260	20.111	20.111	19.524	21.212	21.212	21.306	19.524
36	1.895.417	1.830.620	1.792.830	1.549.692	1.549.692	1.668.905	791.957	791.957	857.904	791.957
37	32.858	28.208	28.208	10.536	10.536	9.438	14.535	15.561	15.561	9.438
38	2.770.980	2.673.689	2.596.922	2.184.947	2.184.947	2.301.771	1.169.271	1.169.271	1.339.434	1.169.271
39	175.412	167.473	166.550	132.833	132.833	132.833	48.685	48.685	48.685	48.685
40	3.150.320	3.013.853	3.020.787	2.635.501	2.635.501	2.781.075	1.375.886	1.375.886	1.473.715	1.375.886
41	81.415	76.501	74.207	63.476	63.476	77.813	79.295	79.295	103.729	63.476
42	192.574	173.946	135.036	124.355	99.839	113.542	133.267	133.267	166.092	99.839
43	2.537	2.306	2.306	1.713	1.751	1.847	2.115	2.115	1.976	1.606
44	247.676	220.537	200.873	68.236	68.236	66.506	67.661	67.661	67.661	63.731
45	346.864	308.842	308.842	79.495	78.730	77.077	98.866	98.866	94.791	77.077
46	37.457	33.485	33.485	11.059	11.517	11.517	14.340	14.340	16.702	10.942
47	348.732	332.215	295.204	233.761	233.761	265.858	206.716	208.508	205.621	205.621
48	41.060	35.909	29.679	18.006	16.403	16.403	19.655	19.655	18.829	16.403
49	505.570	464.118	408.970	301.091	301.091	301.091	215.100	218.214	218.214	214.001
50	31.775	31.720	31.720	31.775	31.775	34.807	47.345	46.286	47.937	31.740

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
51	579.592	535.949	466.686	325.747	325.747	325.747	272.152	259.790	239.072	239.072
52	79.732	74.561	74.561	61.917	61.917	61.917	87.006	87.006	87.006	61.917
53	127.772	112.402	112.402	33.877	33.877	33.040	49.070	57.841	57.841	32.653
54	155.376	138.133	138.133	39.584	38.605	38.605	43.981	41.883	41.883	38.428
55	1.929	1.798	3.055	1.459	1.425	1.459	1.110	1.110	1.110	1.102
56	83.137	73.372	73.372	35.158	35.541	35.541	38.907	38.907	38.907	35.158
57	12.976	12.487	13.806	10.923	11.523	11.523	11.546	11.849	11.849	10.896
58	107.930	77.780	65.360	36.526	38.256	37.486	50.602	50.602	50.602	36.235
59	137.485	102.436	90.314	51.312	47.672	48.462	46.817	44.695	44.695	44.253
60	16.308	16.189	19.249	8.287	8.287	8.287	8.718	9.813	7.425	7.425
61	35.346	30.543	30.543	16.440	16.440	16.440	19.866	17.660	17.660	16.440
62	49.212	43.872	32.386	24.714	25.917	24.714	21.645	21.645	19.708	19.708
63	11.337	12.045	12.045	14.171	14.171	14.171	100	100	279	100
64	317.383	306.299	315.301	283.168	295.786	285.280	133.743	152.538	145.594	118.396
65	634	686	763	845	845	845	364	417	376	364
66	420.243	381.320	381.320	361.949	331.376	331.376	230.074	263.949	242.757	203.855
67	46.501	41.367	43.882	37.186	37.186	38.317	28.704	23.288	23.288	23.288
68	499.271	461.337	454.429	408.648	407.006	409.166	271.173	271.173	294.970	243.419
69	10.220	9.195	9.195	7.214	7.590	7.590	5.844	5.844	10.689	5.844
70	228.531	205.481	174.361	132.206	112.003	114.077	149.676	149.676	149.676	112.003
71	2.774	2.526	1.911	1.539	1.813	1.813	2.064	2.064	1.666	1.528
72	104.599	87.228	79.969	22.354	22.354	24.240	28.735	28.735	34.477	22.354
73	73.817	63.322	63.322	16.773	16.773	19.930	35.594	35.594	33.796	16.773
74	3.478	2.983	3.012	1.451	1.451	1.204	1.909	1.909	1.909	1.204
75	166.031	156.486	156.486	117.542	117.542	117.542	132.438	132.438	160.342	117.542
76	221.695	202.580	184.447	145.910	145.910	157.510	148.298	156.014	145.846	134.537
77	261.599	207.893	220.623	173.549	173.549	189.994	155.883	155.883	171.511	155.883
78	106.720	93.640	93.640	38.543	39.888	43.231	50.595	50.595	50.595	37.960
79	113.527	100.254	100.254	34.031	34.353	34.353	33.307	32.740	36.269	32.740
80	356.618	344.658	369.071	329.003	329.003	345.156	143.539	143.539	161.919	81.300
81	502.715	483.549	483.549	440.828	440.828	450.263	212.029	212.029	283.905	199.045
82	91.620	81.190	81.190	69.935	69.935	81.832	32.488	32.488	36.400	31.313
83	566.328	549.743	578.674	526.811	526.811	554.871	234.723	246.091	269.729	208.226
84	93.776	81.164	52.739	28.368	28.368	29.677	62.165	62.165	61.969	28.368
85	1.816	1.644	1.521	1.188	1.188	1.202	1.810	1.810	2.691	1.188
86	49.139	40.607	33.856	13.598	13.598	13.598	22.319	24.446	24.446	12.976
87	95.457	82.602	82.602	19.548	20.077	21.110	26.508	26.508	26.508	19.427
88	3.903	3.437	3.437	3.242	3.530	3.842	3.752	3.752	3.752	3.100
89	240.743	226.531	223.038	180.593	180.593	180.593	125.565	125.565	91.168	91.168
90	292.680	273.039	264.690	210.665	210.665	210.665	127.749	127.749	145.718	127.749
91	14.748	13.431	14.176	9.956	9.956	13.071	12.140	12.739	10.119	9.286
92	363.829	341.218	327.183	253.653	253.653	295.635	197.007	193.924	193.924	134.714
93	85.384	71.401	71.401	18.216	18.044	18.044	30.073	30.073	30.697	18.044
94	96.861	80.444	72.640	16.605	16.605	16.605	28.606	28.606	28.606	16.605
95	3.416	3.314	4.040	2.980	2.762	2.535	2.581	2.581	2.581	2.220
96	23.659	23.406	30.333	18.487	19.509	19.509	25.037	25.037	27.596	17.466
97	24.283	22.136	21.741	19.491	18.783	18.783	24.824	24.348	25.862	18.783
98	188.958	174.147	181.024	187.372	162.764	162.764	124.021	96.918	85.627	85.627
99	279.028	264.827	274.122	260.299	260.299	254.389	71.681	111.836	71.681	71.681
100	47.100	45.674	48.201	43.713	43.713	49.554	30.512	29.596	44.123	29.596
101	341.686	323.410	320.608	286.342	286.342	289.055	163.166	194.391	198.167	154.579
102	110.935	98.160	110.495	106.314	106.314	122.865	192.818	192.818	192.818	98.160
103	1.573	1.498	2.453	1.349	1.424	1.424	2.498	1.649	2.498	1.299
104	89.614	72.567	65.978	11.485	9.999	9.403	41.809	41.809	41.492	9.403
105	56.989	48.310	43.700	15.571	15.571	18.662	24.000	24.000	23.855	15.513
106	9.937	11.570	11.570	6.673	6.222	6.222	8.099	8.099	8.099	6.222
107	72.715	71.387	71.387	63.351	67.031	67.031	47.965	46.304	46.304	46.304
108	102.779	82.365	82.006	68.620	68.620	68.620	102.048	89.050	122.470	68.620

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Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
109	21.582	21.506	21.506	19.225	19.745	19.745	12.554	16.985	16.668	11.166
110	208.369	171.452	171.452	138.085	137.463	137.463	106.661	106.661	102.956	102.956
111	46.823	40.787	40.787	15.475	15.265	15.475	16.340	16.340	15.950	15.265
112	132.172	116.979	89.000	43.778	43.778	46.779	45.075	45.075	40.243	40.243
113	84.963	77.467	77.467	34.605	34.605	32.743	43.130	46.444	46.444	32.567
114	109.808	82.450	64.052	44.505	41.731	41.731	43.526	43.526	46.798	41.200
115	77.434	69.883	69.883	17.176	17.176	17.176	22.400	22.400	22.400	16.469
116	40.094	35.409	28.587	20.144	20.144	20.144	21.067	21.067	21.749	20.144
117	294.179	177.838	177.838	172.069	142.757	142.757	176.752	176.752	165.364	142.757
118	325.286	289.222	289.222	139.389	135.389	135.389	152.936	152.001	152.001	135.389
119	370.473	335.706	231.249	200.730	179.755	179.755	256.001	279.932	256.001	179.755
120	20.704	21.455	22.452	19.117	19.331	19.331	22.659	22.659	22.659	19.117
121	242.051	225.341	201.272	157.692	130.091	132.034	160.527	160.527	160.527	129.061
122	776.365	875.508	934.418	544.751	544.751	582.023	598.111	598.111	598.111	544.751
123	972.542	845.405	797.182	636.682	608.966	669.279	948.612	653.104	653.104	608.966
124	36.949	34.616	34.616	23.108	23.484	23.484	27.014	27.014	27.014	23.108
125	6.261	6.164	6.260	5.656	5.756	5.756	7.528	7.528	7.406	5.627
126	124.601	111.355	106.920	52.452	52.452	68.029	82.692	82.692	82.692	52.452
127	188.521	171.135	149.368	103.895	103.895	107.083	135.315	135.315	135.315	103.895
128	29.107	24.075	21.615	13.020	14.613	14.613	22.591	22.591	20.427	13.020
129	216.047	195.972	166.747	116.759	119.317	114.110	110.557	110.557	110.557	102.612
130	226.797	198.612	142.099	84.225	82.707	82.707	93.022	74.408	74.249	74.249
131	6.252	5.890	6.054	5.901	5.901	5.829	7.458	7.068	7.024	5.523
132	252.682	240.319	238.930	197.286	197.286	225.702	128.628	128.628	155.783	114.483
133	33.096	30.844	26.683	24.131	24.131	23.320	12.494	12.494	9.413	9.413
134	8.145	7.112	5.629	3.352	3.255	3.255	5.217	3.546	3.637	3.255
135	20.046	17.519	11.957	9.073	9.073	9.073	5.428	5.428	5.428	5.428
136	77.509	69.551	69.551	56.879	55.939	62.549	26.867	26.867	9.664	9.664
137	113.963	103.890	103.890	74.264	74.264	74.264	59.775	59.775	45.729	44.268
138	23.238	18.518	18.518	7.179	9.106	11.368	11.246	11.246	11.246	6.386
139	864.151	754.856	754.856	482.695	482.695	580.391	261.100	261.100	215.614	215.614
140	20.353	19.628	19.628	16.579	16.579	16.579	14.364	14.364	12.918	12.883
141	51.054	44.659	40.747	17.476	17.378	17.378	25.937	25.937	23.320	17.375
142	92.343	81.994	81.994	39.720	39.720	38.719	31.809	31.809	31.367	31.160
143	17.099	14.875	14.875	5.453	5.499	5.499	5.516	5.516	5.656	5.233
144	3.437.031	3.122.153	3.106.780	2.457.298	2.457.298	2.925.268	946.667	946.667	710.005	710.005
145	261.188	246.872	245.644	198.184	198.184	198.184	50.362	50.362	50.362	28.976
146	125.280	84.098	75.180	76.109	76.109	68.423	85.697	85.697	85.697	68.423
147	2.208	1.599	1.502	1.412	1.412	1.301	1.658	1.658	1.755	1.301
148	638.964	589.241	535.196	384.487	384.487	432.381	179.643	168.511	168.511	168.511
149	23.095	22.390	22.390	20.712	20.712	20.712	13.754	13.579	14.435	13.579
150	42.755	36.891	36.891	10.082	10.477	10.477	13.984	13.984	13.984	9.601
151	18.502	17.169	17.169	13.322	12.334	12.341	14.203	14.203	16.597	12.334
152	5.835	4.150	4.005	3.185	2.775	2.775	2.154	2.154	2.154	2.154
153	1.386.800	1.273.940	1.152.710	956.002	956.002	1.093.644	408.458	408.458	289.269	289.269
154	191.263	181.251	192.331	148.003	148.003	161.438	56.181	56.181	86.339	40.687
155	81.008	58.391	58.391	51.215	51.215	52.823	59.842	59.842	59.842	51.215
156	410.315	370.405	331.423	240.339	240.339	264.770	104.453	104.453	105.175	104.453
157	18.364	17.372	16.517	13.929	13.929	13.929	5.429	5.429	7.859	5.429
158	44.306	39.084	34.928	15.398	16.215	16.215	16.980	16.980	16.980	13.988
159	1.517.283	1.429.513	1.376.990	1.158.181	1.158.181	1.259.495	239.114	310.833	239.114	239.114
160	281.715	265.707	260.128	231.421	231.421	256.751	102.615	102.615	105.621	90.786
161	63.228	54.468	41.031	24.272	21.255	21.255	35.289	35.289	38.344	21.255
162	769.945	700.532	685.879	580.943	580.943	601.094	291.765	291.765	270.203	258.390
163	32.388	30.319	26.266	24.546	24.546	21.769	6.733	6.733	10.090	4.530
164	51.290	43.627	43.627	12.701	12.701	13.625	16.413	16.413	16.413	12.216
165	12.247	10.807	12.972	10.251	11.404	13.472	16.910	16.910	16.910	9.759
166	868.516	787.331	787.331	597.485	597.485	663.892	243.272	239.037	239.037	232.976

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
225	283.400	328.031	328.031	254.572	307.679	232.641	296.602	296.602	293.800	232.641
226	1.969.081	1.485.882	1.485.882	986.696	1.089.588	1.180.188	924.134	924.134	924.134	743.159
227	249.969	211.458	191.696	169.956	179.002	179.002	148.747	148.747	148.747	148.747
228	20.151	18.767	18.917	14.711	14.711	14.711	25.490	25.490	25.490	14.711
229	42.567	41.179	47.839	36.071	36.071	30.238	29.888	29.888	41.607	29.011
230	219.009	215.161	215.161	199.413	199.413	199.413	188.127	188.127	371.733	182.556
231	12.635	12.399	12.399	11.567	11.636	11.636	9.542	9.542	12.282	9.542
232	12.729	12.787	14.948	12.043	12.043	14.653	11.268	11.268	14.795	10.826
233	55.290	55.509	47.975	40.829	43.864	40.031	60.437	60.437	78.660	40.031
234	151.874	149.458	149.458	139.392	139.392	139.392	140.616	140.616	140.616	83.635
235	349.739	355.524	355.524	314.891	326.418	326.418	248.918	187.972	186.663	186.663
236	18.750	19.922	19.922	23.438	23.438	23.438	189	189	893	189
237	17.781	16.359	16.162	15.617	15.617	20.558	14.896	14.896	14.896	14.753
238	10.293	11.077	10.930	9.786	9.786	10.396	9.057	9.057	11.635	7.919
239	50.141	51.461	51.028	47.055	51.405	51.405	52.609	58.213	58.539	46.213
240	29.544	28.971	28.971	26.004	26.905	26.905	29.562	28.850	27.392	22.413
241	130.194	150.639	150.639	151.988	145.739	145.739	157.102	157.102	171.089	122.241
242	2.912.581	3.100.427	3.100.427	2.295.028	2.507.834	2.719.949	1.848.473	1.848.473	1.848.473	1.848.473
243	5.173	5.173	5.294	5.214	5.450	5.450	5.584	5.584	5.584	5.214
244	136.264	136.649	145.389	116.857	116.857	116.857	136.826	136.826	132.348	116.248
245	190.396	191.505	191.505	145.153	151.045	147.025	208.055	208.055	261.177	143.699
246	25.316	22.899	22.596	21.813	21.365	22.439	32.747	32.747	44.846	21.321
247	151.940	141.406	138.029	102.053	102.053	114.362	155.258	155.507	147.408	102.053
248	1.191.449	1.157.488	1.127.650	1.076.615	1.118.894	1.088.046	902.112	902.112	1.240.857	902.112
249	10.414	10.351	11.971	11.964	11.920	11.920	5.479	5.479	7.683	5.479
250	3.993	3.930	3.930	3.735	3.735	3.735	4.245	4.551	4.256	3.522
251	21.457	25.725	25.725	24.806	25.402	25.402	31.355	31.355	49.532	20.008
252	2.166	2.219	2.170	2.305	2.308	2.316	1.168	1.168	1.858	1.168
253	431.828	398.835	398.835	247.980	267.289	267.289	228.030	228.030	194.256	194.066
254	6.696	5.407	5.098	3.607	3.164	3.164	13.710	13.710	28.986	2.104
255	515.535	423.972	423.972	353.076	353.076	353.076	414.090	414.090	414.090	340.405
256	335.303	332.864	333.597	329.907	336.819	336.819	328.912	337.444	324.981	324.981
257	491.865	452.634	452.634	453.530	410.116	410.116	342.755	342.755	342.755	342.755
258	195.933	222.603	226.399	180.149	215.265	220.004	141.514	141.514	188.216	141.514
259	187.848	161.922	166.106	116.906	123.990	147.614	171.612	174.313	183.835	113.704
260	214.171	179.668	180.161	132.349	129.127	128.247	248.796	217.575	225.521	128.247
261	26.088	23.316	23.316	11.642	9.572	9.572	19.584	19.584	19.584	9.022
262	104.196	81.116	81.116	64.144	63.014	63.838	114.981	96.076	97.734	62.797
263	6.244	6.532	6.532	6.126	6.463	7.698	7.283	7.283	7.283	6.126
264	92.970	82.947	65.571	50.120	50.120	54.909	64.475	53.294	54.662	47.541
265	13.463	11.624	11.624	9.617	9.617	10.012	18.127	18.127	18.127	9.617
266	3.431	3.426	3.149	2.139	2.126	2.139	3.183	3.183	3.389	2.106
267	2.205	2.159	2.175	1.923	1.828	1.828	1.524	1.312	1.177	1.177
268	1.304	1.939	1.939	1.590	1.768	1.768	2.864	2.864	6.150	1.203
269	1.237	1.137	1.105	1.015	1.015	1.015	1.611	1.611	2.480	1.015
270	3.830	3.493	3.493	2.720	2.904	2.904	5.439	5.439	5.439	2.373
271	56.086	50.012	40.693	29.199	29.199	36.949	43.237	43.237	39.995	29.199
272	40.723	38.198	35.644	28.930	28.930	28.404	26.891	26.891	24.266	24.266
273	20.614	19.563	19.563	17.482	19.254	19.254	16.508	16.508	20.671	16.508
274	18.540	16.731	14.893	13.058	13.058	14.109	16.313	16.313	15.101	13.050
275	7.670	6.856	7.666	5.767	5.767	6.528	9.902	9.902	10.317	5.767
276	11.301	10.967	11.611	10.168	10.168	11.018	14.286	14.286	14.286	10.168
277	63.887	51.829	47.647	28.300	28.955	43.632	34.731	33.152	30.140	28.300
278	411.555	317.103	280.285	191.602	196.131	196.131	383.419	354.179	354.179	191.602
279	3.399	3.295	3.301	2.975	2.975	2.975	5.800	5.800	5.800	1.548

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
280	13.831	12.629	12.884	9.155	9.155	12.073	11.116	11.116	15.111	9.155
281	20.990	19.932	18.141	15.674	15.674	15.674	22.569	22.569	23.417	13.311
282	15.924	15.834	15.834	15.563	15.563	15.563	14.383	14.304	15.195	14.304
283	10.022	9.329	8.383	7.263	7.263	8.068	6.574	6.957	6.957	5.806
284	3.963	4.120	4.120	3.785	3.810	3.810	5.597	5.454	5.454	3.778
285	7.350	7.131	6.773	6.073	6.196	6.196	2.271	2.271	2.306	2.271
286	13.875	13.055	13.424	10.610	10.610	11.120	10.843	10.843	10.843	10.610
287	49.170	45.378	40.602	35.039	35.039	34.850	25.274	25.044	25.044	25.044
288	31.425	22.593	22.593	10.608	11.653	9.481	18.630	18.116	18.646	9.362
289	17	19	20	23	23	23	418	418	326	10
290	35.383	30.851	32.371	26.786	28.075	28.075	50.310	50.310	62.846	26.786
291	12.724	12.010	9.737	9.305	9.305	8.870	6.603	6.603	8.024	6.023
292	9.448	9.220	9.752	8.846	9.148	9.148	11.934	11.934	11.934	7.166
293	2.975	2.648	2.460	1.601	1.601	1.437	2.640	2.640	3.069	1.437
294	1.681	1.538	1.423	1.025	1.025	1.293	1.232	1.232	1.232	1.025
295	986	1.188	1.204	1.014	1.014	1.014	1.264	1.264	1.619	968
296	83.028	75.777	61.357	46.627	46.627	51.149	42.930	42.930	42.930	41.836
297	8.685	8.069	8.069	6.220	6.220	7.248	6.392	7.969	8.849	6.067
298	9.359	9.476	8.548	9.308	9.473	9.014	20.453	20.453	20.453	8.300
299	19.222	16.529	16.529	11.223	11.223	9.913	11.531	8.521	8.521	8.521
300	1.495	1.531	1.514	1.410	1.507	1.507	1.822	1.822	1.822	1.410
301	107.125	93.327	145.817	30.742	29.453	36.932	42.506	42.506	42.506	29.074
302	66.791	58.094	90.565	24.246	23.152	24.246	31.530	31.530	28.004	22.313
303	7.300	7.192	7.192	3.571	3.772	3.586	3.601	3.601	3.562	3.477
304	3.254	3.260	3.735	1.972	2.043	2.043	1.838	1.520	1.330	1.330
305	4.874	4.849	4.849	2.458	2.367	2.326	3.174	3.197	3.319	2.125
306	242.536	215.233	319.168	79.491	79.491	79.491	97.128	85.964	85.964	79.491
307	8.126	7.206	7.206	4.509	5.087	5.087	5.908	5.908	5.808	4.509
308	4.520	4.115	4.115	3.152	3.416	3.200	2.924	2.924	2.924	2.670
309	9.348	9.328	12.369	5.846	5.846	5.846	5.501	5.501	6.210	5.501
310	5.572	4.844	5.734	2.736	2.582	2.582	4.001	4.001	4.128	2.582
311	2.251	2.195	3.784	1.498	1.498	2.008	2.630	1.876	1.876	1.498
312	2.616	2.638	3.334	2.119	2.119	2.119	2.019	2.019	2.019	1.999
313	42.901	39.046	33.876	24.879	26.097	28.778	23.581	29.008	29.008	21.168
314	3.396	3.169	4.163	2.741	2.277	2.440	2.031	1.987	1.967	1.967
315	3.638	3.577	3.577	2.738	3.079	3.079	3.430	3.430	3.430	2.588
316	6.472	5.756	9.224	4.999	4.544	4.999	4.644	4.644	4.435	4.435
317	20.559	17.523	12.767	9.869	10.271	10.271	11.992	11.992	10.702	9.684
318	7.525	6.542	6.169	4.327	4.327	4.327	3.992	3.992	3.613	3.613
319	12.324	14.099	16.913	9.128	10.545	10.545	9.517	7.234	7.234	5.810
320	21.945	21.798	20.304	16.922	18.704	25.454	69.044	69.044	69.044	16.507
321	1.423.281	1.325.698	1.308.632	968.758	968.758	1.051.243	703.253	703.253	793.493	551.442
322	978.527	911.674	913.098	682.577	682.577	682.577	585.351	585.351	621.640	428.809
323	240.351	208.752	207.742	187.588	187.588	197.406	117.563	117.563	117.563	86.167
324	79.831	71.922	69.836	53.000	53.000	58.807	15.324	15.324	35.801	10.010
325	39.389	35.717	35.310	26.826	26.826	30.023	23.390	24.145	24.145	13.858
326	212.754	181.197	181.197	157.753	157.753	157.753	73.788	73.788	73.788	73.788
327	299.199	295.116	306.559	263.994	275.788	279.921	302.376	302.376	322.409	263.994
328	92.411	91.743	91.743	96.567	92.264	91.744	399.156	399.156	228.174	91.572
329	104.989	104.465	108.035	96.830	95.551	103.449	115.167	113.533	113.533	95.551
330	756	670	1.088	579	579	432	3.924	4.004	4.148	432
331	7.483	7.523	7.455	7.641	7.641	7.641	8.251	8.251	8.540	4.958
332	78.374	56.426	52.127	32.400	33.632	35.238	54.382	54.382	53.698	27.418
333	10.474	10.307	12.164	8.723	8.723	11.961	12.663	12.663	20.824	8.723
334	9.454	9.349	9.349	5.024	5.024	6.806	12.449	12.449	12.449	5.024

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
334	9.454	9.349	9.349	5.024	5.024	6.806	12.449	12.449	12.449	5.024
335	6.009	5.210	5.210	2.892	2.895	2.895	9.392	9.392	9.392	2.870
336	52.618	55.391	54.406	50.605	52.954	52.954	50.041	50.041	39.208	39.208
337	2.962	2.897	2.897	3.439	3.439	3.439	9.800	9.800	9.800	2.843
338	9.269	9.098	9.098	9.128	8.982	8.872	15.376	15.376	28.729	8.872
339	1.686	1.693	1.030	1.739	1.739	1.295	1.575	1.575	1.273	1.030
340	19.810	17.438	17.438	13.837	15.199	15.199	18.316	18.497	18.497	13.837
341	3.906	4.091	4.091	2.472	2.472	2.148	4.339	5.300	5.300	2.010
342	1.590.235	1.636.369	1.636.369	1.531.321	1.599.510	1.599.510	1.487.687	1.487.687	1.487.687	1.487.687
343	1.946	1.587	1.568	1.194	1.194	1.194	3.558	3.558	3.592	743
344	2.941	2.742	3.712	2.791	2.791	2.791	3.030	3.030	3.899	2.250
345	9.149	7.348	7.348	4.637	4.637	5.203	5.326	5.326	6.302	4.637
346	1.148	1.115	1.122	1.089	1.089	1.089	2.253	2.253	2.997	1.015
347	12.523	11.200	11.200	10.143	10.869	9.464	8.603	8.603	8.516	6.418
348	23.912	22.220	19.886	20.678	19.271	17.893	34.539	34.539	34.570	17.838
349	5.446	5.660	5.660	3.703	3.703	5.320	4.735	4.735	4.735	3.183
350	5.143	4.632	4.632	3.446	3.431	3.431	5.357	3.442	3.630	3.368
351	33.784	29.438	32.407	20.236	22.186	24.963	22.986	22.986	23.282	16.060
352	28.465	24.589	24.589	17.432	18.786	18.786	20.743	20.743	20.743	13.680
353	12.105	10.735	12.710	8.076	8.866	8.866	17.871	13.342	13.342	5.244
354	2.953	2.740	2.740	2.508	2.580	2.283	2.338	2.477	3.051	1.823
355	1.990	1.826	1.826	1.521	1.579	1.644	1.383	1.383	1.675	1.285
356	6.269	6.063	5.579	4.956	4.305	4.305	3.523	3.523	3.788	2.469
357	47.275	42.704	20.160	9.417	9.110	16.360	13.776	13.776	13.776	9.110
358	32.685	29.451	16.118	6.604	6.604	6.604	11.743	11.743	11.743	6.604
359	3.181	3.131	2.451	1.712	1.712	1.712	1.756	1.756	1.780	1.712
360	1.295	1.209	1.209	976	976	1.259	814	725	725	725
361	3.957	3.403	3.074	1.922	1.922	2.335	1.518	1.798	1.798	1.518
362	101.845	91.204	67.416	19.447	17.212	17.212	19.298	19.298	19.298	17.212
363	3.393	3.107	4.609	2.429	2.600	2.600	2.023	2.023	2.288	2.023
364	1.207	1.184	1.184	722	891	1.117	614	614	766	614
365	3.255	2.944	3.296	1.875	1.875	2.832	1.517	1.517	1.517	1.517
366	2.874	2.865	3.247	2.085	2.159	2.405	1.366	1.366	2.163	1.366
367	1.079	920	956	835	775	775	1.035	1.035	962	775
368	1.551	1.552	1.594	1.505	1.505	1.651	1.596	1.569	1.646	1.505
369	12.208	10.811	12.276	7.454	7.844	9.573	8.001	6.741	6.822	6.741
370	771	748	748	699	736	699	639	639	586	586
371	1.623	1.434	1.434	1.548	1.313	1.313	888	888	888	888
372	2.593	2.610	3.631	2.220	2.417	1.786	2.282	2.282	2.282	1.786
373	6.779	5.226	5.226	3.835	3.835	3.835	2.897	2.897	4.279	2.897
374	2.522	2.341	2.116	1.798	1.960	2.829	1.441	1.441	1.483	1.044
375	9.094	8.311	9.717	5.929	6.789	5.929	7.582	7.582	7.582	5.913
376	5.191	3.785	3.785	2.253	2.455	3.211	3.672	2.030	3.672	1.052
377	5.616	4.904	4.897	2.631	2.631	2.631	3.112	3.112	3.112	1.812
378	1.646	1.594	1.518	1.246	1.444	1.444	1.623	1.623	1.812	578
379	796	804	804	532	597	655	645	645	592	308
380	557	541	513	324	324	344	922	922	922	324
381	6.203	6.210	6.210	4.991	5.604	5.604	7.663	7.663	12.523	4.716
382	25.015	22.416	22.416	15.186	16.931	16.931	20.368	20.368	20.368	14.599
383	14.138	13.492	13.492	10.326	11.369	11.369	17.716	17.716	16.432	10.326
384	5.897	6.833	6.833	5.256	6.060	7.410	7.422	7.422	7.422	3.530
385	897	884	870	778	777	846	873	873	873	777
386	11.234	6.879	5.500	5.124	5.124	4.406	5.027	5.027	5.615	4.406
387	9.927	8.734	4.477	3.590	4.114	4.114	4.513	4.513	5.514	3.509
388	3.352	3.060	2.200	1.759	1.823	1.823	1.918	1.918	1.881	1.732

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
389	6.327	5.640	5.640	2.017	2.017	2.017	2.074	2.456	2.178	1.842
390	1.896	1.748	1.693	1.220	1.220	1.220	1.626	1.626	1.606	1.212
391	1.483	1.068	963	822	888	888	596	596	514	514
392	3.628	3.075	2.108	819	819	819	1.539	1.539	1.573	819
393	24.403	21.394	15.629	10.473	7.358	7.358	7.364	7.364	7.791	7.358
394	2.125	3.239	2.491	1.215	1.186	1.207	1.661	1.661	1.661	1.186
395	2.291	2.135	1.703	1.509	1.431	1.406	1.088	1.088	1.607	1.088
396	12.382	11.074	7.030	3.853	3.937	3.511	3.961	3.961	4.276	3.383
397	9.225	8.265	7.483	2.159	2.159	2.138	1.656	1.656	1.656	1.656
398	1.660	1.221	1.249	1.175	1.247	1.247	1.147	1.147	1.362	840
399	1.210	1.247	1.797	1.033	1.340	1.716	1.104	1.186	1.186	1.009
400	1.556	1.388	1.729	1.651	2.025	2.025	1.071	1.037	1.048	1.037
401	42.597	37.162	37.162	12.554	11.372	11.842	12.732	7.300	4.162	4.162
402	3.432	2.865	2.865	1.412	1.412	1.412	1.068	1.068	1.068	1.068
403	2.602	2.309	2.309	1.144	1.220	1.220	1.221	1.221	1.221	1.066
404	7.966	6.879	6.879	2.817	2.817	3.348	4.776	4.776	4.776	2.817
405	6.972	6.115	7.133	3.420	3.697	3.697	2.165	2.165	2.422	1.893
406	20.107	17.222	21.581	6.639	6.639	6.639	7.724	7.724	8.458	6.639
407	12.591	8.264	6.876	3.486	3.651	3.651	3.081	3.081	3.166	3.081
408	9.955	10.025	13.128	7.550	8.964	12.160	6.370	6.370	6.370	6.370
409	4.378	3.914	2.462	1.588	1.780	1.913	1.247	1.247	1.295	1.247
410	2.495	2.185	2.010	1.015	921	921	938	938	938	921
411	1.344	1.207	1.207	347	410	410	522	522	522	341
412	3.596	2.817	2.817	1.183	1.078	1.078	1.833	1.833	1.833	1.078
413	3.813	3.054	2.336	1.629	1.629	1.629	1.745	1.745	2.753	1.629
414	805	582	562	440	440	636	780	780	1.075	440
415	1.194	972	972	602	602	488	1.228	1.228	982	488
416	512	459	459	291	308	308	291	291	420	211
417	1.963	1.554	1.276	845	955	955	756	1.061	1.221	668
418	8.977	7.666	5.445	3.281	3.281	4.140	3.553	3.553	3.553	2.856
419	2.057	1.877	1.214	1.012	1.012	988	809	809	779	779
420	1.197	1.042	828	578	480	483	619	619	659	480
421	4.882	4.065	4.065	805	881	1.029	1.916	1.916	1.916	805
422	1.907	1.522	1.417	731	569	569	795	795	1.126	502
423	830	772	747	564	564	564	425	425	425	425
424	959	1.172	1.172	971	1.140	1.140	1.077	1.077	1.077	819
425	921	793	713	644	583	583	575	575	575	550
426	6.907	5.217	5.217	2.020	2.020	2.268	3.192	3.192	2.904	1.718
427	1.431	1.262	838	613	613	613	627	627	627	559
428	628	577	586	467	467	467	474	474	2.151	437
429	3.950	3.511	2.368	1.819	1.819	1.819	2.159	2.028	3.422	1.819
430	10.100	8.636	7.875	2.345	2.296	2.296	3.201	3.095	3.167	2.294
431	976	778	770	465	324	324	543	543	405	284
432	1.393	1.334	1.334	1.491	1.271	1.271	1.477	1.477	1.833	1.271
433	354	297	297	285	195	195	288	288	475	112
434	202	200	201	197	197	164	210	210	207	143
435	3.743	3.451	3.451	2.395	2.433	2.396	2.524	2.524	2.524	2.395
436	2.979	2.901	3.210	2.514	2.531	2.531	2.303	2.303	2.303	2.303
437	531	500	687	411	411	411	545	387	387	387
438	2.673	2.613	2.613	2.234	2.280	2.280	2.534	2.534	2.534	2.221
439	1.596	1.827	1.827	940	1.041	1.041	1.112	1.112	1.125	933
440	5.641	5.490	5.490	3.692	3.633	3.914	4.092	4.092	4.780	3.633
441	6.865	4.696	4.696	2.431	2.431	2.431	2.084	2.084	2.084	2.084
442	2.121	1.774	1.610	1.126	1.126	1.202	1.402	1.402	1.587	1.126
443	17.013	16.760	10.981	5.746	4.986	4.644	5.878	5.878	5.878	4.559

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
444	1.808	1.635	1.635	1.582	1.716	1.716	1.688	1.688	1.688	1.506
445	2.614	2.276	2.175	1.923	2.098	2.098	3.538	2.502	2.502	1.657
446	3.988	3.137	2.815	2.580	2.667	2.667	2.853	2.853	3.169	2.545
447	8.951	5.922	5.342	4.461	4.461	4.461	5.289	5.289	5.289	4.124
448	11.416	10.255	9.344	4.150	4.260	4.260	4.580	4.580	4.580	4.150
449	6.300	5.633	4.991	1.753	1.748	1.945	2.101	2.101	2.118	1.748
450	4.978	4.843	4.701	4.037	4.601	4.601	4.166	4.166	3.916	3.761
451	561	528	635	432	462	524	351	351	322	322
452	748	788	885	675	805	805	568	535	535	535
453	493	466	466	508	508	778	531	531	531	401
454	1.674.058	1.557.691	1.519.455	1.189.275	1.189.275	1.189.275	730.294	730.294	730.294	533.930
455	1.408.257	1.311.279	1.311.279	1.020.657	1.020.657	1.038.545	516.348	516.348	516.348	310.106
456	253.739	241.625	241.625	192.857	192.857	215.026	59.330	59.330	59.330	58.996
457	460.227	430.993	421.540	339.668	339.668	396.063	123.085	123.085	123.085	114.065
458	18.409	16.844	15.744	12.298	12.298	12.298	16.004	14.483	17.290	12.207
459	91.828	87.831	87.831	68.579	68.579	67.900	42.763	45.846	44.125	31.105
460	62.995	62.732	65.165	54.445	61.093	61.795	50.836	50.836	58.661	48.059
461	4.825.547	4.432.589	4.432.589	3.602.456	3.602.456	3.891.381	2.209.646	2.209.646	2.546.302	1.081.337
462	305.520	278.575	270.994	200.565	200.565	202.677	61.270	91.217	105.441	53.362
463	286.195	267.315	267.315	219.905	219.905	274.146	70.904	70.904	137.678	70.904
464	737.755	685.438	741.018	574.462	574.462	653.242	156.732	156.732	357.890	156.732
465	488.561	457.206	445.029	333.312	333.312	333.312	169.099	169.099	128.037	128.037
466	9.538	10.582	10.582	7.535	9.119	8.616	4.032	4.032	3.593	3.593
467	33.370	31.973	31.973	26.428	26.428	24.943	15.503	26.805	26.987	12.884
468	7.343	6.957	6.957	5.673	5.673	7.588	8.556	7.081	8.556	5.088
469	14.034	13.251	15.346	10.602	10.602	10.964	13.592	14.788	14.508	10.602
470	74.562	65.049	67.904	49.298	49.298	59.495	35.774	35.774	55.714	35.774
471	1.467	1.430	1.428	1.494	1.317	1.317	530	530	1.157	530
472	10.959	11.004	10.430	8.604	8.604	8.604	11.322	11.322	11.781	8.604
473	87.357	82.677	82.677	62.880	62.880	62.880	53.793	58.378	54.265	53.793
474	30.158	29.817	33.176	25.502	25.502	22.954	20.808	24.877	24.877	16.329
475	27.777	33.615	33.615	25.019	30.443	32.760	15.762	15.762	15.762	15.762
476	18.331	17.038	17.038	11.114	15.086	15.086	10.264	9.894	9.894	5.810
477	3.190	3.114	3.114	2.838	2.838	2.838	1.769	1.769	1.771	1.335
478	96.472	93.472	75.296	81.218	81.218	72.738	67.438	78.159	79.322	53.986
479	119.700	110.346	110.346	71.675	71.675	73.534	49.823	39.110	39.110	39.110
480	52.256	48.998	49.124	39.151	39.151	47.018	21.793	21.793	43.787	21.793
481	187.474	191.373	219.765	153.380	153.380	209.356	132.466	132.466	151.585	132.466
482	10.246	8.951	8.951	5.570	5.570	5.853	11.221	11.221	12.908	5.570
483	10.332	10.004	8.120	8.574	8.649	7.330	8.348	11.778	9.608	7.293
484	95.935	92.872	77.128	84.589	84.589	72.338	52.659	72.174	73.180	52.659
485	15.406	14.915	11.370	12.374	12.873	12.873	11.081	11.081	16.436	10.521
486	96.957	89.129	80.627	69.595	69.595	79.478	58.157	58.157	53.487	43.705
487	80.168	80.982	80.982	78.840	78.253	78.253	71.039	83.329	82.609	71.039
488	111.746	92.948	92.948	73.773	73.773	73.773	100.473	100.473	100.473	47.882
489	2.173	2.253	2.182	2.314	2.314	2.314	1.856	1.856	1.697	1.650
490	73.879	70.798	77.335	61.851	61.851	61.851	36.889	29.846	29.846	19.642
491	8.407	8.654	8.654	7.905	8.283	8.283	6.765	6.765	7.109	5.921
492	285.944	271.996	271.996	224.279	224.279	224.279	157.172	176.506	181.095	157.172
493	86.828	99.911	99.911	76.041	84.521	84.521	63.001	61.686	64.494	61.686
494	73.152	69.425	71.957	64.875	64.875	70.422	43.632	64.510	53.172	43.632
495	187.417	214.497	255.713	188.353	217.917	245.429	48.812	48.812	50.501	48.812
496	134.159	121.620	124.278	125.304	113.752	113.752	125.675	125.675	125.675	109.657
497	65.650	61.344	61.344	53.593	53.593	60.616	65.972	65.972	65.972	47.490
498	48.810	48.431	48.431	47.527	47.097	47.097	57.384	57.384	57.384	47.097

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Cod e	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSE D METHOD
499	67.326	65.737	69.664	63.952	63.952	71.646	102.918	102.918	191.994	63.952
500	1.075	1.093	1.046	1.026	1.085	966	2.428	2.442	2.781	734
501	1.426	1.291	1.299	1.094	1.094	1.197	2.172	2.172	2.172	1.094
502	117.685	103.858	103.858	80.487	90.791	93.592	96.527	96.527	110.069	61.745
503	71.074	70.128	71.136	66.920	67.503	72.171	59.970	59.970	117.569	59.970
504	6.140	5.542	5.441	4.007	4.258	4.007	4.454	4.454	5.365	3.542
505	26.730	24.852	23.631	18.834	18.834	21.000	22.431	22.431	22.431	13.922
506	34.261	34.467	35.209	34.028	34.050	34.050	192.373	192.373	315.064	33.748
507	3.213	3.237	3.237	2.968	3.051	3.051	2.619	2.659	2.407	2.210
508	18.587	18.712	18.497	18.132	18.456	18.456	21.201	21.201	23.419	18.132
509	33.635	33.252	35.375	32.437	32.437	35.768	90.490	90.490	215.137	32.437
510	2.239	2.265	2.252	1.838	1.867	2.344	7.365	7.692	8.138	1.838
511	334	346	388	350	375	375	797	852	852	316
512	4.161	4.146	3.903	3.553	3.553	4.798	2.498	2.498	2.498	2.498
513	44.132	44.065	48.641	44.307	44.307	49.721	65.450	65.450	76.936	44.252
514	4.368	4.341	4.742	4.243	4.243	4.815	5.407	5.407	6.054	4.243
515	44.565	44.359	44.359	44.569	44.312	44.312	39.480	39.480	63.524	39.480
516	2.518	2.404	2.404	2.116	2.116	2.049	11.099	11.099	15.105	1.794
517	8.193	8.197	8.822	8.215	8.215	8.215	12.828	12.828	14.017	7.942
518	19.167	18.878	22.271	17.472	17.472	23.219	2.024	11.788	2.024	2.024
519	4,511.342	4,163.014	4,566.614	3,250.270	3,250.270	3,946.667	2,361.84 2	2,360.19 9	2,503.674	1,513.237
520	3,501.615	3,331.971	3,529.676	2,651.869	2,645.782	3,241.010	1,651.22 3	1,651.22 3	1,651.223	1,269.673
521	662.464	600.104	600.104	427.995	427.995	520.562	193.540	281.661	300.572	143.924
522	1,064.617	991.545	992.007	730.343	730.343	732.762	405.277	405.277	548.635	396.885
523	46.355	44.631	45.102	42.824	41.657	41.885	27.478	30.091	29.897	27.478
524	163.998	152.587	159.582	108.247	108.247	108.247	66.454	66.454	71.276	62.335
525	134.343	140.223	154.301	123.184	133.987	161.132	138.446	138.446	128.941	87.559
526	16,439.13 9	14,771.26 1	15,839.90 5	11,240.48 7	11,240.48 7	13,574.05 5	6,647.52 2	6,647.52 2	10,235.60 5	6,165.591
527	814.405	743.605	706.488	496.542	496.542	496.542	150.176	204.893	204.893	150.176
528	566.994	517.098	514.393	344.484	342.697	342.697	230.013	230.013	230.013	185.535
529	1,185.652	1,104.034	1,107.771	814.886	830.396	1,033.051	481.425	669.358	669.358	298.980
530	1,203.303	1,098.925	1,146.720	719.046	719.046	1,030.759	395.362	804.411	688.967	395.362
531	26.003	25.570	25.850	22.107	23.464	24.781	19.909	19.909	16.114	12.830
532	94.822	86.884	85.407	75.437	75.437	80.234	40.191	57.232	57.232	38.009
533	16.375	15.305	14.930	11.883	13.554	14.167	14.827	14.827	19.729	11.427
534	33.017	33.085	33.085	29.211	32.172	34.909	155.330	155.330	260.340	27.031
535	489.132	417.495	414.898	251.113	321.845	356.556	174.370	272.083	248.859	72.832
536	3.604	3.669	3.640	3.638	3.702	3.732	6.549	4.868	6.549	3.534
537	33.714	34.074	33.986	33.211	33.955	33.955	35.014	34.797	35.179	33.211
538	15.775	14.343	14.343	9.523	9.523	9.523	14.307	14.307	14.847	9.523
539	34.209	31.676	22.022	20.732	20.732	18.122	15.148	15.148	10.820	10.820
540	387.460	351.406	351.406	203.039	203.039	204.272	153.777	153.777	122.366	105.208
541	92.735	84.074	88.896	66.299	69.628	76.467	44.282	51.001	52.694	36.079
542	108.138	101.130	82.192	81.307	81.307	81.307	81.014	81.014	71.519	69.149
543	66.918	54.197	48.140	34.026	32.340	43.226	24.442	24.442	28.766	16.585
544	8.643	7.898	7.893	6.629	6.629	6.565	6.505	6.505	10.573	6.505
545	13.891	13.725	13.975	13.150	13.150	13.632	9.661	9.661	14.596	9.661
546	154.375	143.673	152.838	132.351	132.351	132.351	105.586	105.586	153.191	103.296
547	305.733	276.573	242.977	147.357	147.357	191.022	62.698	62.698	110.910	38.152
548	189.090	169.627	166.344	113.686	123.786	134.152	138.656	71.095	71.095	62.164
549	271.700	251.087	252.655	188.156	187.449	187.449	85.623	85.623	85.623	85.623
550	13.205	13.299	13.640	9.711	11.413	8.215	12.742	12.580	12.742	7.297
551	159.341	136.601	136.601	96.812	82.118	82.118	17.618	17.618	31.994	17.618
552	103.906	98.332	101.168	74.782	74.782	74.782	85.905	85.905	119.748	74.782
553	34.569	31.971	31.971	21.672	21.672	21.648	19.647	19.647	25.773	19.647

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
554	173.177	170.563	179.592	155.330	155.330	195.408	164.322	164.322	208.812	155.330
555	629.567	573.029	534.413	384.829	384.829	509.355	318.517	318.517	318.517	318.517
556	345.392	346.782	346.782	312.290	328.911	328.911	101.035	101.035	101.035	101.035
557	367.425	318.743	344.822	294.071	294.071	250.142	288.239	186.833	186.833	164.254
558	2.008	2.031	2.048	2.102	2.102	2.102	2.078	2.078	2.304	1.721
559	10.893	11.112	11.112	9.543	10.547	10.547	10.507	10.507	11.632	8.828
560	114.759	108.970	97.782	88.115	88.115	80.821	62.875	77.931	91.932	62.873
561	132.766	132.769	132.769	103.472	108.778	108.778	80.161	108.013	100.917	80.161
562	8.226	8.340	8.340	7.311	7.709	6.935	10.818	10.818	11.548	6.600
563	13.386	13.108	13.321	12.617	12.653	12.653	38.012	38.012	38.012	12.617
564	554.839	527.557	527.557	425.603	425.603	399.561	85.389	98.054	98.054	85.389
565	100.460	67.808	67.193	64.271	59.404	58.785	42.861	42.861	53.437	42.861
566	121.175	132.116	112.822	121.866	121.866	105.288	60.954	60.954	61.869	59.831
567	4.492	4.483	4.410	3.812	3.812	3.812	20.979	20.979	29.573	3.812
568	444.340	433.364	409.309	393.987	393.987	350.492	176.530	181.225	163.071	163.071
569	47.800	41.983	41.807	31.620	33.039	31.620	43.307	35.928	39.001	16.653
570	236.355	218.963	218.963	166.542	166.542	145.732	79.365	84.240	87.697	56.913
571	20.913	19.177	15.896	12.972	12.972	11.835	11.426	8.951	10.118	8.246
572	376.511	356.184	380.309	321.246	321.246	561.365	416.823	416.823	422.728	316.748
573	117.269	115.447	166.132	103.707	103.707	157.355	126.012	126.012	129.867	101.844
574	203.471	170.135	170.135	190.579	140.360	191.413	71.636	91.281	86.982	71.636
575	4.495	4.817	5.422	5.809	5.809	5.809	11.122	11.122	53.284	2.947
576	436	343	343	245	245	245	471	486	986	245
577	30.626	29.448	27.278	19.281	22.155	22.155	24.230	24.230	31.751	17.786
578	184.400	157.065	157.065	114.979	129.908	141.221	153.032	153.032	153.032	105.940
579	105.084	92.586	96.012	77.282	77.282	110.447	107.705	107.705	107.705	70.015
580	7.652	6.908	6.908	5.577	5.809	6.066	9.727	9.727	9.727	3.906
581	46.597	42.492	49.217	32.806	35.032	40.373	44.984	44.984	44.984	30.441
582	350	358	360	380	380	376	697	697	697	314
583	2.658	3.086	2.902	2.383	2.718	3.061	2.432	2.432	2.372	1.807
584	91.513	83.940	87.050	65.356	65.356	65.356	107.821	107.821	109.901	36.780
585	930.430	799.459	811.496	571.927	571.927	738.006	772.008	772.008	772.008	571.927
586	20.771	19.176	19.176	15.444	15.444	16.900	14.866	14.866	13.983	9.992
587	5.362	5.692	6.843	4.650	4.650	7.166	6.707	6.707	6.045	4.650
588	56.493	51.217	59.298	33.905	33.905	33.905	47.766	47.766	47.766	32.369
589	22.393	19.370	22.242	14.950	14.950	17.034	28.428	28.428	24.596	8.770
590	2.972	2.758	2.407	2.658	2.976	3.924	6.697	6.697	10.806	2.267
591	1.718	1.973	1.967	1.402	1.971	1.971	900	900	1.854	900
592	13.464	13.038	13.038	12.729	12.956	12.592	38.596	38.596	96.017	12.251
593	81.506	73.011	72.654	49.907	49.907	40.858	74.798	74.798	97.526	40.858
594	97.011	88.799	88.323	68.571	80.876	83.465	81.284	81.284	81.284	50.268
595	567	569	375	441	441	571	875	875	1.406	353
596	4.061	5.390	5.195	4.796	4.846	5.758	103.939	96.866	156.726	4.326
597	47.819	45.091	37.641	31.724	31.724	34.108	28.475	28.475	28.475	17.922
598	5.284	3.167	2.718	3.478	2.903	2.903	4.059	4.059	3.024	2.377
599	5.785	5.529	5.913	5.023	5.023	5.023	14.213	14.213	14.213	5.023
600	18.718	17.855	20.928	18.678	18.678	15.881	20.625	20.625	18.140	15.881
601	24.330	23.544	24.178	18.251	18.251	24.484	13.878	13.878	13.878	13.878
602	10.413	10.425	9.400	9.232	9.220	9.220	10.548	10.548	11.319	7.444
603	4.779	4.451	4.451	3.604	3.161	3.161	4.305	3.588	3.588	2.445
604	30.607	33.439	31.870	18.002	18.002	18.002	25.646	25.646	25.175	14.538
605	50.601	50.009	50.009	47.594	47.594	44.672	66.155	66.155	66.155	41.566
606	242.482	215.565	205.441	138.248	138.248	167.263	306.053	306.053	336.224	138.248
607	37.095	34.150	36.057	21.909	21.909	21.909	41.125	32.264	32.264	21.909
608	2.660	3.005	2.984	2.586	2.586	3.046	2.530	2.968	3.085	2.530

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
609	18.926	18.029	17.002	15.149	15.149	17.586	13.409	13.816	14.452	13.409
610	10.038	10.182	9.891	9.571	9.429	9.429	8.380	8.380	8.380	5.464
611	1.212	1.137	1.130	969	913	913	1.238	1.363	1.238	913
612	9.843	10.221	10.221	8.368	10.221	10.221	9.973	9.973	14.009	7.218
613	13.675	11.732	12.856	8.548	9.386	10.089	8.520	9.543	11.409	6.752
614	1.146	1.096	1.037	921	991	1.026	744	744	1.242	744
615	6.601	5.770	5.770	4.314	4.314	6.395	7.155	7.155	6.236	4.314
616	228	230	243	237	237	245	288	288	292	237
617	683	686	607	637	693	693	530	807	318	318
618	41.271	43.000	43.000	28.678	33.938	41.293	18.179	28.367	18.179	16.172
619	3.067	2.623	3.316	2.319	2.061	2.061	4.398	4.398	4.398	1.748
620	8.092	7.461	7.493	5.184	5.184	6.830	7.476	7.476	6.754	5.074
621	8.747	8.069	8.027	5.971	6.512	6.512	4.551	6.312	8.602	4.551
622	3.204	3.096	3.087	2.788	2.839	2.839	3.941	3.941	4.044	2.130
623	3.320	4.375	4.375	3.520	4.067	4.067	5.278	5.278	11.686	3.111
624	236	249	261	288	288	288	180	180	641	170
625	9.417	9.216	8.775	8.591	8.591	8.458	8.913	8.913	8.913	8.449
626	1.425	1.503	1.448	1.328	1.475	1.475	2.200	2.200	2.200	769
627	268	269	273	271	271	276	435	435	435	269
628	2.189	2.158	2.144	2.000	2.095	1.514	2.044	1.886	1.886	1.514
629	2.528	2.643	2.566	2.487	2.530	2.634	2.599	2.599	3.643	2.446
630	54.284	49.332	56.497	40.498	46.319	51.023	57.848	57.848	57.848	40.498
631	43.028	35.468	35.468	31.050	33.293	37.457	40.339	36.828	36.828	31.050
632	8.551	8.109	8.109	6.943	6.943	8.061	7.804	7.804	8.146	6.191
633	40.729	37.832	37.998	30.157	34.501	34.032	27.181	27.181	26.303	21.725
634	233.964	203.319	207.622	157.528	170.931	170.931	196.253	196.253	196.253	157.528
635	4.644	4.579	4.828	4.385	4.385	4.385	3.270	3.280	5.269	3.270
636	16.881	16.591	16.971	13.337	15.220	16.504	20.893	20.893	20.893	13.337
637	5.922	5.770	5.689	5.119	5.119	5.119	3.824	3.824	3.506	2.754
638	498	503	505	519	519	519	549	549	562	479
639	638	632	638	680	635	636	1.162	1.162	751	635
640	32.309	30.728	28.435	22.461	22.461	25.938	24.738	24.738	27.780	22.461
641	42.532	37.630	39.466	30.439	33.541	33.541	48.705	48.705	81.437	21.859
642	16.761	16.369	16.905	16.982	15.187	15.187	23.098	23.098	23.098	15.110
643	1.348	1.350	1.255	857	1.354	1.225	480	653	480	480
644	9.913	9.959	9.902	10.573	9.614	9.614	11.137	11.137	14.123	9.614
645	1.957	1.936	1.716	1.865	1.865	1.586	3.144	3.144	4.451	1.586
646	72	56	56	35	35	32	42	41	47	32
647	16.539	17.944	17.944	12.961	15.416	17.549	12.136	12.136	14.253	9.909
648	42.961	37.669	37.345	33.949	37.060	37.060	41.033	41.033	41.033	33.949
649	70.042	63.695	65.715	56.216	56.216	56.216	70.414	70.414	70.414	56.216
650	21.562	20.358	20.755	18.480	18.480	19.561	17.856	17.856	21.588	17.856
651	3.873	3.982	3.982	3.626	3.765	3.765	30.306	30.306	43.431	3.408
652	372.246	341.222	341.222	198.475	212.042	181.830	133.916	105.382	108.101	105.382
653	197.515	180.033	180.033	101.438	105.569	105.569	81.838	62.691	62.691	62.691
654	20.887	20.686	20.686	20.238	20.238	20.238	18.690	18.965	19.857	18.668
655	25.290	23.531	26.716	18.673	19.604	19.604	29.999	29.999	25.545	17.148
656	901.211	830.622	602.740	474.314	474.314	472.656	339.359	359.160	359.160	339.359
657	28.433	27.848	28.252	26.292	26.292	26.292	24.938	24.938	25.140	24.911
658	2.140	2.161	2.164	2.116	2.020	2.226	18.722	18.722	59.844	2.020
659	27.242	22.342	22.342	10.867	10.867	13.209	15.803	18.377	18.377	10.867
660	7.094	7.256	7.256	6.221	6.372	6.372	5.224	5.924	5.485	4.533
661	92.177	81.013	81.013	31.056	28.217	28.606	52.408	52.408	52.408	28.217
662	39.508	33.099	30.541	24.242	24.242	28.709	23.138	23.138	23.138	23.138
663	793.677	731.717	731.717	389.069	345.011	341.176	415.774	415.774	338.927	338.927

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Cod e	SBA - RMSE	SBA - MAE	SBA - RGRMS E	CR - RMSE	CR - MAE	CR - RGRMS E	HWM - RMSE	HWM - MAE	HWM - RGRMS E	PROPOSE D METHOD
664	14.783	13.851	13.851	10.267	10.668	8.594	9.053	9.053	12.487	8.549
665	1.263.170	1.140.584	905.946	702.424	702.424	686.114	517.230	517.230	517.230	502.753
666	751.618	680.859	631.398	433.601	433.601	444.740	311.664	332.627	287.618	287.618
667	51.310	46.458	40.395	30.925	30.925	29.734	31.895	31.895	27.761	23.625
668	228.704	191.479	167.605	87.418	87.418	87.418	105.398	118.325	117.120	87.418
669	977	986	1.008	895	895	1.041	3.353	3.353	3.788	889
670	22.495	20.790	19.414	12.272	12.272	12.272	13.006	13.006	12.925	11.401
671	2.771.488	2.464.241	2.017.430	1.461.508	1.461.508	1.376.995	1.124.136	1.124.136	1.098.153	1.098.153
672	10.749	10.547	10.272	9.688	9.891	9.891	12.525	12.525	12.903	9.244
673	64.361	55.969	49.909	38.455	38.455	38.455	36.493	22.686	22.686	22.686
674	19.650	17.547	17.745	12.841	13.136	15.259	20.205	20.205	20.205	12.841
675	193.355	189.136	193.244	176.318	176.318	185.338	78.704	85.193	85.193	78.704
676	9.469	9.636	9.636	9.081	9.081	9.391	6.704	9.681	13.025	6.557
677	40.102	33.117	32.621	22.756	23.439	17.037	40.849	40.153	50.707	14.343
678	33.177	32.988	32.947	32.950	33.301	33.301	35.408	35.408	35.408	32.381
679	3.092	3.109	3.109	1.856	1.545	1.545	4.824	4.631	5.730	1.545
680	5.513	5.492	5.492	5.351	5.372	5.372	5.680	5.680	5.962	5.065
681	5.613	5.641	5.922	4.592	5.227	6.249	5.012	4.859	5.122	4.018
682	8.649	8.350	8.344	7.922	7.922	7.922	11.831	10.436	11.321	7.922
683	927	826	826	825	1.040	734	3.357	3.357	5.298	719
684	495.672	457.339	405.870	274.056	272.189	274.056	346.354	346.354	254.586	254.586
685	229.763	209.365	201.426	115.342	115.342	124.009	159.185	159.185	113.974	113.974
686	14.252	14.960	16.900	11.597	11.597	11.597	13.238	13.423	14.935	10.530
687	1.247	1.117	1.174	1.024	1.024	1.024	1.684	1.684	1.931	1.024
688	2.822.669	2.617.332	1.794.638	1.553.802	1.145.328	1.145.328	1.713.028	1.713.028	1.713.028	1.145.328
689	51.490	43.662	43.662	22.511	26.335	27.745	39.179	39.179	39.179	22.511
690	228.846	206.296	179.611	115.265	109.315	109.315	137.314	173.361	173.361	109.315
691	118.752	107.932	83.211	63.248	63.248	63.248	65.554	81.381	81.381	63.248
692	46.261	42.234	37.330	30.895	30.895	29.619	25.374	25.374	51.559	23.491
693	610.897	556.379	310.984	245.524	250.200	250.200	397.465	397.465	397.465	245.524
694	102	105	111	113	113	113	1.056	1.056	1.332	93
695	51.578	44.974	43.228	21.600	23.582	23.207	33.481	33.481	34.574	21.600
696	162.957	147.842	139.995	72.206	72.206	70.771	151.202	151.202	122.594	70.771
697	109.549	103.728	101.006	82.395	82.395	94.733	103.042	103.042	103.042	82.395
698	1.166.300	1.070.009	707.069	570.924	570.924	570.924	732.314	732.314	993.380	531.616
699	45.300	43.589	42.049	37.472	37.892	37.892	34.055	34.055	51.238	34.055
700	9.305	7.648	7.963	5.834	5.834	6.586	5.476	5.476	5.476	5.242
701	6.231	6.100	6.537	5.963	5.922	5.922	4.208	4.208	5.175	4.208
702	18.716	9.036	8.889	9.903	11.063	11.063	15.578	13.704	15.513	8.889
703	34.968	30.054	33.208	20.195	20.195	17.440	24.649	21.975	21.975	17.440
704	7.350.213	6.524.932	6.524.932	1.933.195	1.773.789	1.712.199	3.426.228	3.426.228	4.558.927	1.712.199
705	5.565.073	4.963.344	3.011.339	1.720.097	1.852.372	1.852.372	2.544.421	3.110.867	3.110.867	1.432.490
706	165.418	155.849	132.632	110.222	110.222	120.692	50.123	50.123	50.123	50.123
707	1.509.333	1.352.948	1.222.668	417.593	455.341	365.740	514.220	514.220	514.220	348.622
708	14.970	14.973	14.925	13.370	13.995	13.995	9.958	11.441	11.441	9.958
709	131.774	90.491	68.077	47.856	47.856	47.856	48.051	48.051	52.293	47.181
710	10.798.397	7.188.629	7.845.004	4.841.419	4.209.978	4.209.978	6.815.321	6.815.321	6.815.321	4.209.978
711	12.476.640	10.801.423	9.863.698	3.551.726	3.195.614	3.195.614	6.393.915	6.393.915	4.855.814	3.184.134
712	1.743.408	1.563.038	1.563.038	689.249	689.249	689.249	661.021	745.079	645.957	645.957
713	49.026	49.583	53.404	38.448	41.394	49.950	31.772	31.772	35.970	25.530

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
714	1.047.296	924.468	924.468	391.323	391.323	422.553	451.507	451.507	347.686	347.686
715	988.096	877.320	677.751	431.967	405.900	412.664	448.068	331.971	526.155	324.387
716	76.211	71.677	60.402	53.220	53.220	51.735	56.837	56.837	68.329	51.735
717	37.531	29.818	29.818	17.043	17.043	18.883	11.765	9.567	9.567	9.567
718	176.578	154.067	93.445	67.093	67.093	67.093	104.285	111.253	111.253	65.192
719	3.933.544	3.410.673	2.356.655	1.257.896	1.118.309	1.118.309	2.156.351	2.156.351	2.156.351	1.118.309
720	1.737.297	1.488.381	1.125.382	644.134	644.134	757.793	922.539	922.539	592.821	525.491
721	28.747	25.126	20.471	10.806	10.806	10.896	14.323	14.323	14.730	10.806
722	147.685	151.145	148.056	151.080	151.080	151.080	110.556	110.556	191.255	110.556
723	127.692	86.512	86.512	70.262	72.483	72.483	81.057	81.057	67.038	61.086
724	772.508	690.829	629.185	263.115	263.115	219.259	242.444	242.444	242.444	219.259
725	79.213	65.567	65.567	33.425	27.227	44.655	44.594	44.594	22.500	19.584
726	167.389	155.147	128.342	87.305	93.229	87.305	66.573	66.573	66.573	65.359
727	294.988	261.619	189.133	103.124	103.124	103.124	157.899	157.899	106.365	103.124
728	18.702	17.084	17.084	9.282	9.282	12.582	14.477	14.477	14.477	9.282
729	4.026	3.823	3.007	3.228	3.228	3.228	3.526	3.526	2.227	2.017
730	55.542	53.841	53.841	46.037	46.037	46.037	66.286	66.716	66.286	46.037
731	88.144	69.882	76.398	23.296	23.296	23.296	12.512	12.512	7.388	7.388
732	36.658	34.729	37.227	31.211	31.211	35.996	34.423	36.465	34.423	31.211
733	95.104	80.773	80.773	79.333	59.661	60.474	84.712	84.712	68.618	59.041
734	435.006	396.578	286.731	251.799	261.600	252.616	389.456	389.456	301.228	245.418
735	3.394.860	2.927.822	2.927.822	1.329.320	1.289.757	1.289.757	2.291.773	2.915.975	2.915.975	1.268.879
736	18.288	16.759	16.553	13.341	13.341	13.964	15.419	19.330	19.330	12.783
737	31.364	30.818	30.274	28.180	28.180	28.313	26.880	26.591	35.403	26.591
738	9.995.419	8.941.784	6.437.506	4.014.155	4.014.155	3.881.190	5.445.141	5.445.141	7.286.236	3.690.974
739	4.836.308	4.018.678	4.018.678	1.462.779	1.462.779	1.509.392	2.876.408	2.876.408	2.241.417	1.462.779
740	40.634	41.172	41.172	36.346	37.613	37.613	13.798	13.798	18.593	13.798
741	801.715	701.250	490.854	286.174	343.620	343.620	371.513	371.513	371.513	286.174
742	193.341	174.809	144.905	99.777	99.777	99.777	130.675	130.675	130.675	99.777
743	597.941	511.924	353.002	176.009	176.009	185.432	279.420	279.420	281.513	176.009
744	307.959	180.697	181.079	161.708	145.629	145.629	205.844	205.844	235.673	142.812
745	14.906	8.248	8.248	8.512	8.512	10.317	72.221	68.854	68.854	6.969
746	17.839	18.138	18.138	15.814	16.566	16.566	23.351	23.351	29.708	13.205
747	148.061	131.889	106.370	85.645	85.645	83.858	51.813	32.690	32.690	32.690
748	31.774	30.915	37.172	30.579	28.683	28.683	48.138	48.138	48.138	28.683
749	30.794	29.073	29.073	24.923	24.923	24.923	18.204	14.240	19.015	14.240
750	25.615	20.851	20.851	12.993	14.232	14.232	16.710	22.800	20.000	11.078
751	52.413	46.480	46.480	22.277	11.730	11.730	43.147	30.875	32.854	11.730
752	9.203	9.182	6.071	9.093	9.093	8.524	6.429	6.429	6.818	2.824
753	8.385	8.539	8.530	9.008	9.008	9.008	14.718	15.509	15.509	5.075
754	2.168.360	1.885.212	1.567.574	958.986	958.986	949.582	742.207	742.207	664.316	664.316
755	1.617.792	1.423.117	1.316.104	667.267	667.267	697.916	401.283	401.283	401.283	393.837
756	81.407	72.978	73.402	64.106	64.106	70.309	27.465	27.465	27.465	21.741
757	473.221	408.786	388.953	229.815	229.815	293.647	110.094	110.094	110.094	98.283
758	16.070	14.946	14.980	13.139	13.139	16.087	8.548	7.979	7.979	6.947
759	54.942	50.802	46.746	36.026	36.026	36.026	17.377	17.377	23.541	13.891
760	2.861.915	2.499.594	1.437.602	1.050.881	871.450	871.450	1.570.634	1.570.634	2.207.619	864.480
761	6.761.547	5.862.024	4.768.663	3.017.654	3.017.654	3.366.081	1.747.679	1.747.679	1.603.586	1.581.646
762	730.397	663.922	663.922	326.675	319.938	310.293	248.038	180.058	184.850	180.058
763	62.046	55.490	56.381	40.685	41.826	50.082	39.021	41.102	41.102	15.993

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
764	535.679	471.977	405.251	233.015	233.015	233.015	132.386	132.386	171.519	97.174
765	578.984	518.138	432.025	298.002	298.002	358.177	140.372	140.372	118.186	118.186
766	16.003	14.249	13.174	10.193	9.989	10.193	4.970	4.970	4.970	4.734
767	45.961	42.685	36.348	33.429	33.429	30.654	17.989	17.989	19.326	17.373
768	98.297	86.559	86.559	38.917	38.917	38.917	78.364	78.364	78.364	38.917
769	1.081.459	909.899	677.930	464.700	464.700	494.434	790.873	790.873	790.873	464.700
770	826.021	719.023	719.023	330.323	330.323	330.323	482.661	482.661	482.661	330.323
771	3.348	3.450	8.097	3.790	3.790	3.790	34.024	34.024	34.024	3.730
772	3.177	2.817	3.049	1.905	1.632	2.276	3.543	3.543	4.145	1.471
773	29.854	18.740	18.740	20.471	18.872	18.872	17.412	17.412	17.412	17.412
774	405.462	372.451	372.451	184.295	184.295	170.016	191.843	101.270	101.270	101.270
775	45.204	39.403	40.653	25.128	25.128	33.433	16.448	16.448	16.448	16.159
776	89.305	89.053	89.053	63.164	68.130	63.164	29.131	29.131	51.008	29.131
777	125.883	113.439	80.167	57.686	57.686	57.686	122.564	122.564	93.640	57.103
778	12.112	10.095	8.631	7.072	5.839	5.839	7.681	7.681	8.065	5.839
779	53.679	51.843	50.372	47.737	47.737	49.947	101.999	101.999	101.999	47.737
780	90.530	80.803	75.771	48.544	48.544	66.172	49.465	50.086	50.086	22.833
781	28.357	27.774	29.365	26.220	26.220	26.220	22.426	22.426	26.244	22.426
782	96.780	90.628	73.016	70.291	70.291	62.160	78.623	79.505	79.505	60.986
783	167.259	149.814	165.663	132.760	132.760	170.289	69.310	69.310	44.455	30.384
784	1.012.634	732.941	702.014	464.703	464.703	471.817	648.711	648.711	648.711	464.703
785	22.282	21.038	21.038	17.190	17.190	17.190	20.590	19.914	19.914	13.548
786	56.893	55.880	53.398	53.377	53.377	53.377	44.198	44.198	59.258	37.883
787	12.123	11.539	9.911	8.265	8.265	7.422	10.723	10.617	10.617	7.280
788	2.079.798	1.795.211	1.393.657	871.606	815.873	864.392	1.225.750	1.225.750	1.677.842	815.873
789	1.706.845	1.454.424	1.086.986	674.199	674.199	828.663	1.209.811	1.209.811	1.209.811	674.199
790	466.069	424.304	369.892	205.322	205.322	205.322	155.757	155.757	155.757	146.628
791	33.120	25.232	25.232	12.694	15.429	15.429	26.668	26.668	40.914	12.694
792	246.296	217.294	174.552	115.319	115.319	122.404	132.916	132.916	132.916	108.118
793	114.597	107.313	97.812	75.710	75.710	75.710	72.337	55.529	58.647	55.529
794	24.505	27.009	21.557	20.936	24.503	20.936	26.220	24.496	25.217	20.044
795	4.434	4.497	4.497	4.017	4.042	4.042	2.696	2.338	2.338	2.338
796	220.068	199.807	165.471	153.573	153.573	132.973	34.854	34.854	35.621	32.951
797	29.746	27.195	25.173	22.118	18.061	17.602	14.003	18.079	20.944	14.003
798	57.181	53.932	53.932	41.231	41.231	41.231	39.255	39.255	45.991	36.723
799	24.677	18.581	18.581	4.639	6.447	6.447	7.700	7.700	9.123	4.639
800	18.574	15.171	14.070	12.326	13.574	13.574	17.983	17.983	16.968	3.276
801	24.208	24.292	24.957	24.565	24.565	24.565	307.850	307.850	929.479	24.517
802	2.552	2.712	2.635	3.203	3.203	2.967	2.993	2.993	2.993	2.082
803	8.338	7.932	8.985	7.197	7.197	7.197	11.901	15.532	19.365	7.197
804	106.996	96.591	96.868	74.513	74.513	103.448	64.718	64.718	76.223	64.718
805	78.396	65.996	65.996	9.922	9.922	9.922	27.990	27.990	29.586	9.922
806	37.013	31.645	31.645	8.972	8.972	8.972	14.802	14.802	14.802	7.525
807	16.388	13.974	12.929	7.646	7.646	8.156	11.948	11.948	11.737	7.646
808	6.834	6.159	6.159	5.312	4.685	4.824	3.409	3.409	7.663	2.920
809	87.363	78.435	78.435	38.854	38.854	35.860	42.029	42.029	42.029	35.860
810	1.202.959	1.054.203	1.054.203	371.289	371.289	379.987	402.110	402.110	423.315	362.386
811	824.567	728.761	679.508	253.442	246.831	253.442	261.539	261.539	261.539	163.042
812	576.091	511.983	304.233	200.549	200.549	237.807	238.949	238.949	323.808	197.504
813	183.901	164.247	164.247	58.552	58.552	58.552	80.928	80.928	67.112	56.605
814	40.876	35.749	28.219	13.563	13.563	17.258	13.113	12.416	12.416	12.416
815	11.419	9.986	9.986	6.990	6.990	8.445	12.638	12.638	12.638	5.393
816	15.654	13.755	13.755	9.342	10.164	11.104	5.358	7.705	6.673	4.042
817	13.219	12.590	12.881	11.196	11.196	12.109	4.936	5.944	2.066	2.066
818	2.800	2.784	2.416	2.291	2.410	2.135	1.580	1.580	1.385	1.385

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
819	647.844	605.338	585.008	423.641	423.641	423.641	181.046	173.370	164.121	122.700
820	401.661	373.453	373.453	262.158	262.158	262.158	104.934	104.934	104.345	91.026
821	87.986	82.663	82.663	57.921	57.921	57.921	42.495	40.398	40.398	23.443
822	20.319	18.547	20.942	13.549	13.549	13.823	18.789	18.789	18.789	8.303
823	16.040	15.150	13.891	11.698	11.698	11.698	7.792	16.266	16.266	7.792
824	149.163	145.843	145.843	131.349	131.349	131.349	160.062	160.062	182.175	121.737
825	60.936	53.002	53.002	15.646	15.646	15.646	43.774	43.774	32.101	15.646
826	26.132	23.446	20.242	10.236	7.974	7.974	13.940	13.940	16.317	7.552
827	10.400	9.198	7.983	4.187	4.187	4.964	9.135	9.135	9.135	4.187
828	6.072	5.765	4.455	4.043	4.043	3.850	3.590	3.590	5.787	3.590
829	1.911	1.223	1.254	1.610	1.610	1.273	2.063	2.063	2.336	1.110
830	21.814	19.421	16.675	12.373	12.373	13.997	11.534	11.534	10.429	10.429
831	826.309	721.263	533.513	369.529	369.529	359.664	257.227	228.102	190.140	190.140
832	593.948	523.659	523.659	267.562	267.562	267.067	187.518	187.518	162.381	150.690
833	315.766	275.577	215.191	118.043	118.043	110.288	117.941	117.941	117.941	98.451
834	104.761	93.340	88.421	44.534	44.534	45.862	34.582	34.582	34.939	34.582
835	29.566	26.154	23.010	10.155	10.155	10.155	9.517	9.517	8.691	7.393
836	4.494	5.031	4.909	4.203	4.203	5.074	6.592	6.404	5.941	4.203
837	1.573	1.096	1.125	1.072	978	978	796	796	927	796
838	996	985	1.018	930	930	930	1.001	1.001	1.324	930
839	17.727	15.357	16.017	18.155	14.213	14.515	15.594	13.976	13.976	13.867
840	9.114	7.869	7.869	5.691	5.639	5.639	5.351	5.709	5.351	5.351
841	4.827	4.416	4.416	3.985	3.985	4.044	4.705	4.705	4.918	3.956
842	1.200	616	660	627	627	531	2.132	2.132	2.284	519
843	4.498	3.471	3.471	2.746	1.696	1.696	4.406	4.233	4.233	1.587
844	4.038	3.286	3.057	2.366	2.663	1.572	2.470	2.470	3.356	1.506
845	2.001	1.775	1.775	815	815	777	640	640	702	640
846	4.268	3.620	3.298	1.605	1.406	1.406	2.670	2.670	2.670	1.406
847	1.356	1.192	1.192	650	650	650	1.014	1.070	1.070	650
848	2.168	1.963	1.481	1.144	953	953	1.023	1.023	1.015	953
849	2.182	1.663	1.663	555	689	703	1.725	1.725	1.379	504
850	10.893	8.970	8.970	4.783	4.084	4.783	6.986	6.986	6.986	3.437
851	5.657	4.937	2.522	1.555	1.555	1.495	2.698	2.698	2.698	1.440
852	3.262	2.854	2.854	1.184	1.230	1.184	1.583	1.583	1.583	1.150
853	8.541	7.145	4.059	2.767	2.767	3.054	5.002	5.002	4.919	2.767
854	4.263	3.381	2.940	1.540	1.789	1.789	1.560	1.681	1.681	1.049
855	1.354	1.072	1.072	619	619	619	579	647	639	523
856	708	628	586	605	605	558	406	406	408	401
857	2.358	2.081	2.081	935	935	991	956	727	727	727
858	8.768	6.288	6.288	3.049	3.049	3.704	6.449	6.449	6.449	1.610
859	1.609	1.464	1.464	928	928	917	1.398	1.398	1.072	908
860	1.491	1.404	1.048	1.020	894	641	699	699	699	641
861	1.295	1.142	1.151	934	947	947	1.336	1.336	1.336	932
862	11.332	10.831	12.215	9.454	9.454	12.438	9.692	9.692	9.692	9.454
863	1.917	1.764	1.763	1.801	2.132	1.618	1.836	1.858	1.890	1.618
864	11.688	8.717	8.717	2.796	2.379	2.087	5.059	4.737	4.737	2.051
865	4.193	3.484	3.484	1.281	1.393	1.469	2.353	2.353	2.353	1.049
866	417	416	347	251	251	251	577	577	822	251
867	13.577	12.104	9.612	6.738	6.738	6.738	10.061	10.061	10.061	6.719
868	5.437	4.814	4.814	1.977	1.977	1.977	5.068	5.068	4.193	1.784
869	4.168	3.733	3.733	1.904	1.904	2.028	3.662	3.662	3.662	1.621
870	818	738	738	581	580	586	632	632	637	580
871	4.594	4.054	2.935	2.058	2.058	2.053	2.691	2.691	2.779	2.051
872	1.511	1.300	1.203	597	597	616	996	1.130	1.130	597
873	1.534	1.386	1.085	865	865	865	900	900	909	823

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Cod e	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
874	1.549	994	855	534	558	558	590	590	818	531
875	7.029	6.100	5.756	3.340	3.676	3.676	5.889	5.889	5.889	1.824
876	3.079	2.619	2.024	1.341	1.299	1.287	1.937	1.937	1.755	1.287
877	2.180	1.925	1.418	1.000	1.000	1.124	1.408	1.408	1.624	1.000
878	7.002	6.121	4.431	2.519	1.786	1.881	1.906	1.906	2.461	1.786
879	3.716	3.191	1.918	1.297	1.143	1.143	1.315	1.315	2.084	1.143
880	1.517	1.373	1.373	800	530	530	487	487	771	487
881	425	353	466	401	456	456	295	296	531	295
882	1.180	1.203	1.203	894	949	949	1.300	1.300	1.790	778
883	5.713	4.583	4.347	2.184	2.184	3.344	2.901	2.901	5.431	1.013
884	682	608	421	299	299	229	507	502	488	222
885	1.798	3.233	3.233	1.345	3.170	3.170	2.775	2.775	2.775	1.345
886	3.448	2.743	2.592	2.162	2.305	2.305	2.585	2.762	2.762	2.064
887	358	308	291	283	256	216	438	438	438	216
888	10.352	9.109	4.644	2.832	2.832	3.060	4.413	4.413	4.528	2.832
889	2.611	2.111	2.211	745	892	892	1.474	1.474	1.680	695
890	878	901	1.016	634	592	582	598	598	1.094	582
891	10.174	9.123	9.123	4.442	4.442	4.442	6.420	6.420	7.461	4.442
892	689	628	507	353	397	397	322	322	507	322
893	3.084	2.603	2.603	1.010	915	915	1.588	1.588	1.284	915
894	1.876	1.359	1.359	446	402	446	661	661	913	337
895	350	314	314	228	228	228	192	192	177	137
896	588	600	436	339	339	575	382	382	382	290
897	2.088	1.713	1.399	415	415	491	497	497	803	394
898	1.731	1.507	1.132	648	648	704	665	734	1.000	648
899	542	511	511	398	398	397	358	358	694	358
900	1,366.400 11.339.207	1,274.292	1,287.681	1,009.252	1,108.465	1,197.561	640.852	640.852	983.105	640.852
901	841.535	708.832	699.118	483.784	566.556	566.556	367.225	367.225	503.218	245.498
902	314.896	255.299	246.379	139.728	139.728	203.140	81.933	81.933	81.933	79.780
903	74.644	67.536	67.536	54.742	54.742	57.169	28.208	28.208	38.757	25.473
904	21.677	18.285	20.776	14.826	15.470	15.470	12.880	12.880	17.893	12.839
905	97.802	81.017	80.904	46.730	51.833	46.730	36.299	27.784	27.784	27.784
906	20.122	19.751	19.078	17.276	17.276	13.136	20.265	20.265	20.265	12.538
907	6.107	6.912	3.970	4.824	4.824	3.757	4.902	5.421	6.021	2.511
908	143.620	126.200	126.200	82.106	95.001	82.106	164.505	164.505	144.865	77.827
909	5.432	5.151	4.899	4.097	4.486	4.097	8.789	8.789	8.193	2.353
910	5.118	5.027	6.109	4.179	4.592	4.592	2.621	2.621	5.112	2.621
911	1.526	1.376	1.488	1.182	1.251	1.251	4.246	4.246	4.246	1.182
912	7.117	6.972	7.123	6.404	6.311	6.311	6.903	6.903	7.189	5.758
913	8.679	9.029	9.066	8.771	8.978	8.978	7.466	7.466	7.466	7.466
914	1.823	1.788	1.855	1.851	1.783	1.783	6.286	5.880	6.286	1.774
915	44.597	40.887	40.887	18.836	16.790	16.790	34.551	34.551	34.551	16.790
916	44.098	46.170	46.170	52.487	52.064	53.365	31.962	31.962	39.375	31.962
917	4.339	4.030	3.102	2.764	2.527	2.527	2.436	2.436	2.436	2.436
918	41.881	38.895	38.895	27.373	31.427	33.345	43.572	43.572	50.552	26.416
919	11.887	11.591	11.713	10.154	10.154	11.106	10.880	10.880	16.951	10.154
920	3.595	4.098	6.342	4.452	4.452	4.452	3.045	3.060	3.580	3.045
921	36.550	35.558	41.725	31.832	31.832	35.810	29.144	29.144	29.144	29.144
922	663	666	656	637	662	653	959	959	959	548
923	1.654	1.817	1.520	1.371	1.513	1.513	2.027	2.027	2.027	1.005
924	829	901	1.043	524	599	599	813	813	623	489
925	3.331	3.141	3.141	2.734	2.802	2.739	2.559	2.559	2.559	2.559
926	22.681	20.756	22.053	18.127	18.127	22.686	11.111	11.111	10.227	10.227
927	86.257	69.760	69.760	40.571	43.100	61.611	36.494	36.494	36.929	36.494

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
929	53.124	52.577	55.874	40.218	41.825	57.383	25.637	25.637	47.673	25.637
930	54.736	55.276	55.276	43.686	49.909	53.796	41.472	50.323	50.418	34.914
931	140.009	126.049	126.049	99.859	100.851	99.513	69.221	69.221	70.587	51.414
932	21.440	19.483	19.483	12.462	12.462	14.840	8.900	8.716	8.900	8.716
933	320.498	280.625	280.625	192.764	192.764	266.128	98.441	98.441	152.998	77.925
934	25.191	22.235	21.286	16.068	16.068	17.592	18.074	18.074	15.262	13.350
935	50.874	58.412	58.412	37.946	37.946	37.946	17.373	17.373	17.373	17.316
936	9.366	8.224	6.224	4.933	4.933	4.459	5.842	5.842	6.305	4.459
937	1.781	1.948	2.217	1.622	1.920	1.720	1.332	1.332	2.163	1.332
938	2.317	2.289	2.603	1.967	2.110	2.110	7.513	7.513	10.227	1.960
939	11.189	11.082	11.082	10.786	10.786	10.786	21.463	21.463	37.838	10.786
940	1.768	1.681	1.740	1.189	1.189	1.349	3.997	3.997	4.481	1.189
941	15.200	14.849	14.849	13.254	13.566	12.544	14.089	14.089	16.737	12.514
942	25.428	23.282	24.089	18.716	19.750	19.750	22.054	22.403	20.170	18.716
943	3.229	2.618	2.748	2.110	2.110	2.380	2.123	2.123	2.123	2.110
944	3.217	3.433	3.529	4.126	4.126	4.126	4.076	4.144	5.745	2.424
945	32.338	29.389	29.389	21.916	23.574	23.574	24.592	26.302	29.321	21.916
946	417	424	410	446	446	446	243	243	701	156
947	29.700	24.274	24.274	18.710	21.360	26.712	26.560	26.560	26.560	17.770
948	10.212	9.786	9.786	7.670	7.670	9.773	11.172	11.172	11.172	7.670
949	1.275	1.109	1.109	549	578	670	714	714	714	549
950	5.699	5.035	5.035	1.872	1.872	1.872	2.430	2.430	2.430	1.800
951	401	412	412	458	458	458	381	381	366	355
952	7.547	6.439	6.439	1.744	1.611	1.609	2.042	2.042	2.177	1.609
953	4.611	3.978	3.978	1.530	1.582	1.678	2.611	2.611	2.611	1.530
954	1.240	1.015	1.118	802	802	978	728	728	728	604
955	495	465	468	341	341	463	551	551	590	341
956	1.480	1.241	1.241	580	580	580	926	926	845	506
957	920	873	859	677	677	433	728	728	728	427
958	434	397	397	330	330	330	602	467	602	330
959	11.077	8.523	8.523	6.957	6.957	7.513	66.582	54.970	57.517	6.833
960	6.146	5.646	5.646	4.254	4.254	4.783	13.819	13.819	22.208	4.062
961	25.586	24.039	23.308	20.418	22.246	22.246	87.584	87.584	87.584	18.421
962	278	299	299	276	297	297	364	364	409	269
963	176	191	210	239	239	239	35	33	136	33
964	22.466	16.388	15.848	11.125	10.925	10.781	9.964	10.696	10.505	7.193
965	29.415	27.439	25.114	19.721	19.721	19.721	21.861	21.861	21.861	18.447
966	775	1.339	1.339	839	898	622	1.902	1.902	2.068	622
967	7.098	6.656	6.656	4.729	4.729	4.729	5.161	5.161	5.161	4.727
968	1.130	1.189	1.103	1.008	1.008	1.028	1.180	1.180	1.542	995
969	14.001	13.933	13.933	13.693	13.693	13.693	16.398	16.398	15.171	13.423
970	53.452	46.148	46.148	29.109	29.109	30.184	38.016	33.508	31.169	28.870
971	9.739	9.260	8.324	7.868	8.824	8.821	8.629	8.629	8.629	7.699
972	40.652	45.376	52.346	37.467	46.960	49.943	29.502	25.852	26.393	25.852
973	18.830	13.968	13.640	14.232	11.397	11.397	11.298	12.114	13.209	11.265
974	10.369	10.041	10.002	9.952	10.021	10.021	9.515	9.515	13.042	9.515
975	3.243	3.212	3.212	3.225	3.196	3.196	5.512	5.512	14.009	3.191
976	9.164	9.139	8.883	8.949	9.042	9.042	10.322	10.678	12.889	8.477
977	753	806	809	964	964	964	588	552	594	525
978	8.019	9.871	9.871	7.811	8.967	8.967	8.266	8.266	7.723	7.406
979	25.106	25.437	25.437	20.792	21.628	21.628	17.631	21.388	21.616	17.631
980	21.954	23.765	23.765	19.753	20.722	20.722	16.270	15.306	15.083	15.083
981	1.154	1.124	1.164	1.331	1.317	1.317	1.005	1.005	1.005	1.005
982	12.839	13.964	11.467	11.400	13.109	11.392	16.904	17.629	22.118	10.898
983	5.351	5.529	5.529	4.965	5.133	5.133	5.298	5.367	5.954	4.632

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
984	42.000	53.282	53.282	43.514	46.509	37.517	34.790	28.773	35.934	28.773
985	11.552	11.679	11.679	9.265	10.420	10.420	8.588	8.588	8.748	8.588
986	39.036	38.525	38.525	34.456	36.260	36.260	39.600	44.488	46.598	30.093
987	20.056	19.534	18.060	17.932	17.932	18.819	21.524	23.357	23.355	16.922
988	2.588	2.608	2.608	2.523	2.580	2.580	6.516	6.465	7.580	2.227
989	3.723	3.698	3.825	3.628	3.628	3.673	13.717	13.717	19.285	3.628
990	131.374	130.716	138.597	128.370	128.370	128.370	170.516	170.984	170.516	125.289
991	6.357	6.369	6.369	6.409	6.409	6.409	6.514	6.514	7.467	6.401
992	119	110	110	115	115	115	51	51	111	47
993	17.594	16.241	16.241	10.916	10.916	10.373	7.190	6.912	8.669	6.912
994	18.225	17.000	17.000	12.865	13.198	10.503	13.928	13.928	11.057	10.503
995	1.739	1.735	2.007	1.507	1.629	1.629	1.422	1.422	1.644	1.422
996	7.921	7.453	7.453	7.016	7.016	7.016	8.289	8.299	8.289	6.623
997	7.083	6.890	6.890	5.997	6.308	5.997	6.740	6.720	6.720	5.983
998	3.297	2.850	2.850	2.622	2.622	2.548	2.730	2.730	2.730	2.548
999	8.413	6.390	5.055	4.180	4.180	4.647	4.467	4.419	4.419	4.147
1000	1.140	1.174	1.174	1.042	1.082	1.082	723	723	1.035	723
1001	618	530	582	523	506	510	752	744	782	506
1002	1.577	1.570	1.767	1.190	1.368	1.209	919	790	790	790
1003	2.612	2.703	2.825	2.331	2.331	2.117	3.231	3.198	3.663	2.117
1004	716	684	684	692	692	706	818	824	983	682
1005	120	123	123	132	132	123	203	203	268	108
1006	2.613	2.608	2.567	2.409	2.429	2.542	3.951	3.951	4.521	2.409
1007	45.049	41.874	45.237	37.033	37.033	37.033	49.024	46.687	48.680	35.900
1008	1.664	1.630	1.630	1.485	1.482	1.598	2.137	2.137	2.137	1.482
1009	1.538	1.531	1.570	1.475	1.447	1.447	2.268	2.268	2.945	1.447
1010	2.021	1.865	2.128	1.322	1.322	1.322	1.701	1.369	1.369	1.220
1011	53.196	48.639	48.639	35.437	35.437	36.286	42.044	42.044	45.764	34.949
1012	57.887	53.251	46.397	42.858	42.858	42.858	49.351	49.351	49.254	41.655
1013	7.102	6.830	6.905	5.747	5.747	5.747	4.988	4.988	4.988	4.988
1014	20.537	18.567	14.410	12.433	12.811	11.687	14.160	13.337	12.173	11.293
1015	3.942	3.981	3.981	3.721	3.709	3.709	3.340	3.340	6.825	3.340
1016	17.331	16.360	15.234	13.955	13.955	13.955	15.121	15.121	14.714	13.658
1017	9.585	8.901	9.079	8.690	8.675	8.675	14.786	12.872	12.872	8.433
1018	22.144	20.382	20.382	14.153	14.153	13.472	16.989	16.989	14.867	13.472
1019	1.480	1.415	1.354	782	743	743	1.809	1.809	1.809	743
1020	3.518	3.331	3.180	2.845	2.846	3.169	2.951	2.951	2.951	2.845
1021	95	96	90	86	88	92	89	89	93	85
1022	452	550	550	408	514	514	734	734	724	343
1023	756	732	738	673	673	673	684	684	899	673
1024	6.231	5.074	4.973	4.785	5.320	4.467	5.500	5.500	5.500	4.467
1025	7.523	7.703	7.703	6.656	6.774	6.774	6.080	6.080	6.080	6.080
1026	2.284	2.207	2.207	1.906	1.946	1.946	1.766	1.766	3.112	1.766
1027	2.607	2.566	2.840	2.396	2.390	2.422	2.114	2.114	2.114	1.912
1028	353	358	360	381	381	381	588	588	576	329
1029	4.857	4.540	4.049	3.183	3.183	3.270	3.647	3.647	3.624	3.183
1030	105.115	93.396	81.398	60.359	60.359	60.359	76.524	76.524	72.349	59.828
1031	2.932	2.665	2.665	1.586	1.679	1.854	3.128	3.128	3.566	1.491
1032	710	701	701	662	673	673	802	802	954	624
1033	661	666	670	669	669	650	881	881	1.071	650
1034	6.146	5.908	6.625	5.355	5.355	6.690	6.138	6.138	8.587	5.355
1035	495	525	694	545	545	753	683	683	683	529
1036	424	421	420	409	402	399	381	381	486	381
1037	1.534	1.494	1.751	1.435	1.435	1.573	2.952	2.952	4.064	1.435
1038	8.912	8.190	8.190	5.533	5.533	5.638	4.905	4.905	6.033	4.905

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1039	539	525	525	464	476	443	1.155	1.155	1.761	411
1040	3.367	3.320	3.531	3.273	3.403	3.403	4.748	4.748	4.748	3.064
1041	1.618	1.555	1.509	1.431	1.523	1.570	2.246	2.246	2.246	1.348
1042	375	371	390	376	380	380	310	310	433	272
1043	3.072	2.990	2.977	2.927	2.927	2.927	2.466	2.429	2.592	2.429
1044	2.709	2.644	2.644	2.400	2.400	2.400	2.179	2.179	2.935	2.069
1045	1.051	1.052	1.226	1.102	1.102	1.102	677	677	828	677
1046	2.637	3.212	3.212	3.084	3.084	3.464	3.831	3.919	4.074	2.858
1047	1.115	1.207	1.140	1.206	1.178	1.178	1.481	1.481	2.083	1.090
1048	304	313	259	287	287	298	234	234	234	234
1049	553	555	555	525	534	534	523	523	523	523
1050	145	144	143	140	140	140	791	791	1.296	137
1051	1.191	1.023	1.021	1.113	1.134	1.007	1.149	1.123	1.123	1.007
1052	6.127	6.027	5.938	4.747	4.747	5.779	6.534	6.534	6.534	4.598
1053	289	276	280	271	271	270	411	411	388	270
1054	563	566	551	532	532	566	656	607	722	532
1055	333	332	333	328	327	327	291	291	291	291
1056	58.950	55.722	44.200	42.511	42.511	39.330	45.933	45.933	47.547	39.208
1057	58.336	52.316	40.604	36.134	36.134	35.547	41.616	41.616	42.637	34.172
1058	8.117	7.584	7.137	3.609	3.463	3.730	4.046	4.046	4.078	3.463
1059	18.626	16.230	16.023	14.175	14.175	14.953	15.093	13.865	14.488	13.865
1060	3.584	3.465	4.516	3.107	3.107	4.991	3.932	3.932	3.932	3.107
1061	19.534	18.253	18.253	14.303	14.303	14.303	16.858	16.858	16.858	13.968
1062	12.310	11.244	11.244	13.616	13.616	14.484	22.650	22.650	26.179	11.366
1063	26.182	20.420	22.525	17.937	17.937	17.280	15.338	15.338	18.301	15.338
1064	2.892	2.808	2.728	2.423	2.489	2.489	7.360	7.360	11.960	2.423
1065	4.136	3.905	3.905	3.003	3.003	2.823	3.077	3.077	3.961	2.823
1066	6.725	6.402	5.518	5.247	5.379	5.009	4.770	4.770	5.283	4.556
1067	9.598	9.879	9.879	8.154	8.604	7.513	4.924	4.924	5.028	4.457
1068	3.368	3.305	3.156	2.987	3.047	3.047	3.414	3.414	3.414	2.987
1069	5.345	4.880	5.695	4.537	4.537	5.399	5.991	6.200	6.405	4.467
1070	109.508	73.563	73.563	64.668	64.668	58.645	76.712	74.446	75.549	58.645
1071	1.208	1.148	1.139	1.189	1.155	1.155	1.311	1.311	1.311	1.153
1072	3.667	3.161	3.167	3.633	3.782	2.871	6.445	6.445	8.490	2.871
1073	453	455	455	398	408	408	779	779	1.588	391
1074	479	480	486	459	459	459	584	474	548	449
1075	4.549	3.936	3.907	3.313	3.313	4.403	6.106	6.106	6.106	3.295
1076	513	516	516	528	528	528	712	712	915	526
1077	1.329	1.450	1.379	1.296	1.274	1.274	1.138	1.138	3.137	1.138
1078	9.422	8.943	8.943	7.628	7.628	8.543	7.948	7.948	9.019	7.628
1079	635	600	903	568	606	606	618	618	618	458
1080	42.028	29.361	28.514	26.529	26.529	24.590	31.430	37.622	40.411	24.498
1081	45.796	30.099	30.099	31.255	26.910	29.059	44.161	37.049	37.049	26.910
1082	4.243	3.830	3.811	3.300	3.300	3.901	7.178	7.178	10.037	3.300
1083	13.949	12.236	10.213	6.305	6.305	6.319	8.822	8.822	8.822	6.305
1084	3.368	3.351	3.351	3.149	3.160	3.160	2.389	2.389	2.389	2.389
1085	11.858	7.137	7.535	8.555	6.587	6.637	9.174	7.598	8.533	6.587
1086	8.884	8.190	8.190	7.145	7.145	7.546	9.865	9.161	10.386	6.995
1087	16.228	14.307	12.001	8.722	8.722	8.304	12.311	12.311	10.651	8.304
1088	3.665	3.560	4.298	3.539	3.539	3.539	5.348	5.348	6.939	3.511
1089	2.878	2.683	2.297	2.244	2.244	2.217	2.509	2.509	2.197	2.197
1090	969	977	1.345	1.005	1.005	1.005	1.795	1.795	2.207	1.000
1091	9.037	8.587	8.498	7.537	7.537	7.537	8.065	8.065	8.065	7.395
1092	6.267	6.032	5.726	5.001	4.996	4.996	6.321	6.321	7.259	4.996
1093	819	807	838	765	765	777	1.321	1.321	1.637	765

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1094	1.444	1.455	1.175	1.182	1.182	1.078	1.382	1.382	1.703	1.078
1095	1.730	1.867	1.867	1.381	1.452	1.452	1.386	1.386	1.505	1.355
1096	908	906	1.049	900	900	900	1.127	1.035	1.161	900
1097	5.727	5.345	5.180	3.940	3.940	4.182	5.008	5.008	5.008	3.940
1098	93.933	77.452	60.025	56.324	50.185	52.538	109.583	102.183	109.312	50.185
1099	808	831	853	872	892	892	860	860	1.115	812
1100	2.271	1.758	1.761	1.527	1.527	1.527	2.250	2.250	2.250	1.473
1101	893	862	862	724	724	724	3.466	3.466	5.056	714
1102	4.887	4.101	4.101	4.049	3.916	3.916	7.501	7.501	8.294	3.706
1103	455	463	578	493	493	655	1.968	1.968	3.682	484
1104	310	347	347	324	328	328	419	419	822	291
1105	7.684	7.103	7.103	5.001	5.001	4.155	5.919	5.919	5.919	4.060
1106	286	304	304	358	358	358	7	7	9	7
1107	158	164	164	185	185	185	181	181	267	181
1108	270	279	278	306	306	308	374	374	374	236
1109	121.688	66.225	66.225	45.415	45.415	42.376	90.504	90.504	61.739	40.700
1110	53.564	47.865	27.487	22.380	24.547	20.548	30.101	30.101	36.399	20.317
1111	5.203	5.220	4.652	4.377	4.599	4.599	4.672	4.672	4.672	4.195
1112	39.164	35.387	32.219	19.978	18.609	17.458	18.780	18.780	20.509	17.458
1113	23.321	21.164	15.080	13.732	13.732	12.898	13.914	12.803	17.787	11.973
1114	146.139	130.735	130.735	64.312	66.747	66.747	79.576	79.576	98.440	63.400
1115	69.240	53.662	53.662	39.444	41.133	41.133	47.796	47.796	48.799	39.444
1116	2.481	2.068	2.381	2.275	2.550	1.919	3.722	3.722	3.722	1.919
1117	47.170	41.030	41.030	24.121	29.337	34.295	37.929	37.929	37.929	20.468
1118	32.089	31.671	31.671	18.933	18.733	21.272	31.593	21.338	21.898	18.733
1119	3.421	3.531	3.440	2.795	3.474	3.474	1.219	1.219	3.863	1.219
1120	117.940	127.395	127.395	86.977	97.108	97.108	82.086	82.086	74.699	73.429
1121	65.802	60.085	58.021	44.398	44.398	47.991	43.008	43.008	36.224	36.224
1122	9.508	9.451	9.451	9.330	9.330	9.330	11.437	11.587	11.710	9.233
1123	49.586	44.073	44.073	33.580	33.773	33.773	29.401	29.401	29.401	29.401
1124	38.092	35.519	26.300	23.418	22.821	22.821	26.774	26.774	26.774	20.179
1125	70.382	72.680	55.582	56.335	60.085	50.908	59.515	59.515	60.982	49.609
1126	29.512	26.710	26.710	19.021	20.607	20.607	13.302	13.302	11.844	11.108
1127	25.503	23.779	20.207	21.435	21.435	24.003	27.473	27.473	34.368	18.140
1128	25.243	24.312	22.166	21.821	26.158	26.158	24.626	24.626	29.395	19.539
1129	375	398	398	468	468	468	30	27	201	27
1130	15.601	16.380	16.380	15.550	15.968	15.968	14.759	14.759	21.275	14.759
1131	932	864	924	1.134	1.134	798	2.153	2.153	2.147	720
1132	922	1.012	1.004	918	918	918	1.553	1.604	1.635	918
1133	7.778	7.856	10.784	8.167	8.167	12.185	16.690	16.690	49.926	8.106
1134	18.663	18.748	25.113	20.090	20.090	26.419	248.581	212.724	323.700	19.784
1135	5.469	5.501	5.535	5.711	5.598	5.598	4.165	4.165	4.165	4.165
1136	1.007	1.012	1.012	1.027	1.027	1.027	1.073	1.073	1.073	982
1137	5.739	5.603	5.603	4.435	5.361	5.361	7.004	7.048	7.048	4.435
1138	6.999	7.230	7.466	6.818	6.818	6.818	3.169	3.169	11.437	3.169
1139	6.866	7.107	8.545	8.059	8.059	10.544	5.643	5.643	6.457	5.643
1140	11.634	11.233	11.233	9.739	9.739	9.739	10.948	10.948	12.389	9.739
1141	6.729	7.425	9.745	7.949	7.949	7.949	8.292	8.292	11.775	7.425
1142	3.245	3.204	3.914	2.761	2.792	3.407	4.720	4.720	4.973	2.761
1143	2.445	2.330	2.330	1.971	1.971	1.971	2.479	2.479	2.841	1.971
1144	113.542	113.600	123.651	138.804	136.432	153.887	133.523	133.177	133.177	115.138
1145	64.919	65.086	73.645	52.737	58.266	78.865	51.572	51.572	51.218	50.938
1146	3.583	4.318	3.642	3.466	3.466	4.011	5.857	5.857	6.553	3.403
1147	42.844	42.052	42.052	34.868	39.534	39.534	45.401	45.401	45.401	31.569
1148	1.540	1.615	1.615	1.661	1.661	1.723	1.338	1.338	1.734	1.338

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1149	34.794	31.968	32.689	27.045	30.402	30.402	31.095	31.095	37.818	27.045
1150	629.563	445.060	423.275	434.844	434.844	374.743	411.576	377.647	380.828	374.679
1151	356.084	323.862	272.794	264.389	264.389	240.353	243.842	235.079	237.468	235.079
1152	30.329	28.772	26.130	23.005	23.005	21.828	22.132	22.132	27.267	20.383
1153	242.965	238.000	238.000	182.828	182.828	182.828	178.306	178.306	182.478	162.862
1154	18.024	17.231	13.858	13.277	12.223	11.356	13.900	14.528	14.528	11.356
1155	210.744	212.015	212.015	163.930	163.930	133.845	143.529	145.200	134.507	126.068
1156	3.844	4.061	4.197	3.000	3.148	3.032	2.151	2.151	2.050	2.050
1157	188.231	173.363	173.363	109.263	109.263	103.420	98.634	98.634	92.885	90.523
1158	101.218	93.951	93.951	62.225	57.072	57.072	52.747	52.747	58.520	52.747
1159	5.346	4.964	4.964	3.789	3.789	3.789	3.141	3.127	3.193	3.098
1160	76.267	70.595	56.343	50.402	50.402	47.418	46.844	42.938	43.373	42.938
1161	59.671	56.190	45.839	41.119	38.666	38.666	33.041	33.041	36.156	33.041
1162	1.374	1.357	1.438	1.302	1.302	1.302	2.049	2.049	3.536	1.302
1163	9.162	8.538	8.917	8.395	8.395	8.395	64.093	64.093	248.214	8.395
1164	11.212	8.718	8.718	8.829	8.393	9.435	7.264	7.264	7.761	7.264
1165	110.411	104.426	104.426	96.878	103.927	87.314	89.012	88.516	81.018	81.018
1166	84.364	79.387	79.387	62.032	67.836	67.836	69.466	69.801	63.078	57.522
1167	11.273	11.289	11.289	10.800	10.902	10.902	8.612	8.612	10.878	8.276
1168	37.917	29.292	29.152	30.032	25.334	25.334	30.134	30.134	30.134	25.334
1169	3.163	2.433	2.381	2.527	2.809	2.809	2.656	2.648	3.134	2.208
1170	59.454	62.697	62.697	55.464	55.464	55.464	59.130	59.130	59.623	52.573
1171	13.468	13.815	13.876	12.245	12.635	13.524	74.272	74.272	146.285	11.754
1172	5.410	5.846	5.846	4.768	5.512	5.752	6.835	9.300	8.657	4.014
1173	92	96	97	113	113	113	131	89	119	80
1174	4.652	5.445	5.399	4.670	4.670	5.467	8.993	8.993	11.384	4.657
1175	12.126	12.548	12.384	12.569	12.811	12.267	53.989	53.989	250.677	10.717
1176	6.960	7.069	6.516	6.476	6.900	7.494	30.065	30.065	49.375	5.703
1177	5.023	6.192	5.669	5.128	6.003	6.003	20.047	20.047	29.198	5.042
1178	4.566	4.148	4.196	3.639	3.639	3.635	4.229	4.229	3.923	3.635
1179	42.576	39.562	25.267	22.006	22.562	23.750	24.507	24.507	31.602	22.006
1180	52.145	48.424	45.686	28.427	29.515	29.515	28.196	28.196	31.339	28.167
1181	31.579	29.636	22.127	21.360	22.669	18.678	15.639	15.639	15.639	15.639
1182	17.561	15.932	15.932	10.050	10.050	10.050	12.932	12.243	12.243	10.050
1183	36.734	26.541	26.541	23.287	21.930	21.802	33.424	33.031	33.031	21.802
1184	63.114	57.667	49.299	45.730	42.336	42.336	52.896	52.896	54.973	42.336
1185	188.602	117.741	91.481	64.062	57.340	57.340	99.412	99.412	90.638	57.340
1186	21.349	15.927	14.775	9.807	9.612	9.612	13.969	15.794	14.878	9.612
1187	47.001	42.246	63.657	31.871	31.871	38.904	23.936	22.532	22.532	22.532
1188	56.250	46.834	44.096	32.544	32.544	37.210	34.844	34.844	34.844	32.544
1189	37.592	29.021	29.021	29.012	25.111	25.111	46.767	46.570	47.710	25.111
1190	265.164	265.782	382.934	233.462	323.782	323.782	228.953	228.953	301.860	228.953
1191	413	399	416	352	352	352	361	491	516	352
1192	49.006	49.275	49.275	48.246	48.823	48.823	40.100	40.100	36.532	36.312
1193	331.313	291.027	291.027	145.361	145.361	145.361	135.851	135.851	135.851	125.273
1194	122.134	111.552	111.552	61.832	50.700	51.352	48.993	48.993	92.853	48.993
1195	64.917	63.110	63.110	23.239	23.342	25.587	25.231	23.228	24.533	23.228
1196	6.363	5.953	6.141	4.987	4.987	4.987	5.941	6.396	5.462	4.987
1197	4.478	3.959	3.611	4.035	4.573	5.371	16.763	16.763	20.720	3.604
1198	155.905	112.608	112.608	94.634	94.634	91.998	122.317	122.317	128.986	81.894
1199	3.086	2.991	2.916	3.035	2.920	2.968	4.164	4.164	5.474	2.896
1200	48.189	36.439	32.475	27.739	30.202	28.786	32.912	31.977	31.977	27.739
1201	55.669	43.716	43.176	38.997	38.997	39.291	28.576	23.245	22.507	22.507
1202	41.436	44.977	42.730	38.468	40.550	40.550	40.402	40.402	40.402	36.645
1203	23.803	22.819	22.819	20.155	20.155	21.841	35.989	35.989	35.989	20.155

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1204	17.336	12.954	12.954	9.945	9.945	9.945	12.105	12.105	12.331	9.796
1205	2.616	1.520	2.495	2.108	2.108	1.263	2.740	2.340	2.167	1.263
1206	8.563	8.798	6.748	8.139	9.356	9.356	9.525	9.525	8.162	6.596
1207	90.620	74.761	74.761	43.930	43.930	43.930	63.790	63.790	63.790	43.930
1208	1.036	1.105	1.128	929	1.002	1.091	1.023	1.023	1.023	754
1209	14.357	10.772	13.892	12.278	12.278	12.278	15.186	15.186	19.184	10.852
1210	12.313	12.643	12.643	10.972	11.605	12.942	11.489	11.489	11.489	10.310
1211	7.494	6.043	6.759	5.082	5.082	5.407	4.840	4.840	5.564	4.840
1212	4.835	4.478	4.478	2.901	2.901	2.822	4.398	4.398	5.475	2.817
1213	579	564	564	508	508	508	907	907	1.462	448
1214	825	784	823	624	648	671	830	830	830	624
1215	5.024	6.216	6.036	5.589	5.589	5.575	10.586	10.586	12.386	5.044
1216	1.117	1.053	1.053	1.086	971	971	1.054	1.054	1.817	971
1217	2.111	2.092	2.234	2.044	2.044	2.221	1.931	1.876	1.893	1.842
1218	1.326	1.306	1.357	1.217	1.227	1.227	1.801	1.801	1.801	1.213
1219	190	245	233	208	216	216	246	246	219	177
1220	6.355	6.465	6.465	6.658	6.780	7.306	7.377	7.377	7.377	6.332
1221	337	336	336	338	338	338	1.285	1.196	1.448	337
1222	38.744	33.032	33.032	14.124	14.124	15.472	9.618	9.618	9.618	9.551
1223	20.687	19.775	18.971	14.885	14.885	14.885	15.519	15.519	21.745	14.885
1224	18.264	18.634	18.634	10.406	12.764	9.602	8.533	8.533	8.840	8.313
1225	14.738	12.530	11.656	3.793	3.793	3.793	5.625	5.625	5.625	3.793
1226	4.929	4.218	4.275	1.876	2.142	2.142	2.774	2.774	2.972	1.199
1227	21.702	21.396	21.999	20.329	20.329	20.329	21.419	21.419	21.900	20.329
1228	2.765	2.499	2.499	1.430	1.430	1.353	2.007	2.007	2.007	1.353
1229	6.881	7.515	7.515	6.171	6.883	6.883	3.845	3.845	6.899	3.845
1230	135.560	131.301	131.301	111.211	111.211	111.211	110.927	110.927	136.544	108.150
1231	34.425	33.465	33.465	29.390	29.390	29.390	105.397	105.397	125.900	28.401
1232	45.263	45.939	45.939	40.399	41.365	41.365	60.070	60.070	87.313	40.253
1233	68.167	68.336	76.437	80.569	83.341	83.341	88.221	88.221	97.053	66.494
1234	7.266	6.694	6.069	4.911	4.911	5.408	4.790	4.790	4.171	4.171
1235	5.455	5.403	6.045	4.197	4.197	4.197	3.916	3.916	5.899	3.093
1236	5.666	5.393	5.204	4.438	4.438	4.231	5.479	5.479	7.102	4.000
1237	1.250	1.203	1.211	1.234	1.259	1.382	1.464	1.464	1.836	1.158
1238	470	491	570	424	505	505	415	415	534	412
1239	636	650	645	642	689	689	489	489	637	421
1240	23.404	21.740	18.108	17.585	17.585	17.585	13.567	13.567	13.567	13.567
1241	9.687	9.370	9.370	8.407	8.407	8.407	54.090	54.090	82.986	8.407
1242	7.694	7.749	7.749	5.936	6.325	5.478	27.546	27.546	56.641	5.202
1243	8.476	7.998	7.618	7.074	7.074	7.074	16.190	16.190	20.907	7.074
1244	4.041	3.417	3.417	3.709	3.353	3.353	4.331	4.331	4.331	3.353
1245	6.564	6.384	6.316	6.635	6.635	6.635	9.404	9.404	9.404	6.205
1246	2.682	2.693	2.693	2.678	2.661	2.661	5.190	5.190	8.113	2.638
1247	17.753	15.594	14.365	7.156	7.156	7.156	6.606	6.606	6.606	6.606
1248	9.225	9.299	9.299	8.269	8.556	7.801	10.570	10.570	10.570	7.605
1249	5.876	5.816	5.958	5.636	6.062	7.344	6.157	7.394	7.394	5.636
1250	7.149	6.576	6.576	5.903	6.228	6.007	7.720	7.720	9.098	5.848
1251	3.456	2.514	3.281	2.481	2.322	2.137	2.791	2.791	3.502	2.137
1252	2.902	3.046	3.046	2.863	2.676	2.676	3.755	3.755	4.212	2.472
1253	2.232	2.293	2.186	2.182	2.182	2.170	2.008	2.008	2.731	2.008
1254	12.550	12.638	13.729	10.167	8.920	8.629	13.433	13.433	13.433	8.629
1255	7.416	7.254	8.083	6.705	6.705	6.705	37.135	37.135	37.135	6.669
1256	3.976	4.144	3.943	3.655	3.838	3.838	3.152	3.152	3.152	3.152
1257	5.115	4.689	4.689	4.544	4.791	4.791	6.173	6.416	7.779	4.452
1258	970	836	941	744	744	744	1.833	1.413	1.936	706

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1259	242	242	242	223	235	235	299	299	299	210
1260	143	140	140	142	138	138	128	135	170	128
1261	6.767	6.732	6.732	6.794	6.727	6.727	71.404	71.404	266.312	6.726
1262	1.727	1.127	1.127	965	965	965	5.765	5.765	8.677	965
1263	1.603	1.574	2.061	1.479	1.479	1.485	2.707	2.707	3.603	1.479
1264	9.928	9.900	9.900	9.993	9.823	9.823	30.910	30.910	79.784	9.823
1265	11.194	10.556	10.556	8.004	8.373	8.373	13.045	13.045	13.938	6.565
1266	2.498	2.284	2.511	1.964	1.964	1.964	1.846	1.846	1.846	1.846
1267	4.284	4.786	4.548	3.060	3.060	3.086	4.124	4.124	4.124	2.944
1268	6.330	5.729	5.907	4.905	4.905	4.905	8.468	10.609	10.609	4.905
1269	48.513	46.116	46.116	35.633	35.633	35.633	72.441	72.441	105.572	35.608
1270	7.555	7.343	8.945	6.610	6.610	6.610	12.094	12.094	11.126	6.610
1271	12.294	11.828	10.939	10.329	10.329	10.019	12.781	12.781	18.217	9.990
1272	13.958	12.197	12.243	10.420	10.420	12.075	16.898	16.898	16.898	10.323
1273	162.524	129.566	129.566	106.949	108.647	111.873	143.871	119.391	119.391	106.297
1274	40.234	33.553	31.316	27.490	27.049	27.049	66.625	64.328	69.147	27.049
1275	116.141	86.276	86.276	83.117	83.117	80.020	70.690	69.522	93.872	69.522
1276	130.360	109.096	106.328	102.047	102.047	103.851	91.628	91.252	91.252	91.252
1277	49.744	44.296	39.739	20.581	20.581	20.581	25.081	25.081	28.097	19.507
1278	44.135	40.019	31.691	26.041	26.041	24.976	24.807	23.711	30.257	23.201
1279	28.549	23.579	22.851	19.849	19.849	19.849	23.309	20.050	21.547	19.627
1280	261.986	308.554	270.560	289.918	289.918	251.219	274.554	274.554	286.443	251.219
1281	87.202	89.371	89.371	96.303	94.384	95.397	112.987	112.987	120.200	84.242
1282	95.407	94.187	104.035	90.564	90.564	97.417	153.814	153.814	153.814	90.564
1283	116.206	124.984	135.748	108.293	108.293	113.814	226.760	214.769	218.505	108.293
1284	25.380	22.942	17.621	12.379	12.379	12.258	16.764	16.764	18.437	12.258
1285	16.194	13.669	12.853	10.042	10.042	11.460	11.333	11.333	12.109	9.834
1286	9.768	8.607	8.616	7.067	8.542	8.542	9.202	9.202	9.202	7.067
1287	15.089	15.070	19.781	10.396	10.396	14.918	9.550	9.550	9.550	9.550
1288	6.741	6.606	6.606	6.205	6.205	6.205	7.579	7.579	10.471	6.132
1289	4.914	4.904	4.904	4.358	4.692	4.692	9.597	9.597	9.597	4.358
1290	6.262	6.351	8.516	6.725	7.597	7.597	11.466	11.466	10.977	5.758
1291	22.069	20.118	20.118	13.377	13.040	13.019	12.615	13.082	13.535	12.615
1292	8.957	8.710	8.710	8.056	8.056	8.056	10.533	10.533	13.272	8.038
1293	7.498	6.795	6.795	6.283	6.361	6.732	9.055	9.055	11.682	6.211
1294	10.921	10.370	10.370	9.585	10.131	9.286	5.879	5.879	5.879	5.879
1295	6.967	7.386	7.386	5.789	6.654	5.141	7.958	7.958	7.958	5.126
1296	7.325	7.169	7.169	6.664	6.664	6.664	6.626	6.626	8.158	6.248
1297	53.028	53.060	52.955	52.357	52.188	52.188	51.944	51.944	51.944	51.944
1298	13.856	15.572	15.424	14.072	14.072	15.846	25.571	25.571	38.473	14.033
1299	18.114	18.291	18.291	17.772	18.099	18.099	17.160	17.160	19.299	17.160
1300	41.300	41.121	41.072	40.943	40.954	40.896	40.492	40.227	42.775	40.227
1301	28.406	26.631	20.214	18.109	18.845	18.845	37.406	37.406	29.364	16.819
1302	9.640	9.457	10.858	8.855	8.855	8.855	8.672	8.672	11.603	7.507
1303	8.051	7.963	7.963	7.738	8.491	7.738	8.093	8.093	8.093	7.236
1304	16.181	16.900	16.900	13.738	14.919	17.680	14.701	14.701	14.701	13.727
1305	3.558	3.509	3.363	2.928	2.791	2.791	8.414	8.414	5.619	2.791
1306	3.436	3.143	3.056	2.588	2.195	2.195	6.867	6.262	6.867	2.132
1307	12.734	12.402	12.092	11.055	11.055	11.055	17.559	17.559	25.125	10.514
1308	42.267	51.830	50.520	44.758	46.958	46.958	49.893	49.893	44.789	38.775
1309	6.406	6.354	7.468	6.181	6.181	6.200	12.107	12.107	22.778	6.181
1310	5.139	5.090	5.473	5.025	5.025	5.025	6.804	6.804	7.607	5.016
1311	4.152	3.723	3.975	3.582	3.582	3.582	4.425	4.425	6.089	3.525
1312	11.970	11.954	11.954	10.367	10.634	10.634	10.012	10.012	9.558	9.497
1313	7.983	7.758	11.608	9.109	11.273	11.273	3.593	3.593	3.593	3.593

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1314	23.371	23.642	28.600	24.742	24.742	30.786	137.944	137.944	621.452	24.535
1315	44.194	50.564	43.265	41.919	47.780	47.780	42.389	42.389	42.389	40.261
1316	4.851	4.862	5.253	4.769	4.740	4.740	12.320	12.320	19.411	4.740
1317	3.954	3.779	3.634	3.350	3.560	3.350	3.599	3.947	3.947	3.350
1318	1.741	1.739	2.154	1.739	1.739	1.739	3.219	3.219	5.075	1.738
1319	27.566	24.779	24.779	21.477	22.483	22.483	146.475	146.475	146.475	20.634
1320	51.150	50.902	54.285	50.990	52.031	52.031	329.361	320.892	329.361	49.826
1321	34.212	34.154	34.154	33.901	33.901	33.901	54.142	54.142	153.937	33.901
1322	21.699	20.320	17.843	17.966	17.966	15.328	18.910	19.318	17.652	15.328
1323	6.813	6.406	5.202	5.286	5.286	4.424	5.839	7.046	7.046	4.354
1324	8.234	8.557	7.853	6.856	7.052	8.064	6.149	6.149	6.684	6.149
1325	25.776	25.925	47.826	27.242	27.242	27.242	43.451	43.451	44.498	26.736
1326	3.229	3.020	3.020	2.475	2.678	2.678	2.298	3.937	3.360	2.298
1327	2.317	2.464	2.464	1.972	2.189	2.309	1.486	832	2.211	732
1328	35.936	32.149	37.315	26.903	26.516	26.516	41.105	41.105	43.186	26.516
1329	15.602	14.794	15.004	13.382	13.785	13.785	58.675	58.675	104.141	13.382
1330	37.397	41.771	41.771	33.821	38.192	35.644	41.836	41.836	61.949	31.003
1331	22.591	25.408	25.408	22.068	21.862	21.862	9.564	9.564	10.967	9.564
1332	12.265	11.715	11.476	9.638	9.638	10.554	9.570	7.402	9.570	5.881
1333	9.919	9.541	9.110	8.425	8.425	7.699	5.561	5.561	5.999	5.472
1334	6.175	5.915	5.915	5.310	5.310	5.310	2.420	2.420	2.551	2.420
1335	1.737	1.367	1.416	1.174	1.194	1.194	1.010	1.010	1.124	1.010
1336	2.127	2.098	2.325	1.995	1.995	1.995	3.693	3.693	6.364	1.984
1337	197	143	143	125	125	125	491	491	645	120
1338	67.791	61.230	62.184	54.606	54.606	60.479	66.206	66.206	66.206	54.606
1339	15.823	15.097	12.572	12.036	12.036	10.793	11.617	14.930	13.638	10.711
1340	21.532	22.372	19.850	17.946	19.023	19.023	19.736	19.736	19.736	17.329
1341	18.944	19.927	17.078	15.009	15.910	15.910	14.793	14.793	11.184	10.863
1342	31.782	31.531	33.069	31.099	31.099	31.099	32.868	32.868	32.868	31.099
1343	3.394	3.329	3.513	3.061	3.061	3.061	2.745	2.564	2.878	2.564
1344	38.018	37.990	41.075	37.956	37.956	37.956	38.448	38.448	44.032	37.956
1345	99.666	91.342	91.342	58.150	58.150	58.150	48.933	48.933	48.933	48.933
1346	19.010	17.899	17.899	14.737	14.998	11.416	21.804	21.804	25.748	11.416
1347	23.228	22.515	25.247	22.842	27.591	21.038	18.476	18.476	23.179	18.476
1348	31.554	40.642	31.908	28.285	37.251	34.426	46.676	26.868	26.868	26.868
1349	37.805	37.431	38.699	36.373	40.751	40.751	46.795	46.795	46.795	36.373
1350	9.215	8.746	8.746	7.499	7.499	7.860	14.941	14.941	14.941	7.499
1351	20.083	22.705	20.220	19.315	22.866	22.866	24.987	24.987	25.205	19.315
1352	38.039	36.594	38.008	37.188	37.188	42.688	183.976	169.300	169.300	36.115
1353	7.696	7.477	7.727	7.676	7.513	7.492	34.413	34.413	45.744	7.394
1354	5.488	5.373	5.572	5.572	5.572	7.090	25.748	25.998	25.748	5.387
1355	7.491	7.348	8.412	6.800	6.582	6.750	11.515	11.515	11.515	6.582
1356	10.562	10.351	10.410	9.663	9.663	9.389	10.998	11.154	11.154	9.389
1357	47.426	42.865	41.079	27.748	27.748	36.826	39.134	48.071	48.471	27.748
1358	4.607	3.888	3.324	2.081	2.081	1.683	4.320	4.320	4.766	1.437
1359	15.298	13.632	14.017	12.136	12.282	11.929	18.477	17.570	17.570	11.876
1360	15.667	14.761	13.890	11.286	11.286	11.286	16.078	16.078	17.961	11.112
1361	18.092	17.386	15.510	14.018	13.276	12.727	80.731	80.731	143.157	12.682
1362	9.908	9.512	9.512	7.437	7.437	7.437	8.226	8.226	11.067	7.057
1363	7.888	7.677	7.644	7.091	7.091	7.211	9.033	9.033	13.165	7.086
1364	23.821	20.370	20.370	13.423	14.477	16.148	20.267	20.267	20.267	7.964
1365	5.349	4.207	3.861	2.379	2.379	2.716	11.199	11.199	13.964	2.355
1366	5.579	5.020	5.020	3.465	3.543	3.543	13.232	13.232	14.814	3.450
1367	8.573	7.805	7.032	5.078	5.078	5.078	4.912	4.912	4.912	4.603
1368	6.562	6.481	6.338	5.702	5.702	5.953	3.425	3.011	1.815	1.815

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1369	7.330	6.692	6.574	4.716	5.480	5.480	6.527	6.527	8.131	3.159
1370	9.171	9.161	9.161	9.128	9.128	9.128	25.782	25.782	73.852	9.128
1371	2.844	3.019	2.981	3.363	3.324	3.324	7.921	7.921	14.775	1.966
1372	5.830	5.459	5.634	5.390	5.390	6.033	5.798	5.392	5.392	5.251
1373	1.902	1.754	1.490	1.239	1.239	1.239	1.574	1.574	1.499	1.239
1374	3.659	3.639	3.639	3.642	3.642	3.642	14.917	14.917	23.394	3.637
1375	3.596	3.576	3.576	3.515	3.515	3.515	4.107	4.107	4.994	3.515
1376	1.573	1.984	2.061	1.839	1.839	2.027	9.669	9.669	33.994	1.741
1377	4.248	4.875	4.094	4.257	4.451	4.023	13.857	13.857	15.813	3.767
1378	971	975	975	991	991	991	32.465	32.465	88.141	988
1379	1.071	1.060	1.060	1.044	1.044	1.044	10.378	10.378	16.666	1.044
1380	809	803	803	788	782	782	1.037	1.032	1.101	782
1381	354	382	368	349	347	347	340	340	454	328
1382	10.469	10.189	10.189	11.117	11.117	12.209	19.869	17.692	18.785	9.921
1383	196	197	197	199	199	199	258	258	289	199
1384	1.060	1.006	1.006	1.104	1.016	1.016	2.896	2.896	5.134	1.014
1385	10.875	10.195	10.195	7.075	7.533	7.075	12.148	12.148	13.771	6.939
1386	14.107	10.327	10.861	10.452	10.452	10.452	4.283	4.283	4.283	4.283
1387	2.317	2.236	2.225	2.143	2.399	1.963	2.431	2.431	2.125	1.963
1388	1.445	1.399	1.603	1.242	1.242	1.739	1.244	1.369	1.369	1.242
1389	7.920	8.349	7.291	7.415	8.149	8.149	8.562	8.562	10.379	6.728
1390	136.352	120.118	133.179	117.927	117.927	135.783	145.301	145.301	136.977	113.358
1391	5.399	5.560	5.974	4.924	4.935	5.068	16.034	16.034	17.469	4.924
1392	22.579	22.439	22.439	21.594	21.901	21.594	13.627	13.627	13.627	13.627
1393	21.736	20.930	20.930	17.005	17.830	15.675	12.606	12.606	12.946	12.450
1394	20.574	20.155	20.155	17.922	18.350	18.350	18.476	25.331	21.096	17.423
1395	21.997	21.835	20.793	24.182	30.940	33.632	29.262	27.839	26.838	18.603
1396	333	338	226	216	216	216	248	223	1.038	216
1397	17.794	15.605	11.931	10.377	10.377	11.449	12.564	12.564	12.564	9.966
1398	9.050	8.272	6.766	6.558	6.558	6.367	6.584	6.198	6.584	6.114
1399	4.615	4.385	4.698	3.980	4.270	4.949	20.283	20.283	72.302	3.702
1400	4.546	4.284	4.284	3.095	3.146	3.146	3.495	3.495	3.495	3.095
1401	1.622	1.422	1.422	1.515	1.448	1.448	2.001	1.981	1.981	1.442
1402	1.708	1.811	1.811	2.222	2.188	2.497	1.212	1.212	1.212	1.212
1403	1.554	1.542	1.769	1.615	1.615	1.615	31.406	31.406	37.447	1.594
1404	679	683	763	730	730	730	22.448	22.448	22.448	730
1405	3.798	3.306	3.306	2.997	2.997	2.997	4.541	4.541	4.580	2.997
1406	10.273	9.680	12.585	8.735	8.735	8.947	12.563	12.563	12.118	8.735
1407	3.431	3.269	3.269	3.027	3.027	3.085	20.546	15.394	20.513	3.027
1408	213	211	219	209	207	207	236	236	308	207
1409	2.346	3.021	2.910	2.480	2.480	2.377	4.055	4.055	4.055	2.216
1410	851	918	918	965	953	963	1.212	1.212	1.883	840
1411	161	170	161	157	162	162	100	107	107	100
1412	2.333	2.468	2.621	2.519	2.580	3.033	2.712	2.712	3.607	2.416
1413	660	673	663	693	693	716	1.235	1.241	1.360	594
1414	1.655	1.337	1.427	1.448	1.356	1.356	1.743	1.743	2.026	1.356
1415	22.241	16.769	15.158	10.456	10.456	10.566	8.742	8.588	8.588	8.588
1416	1.337	1.156	1.237	1.096	1.068	1.049	26.009	26.009	47.919	1.045
1417	1.399	1.322	1.160	1.070	1.070	1.077	1.492	1.492	1.645	1.052
1418	1.543	1.494	1.542	1.537	1.392	1.392	1.761	1.761	1.761	1.392
1419	23.601	20.061	18.716	12.602	13.664	13.664	14.290	12.075	10.962	10.962
1420	44.063	38.405	28.246	20.268	20.268	17.019	17.717	17.717	16.995	16.925
1421	7.469	6.503	5.623	3.322	3.322	4.235	4.530	4.530	5.654	3.322
1422	8.925	8.008	8.008	5.436	5.436	8.126	7.943	7.943	12.879	5.436
1423	5.843	4.536	4.447	3.953	4.068	4.068	3.963	4.441	3.963	2.488

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1424	5.254	5.207	6.439	5.091	5.091	5.091	8.529	7.384	7.994	5.091
1425	316.616	278.626	195.308	113.828	113.573	126.576	170.653	199.726	168.345	113.573
1426	10.005	8.741	8.725	6.887	6.887	9.201	13.218	13.218	13.218	6.887
1427	14.650	12.270	11.258	8.081	8.081	8.870	15.414	15.414	13.234	8.081
1428	29.926	29.058	27.210	24.800	25.529	26.620	23.611	23.611	23.611	23.611
1429	11.249	10.834	10.834	9.141	9.141	9.141	8.344	8.232	8.232	7.164
1430	1.130	1.189	1.721	1.068	1.392	1.632	2.235	1.700	2.394	990
1431	1.904	1.401	1.401	949	950	949	1.567	1.567	2.016	949
1432	13.514	12.562	10.173	7.786	7.786	8.985	12.511	9.513	8.380	7.560
1433	33.766	35.819	40.031	21.613	21.002	21.002	34.221	34.221	34.221	21.002
1434	18.472	18.749	18.749	18.101	18.357	18.357	41.031	41.031	48.804	17.968
1435	33.065	30.911	30.911	16.467	14.613	14.613	23.172	22.838	22.838	14.613
1436	98.964	92.450	92.450	68.199	70.523	70.523	81.908	81.908	86.656	58.088
1437	3.086	2.921	3.779	4.170	4.515	4.515	3.532	3.748	4.754	2.784
1438	13.771	17.483	15.680	12.783	12.783	16.656	15.939	15.939	15.939	12.783
1439	1.687	1.558	1.755	1.769	1.769	1.213	1.835	1.696	1.086	130
1440	3.168	2.812	2.754	3.096	3.096	2.915	4.239	4.239	5.353	2.547
1441	27.570	24.051	28.059	20.375	20.375	19.683	31.706	69.865	40.731	19.683
1442	516	462	462	486	486	486	528	528	528	463
1443	86	82	84	90	81	80	306	306	361	77
1444	72	74	73	65	65	65	69	69	69	62
1445	217	312	304	257	257	340	1.040	1.040	1.139	248
1446	227	239	232	272	272	272	234	234	355	166
1447	220	219	209	185	145	134	272	275	163	131
1448	3.116	3.067	4.163	3.902	3.902	3.902	6.389	6.389	8.703	3.707
1449	174	204	180	196	199	232	230	230	260	167
1450	9.444	8.896	10.992	8.595	8.595	8.595	16.559	16.559	23.969	8.520
1451	2.353	2.285	2.721	2.152	2.152	2.152	3.663	3.663	4.540	2.152
1452	1.327	1.291	1.291	1.320	1.229	1.229	1.653	1.653	1.653	1.229
1453	383	388	398	424	402	402	459	459	539	367
1454	7.532	7.268	7.003	6.399	6.399	6.399	35.564	35.564	42.331	6.393
1455	776	759	826	729	729	765	769	778	778	725
1456	409	406	419	396	399	399	1.914	1.914	1.914	396
1457	6.500	6.257	5.758	5.461	5.488	5.497	7.090	7.175	7.175	5.461
1458	285	291	291	276	285	285	189	189	189	189
1459	9.239	8.950	8.950	7.963	7.963	6.779	6.627	6.614	6.614	6.614
1460	24.717	23.046	23.046	20.801	20.322	20.322	37.871	37.871	38.215	20.322
1461	8.792	8.694	8.385	8.331	8.331	8.026	24.032	23.478	36.469	8.026
1462	115.626	109.808	96.180	91.862	91.862	91.862	100.552	83.212	115.720	83.212
1463	5.092	4.974	4.974	5.539	5.539	4.424	10.885	8.735	10.887	4.424
1464	5.210	5.479	5.479	4.633	5.159	5.159	4.950	4.950	5.383	4.588
1465	18.043	15.164	15.318	14.032	14.032	12.447	23.536	23.536	29.990	12.357
1466	4.308	4.084	4.111	3.721	3.863	3.863	5.481	5.481	5.481	3.721
1467	21.894	17.479	17.479	14.714	13.344	13.344	16.976	16.976	16.976	13.344
1468	11.880	11.970	11.447	10.599	10.826	10.826	12.200	11.721	13.024	10.193
1469	3.252	3.262	3.207	3.117	3.146	3.146	3.409	3.409	3.839	3.117
1470	6.710	6.740	6.232	6.072	6.072	6.072	7.526	8.207	7.975	5.836
1471	2.669	2.660	2.892	2.663	2.644	2.644	2.769	2.479	2.479	2.479
1472	5.197	4.913	4.681	3.947	3.954	3.908	5.666	5.666	6.604	3.874
1473	11.609	10.712	11.767	9.176	9.176	9.176	22.686	18.659	19.706	9.125
1474	1.170	1.180	1.180	1.150	1.175	1.175	1.969	1.969	1.820	1.135
1475	5.356	4.892	4.867	4.436	4.436	6.015	9.039	8.663	8.663	4.216
1476	186	187	187	191	191	191	266	206	266	189
1477	1.228	1.223	1.166	1.097	1.097	1.164	2.871	2.460	2.574	1.097
1478	6.088	6.952	6.952	6.422	6.450	6.450	4.056	4.056	4.211	4.056

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1479	563	560	753	573	573	573	636	674	856	569
1480	7.031	6.906	6.889	6.349	6.349	6.349	4.792	4.973	4.792	4.792
1481	10.983	9.379	9.379	8.013	7.850	7.850	20.721	20.721	27.101	7.850
1482	1.691	1.733	1.718	1.679	1.689	1.746	2.023	2.023	3.042	1.650
1483	2.504	2.452	2.468	2.349	2.335	2.741	7.827	7.827	9.312	2.335
1484	40.187	37.986	37.986	32.196	32.196	32.196	23.760	20.398	20.398	20.398
1485	40.797	37.741	40.893	28.749	28.749	28.913	21.978	21.978	21.978	21.978
1486	2.480	2.505	2.505	2.194	2.406	1.808	5.304	5.304	6.407	1.763
1487	7.563	7.001	6.630	3.943	4.210	4.210	3.546	3.546	3.546	3.546
1488	7.111	5.150	4.602	4.375	3.241	3.241	4.738	4.668	4.748	3.241
1489	3.682	3.486	3.332	2.984	2.984	2.984	3.237	2.526	2.369	2.359
1490	182.667	177.625	183.716	141.650	141.650	141.650	215.611	215.611	217.549	141.650
1491	24.479	24.277	28.987	24.963	24.963	28.260	57.535	57.535	80.885	24.768
1492	43.476	42.784	42.784	41.026	41.026	41.026	11.600	13.813	16.834	11.600
1493	12.307	11.119	10.207	7.765	7.765	7.765	10.663	9.904	9.839	7.765
1494	27.508	27.402	28.765	26.950	26.949	26.949	25.037	22.957	24.046	22.957
1495	2.612	2.532	2.532	2.363	2.363	2.363	2.675	2.675	2.099	2.099
1496	5.350	4.984	4.112	3.327	3.327	3.327	3.247	3.247	3.247	2.868
1497	12.731	13.735	13.735	10.155	11.936	8.864	10.699	10.699	10.699	8.759
1498	43.724	34.852	30.843	29.019	29.019	25.804	37.932	37.932	43.646	25.174
1499	46.348	34.601	34.601	31.247	26.005	26.005	55.378	37.208	37.243	26.005
1500	12.559	11.197	11.925	11.451	11.451	13.174	10.596	10.596	13.087	10.596
1501	7.843	7.712	9.309	7.219	7.219	7.179	7.800	7.800	7.800	7.179
1502	670	760	723	681	681	794	885	885	2.291	674
1503	381	380	365	320	300	296	537	537	537	296
1504	240	286	286	266	265	265	597	584	698	239
1505	194	195	211	200	198	212	222	222	195	195
1506	9.521	8.960	10.999	8.825	8.850	9.887	9.503	9.503	10.806	8.825
1507	150	163	164	164	164	171	644	644	1.091	149
1508	18.064	17.171	16.229	15.311	15.311	17.265	21.969	21.969	21.969	15.284
1509	2.720	2.257	2.910	2.550	2.151	2.151	2.256	2.256	2.256	2.151
1510	371	337	337	372	343	302	330	330	260	218
1511	136.715	105.921	105.921	101.919	95.108	95.108	134.131	134.131	134.131	92.818
1512	3.171	3.584	4.083	2.859	3.182	3.938	3.602	3.602	3.602	2.859
1513	9.202	9.094	9.094	8.700	8.723	8.723	5.761	5.761	4.701	4.434
1514	1.319	1.272	1.272	1.121	1.121	1.121	1.351	1.351	1.696	855
1515	19.340	17.872	19.818	18.678	19.372	19.372	26.684	26.684	26.684	17.367
1516	2.246	2.131	2.059	1.699	1.699	1.699	3.540	3.540	3.540	1.699
1517	3.046	3.016	3.399	2.974	2.932	2.932	6.153	6.153	6.153	2.932
1518	3.184	3.138	3.138	3.062	3.005	3.005	12.676	12.676	12.676	3.005
1519	5.366	4.987	4.234	3.936	3.936	3.936	6.361	6.361	6.843	3.446
1520	1.812	1.929	1.929	1.689	1.863	1.863	1.545	1.545	1.448	1.249
1521	57.301	56.125	52.601	50.234	51.652	47.853	34.124	34.124	34.124	34.124
1522	7.960	8.469	7.797	7.401	8.044	8.044	9.997	9.997	15.069	7.339
1523	3.298	2.820	2.834	2.797	2.711	2.965	6.966	6.966	3.919	2.516
1524	797	762	762	749	709	709	764	764	764	597
1525	377	369	438	362	362	362	482	482	482	362
1526	525	539	552	523	523	563	895	874	1.228	521
1527	1.416	1.412	1.396	1.354	1.354	1.343	1.890	1.890	2.816	1.307
1528	1.925	1.818	1.818	1.889	1.889	1.889	3.150	3.182	3.419	1.759
1529	3.386	3.142	3.035	2.523	2.523	2.634	5.740	5.740	5.756	2.523
1530	5.498	5.010	5.010	3.213	4.525	4.525	3.967	3.967	3.967	2.989
1531	21.560	19.368	19.368	15.252	15.658	15.658	15.736	15.736	16.279	10.664
1532	2.289	1.888	1.888	2.106	1.653	1.653	3.703	3.703	6.730	1.653
1533	2.245	2.218	2.218	1.755	1.846	1.846	1.898	1.898	2.822	1.318

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1534	3.921	3.939	3.680	3.437	3.679	3.679	4.560	4.560	4.560	3.356
1535	4.738	4.731	4.731	3.419	3.828	3.247	3.779	3.779	4.463	3.195
1536	6.735	6.477	6.206	5.708	5.708	5.708	7.996	7.996	9.967	5.707
1537	2.914	2.586	2.561	2.131	2.123	2.123	7.531	7.237	7.576	2.057
1538	2.025	2.191	2.191	1.820	1.820	2.113	3.748	3.679	4.312	1.809
1539	1.461	1.437	1.437	1.374	1.439	1.400	1.020	1.020	1.481	1.020
1540	592	548	548	565	574	574	1.160	1.226	1.160	529
1541	891	864	864	816	816	816	1.091	1.091	1.598	812
1542	424	420	447	407	407	415	590	585	562	407
1543	648	647	639	623	629	629	1.407	1.438	1.861	621
1544	2.468	2.364	2.364	2.127	2.314	2.314	2.269	2.269	2.269	1.960
1545	275	276	468	290	290	290	587	587	612	287
1546	7.086	6.517	6.289	4.015	4.015	4.333	6.200	5.737	5.808	3.970
1547	10.971	9.741	9.741	5.506	5.506	9.117	8.723	9.576	13.140	5.506
1548	2.792	2.535	2.514	2.452	2.368	2.499	3.126	3.126	3.256	2.354
1549	2.660	2.669	2.669	2.548	2.619	2.708	2.514	2.514	4.767	2.514
1550	59.805	54.024	51.550	30.148	30.148	30.148	56.438	71.877	68.246	30.148
1551	2.819	2.804	2.804	2.744	2.744	2.744	5.084	5.084	6.694	2.744
1552	1.448	1.353	1.336	1.158	1.158	1.158	1.385	1.337	1.337	1.158
1553	3.406	3.392	3.392	2.859	2.939	2.939	3.004	3.004	5.534	2.205
1554	13.562	12.973	12.437	10.957	10.957	10.957	15.834	15.834	18.909	10.765
1555	15.919	16.079	16.904	14.594	14.594	14.594	21.852	21.412	27.541	14.129
1556	3.470	3.331	3.342	3.270	3.330	3.330	3.674	3.308	3.362	3.217
1557	9.011	9.204	9.112	8.900	9.133	9.133	6.767	6.767	10.245	6.767
1558	1.837	1.780	1.812	2.021	1.660	2.624	5.852	6.111	5.508	1.660
1559	453	453	453	432	438	438	235	235	265	235
1560	5.107	5.094	5.725	5.046	5.046	5.046	4.433	4.433	2.791	2.791
1561	3.683	3.599	3.504	3.314	3.356	3.356	9.526	9.087	12.413	3.246
1562	7.552	7.425	7.425	6.949	6.949	6.949	11.784	12.147	12.704	6.722
1563	18.300	17.861	17.861	16.165	15.967	15.967	36.691	36.691	49.855	15.967
1564	301.900	270.097	249.569	134.595	134.595	208.777	277.042	277.042	288.562	127.192
1565	514.805	458.306	432.716	197.017	202.248	198.441	194.534	194.534	194.534	175.381
1566	1.542.222	1.365.267	1.365.267	590.966	567.030	567.030	552.781	552.781	552.781	520.271
1567	2.724.691	2.433.581	2.218.813	1.327.066	1.327.066	1.327.066	646.895	646.895	901.570	614.408
1568	4.623.893	4.203.644	3.977.417	2.483.953	2.483.953	2.571.822	1.642.575	1.200.397	1.200.397	1.200.397
1569	2.068.498	1.803.898	1.461.979	735.943	735.943	710.238	425.860	425.860	698.552	419.446
1570	421.447	466.422	363.112	309.296	318.971	308.838	304.910	304.910	247.885	238.440
1571	3.829.349	3.347.739	2.572.732	1.520.271	1.520.271	1.444.955	547.954	547.954	547.954	358.606
1572	1.601.100	1.440.383	1.311.992	607.233	607.233	667.758	351.249	351.249	388.480	338.221
1573	630.855	567.878	531.936	287.611	264.047	264.047	401.063	401.063	401.063	264.047
1574	1.065.543	938.318	938.318	439.476	439.476	447.849	556.468	524.320	489.313	439.476
1575	2.197.120	1.938.677	1.800.109	920.784	920.784	920.784	1.156.811	1.156.811	974.032	886.879
1576	3.171.434	2.780.370	2.780.370	1.300.137	1.300.137	1.287.940	1.276.378	1.276.378	1.276.378	1.234.293
1577	3.382.036	3.024.553	2.516.914	1.669.230	1.669.230	1.585.806	1.513.270	1.513.270	1.305.405	1.259.559
1578	1.781.262	1.569.961	1.225.151	778.324	778.324	785.376	740.861	740.861	719.512	719.512
1579	177.254	153.638	153.638	125.187	132.589	125.187	271.787	192.513	150.787	125.187
1580	2.604.093	2.356.771	2.165.112	1.183.138	1.183.138	1.113.332	1.028.345	1.028.345	862.150	858.717
1581	1.139.451	1.021.258	659.991	398.367	398.367	392.101	243.271	243.271	243.271	243.271
1582	12.312	11.708	12.775	10.230	11.008	9.526	8.540	8.540	11.101	8.540
1583	47.190	34.320	34.320	38.036	38.036	35.019	42.014	43.212	42.128	32.031
1584	220.268	199.839	182.144	113.530	113.530	113.530	85.373	85.373	85.373	76.524
1585	470.402	421.213	421.213	218.193	218.193	218.193	200.848	198.158	198.158	198.158
1586	13.828	11.997	11.997	3.574	3.620	3.620	4.929	6.019	6.019	3.548
1587	213.722	183.149	183.149	61.475	61.475	61.024	95.835	95.835	95.835	61.024
1588	1.142	880	880	288	288	412	592	592	592	258

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1589	2.051	1.849	1.666	687	687	654	765	647	684	607
1590	800.599	723.017	723.017	635.388	662.681	674.808	189.196	189.196	185.103	185.103
1591	27.174	22.388	22.388	15.158	12.044	12.044	21.119	21.119	19.900	9.757
1592	123.544	121.079	134.751	113.601	113.601	120.462	119.671	121.063	145.345	113.601
1593	293.231	251.023	236.085	196.032	196.032	203.125	64.460	87.725	64.460	64.460
1594	138.757	129.813	121.663	108.951	108.951	111.342	42.196	42.196	42.196	42.196
1595	114.748	100.568	96.907	83.905	83.905	85.092	33.915	33.915	33.915	33.535
1596	92.075	80.154	73.864	69.283	69.283	64.881	27.145	38.134	42.070	20.532
1597	42.263	39.061	37.858	24.229	24.229	24.229	9.551	18.952	19.341	3.733
1598	29.437	27.625	20.391	23.873	23.873	17.395	20.063	20.734	18.190	17.383
1599	76.021	60.232	59.187	54.916	54.916	54.916	58.948	65.090	62.208	51.501
1600	40.205	41.736	39.040	36.744	37.769	37.769	23.213	23.213	32.151	22.298
1601	22.979	21.941	23.317	18.787	18.692	18.692	20.371	20.371	20.371	18.692
1602	25.515	21.605	24.254	20.878	19.371	20.878	41.426	41.426	41.426	19.371
1603	4.639	4.116	2.290	1.277	1.602	1.399	1.327	1.327	1.327	1.200
1604	3.629	3.145	3.145	910	910	965	765	765	821	765
1605	4.199	3.699	3.699	1.114	1.086	1.122	1.284	1.284	1.284	980
1606	8.369	7.374	6.475	4.404	4.404	3.957	4.220	4.220	5.110	3.957
1607	10.127	9.594	9.594	8.416	8.416	8.416	10.767	9.090	9.451	8.416
1608	1.737	1.194	1.224	723	723	876	2.259	2.259	2.259	723
1609	70.119	70.905	70.905	54.353	58.871	58.871	58.954	58.954	68.052	53.212
1610	15.165	14.065	14.204	12.886	12.713	12.792	13.929	13.929	13.929	9.508
1611	813.792	770.399	800.431	625.899	625.899	768.074	205.882	205.882	205.882	104.917
1612	96.206	84.327	49.033	24.733	24.733	24.733	31.982	31.358	44.542	24.733
1613	8.859	7.645	7.645	1.909	2.101	2.237	4.217	4.217	4.123	1.909
1614	24.783	22.136	22.136	7.410	7.827	8.599	11.264	12.769	9.425	7.210
1615	4.275	3.807	3.807	1.067	1.067	1.067	1.178	1.178	1.139	949
1616	15.639	13.274	13.274	2.576	2.576	2.576	4.521	4.521	4.969	2.576
1617	84.186	73.751	73.751	58.082	59.105	58.082	44.166	52.389	43.808	40.885
1618	65.574	53.776	54.162	46.263	46.263	46.263	48.225	46.584	46.584	46.068
1619	11.789	12.509	12.509	11.028	11.632	11.632	12.679	10.158	13.135	10.158
1620	28.238	26.046	28.823	18.118	15.850	15.770	13.358	13.358	13.358	13.358
1621	10.689	10.794	11.741	9.322	10.007	10.007	8.352	8.352	8.352	8.352
1622	176.103	152.045	137.841	121.331	113.527	116.256	84.161	66.100	90.491	58.369
1623	53.610	54.657	54.657	48.685	49.731	49.731	49.761	49.470	50.891	48.169
1624	141.797	155.726	155.726	97.422	87.206	97.422	72.999	72.999	61.859	56.461
1625	3.826	3.754	4.608	3.606	3.812	4.542	6.471	6.471	7.704	3.598
1626	2.978	3.084	3.084	2.878	2.983	2.983	3.856	3.856	5.090	2.665
1627	1.944	1.972	1.941	1.911	1.917	1.905	2.380	2.380	3.414	1.905
1628	2.019	2.235	2.319	1.897	2.078	2.165	2.006	2.588	2.785	1.871
1629	2.319	2.253	2.309	2.219	2.273	2.273	1.019	1.019	1.719	1.019
1630	87.979	69.731	69.731	55.795	61.859	61.859	49.907	49.907	49.907	49.907
1631	9.327	9.684	9.565	8.910	9.437	9.193	9.212	9.212	9.212	8.740
1632	388.603	365.653	399.952	322.056	392.170	458.550	287.811	287.811	287.811	228.762
1633	19.478	21.026	20.855	19.599	19.503	19.503	21.589	21.589	21.589	19.502
1634	2.910	3.314	3.595	3.028	3.203	3.556	8.101	8.101	8.101	2.761
1635	2.105	2.050	2.050	2.079	2.060	2.060	2.118	1.231	2.134	1.231
1636	33.834	31.864	31.864	30.344	35.075	30.738	30.812	30.812	30.812	24.323
1637	84.074	78.252	57.183	48.894	50.362	53.063	58.124	63.751	63.751	48.486
1638	83.764	87.629	94.339	59.527	59.527	66.965	62.047	62.047	87.661	58.375
1639	7.766	8.119	8.580	7.084	7.856	7.856	7.139	7.373	7.615	6.886
1640	68.275	59.780	70.269	50.303	50.303	50.303	69.816	69.816	76.006	49.364
1641	10.211	9.086	11.570	8.822	8.822	11.405	8.499	8.499	12.070	8.499
1642	103.079	80.502	74.627	51.938	51.938	63.334	44.431	44.431	52.459	42.293
1643	28.769	27.595	30.782	23.763	26.287	26.287	17.911	17.911	17.911	17.911

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1644	173.751	164.495	189.468	118.884	118.884	118.884	92.216	125.700	125.700	92.216
1645	2.251	2.198	2.687	2.016	2.016	2.016	3.312	3.312	3.458	2.016
1646	109.981	114.314	122.924	83.517	83.517	81.671	68.534	68.534	85.146	68.534
1647	714.310	725.893	794.184	651.263	685.057	771.016	749.598	749.598	749.598	630.783
1648	5.060	4.977	6.206	5.125	5.672	5.672	3.491	5.129	4.492	3.486
1649	3.225	3.024	3.024	2.909	3.631	4.259	2.250	1.832	2.006	1.832
1650	2.537	2.698	2.698	2.488	2.687	2.687	3.598	2.716	2.716	2.467
1651	55.345	53.065	53.065	39.872	39.872	38.877	48.440	48.440	49.703	37.888
1652	3.281.337	3.365.657	3.365.657	2.403.002	2.570.972	2.403.002	1.263.956	1.362.743	1.652.341	1.263.956
1653	2.664.459	2.705.255	2.705.255	1.914.070	2.040.472	1.839.120	1.268.260	1.183.556	1.183.556	1.122.357
1654	363.575	365.614	365.614	284.727	294.204	294.204	135.764	100.803	135.764	100.803
1655	949.108	895.294	831.375	630.855	657.197	657.197	299.113	299.113	304.915	299.113
1656	50.026	52.306	48.380	47.718	47.718	46.225	35.727	32.618	32.618	32.618
1657	157.846	148.338	148.338	114.298	118.339	114.298	57.709	56.095	60.205	56.095
1658	945.468	936.413	1.129.577	560.353	544.814	632.483	716.590	716.590	716.590	544.814
1659	8.642.123	8.875.259	8.875.259	6.522.510	6.908.526	6.908.526	3.976.994	3.976.994	3.976.994	3.124.722
1660	528.768	549.508	549.508	497.727	532.040	532.040	263.978	263.978	304.712	249.827
1661	810.286	840.986	925.854	582.335	636.370	636.370	356.795	356.795	292.563	292.563
1662	1.305.700	1.320.152	1.320.152	924.319	996.551	903.690	384.074	384.074	384.074	384.074
1663	1.580.958	1.617.769	1.487.806	1.101.248	1.260.112	1.260.112	377.664	390.916	390.916	368.235
1664	69.134	64.748	55.799	51.278	51.278	48.218	52.706	52.706	54.717	44.554
1665	138.620	131.558	131.558	106.653	108.306	108.306	30.541	30.541	26.480	26.480
1666	90.844	92.393	92.393	65.276	71.004	86.716	45.471	45.648	47.654	45.471
1667	432.141	396.784	348.951	281.390	287.842	280.411	310.869	310.869	310.869	278.418
1668	651.109	514.114	457.751	365.437	400.543	400.543	271.736	254.404	254.404	237.294
1669	33.564	34.493	25.028	25.446	26.897	21.810	29.274	29.274	19.132	19.132
1670	39.100	35.643	25.514	20.727	20.727	19.269	14.493	15.622	16.793	14.142
1671	349.590	323.155	323.155	202.036	217.333	185.591	113.256	113.256	113.256	107.845
1672	222.819	204.894	204.894	135.948	143.062	135.948	58.802	55.549	55.549	42.463
1673	102.873	91.303	79.084	57.178	57.178	58.718	54.575	54.575	54.575	39.640
1674	137.027	128.231	90.723	79.151	68.358	68.358	43.608	57.260	43.608	43.608
1675	26.734	21.784	19.844	15.717	17.929	17.929	14.327	14.327	12.373	12.108
1676	15.447	13.063	17.036	13.334	15.881	15.881	14.540	12.050	9.616	6.891
1677	143.424	134.388	134.388	93.351	93.351	100.455	56.280	56.280	61.283	56.280
1678	609.629	572.972	572.972	385.402	432.671	370.949	222.497	222.497	166.196	166.196
1679	41.542	42.090	42.090	40.652	41.510	41.510	39.521	39.521	44.680	39.521
1680	297.551	325.097	269.136	236.523	273.441	273.441	181.335	226.325	226.325	161.915
1681	323.525	294.590	294.590	204.898	204.898	230.847	129.059	129.059	125.435	125.435
1682	361.215	329.979	305.635	195.752	199.381	212.465	251.214	251.214	251.214	195.752
1683	72.714	85.154	85.154	67.926	71.677	71.677	63.468	63.468	84.360	63.051
1684	68.040	65.420	62.026	51.089	51.089	58.491	41.220	41.220	41.220	41.220
1685	15.321	15.460	15.460	14.445	15.255	15.255	16.442	16.442	19.245	14.063
1686	49.070	54.425	59.996	38.904	49.912	49.912	31.975	32.466	32.466	31.493
1687	412.135	409.513	517.230	250.888	250.888	250.888	336.061	458.844	458.844	250.888
1688	491.289	494.485	461.890	343.830	354.808	506.405	249.742	249.742	263.202	234.957
1689	2.916	2.873	2.985	3.286	2.744	2.744	5.220	5.220	5.220	2.744
1690	150.006	156.935	144.268	130.870	139.806	151.269	68.001	52.511	52.511	52.511
1691	529.209	489.704	489.704	267.223	294.585	267.223	143.645	143.645	144.246	143.645
1692	206.029	192.197	170.061	140.906	140.906	140.906	69.622	69.622	94.297	69.622
1693	59.948	55.487	48.120	41.702	41.702	41.131	40.291	40.291	40.846	37.618
1694	157.645	155.353	167.595	128.015	136.729	136.729	114.928	114.928	96.784	96.784
1695	227.490	211.315	187.777	155.300	155.300	155.300	163.588	163.588	206.824	149.845
1696	100.612	120.653	120.653	88.930	103.507	114.992	84.592	69.734	69.734	69.734
1697	44.654	45.064	43.602	41.831	43.063	43.063	50.969	50.969	50.969	41.165
1698	52.906	52.379	50.991	46.767	49.422	56.967	39.939	39.939	39.939	39.706

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1699	7.960	8.740	9.579	7.775	8.393	9.227	11.124	11.124	17.393	7.155
1700	13.696	16.055	11.324	12.889	15.289	15.289	14.115	14.115	12.063	10.194
1701	674.511	629.053	629.053	439.387	455.252	455.252	183.683	227.967	227.967	169.402
1702	133.966	145.690	112.656	111.443	125.978	125.978	58.083	58.083	58.083	49.896
1703	221.553	223.491	223.491	188.893	197.487	197.487	93.182	94.651	94.651	82.038
1704	1.598.498	1.599.315	1.390.858	1.210.118	1.248.034	1.248.034	664.550	664.263	664.263	664.263
1705	1.556.601	1.472.384	1.472.384	1.139.995	1.147.037	1.147.037	574.346	560.745	574.346	560.745
1706	206.726	207.233	180.595	162.653	168.111	168.111	48.325	48.325	66.936	48.325
1707	483.361	451.948	393.929	339.010	339.010	323.306	115.392	91.223	91.223	88.518
1708	32.886	34.200	30.960	30.851	30.851	28.304	15.170	15.170	15.170	15.170
1709	80.488	76.484	67.266	65.188	65.188	61.712	43.419	37.920	43.419	37.920
1710	235.280	213.477	193.893	122.293	111.058	111.058	141.238	141.238	141.238	111.058
1711	4.497.578	4.543.491	4.272.679	3.355.775	3.606.914	3.355.775	1.537.382	1.393.646	1.393.646	1.359.631
1712	406.261	398.357	436.219	381.197	407.730	407.730	124.351	114.200	119.434	109.455
1713	443.884	446.703	446.703	324.776	343.273	343.273	139.719	129.566	130.690	128.169
1714	732.599	683.682	564.393	495.840	516.961	516.961	181.508	154.751	291.264	154.751
1715	927.689	939.733	815.861	704.501	740.602	696.036	284.757	274.528	274.528	274.528
1716	22.389	19.532	17.508	21.409	15.576	15.576	19.859	19.039	18.820	15.576
1717	127.064	128.361	110.452	101.604	109.374	101.604	63.144	63.144	63.144	46.429
1718	39.338	34.727	56.715	29.009	28.858	28.858	31.915	31.915	31.915	28.858
1719	152.850	138.910	138.910	79.246	83.046	87.192	78.847	78.847	82.005	76.022
1720	291.473	307.469	338.979	185.304	185.304	172.246	88.894	83.532	86.676	83.532
1721	5.802	6.062	6.062	5.420	5.789	5.789	2.065	2.065	2.065	2.065
1722	13.948	12.174	11.179	10.933	9.878	9.922	21.895	21.895	34.764	9.788
1723	22.405	23.675	23.675	16.107	16.107	14.611	19.086	17.789	19.536	14.611
1724	168.016	197.960	197.960	108.673	119.169	92.748	31.039	31.039	56.637	30.217
1725	143.565	132.441	108.882	97.215	97.215	87.786	64.761	64.761	99.802	64.761
1726	42.189	31.833	20.254	12.426	12.426	9.228	18.609	18.609	18.999	9.216
1727	68.325	71.516	55.491	47.073	47.073	47.073	25.669	25.669	39.126	24.980
1728	14.666	15.033	13.352	10.025	10.933	14.164	9.560	9.560	9.560	8.787
1729	164.699	167.460	167.460	148.700	151.639	151.639	72.122	72.122	72.386	65.689
1730	311.663	199.727	199.727	162.766	153.624	153.624	99.612	99.612	99.612	57.546
1731	32.371	32.584	32.584	32.259	32.542	32.542	27.779	27.779	34.058	27.779
1732	147.499	149.073	125.562	117.505	126.444	117.505	51.214	51.214	60.730	44.362
1733	190.112	179.889	179.889	144.138	144.138	144.138	94.010	94.010	128.676	94.010
1734	123.472	112.940	106.774	78.678	75.469	90.763	91.571	91.571	91.571	75.469
1735	68.026	60.066	88.129	64.101	77.529	77.529	54.003	47.637	64.515	47.186
1736	24.509	22.747	22.206	16.229	16.229	14.218	13.681	13.681	17.112	13.681
1737	19.321	17.692	19.375	14.043	14.732	13.108	35.481	35.481	42.163	13.108
1738	126.365	133.100	144.276	91.013	91.013	106.726	115.345	115.345	115.345	91.013
1739	237.932	221.186	196.263	158.881	165.347	217.491	207.426	207.426	207.426	157.358
1740	69.366	69.648	69.648	59.802	61.861	61.861	22.029	22.029	22.029	22.029
1741	271.086	249.492	203.278	170.715	170.715	163.570	95.563	95.563	95.563	95.563
1742	76.344	70.591	72.423	61.156	61.156	66.449	15.259	15.259	18.730	14.987
1743	16.498	14.843	14.843	8.022	8.022	8.201	15.724	15.724	16.438	8.022
1744	87.296	90.841	97.203	81.270	82.561	82.561	49.939	43.382	43.382	43.382
1745	154.049	163.835	163.835	132.859	161.164	161.164	224.699	224.699	677.980	118.233
1746	47.500	45.582	45.582	40.278	40.278	40.278	51.947	51.947	55.436	40.278
1747	5.301	5.016	4.565	4.187	4.539	5.689	3.948	3.948	3.948	3.901
1748	41.653	33.923	34.294	31.148	31.148	31.148	29.374	29.374	39.622	29.035
1749	502.831	505.731	438.320	400.832	411.125	411.125	73.709	73.709	98.794	73.081
1750	102.690	117.518	117.518	82.366	96.960	96.960	28.694	27.801	28.659	27.801
1751	204.848	210.514	197.674	177.423	185.444	185.444	83.012	83.012	83.012	72.618
1752	632.339	576.490	543.292	375.071	353.668	562.112	309.262	309.262	309.262	309.262
1753	1.380.842	1.514.671	1.514.671	893.909	1.001.695	1.001.695	438.998	438.998	474.863	438.998

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1754	959.243	985.838	985.838	556.948	666.122	666.122	188.635	184.040	184.040	184.040
1755	421.833	445.311	335.667	270.416	270.416	270.416	80.330	80.330	80.330	79.891
1756	167.679	152.246	152.246	100.295	107.007	145.711	66.015	94.588	94.588	63.575
1757	85.178	86.290	86.290	55.578	61.017	66.143	32.974	32.974	37.871	29.445
1758	718.992	722.641	722.641	466.830	466.830	456.225	510.953	510.953	491.528	391.414
1759	968.219	1.024.168	1.024.168	682.300	824.882	824.882	220.949	202.379	202.379	168.390
1760	686.812	697.397	697.397	403.190	403.190	403.190	87.863	65.665	105.463	65.665
1761	246.552	278.862	278.862	151.614	151.614	140.880	87.734	84.467	76.295	60.666
1762	100.063	100.828	70.551	57.117	57.117	49.427	33.975	33.975	23.668	23.668
1763	49.190	51.237	55.505	34.369	38.402	31.517	16.154	16.154	16.766	16.154
1764	12.814	14.942	14.942	10.219	13.191	13.191	13.019	13.019	9.983	9.525
1765	8.898	8.087	6.564	4.604	4.145	4.145	4.775	4.775	9.377	4.145
1766	5.314	5.140	5.351	4.588	4.905	4.686	5.259	5.259	3.386	3.175
1767	62.531	62.885	60.156	58.190	58.997	60.612	60.794	60.794	60.794	58.162
1768	39.780	41.857	43.513	38.658	39.956	41.346	34.690	28.804	41.210	28.804
1769	5.167	5.385	5.385	4.551	5.138	5.138	7.368	7.368	9.709	4.431
1770	14.570	12.634	12.634	5.924	6.038	6.428	8.546	8.546	7.381	5.913
1771	9.059	8.945	7.715	4.808	4.808	8.155	5.075	5.075	5.075	4.756
1772	4.505	4.542	5.379	2.246	2.132	2.083	1.787	1.281	1.403	1.273
1773	1.395	1.241	2.323	801	825	897	942	894	866	801
1774	1.200	1.024	1.024	549	549	549	722	661	661	474
1775	6.846	6.700	6.160	4.588	4.518	6.450	5.201	4.485	4.485	4.485
1776	4.687	4.053	3.608	2.210	2.174	2.178	2.535	2.246	2.246	2.174
1777	2.406	2.183	1.902	1.392	1.859	1.392	1.284	1.307	1.507	1.198
1778	1.154	1.014	894	703	748	880	1.106	1.106	907	652
1779	1.453	1.671	2.110	1.089	1.284	848	812	871	781	781
1780	138.286	135.169	135.169	136.477	125.194	125.194	95.694	95.694	95.694	65.699
1781	40.937	39.087	37.036	36.649	36.649	36.649	55.278	39.540	39.540	32.784
1782	968	1.038	1.050	1.251	1.251	1.251	624	631	643	624
1783	108.587	94.784	107.954	44.258	44.258	44.258	37.243	37.243	37.243	37.243
1784	74.516	64.935	73.956	30.148	30.148	30.148	24.432	24.432	24.308	24.308
1785	2.182	1.950	3.067	1.443	1.177	1.210	1.200	1.200	1.200	1.177
1786	14.352	16.161	16.161	6.569	6.569	6.901	9.324	9.324	9.417	6.569
1787	4.854	4.383	4.383	2.675	2.675	2.585	3.936	3.936	3.936	2.585
1788	115.891	114.223	114.223	55.644	54.243	103.444	86.620	86.620	86.620	54.243
1789	20.535	19.598	23.073	7.866	7.866	11.224	8.685	8.685	8.541	7.866
1790	50.108	43.782	71.040	26.317	28.600	28.600	26.665	19.240	19.470	19.240
1791	16.709	14.185	16.635	5.908	5.908	5.908	8.126	8.126	7.223	5.908
1792	3.349	3.262	2.951	1.682	1.610	2.831	2.083	1.891	1.891	1.610
1793	3.524	3.823	4.532	1.933	1.933	1.995	1.705	1.705	1.705	1.705
1794	11.593	10.165	11.562	4.652	4.690	4.914	3.654	3.654	3.297	3.295
1795	42.417	37.311	37.311	16.067	16.067	16.067	25.768	20.726	20.726	16.067
1796	4.551	4.458	6.414	2.293	2.293	2.491	2.767	2.767	2.764	2.293
1797	4.568	4.193	7.297	3.250	3.684	3.684	2.784	2.784	2.784	2.498
1798	30.768	26.579	26.579	10.908	11.250	13.678	8.221	8.589	7.949	7.566
1799	14.364	13.122	11.337	8.882	10.241	11.755	7.681	9.221	7.433	7.433
1800	146.419	143.034	143.034	63.843	63.843	68.775	58.740	54.092	54.092	53.383
1801	5.951	4.402	4.260	3.036	3.488	3.488	6.620	4.589	4.589	2.908
1802	2.657	2.708	2.985	2.158	2.158	3.175	2.030	2.030	1.795	1.795
1803	37.628	31.845	31.845	11.038	11.038	11.038	13.199	13.199	12.360	11.038
1804	21.114	17.073	15.852	10.216	9.955	11.753	10.431	7.883	7.274	7.274
1805	1.602	1.787	1.608	1.326	1.455	1.455	1.052	1.052	1.052	1.052
1806	5.039	4.664	4.664	3.860	4.237	5.726	4.685	4.685	3.764	3.195
1807	47.948	41.639	41.639	18.549	18.760	18.760	20.702	20.702	18.636	18.549
1808	37.364	41.324	49.946	18.535	19.148	19.148	22.564	22.564	26.256	18.535

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1809	32.164	31.474	37.678	15.270	14.887	20.206	18.531	18.531	18.810	14.887
1810	1.634	1.630	781	821	821	821	699	521	588	521
1811	8.524	7.687	7.025	5.102	5.031	5.031	5.825	5.825	5.820	5.031
1812	1.865	1.544	2.310	798	770	865	1.165	1.165	1.165	770
1813	49.406	47.671	68.913	25.044	25.298	25.298	33.867	33.867	31.890	24.456
1814	12.016	11.780	16.304	5.273	5.273	5.273	8.803	8.803	8.803	5.224
1815	17.983	17.632	20.398	5.830	5.830	6.019	7.345	7.345	7.109	5.830
1816	8.488	8.284	8.284	3.968	3.824	3.824	4.790	4.497	6.927	3.824
1817	2.569	2.371	1.933	1.752	1.632	1.554	1.913	1.913	1.911	1.554
1818	3.290	3.255	5.168	1.596	1.596	1.596	1.683	1.683	1.683	1.515
1819	6.134	4.605	4.605	3.348	3.948	3.162	3.512	3.512	3.512	3.162
1820	15.599	15.563	15.563	4.248	4.248	6.343	3.549	3.573	3.549	3.549
1821	3.026	2.186	1.917	1.275	1.367	1.367	1.794	1.794	1.553	1.273
1822	2.911	2.224	2.224	2.214	2.531	2.776	1.990	1.990	1.698	1.698
1823	9.141	8.925	8.179	4.986	4.986	8.545	7.095	5.275	5.275	4.986
1824	8.340	7.805	7.597	5.889	5.970	8.385	8.912	8.912	6.295	5.795
1825	3.710	3.702	4.005	3.571	3.571	3.571	3.819	3.996	3.996	3.308
1826	60.969	59.422	67.666	33.116	33.116	33.116	62.725	62.725	62.725	33.116
1827	3.811	4.342	5.147	2.274	1.309	1.349	2.292	2.292	2.292	1.309
1828	1.901	1.936	1.936	1.817	1.858	1.858	1.323	1.323	1.536	1.323
1829	13.685	11.589	11.589	3.807	3.831	3.831	6.074	6.074	4.797	3.807
1830	5.470	5.410	5.410	4.269	4.509	5.841	5.279	5.279	5.146	4.269
1831	2.215	2.103	2.140	1.772	1.867	1.867	1.812	1.812	1.827	1.766
1832	2.727	2.522	2.284	2.327	2.711	1.937	2.248	2.248	2.197	1.896
1833	29.635	29.102	29.102	21.276	20.431	35.209	34.515	34.515	36.234	20.431
1834	175.056	169.096	154.713	164.840	149.416	149.416	153.831	153.831	153.831	106.063
1835	109.839	118.137	131.421	103.532	113.830	107.344	346.925	346.925	346.925	101.902
1836	418.528	407.524	466.848	367.905	367.905	442.375	251.589	251.589	251.589	251.589
1837	101.235	104.833	97.743	98.385	107.789	98.385	106.884	106.884	106.884	94.692
1838	55.303	61.065	62.090	52.427	59.501	60.777	2.247.689	2.247.689	3.427.456	52.427
1839	19.640	19.691	19.691	19.303	19.425	19.425	36.394	36.394	51.429	19.188
1840	55.107	56.872	59.834	53.838	56.110	59.371	647.406	647.406	994.238	53.770
1841	19.296	20.614	19.450	17.257	19.910	20.685	27.727	27.727	47.666	16.909
1842	16.617	17.660	17.660	15.771	17.239	17.239	795.145	795.145	1.308.437	15.336
1843	17.701	17.667	17.667	17.046	17.241	17.241	9.864	9.864	10.062	9.077
1844	3.879	3.742	3.755	3.570	3.623	3.623	4.914	4.914	4.914	3.518
1845	79.486	81.858	81.858	68.799	73.778	84.584	56.937	56.937	56.937	56.937
1846	21.573	27.535	27.535	22.309	26.451	26.451	7.436	8.650	7.436	7.436
1847	10.542	10.568	11.595	9.796	9.796	9.796	15.095	15.095	15.205	8.527
1848	67.879	66.562	66.562	64.843	64.843	64.843	62.306	62.306	66.465	62.306
1849	60.209	61.074	71.802	52.190	56.520	62.171	33.858	33.858	33.858	30.732
1850	1.731	1.686	1.686	1.749	1.682	1.682	3.313	3.313	6.361	1.682
1851	7.782	7.341	7.341	7.550	7.341	7.341	36.662	36.662	159.871	7.341
1852	1.891	1.768	1.768	2.000	1.787	1.787	7.677	7.677	17.279	1.784
1853	580	591	591	574	587	587	793	793	899	553
1854	9.670	9.286	9.286	9.416	9.170	9.170	20.344	20.344	20.344	9.170
1855	2.748	2.629	2.629	2.841	2.639	2.639	3.408	3.408	3.408	2.637
1856	58.337	30.608	30.608	29.890	29.890	29.890	162.211	162.211	280.992	20.719
1857	21.770	19.664	30.111	13.602	13.602	15.500	7.492	9.667	7.813	7.492
1858	6.240	5.695	5.159	4.355	4.164	4.748	3.840	3.840	3.840	3.840
1859	7.330	6.887	7.377	5.452	5.853	5.452	4.687	4.687	4.687	4.687
1860	2.631	2.634	2.385	2.161	2.161	1.958	2.010	2.010	2.010	1.929
1861	1.436	1.292	1.997	930	930	985	1.758	1.525	1.654	911
1862	4.337	4.312	4.076	3.596	3.887	3.887	2.431	2.431	2.431	2.431
1863	1.082	939	939	722	694	722	1.514	1.514	2.913	679

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1864	960	964	964	788	1.053	1.053	1.242	1.242	1.771	788
1865	2.929	2.940	3.388	2.605	2.605	2.339	2.119	2.119	2.893	2.119
1866	2.562	2.253	4.073	1.865	1.865	4.314	2.184	2.184	2.184	1.865
1867	943	812	812	696	696	696	1.211	1.158	1.158	685
1868	3.938	3.623	3.357	2.676	2.937	3.534	2.006	2.006	2.006	2.006
1869	21.263	21.324	21.324	15.466	15.466	15.466	14.634	14.634	16.883	13.946
1870	1.910	1.754	1.754	1.590	1.456	2.406	759	759	759	759
1871	8.990	8.552	9.150	7.414	8.535	7.691	6.087	6.087	6.087	6.087
1872	5.926	5.219	5.219	2.632	2.632	2.632	3.830	3.830	3.830	2.632
1873	4.486	4.069	3.915	3.619	3.599	4.029	4.759	4.407	4.531	3.599
1874	1.613	1.379	1.484	1.208	1.268	1.199	1.753	1.332	1.050	1.050
1875	716	759	727	741	741	806	1.305	1.305	1.974	690
1876	2.781	2.542	2.329	1.776	1.776	1.776	2.539	2.539	1.946	1.679
1877	4.021	3.495	3.201	1.980	1.980	2.600	1.777	1.777	1.777	1.777
1878	2.202	2.268	2.585	1.772	1.772	1.656	1.775	1.879	1.879	1.656
1879	1.446	1.190	1.190	1.042	1.064	1.064	868	868	1.042	868
1880	1.162	1.063	1.464	1.196	882	882	718	718	1.030	641
1881	3.129	2.584	4.318	2.400	2.400	2.400	2.212	2.212	2.212	2.212
1882	5.125	4.831	4.831	4.214	4.356	4.356	4.334	4.921	4.921	4.082
1883	638	574	962	584	452	351	540	540	606	351
1884	2.653	2.595	2.595	2.328	2.359	2.359	1.425	1.533	1.646	1.425
1885	2.491	2.241	2.285	2.177	2.385	2.385	1.104	1.104	1.104	861
1886	31.050	28.299	31.463	24.197	19.224	20.494	12.406	12.406	12.406	12.406
1887	1.892	2.184	2.089	1.930	1.817	1.817	4.415	4.415	6.474	1.817
1888	5.510	4.947	4.531	3.104	3.104	5.738	2.786	2.786	3.767	2.786
1889	1.787	1.639	1.530	1.150	1.150	1.091	1.355	1.355	1.460	1.087
1890	1.446	1.337	1.337	1.085	1.141	1.141	851	851	851	851
1891	537	526	634	492	513	610	514	560	628	477
1892	1.442	1.336	1.336	1.217	1.217	1.332	1.476	1.363	1.363	1.212
1893	712	615	595	547	488	479	486	486	493	456
1894	1.173	988	1.452	911	911	851	807	496	496	496
1895	1.936	1.718	1.419	1.618	1.453	1.291	1.609	1.609	2.895	1.291
1896	5.942	4.747	4.100	3.199	3.199	3.199	2.064	2.064	2.064	2.064
1897	2.374	2.785	2.785	2.034	2.611	2.611	1.434	1.434	1.521	1.322
1898	3.990	3.934	3.934	2.450	2.450	3.063	2.082	2.392	2.530	2.082
1899	4.203	3.743	3.041	2.035	2.035	2.035	1.852	1.852	1.771	1.312
1900	1.571	1.346	1.293	1.140	1.140	1.214	830	830	763	763
1901	408	487	407	431	469	469	366	322	401	253
1902	1.057	956	1.453	689	697	697	820	800	910	637
1903	2.041	2.408	2.774	1.770	1.968	2.277	1.521	1.518	1.521	1.516
1904	1.715	1.804	1.804	1.427	1.662	1.922	1.649	1.649	1.649	1.264
1905	870	663	1.205	747	528	528	412	412	743	412
1906	1.257	1.237	1.340	996	957	1.189	910	1.023	1.098	910
1907	2.519	2.305	2.948	1.701	1.826	2.633	1.872	2.588	2.588	1.546
1908	1.677	1.506	1.721	1.086	1.208	1.086	1.235	1.155	1.155	1.083
1909	1.175	970	976	945	891	860	498	1.141	1.141	429
1910	13.291	13.173	13.173	9.249	10.599	8.771	3.961	3.287	5.922	3.287
1911	633	757	620	597	721	721	253	248	297	222
1912	547	540	527	563	515	638	465	465	557	329
1913	10.257	10.060	10.206	9.603	9.299	10.091	9.620	9.620	11.402	9.299
1914	3.973	3.984	3.919	4.013	4.013	4.501	3.885	3.885	3.885	3.885
1915	3.846	3.632	3.895	3.268	3.268	3.268	4.360	4.360	3.317	3.268
1916	1.854	1.664	1.549	1.161	1.161	1.161	1.469	1.469	1.737	1.160
1917	1.350	1.271	2.531	1.196	1.136	1.136	1.462	1.462	1.501	1.136
1918	3.063	3.286	3.657	2.803	2.969	2.969	3.585	3.585	2.968	2.471

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1919	991	1.004	1.128	821	510	510	1.033	1.033	1.372	510
1920	879	870	863	840	840	787	1.200	1.200	1.200	787
1921	1.281	1.249	1.234	1.202	1.202	1.387	1.828	1.828	1.976	1.201
1922	3.968	3.606	4.619	3.698	3.951	3.150	4.156	4.156	4.156	3.110
1923	963	905	947	921	921	810	1.005	1.005	1.005	810
1924	1.691	1.643	1.765	1.121	1.084	1.084	1.295	1.295	1.295	1.084
1925	1.922	1.863	1.875	1.729	1.761	1.761	2.326	2.326	3.020	1.729
1926	8.589	8.226	8.585	7.114	7.114	7.114	9.004	9.004	9.004	7.114
1927	1.382	1.231	1.231	1.051	967	967	1.116	1.116	1.065	967
1928	3.521	3.174	4.993	2.700	2.700	2.871	2.576	2.576	2.576	2.576
1929	6.383	5.849	5.535	4.820	4.712	4.712	6.679	5.545	5.545	4.712
1930	5.174	4.992	5.547	4.225	4.881	4.881	3.827	3.827	3.827	3.827
1931	2.949	2.584	2.510	2.319	2.319	2.319	1.556	1.556	1.556	1.556
1932	1.010	917	871	728	728	636	920	920	920	636
1933	3.682	3.683	4.046	3.294	3.294	3.335	4.563	4.507	4.507	3.291
1934	4.518	4.615	5.146	3.658	4.482	4.482	1.954	1.954	1.954	1.954
1935	3.606	3.367	5.939	2.745	2.759	2.759	3.642	3.883	4.271	2.745
1936	17.327	16.491	16.491	15.197	15.197	19.987	18.583	18.583	18.583	15.197
1937	2.498	2.489	2.904	2.151	2.151	2.976	2.386	2.386	2.516	2.151
1938	1.382	1.354	1.449	1.296	1.429	1.429	1.310	1.151	1.151	1.058
1939	1.000	956	1.102	982	845	845	1.080	859	876	845
1940	396	392	493	415	455	362	445	565	525	362
1941	904	948	1.132	829	926	829	983	1.128	1.202	817
1942	247	257	257	287	287	287	179	226	172	172
1943	344	554	560	465	493	493	518	518	508	235
1944	1.931	1.839	2.869	1.628	1.628	1.628	1.282	1.282	1.282	1.273
1945	9.799	9.709	9.709	5.107	4.955	4.955	4.695	4.695	4.695	4.694
1946	5.278	5.390	6.216	3.605	3.605	3.605	2.924	2.924	3.763	2.645
1947	1.812	1.547	1.547	1.124	1.063	1.063	1.717	2.175	1.718	1.063
1948	870	757	1.080	673	606	536	760	1.138	997	536
1949	2.981	3.171	3.171	2.601	3.081	3.081	1.924	1.924	2.163	1.924
1950	3.180	2.692	3.623	2.220	1.997	1.997	1.867	1.867	2.725	1.867
1951	1.655	1.565	1.516	1.308	1.517	1.517	945	945	1.132	845
1952	1.567	1.672	1.672	1.148	1.314	1.314	868	868	1.242	868
1953	1.004	986	986	895	902	902	793	793	834	793
1954	4.431	4.511	4.511	3.350	2.408	2.408	2.908	2.908	4.037	2.380
1955	3.899	3.619	3.619	3.793	3.501	3.501	5.285	5.285	5.419	3.501
1956	3.493	3.476	3.679	3.470	3.412	3.889	4.538	4.538	6.325	3.412
1957	1.811	1.982	1.982	1.623	1.623	2.339	1.516	1.516	2.120	1.310
1958	21.331	19.197	19.197	16.426	16.301	22.775	17.684	17.684	17.699	15.006
1959	8.909	8.012	8.012	7.729	7.913	9.230	5.942	5.942	5.942	5.942
1960	1.001	937	1.035	844	735	695	1.108	1.108	1.108	695
1961	5.750	5.348	7.300	4.136	4.136	5.985	3.889	3.889	3.889	3.844
1962	39.060	33.290	32.248	32.513	30.030	31.172	31.356	30.160	33.417	30.030
1963	35.114	31.572	31.572	26.725	25.998	25.518	25.461	24.378	27.496	24.378
1964	3.466	2.934	2.934	2.633	2.578	3.305	3.714	3.714	4.002	2.578
1965	1.311	1.330	1.330	1.178	1.274	1.274	970	970	999	970
1966	13.363	12.194	12.194	10.770	10.523	11.901	10.354	10.532	10.251	10.251
1967	6.156	5.719	5.719	4.171	3.808	3.641	2.896	2.896	3.575	1.673
1968	10.978	9.660	9.433	9.285	8.812	8.943	8.570	8.964	8.964	8.570
1969	1.994	1.892	1.938	2.013	2.422	2.422	2.378	2.378	2.378	1.788
1970	496	469	525	498	419	419	771	755	771	419
1971	2.059	1.824	1.775	1.396	1.396	1.353	1.655	1.655	1.779	1.353
1972	18.622	17.088	17.088	16.373	16.132	16.075	15.635	14.932	14.932	14.932
1973	1.740	1.481	1.481	1.270	1.270	1.804	862	700	700	700

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
1974	5.068	5.072	5.072	4.489	4.922	4.922	4.127	4.211	4.211	4.127
1975	2.005	1.800	2.477	1.621	1.621	2.117	982	982	548	548
1976	86.803	82.613	78.636	70.009	63.935	63.652	55.710	54.899	54.899	54.899
1977	1.320	1.502	1.502	1.268	1.464	1.464	1.317	1.418	2.015	1.090
1978	7.221	6.304	6.059	5.690	4.619	4.646	5.620	4.506	4.506	4.430
1979	3.335	3.215	3.225	3.272	3.214	3.388	2.528	2.528	2.528	2.528
1980	7.407	7.172	7.928	5.161	4.891	4.891	3.640	3.640	3.640	2.897
1981	11.681	10.287	15.448	9.305	7.679	7.679	10.835	14.991	14.991	7.679
1982	9.909	9.023	9.023	6.587	6.018	8.567	7.124	7.124	4.983	4.983
1983	4.781	4.184	4.184	4.023	4.026	4.278	3.410	3.410	3.410	3.410
1984	2.205	1.862	1.755	1.304	1.304	1.304	1.229	1.229	1.229	1.229
1985	6.836	5.811	5.811	4.824	5.276	5.276	3.113	2.999	3.513	2.999
1986	2.344	2.224	2.244	2.271	2.271	2.468	3.184	3.184	3.496	2.271
1987	4.310	4.212	4.291	4.235	4.235	3.915	2.521	2.521	2.941	2.521
1988	2.220	2.264	2.475	1.947	1.947	2.569	2.397	2.397	1.810	1.707
1989	4.094	3.709	5.804	3.252	3.500	4.598	2.316	2.316	1.920	1.920
1990	4.925	4.598	4.390	3.805	4.321	4.321	6.482	6.482	10.034	3.726
1991	3.168	2.900	4.771	2.146	2.036	2.038	3.122	3.122	3.122	2.036
1992	35.635	32.387	32.387	21.632	19.471	19.471	19.106	14.745	14.925	14.633
1993	12.178	11.580	16.967	11.906	11.568	11.381	9.084	9.084	9.734	9.084
1994	1.758	1.589	1.490	1.220	1.268	1.268	1.803	1.749	1.955	1.212
1995	11.742	10.697	10.697	9.873	11.716	13.651	8.343	8.343	10.687	8.343
1996	2.308	2.105	2.305	2.042	1.811	2.365	1.268	1.268	1.268	1.172
1997	2.784	2.653	2.653	2.308	2.170	2.170	1.944	2.099	2.099	1.742
1998	662	660	648	729	851	618	1.015	1.015	1.015	618
1999	483	461	681	541	660	660	515	515	470	409
2000	798	775	788	819	947	768	796	796	807	749
2001	2.057	2.222	2.222	1.828	1.828	1.724	2.010	2.010	2.066	1.600
2002	391	384	389	383	383	383	484	484	484	383
2003	937	964	964	887	958	958	985	985	985	831
2004	2.360	2.423	2.367	2.522	2.522	2.522	2.027	2.027	2.027	2.027
2005	635	660	516	489	489	489	440	440	481	440
2006	703	654	710	535	535	584	614	614	711	525
2007	853	873	639	616	616	616	824	824	824	616
2008	6.022	5.880	8.218	4.061	4.061	4.061	3.660	4.354	4.623	3.660
2009	1.383	1.250	1.644	1.315	1.481	1.481	1.538	1.538	1.615	1.203
2010	929	955	1.001	1.072	1.072	1.072	618	618	724	595
2011	1.663	1.672	1.326	1.397	1.397	1.397	1.663	1.663	1.890	1.385
2012	32.744	32.446	50.423	21.299	20.401	25.882	18.602	18.602	18.602	18.602
2013	31.183	28.434	41.863	21.131	18.349	18.032	15.608	15.608	15.608	15.608
2014	9.786	9.044	8.529	6.837	5.998	5.998	3.788	3.788	4.429	3.788
2015	1.746	1.943	1.943	1.622	1.772	1.772	1.630	1.630	2.084	1.401
2016	7.842	6.816	6.816	5.484	5.484	5.484	2.546	2.444	2.585	2.420
2017	11.510	11.508	13.161	8.290	8.290	7.635	4.777	4.777	4.777	4.777
2018	2.114	2.120	2.377	1.589	1.654	1.654	1.500	1.500	1.308	1.282
2019	4.451	4.130	3.693	3.159	3.159	2.954	2.447	2.345	2.556	2.181
2020	2.386	2.298	2.298	2.073	2.278	2.558	945	945	1.358	763
2021	5.845	5.256	5.926	2.919	2.919	2.919	1.897	1.839	1.897	1.786
2022	20.587	21.366	21.366	17.955	19.164	19.164	14.478	14.266	14.266	14.266
2023	2.806	2.582	3.541	1.939	1.939	1.841	1.907	1.907	1.907	1.752
2024	11.413	11.512	12.735	10.005	10.886	8.584	6.332	6.332	6.503	6.254
2025	5.581	5.624	7.099	4.463	4.089	3.905	2.968	2.968	2.968	2.968
2026	96.489	90.470	131.730	82.035	70.631	67.809	60.201	60.201	60.201	60.147
2027	13.308	12.561	12.561	11.330	12.265	9.254	6.930	6.930	7.269	6.930
2028	3.678	2.997	2.997	2.365	2.365	2.365	2.637	2.637	2.637	2.365

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2029	23.999	24.549	28.579	19.209	23.717	23.717	9.870	9.870	9.870	9.584
2030	2.381	2.314	2.314	2.242	2.242	2.242	3.334	3.334	3.334	2.242
2031	4.290	4.147	4.286	4.243	4.159	4.159	5.439	5.439	6.118	4.122
2032	119	121	121	126	126	126	195	195	195	111
2033	500	495	495	485	485	485	621	653	621	484
2034	751	754	770	747	752	765	997	997	1.708	744
2035	5.769	5.814	5.814	5.687	5.670	5.880	7.750	7.750	7.750	5.663
2036	9.890	8.918	8.918	7.552	8.435	8.435	10.057	9.294	9.899	7.489
2037	10.213	9.922	13.751	5.381	5.360	5.522	7.335	7.335	7.335	5.360
2038	2.863	2.826	5.359	1.756	1.669	2.028	2.937	2.234	2.510	1.669
2039	2.348	2.343	2.372	2.711	2.664	2.664	2.599	2.599	2.587	2.587
2040	2.055	1.690	2.610	1.172	1.077	1.077	1.440	1.275	1.611	1.077
2041	6.227	5.901	7.216	5.109	4.786	4.786	5.320	4.934	4.934	4.786
2042	1.726	1.661	1.733	1.565	1.565	1.565	1.329	1.329	2.082	1.329
2043	2.535	2.457	2.936	2.012	2.012	1.883	1.198	1.198	1.355	1.198
2044	2.268	2.001	2.099	2.141	1.753	1.753	1.908	2.028	2.472	1.653
2045	3.480	3.215	4.073	2.731	2.731	2.625	2.778	2.782	2.778	2.618
2046	6.892	7.176	9.400	5.976	6.532	6.532	4.405	4.405	4.637	4.405
2047	2.182	2.063	2.499	1.983	1.871	1.871	2.165	2.165	2.165	1.871
2048	4.155	3.784	3.732	3.066	3.066	3.054	3.840	3.939	3.543	3.054
2049	3.602	3.477	3.781	3.089	2.983	2.802	2.861	2.861	2.861	2.802
2050	26.148	23.322	19.804	13.217	12.211	12.211	21.065	22.365	21.025	12.211
2051	5.582	5.442	12.665	5.161	5.011	5.011	9.361	9.361	9.361	5.011
2052	2.527	1.946	1.946	1.630	1.630	1.630	1.514	1.514	1.757	1.494
2053	7.999	6.883	6.239	4.619	4.704	5.069	6.443	5.678	5.567	4.608
2054	7.789	7.534	6.749	4.789	4.839	4.839	4.246	4.246	4.246	4.091
2055	6.041	5.462	8.528	3.376	3.376	3.376	2.653	2.653	3.860	2.653
2056	2.115	1.946	3.290	2.026	1.892	1.892	3.303	3.183	3.240	1.892
2057	678	697	697	555	596	596	872	789	1.058	496
2058	1.827	1.710	1.710	1.584	1.722	1.495	1.340	1.340	1.532	1.172
2059	1.958	1.743	1.723	1.457	1.560	1.436	1.414	1.401	1.074	976
2060	1.194	1.164	1.100	1.297	1.286	1.286	1.901	1.901	2.172	1.274
2061	599	619	619	660	570	544	759	759	905	543
2062	717	641	887	714	615	562	929	929	900	527
2063	1.536	1.365	1.973	1.488	948	2.531	2.451	2.451	1.721	948
2064	816	829	829	919	894	894	1.172	1.172	2.012	787
2065	1.355	1.036	1.036	1.071	1.071	984	675	734	734	675
2066	1.074	1.220	1.220	1.002	1.092	1.092	825	825	739	712
2067	17.628	16.321	15.362	12.651	13.584	13.584	10.441	10.441	10.850	10.441
2068	2.012	2.262	2.262	2.010	2.258	2.258	1.519	1.894	2.038	1.519
2069	1.352	1.383	1.375	1.439	1.446	1.450	1.380	1.639	1.287	1.198
2070	6.699	6.697	6.697	5.959	5.959	6.347	10.946	10.946	11.803	5.959
2071	6.350	5.905	6.996	5.221	5.078	6.558	6.810	6.810	6.810	5.078
2072	5.486	5.177	5.177	4.308	4.114	5.399	5.550	5.550	5.550	4.114
2073	2.046	1.746	2.533	873	887	1.148	1.318	1.318	1.399	873
2074	721	707	881	772	702	868	679	679	679	596
2075	1.719	1.685	1.685	966	972	972	695	696	696	454
2076	3.594	3.576	4.178	1.689	1.552	1.552	2.732	2.081	2.358	1.552
2077	1.574	1.596	1.498	1.455	1.516	1.447	1.689	1.689	1.982	1.447
2078	1.675	1.485	1.485	1.183	969	1.502	890	730	730	577
2079	1.716	1.660	2.059	1.644	1.629	1.631	3.182	3.182	3.791	1.629
2080	1.974	2.070	2.770	1.516	1.359	1.359	1.078	1.078	1.078	1.078
2081	3.935	3.606	3.606	3.027	3.027	3.628	2.185	2.185	2.185	2.185
2082	967	941	1.499	872	824	1.132	1.075	719	719	719
2083	2.817	3.058	3.058	2.427	2.874	2.874	3.051	3.051	3.436	2.334

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2084	2.455	2.407	2.680	1.881	2.073	2.073	1.192	1.192	1.192	848
2085	12.840	11.560	9.864	7.074	7.074	7.884	8.012	8.012	8.012	7.074
2086	4.671	4.333	4.803	3.146	3.146	3.146	2.088	2.088	3.272	2.088
2087	1.264	1.231	1.231	1.188	1.289	1.289	1.150	1.150	1.080	1.073
2088	5.061	4.826	4.826	3.953	3.953	3.953	2.776	3.569	4.563	2.277
2089	46.228	53.737	44.099	49.941	51.784	51.784	41.445	41.445	41.445	41.445
2090	40.711	38.482	39.689	43.794	48.036	48.036	44.056	44.056	44.056	38.580
2091	49.567	54.918	48.160	51.614	52.321	52.321	45.027	45.027	45.027	45.027
2092	22.055	21.158	23.196	18.789	18.789	18.789	28.200	28.200	28.200	18.789
2093	30.095	30.278	30.278	24.848	23.466	24.848	46.122	46.122	46.122	23.466
2094	22.719	22.345	39.832	21.959	22.007	39.088	24.768	24.768	35.623	21.805
2095	23.473	21.098	21.778	20.774	18.876	23.503	23.929	23.929	25.735	18.876
2096	20.604	19.058	35.715	14.141	14.141	14.788	29.404	29.404	29.404	14.141
2097	23.733	22.667	23.701	21.410	18.700	18.700	18.695	16.608	17.377	16.380
2098	33.206	33.630	36.482	33.629	34.371	38.352	39.645	39.645	64.945	30.371
2099	31.270	30.390	30.390	30.325	33.371	37.606	29.504	29.504	34.785	29.113
2100	37.265	37.781	34.909	36.126	38.869	33.375	34.505	34.505	44.812	33.375
2101	73.044	72.184	74.296	72.038	84.165	96.860	70.560	64.176	78.797	64.176
2102	45.726	46.698	57.776	44.467	55.068	45.025	41.380	41.380	42.821	39.187
2103	65.686	61.222	62.075	65.165	75.069	88.819	70.551	70.551	81.246	60.032
2104	37.985	34.806	47.270	38.257	44.274	32.708	38.891	38.891	37.379	32.708
2105	41.474	44.905	42.672	42.313	46.017	36.714	45.890	45.890	47.838	36.714
2106	57.643	64.350	53.940	59.479	61.231	51.648	61.531	61.531	82.218	51.648
2107	2.216	2.008	2.604	1.607	1.439	1.439	1.450	1.471	1.450	1.339
2108	976	1.272	1.399	785	785	822	1.353	1.353	1.246	785
2109	3.034	2.859	2.779	2.349	2.466	2.852	1.837	1.837	1.678	1.678
2110	1.732	1.622	2.008	1.257	1.158	1.158	826	822	1.132	822
2111	480	471	581	498	559	559	592	592	668	443
2112	18.382	18.384	18.384	11.161	11.161	11.042	13.238	13.238	11.635	11.042
2113	8.043	8.071	9.136	5.912	5.912	5.912	5.116	4.704	4.564	4.564
2114	6.088	5.499	5.499	4.194	4.525	4.525	3.391	2.606	2.606	2.606
2115	2.356	2.385	2.582	1.973	1.823	2.869	1.600	1.600	2.029	1.600
2116	1.111	1.086	1.086	1.005	1.000	1.000	1.235	1.265	1.265	1.000
2117	891	889	889	902	902	902	1.466	1.466	1.474	897
2118	7.692	6.740	7.457	6.685	6.320	6.320	6.486	5.537	5.537	5.537
2119	8.923	8.506	9.079	7.304	6.767	6.910	7.176	7.176	8.200	6.767
2120	6.667	6.422	6.761	5.543	5.327	5.327	5.028	5.028	5.466	5.028
2121	1.675	1.374	1.374	966	966	966	789	850	850	704
2122	2.203	2.242	2.081	2.108	2.092	2.092	2.260	2.145	2.145	2.023
2123	971	954	1.295	986	986	867	901	901	771	693
2124	2.417	2.188	3.964	1.899	1.899	1.899	3.046	3.046	3.046	1.899
2125	5.430	4.626	4.626	3.801	3.804	6.108	3.086	3.086	3.086	3.086
2126	6.237	5.840	5.840	4.562	4.425	4.425	6.018	6.018	6.014	4.425
2127	3.119	2.937	3.172	2.663	2.753	2.753	2.189	2.189	2.189	2.189
2128	1.601	1.591	2.095	1.448	1.574	1.941	1.672	1.672	1.580	1.408
2129	21.785	19.615	18.017	10.997	10.997	10.997	9.806	9.497	9.497	9.497
2130	6.438	6.322	6.322	4.105	4.178	4.178	2.484	2.484	2.598	2.484
2131	3.823	3.770	3.770	3.047	3.047	2.939	3.158	3.158	3.158	2.939
2132	2.008	2.039	1.895	1.844	2.051	2.051	2.948	2.948	3.588	1.796
2133	411	427	422	476	476	418	399	399	468	335
2134	4.594	4.139	3.868	3.157	3.404	3.404	2.688	3.221	3.221	2.669
2135	7.694	7.542	7.542	4.124	4.782	5.581	2.969	2.969	2.969	2.969
2136	3.830	3.755	3.429	2.757	2.757	3.158	2.414	2.414	2.449	2.414
2137	3.525	3.615	3.615	3.314	3.462	3.462	4.700	4.700	5.086	3.314
2138	720	851	851	629	670	550	841	821	821	550

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2139	1.772	1.680	1.680	1.855	1.808	1.808	434	434	868	434
2140	732	837	837	709	745	811	565	787	787	554
2141	4.660	4.788	4.788	3.531	3.531	3.304	3.046	3.563	3.801	3.046
2142	4.541	4.468	5.116	2.841	2.841	3.088	2.661	2.570	3.090	2.570
2143	2.493	2.580	2.580	2.007	2.007	2.007	1.857	1.857	1.857	1.715
2144	2.059	2.088	2.088	2.252	2.158	2.158	2.161	2.161	2.417	2.047
2145	1.570	1.596	1.534	1.697	1.633	1.674	1.253	1.253	1.312	1.253
2146	1.623	1.670	1.777	1.770	1.701	1.701	1.461	1.173	1.322	1.173
2147	3.102	2.873	2.725	2.367	2.367	2.367	2.557	2.557	2.535	2.343
2148	1.938	1.921	2.004	1.964	1.961	1.961	1.063	1.063	1.063	1.063
2149	688	701	696	749	749	878	1.706	1.706	1.706	705
2150	853	911	888	1.065	1.061	1.090	782	782	2.621	575
2151	991	1.041	1.029	904	904	904	1.151	1.151	2.355	702
2152	2.965	2.740	3.602	1.999	1.999	3.650	1.465	1.452	1.526	1.092
2153	2.793	3.037	3.037	2.180	2.010	1.899	943	943	820	788
2154	2.188	2.017	2.017	1.477	1.477	1.485	1.478	1.478	1.478	1.440
2155	1.514	1.381	1.381	1.434	1.434	2.685	2.130	2.100	2.100	1.434
2156	848	870	872	941	941	941	1.421	1.433	1.433	741
2157	3.051	2.940	2.965	2.693	2.858	2.858	3.550	2.649	3.904	2.649
2158	37.543	33.758	44.179	20.228	19.432	19.432	13.990	13.990	13.990	13.990
2159	15.688	14.739	14.739	11.714	10.958	10.883	9.616	9.616	9.616	9.043
2160	10.150	9.821	10.442	8.877	9.303	9.303	6.705	6.705	7.243	6.705
2161	3.945	3.507	3.212	2.661	2.707	3.616	2.471	2.494	2.494	2.438
2162	10.722	10.074	10.410	9.889	9.902	9.320	7.536	7.569	7.785	7.536
2163	3.563	3.269	3.661	2.559	2.559	2.536	1.454	1.275	1.275	1.275
2164	2.939	2.913	2.975	2.833	2.833	2.833	3.274	3.274	3.563	2.833
2165	21.816	19.101	19.018	16.026	16.660	24.519	11.915	11.915	11.915	11.915
2166	10.045	9.356	14.207	7.125	6.406	6.439	4.309	4.309	4.309	4.309
2167	7.248	6.830	9.218	5.997	5.510	5.275	4.954	4.954	4.954	4.954
2168	3.574	3.446	3.998	2.936	2.936	2.930	4.884	5.038	4.606	2.930
2169	1.851	1.819	1.819	1.784	1.802	1.802	1.879	1.860	1.911	1.735
2170	3.044	3.027	3.681	2.981	2.981	2.981	3.128	3.128	4.747	2.980
2171	893	881	888	841	841	841	4.825	4.825	5.640	791
2172	1.463	1.178	1.223	1.060	1.060	1.060	3.232	3.232	4.517	1.060
2173	992	999	999	1.026	1.026	1.026	1.141	1.140	1.157	1.021
2174	171	187	192	234	234	234	550	550	679	98
2175	144	150	154	166	166	171	101	101	101	89
2176	1.059	1.100	1.046	972	972	1.112	1.647	1.508	2.150	853
2177	800	763	705	653	653	721	1.312	1.312	1.312	646
2178	2.374	2.395	2.361	2.401	2.364	2.364	3.126	3.126	4.623	2.245
2179	1.366	1.343	1.385	1.274	1.274	1.617	1.975	1.975	1.975	1.274
2180	295	314	314	369	369	369	12	12	48	12
2181	25.944	25.015	33.948	23.936	23.936	23.936	63.492	62.064	68.542	23.654
2182	473	481	482	505	505	505	418	419	418	412
2183	1.021	1.014	1.246	1.058	1.058	1.244	1.942	1.942	2.632	1.033
2184	4.193	3.905	3.905	3.370	3.370	3.370	2.081	2.068	2.735	2.067
2185	1.613	1.590	2.455	2.045	2.243	2.243	4.174	4.174	4.195	1.522
2186	192	197	205	211	211	211	197	200	258	174
2187	155	151	149	141	141	141	274	272	287	136
2188	4.538	4.246	3.724	3.616	3.560	3.560	4.107	4.197	4.269	3.560
2189	199	202	198	176	186	213	164	168	174	147
2190	4.834	4.819	4.857	4.802	4.802	4.802	9.264	9.264	14.421	4.801
2191	13.115	12.008	12.840	13.063	12.988	13.433	13.917	13.917	13.917	11.796
2192	3.186	2.787	2.787	1.978	1.978	2.300	3.423	3.423	5.039	1.978
2193	410	414	427	428	428	428	355	355	366	355

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2194	1.186	1.189	1.189	1.202	1.202	1.202	2.588	2.588	2.779	1.200
2195	1.707	1.704	1.629	1.344	1.243	1.243	1.700	1.700	1.958	1.057
2196	4.056	3.831	3.328	3.103	3.103	2.877	4.260	4.260	4.518	2.716
2197	62	66	67	79	79	79	48	48	71	42
2198	639	685	730	824	824	824	833	833	842	416
2199	176	173	141	189	188	188	332	332	250	130
2200	176	180	173	191	191	161	640	640	730	137
2201	19.257	20.460	22.609	13.532	13.532	13.532	35.551	35.551	30.583	13.532
2202	1.183	1.206	1.209	1.275	1.275	1.275	2.041	2.041	1.411	1.071
2203	584	632	605	768	768	768	563	469	563	468
2204	3.212	3.200	3.200	3.176	3.176	3.176	2.473	2.473	11.820	2.473
2205	1.516	1.504	1.685	1.820	1.820	1.475	1.941	1.941	1.941	1.475
2206	9.087	9.192	9.661	10.481	10.481	9.528	17.940	17.940	17.940	8.606
2207	1.068	1.071	1.244	1.084	1.084	1.084	2.369	2.369	5.483	1.081
2208	7.861	7.985	7.871	7.360	7.360	7.360	6.267	6.267	6.469	6.267
2209	103	101	101	96	96	96	72	72	139	72
2210	6.525	6.468	6.468	5.534	5.675	5.675	11.943	11.943	11.943	4.704
2211	205	217	248	207	207	207	356	356	375	206
2212	3.967	3.972	4.985	4.176	4.176	4.176	7.086	7.658	7.655	4.084
2213	5.607	5.418	6.352	5.146	5.146	6.598	6.143	6.143	5.686	5.146
2214	710	705	671	603	630	603	832	905	687	564
2215	3.090	3.025	4.372	3.217	3.042	3.042	5.617	5.484	7.453	3.041
2216	10.665	10.608	13.557	11.228	11.228	14.555	28.126	28.126	28.976	10.968
2217	167	167	167	165	165	165	196	196	196	165
2218	1.459	1.518	1.505	1.687	1.696	1.696	1.279	1.279	1.636	1.170
2219	1.492	1.501	1.501	1.543	1.543	1.543	326	488	847	322
2220	12.316	11.235	11.235	9.824	9.824	13.075	24.009	23.634	25.373	9.409
2221	3.650	3.616	5.516	3.581	3.581	3.581	4.664	4.547	5.165	3.554
2222	260	277	278	326	326	326	31	31	144	31
2223	450	489	495	598	598	611	336	336	1.604	271
2224	1.541	1.538	1.635	1.528	1.521	1.521	990	1.307	1.479	990
2225	2.033	2.019	2.019	1.973	1.973	1.973	3.379	3.191	3.736	1.973
2226	8.902	8.006	8.345	7.680	7.757	7.757	21.260	21.260	27.154	7.680
2227	1.224	1.220	1.220	1.198	1.198	1.198	1.233	1.466	1.277	1.198
2228	314	311	311	301	301	301	335	335	417	301
2229	7.010	6.948	7.020	6.746	6.746	6.746	7.920	7.999	8.027	6.379
2230	2.803	2.651	2.651	2.944	2.712	2.712	5.243	5.243	21.264	2.702
2231	2.438	2.466	2.495	2.615	2.615	2.615	5.165	5.165	5.165	2.443
2232	543	483	483	522	522	522	921	789	871	515
2233	6.201	5.930	5.930	6.357	6.096	6.607	10.928	10.928	10.928	6.061
2234	620	609	747	584	584	584	1.780	1.780	4.708	584
2235	722	725	692	731	731	683	1.816	1.774	2.384	636
2236	49.997	53.857	39.646	40.238	44.183	44.183	36.643	36.643	36.643	35.414
2237	53.691	55.715	64.161	45.537	45.537	39.424	46.575	46.575	41.751	38.600
2238	10.069	9.334	10.578	7.073	7.073	6.636	7.471	7.471	7.471	6.636
2239	30.478	27.561	27.561	19.093	19.093	21.639	23.337	23.337	21.113	17.915
2240	621	551	566	564	626	637	575	535	633	518
2241	1.601	1.516	1.536	1.290	1.314	1.314	1.826	1.826	5.436	1.271
2242	20.050	14.743	15.044	13.793	15.335	15.335	13.483	13.483	13.483	13.194
2243	32.974	31.264	31.264	26.476	29.120	26.476	31.086	31.086	32.446	26.476
2244	38.001	39.453	39.453	30.306	32.001	36.717	30.455	30.455	30.455	28.232
2245	22.824	22.908	22.692	22.557	22.192	22.557	31.755	31.755	36.261	22.192
2246	7.101	7.456	7.456	6.337	7.105	7.105	6.200	6.200	5.413	4.906
2247	17.419	17.287	22.151	17.941	17.101	17.101	45.673	45.673	68.492	17.101
2248	11.743	10.708	7.563	6.256	6.803	6.256	7.255	7.255	10.600	5.699

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2249	897	849	849	713	713	713	2.620	2.620	4.340	713
2250	12.109	16.427	16.427	11.503	12.964	12.964	7.619	7.619	8.774	7.574
2251	21.580	20.784	22.301	18.115	19.203	18.115	28.807	28.807	33.878	17.594
2252	3.025	3.304	2.634	2.726	3.085	3.085	2.493	2.493	2.582	1.954
2253	5.228	5.884	5.884	5.138	5.505	5.505	5.106	5.106	3.860	3.860
2254	1.073	1.063	1.024	984	984	984	1.645	1.645	1.937	917
2255	18.086	18.471	18.471	13.860	13.860	12.724	11.532	10.867	9.982	9.982
2256	256.175	269.682	269.682	221.455	237.669	255.075	207.585	227.653	227.653	204.048
2257	2.041	1.991	2.112	2.617	2.976	1.871	8.018	8.018	12.344	1.871
2258	37.553	35.978	33.973	29.795	29.795	26.986	36.619	36.619	36.619	26.986
2259	682	680	680	672	671	671	725	725	725	671
2260	4.992	4.838	4.341	4.271	4.271	3.995	8.195	8.084	8.617	3.980
2261	5.210	4.829	4.289	4.288	4.288	4.157	2.160	2.160	3.323	2.095
2262	752	686	830	1.006	857	1.414	721	644	721	536
2263	939	907	907	822	862	862	1.069	1.069	1.069	819
2264	1.826	1.803	1.714	1.635	1.670	1.670	1.143	978	978	978
2265	3.610	3.500	3.756	3.230	3.230	3.569	8.939	8.939	47.913	3.230
2266	11.133	10.991	10.991	10.653	10.653	10.653	15.049	15.049	15.049	10.653
2267	3.640	3.621	4.384	3.794	3.794	4.443	5.985	5.985	8.337	3.403
2268	4.505	4.342	4.342	3.515	3.645	3.645	3.087	3.087	3.762	3.037
2269	9.509	11.351	11.351	8.340	9.139	9.733	5.012	5.012	9.168	5.012
2270	81.082	86.115	89.639	76.873	80.554	80.554	50.404	50.404	58.232	47.596
2271	40.647	46.510	46.510	33.634	37.728	37.728	31.689	31.689	33.988	27.155
2272	42.166	39.816	39.816	32.931	36.026	29.858	31.041	31.041	29.598	29.598
2273	7.054	6.115	8.098	5.531	5.531	4.452	6.553	5.528	5.549	4.452
2274	18.388	17.032	17.032	14.284	15.217	16.677	15.076	15.076	20.665	14.284
2275	1.003	899	958	905	818	818	936	884	884	720
2276	14.377	12.848	13.614	11.990	13.796	16.214	11.568	12.933	11.720	10.923
2277	18.298	20.286	20.286	14.635	16.247	17.833	13.265	13.265	17.249	13.265
2278	26.756	35.597	35.597	23.364	26.910	26.910	20.952	19.442	23.446	19.442
2279	1.680	1.779	1.674	1.934	1.887	1.887	2.973	2.973	4.124	1.267
2280	5.665	5.686	6.154	4.792	4.903	5.312	5.102	5.102	5.102	4.789
2281	6.222	6.205	6.205	6.184	6.184	6.184	8.835	7.881	7.881	6.184
2282	1.545	1.475	1.475	1.333	1.401	1.307	1.578	1.578	1.578	1.307
2283	5.355	5.726	5.726	4.558	5.258	5.258	2.808	2.808	2.808	2.790
2284	982	1.094	1.094	876	992	669	953	953	1.215	665
2285	11.285	10.393	15.099	9.774	10.664	13.798	9.299	8.857	8.857	8.857
2286	4.195	3.768	4.436	2.973	2.973	2.384	3.424	3.424	4.263	2.384
2287	4.165	4.364	4.364	4.259	4.259	4.259	3.472	4.752	4.752	3.472
2288	1.393	1.435	1.435	1.341	1.352	1.365	2.289	2.330	2.289	1.296
2289	25.808	28.235	28.235	18.455	21.055	21.055	14.974	14.470	14.974	14.470
2290	115.520	104.306	126.417	79.404	87.689	87.689	80.640	67.327	72.815	64.550
2291	9.755	8.711	8.397	8.933	8.933	10.716	7.966	7.966	7.966	7.966
2292	4.071	4.072	4.222	4.099	4.046	4.105	6.495	6.495	7.502	4.046
2293	4.258	4.830	3.657	3.702	4.513	3.239	3.054	3.054	3.054	3.054
2294	3.899	3.633	3.896	3.596	3.596	3.596	6.008	6.008	6.008	3.596
2295	2.211	3.322	3.322	2.757	3.228	3.228	2.776	2.776	4.112	2.001
2296	2.149	2.188	2.188	1.979	2.026	2.026	1.545	1.545	2.544	1.545
2297	3.745	3.500	3.500	3.545	3.440	4.028	4.020	4.020	4.925	3.440
2298	2.266	2.330	1.931	2.013	2.233	2.233	1.462	1.462	2.020	1.368
2299	11.657	11.042	12.659	11.324	10.850	11.085	32.782	31.545	32.952	10.850
2300	31.251	29.815	29.815	30.410	29.468	29.468	79.953	79.953	103.123	29.468
2301	3.809	3.598	3.533	3.290	3.290	3.290	8.128	8.128	16.310	3.201
2302	59.650	60.441	68.744	46.528	49.356	42.072	60.714	60.714	62.687	42.036
2303	66.974	68.843	68.843	52.130	62.436	47.556	53.265	53.265	59.224	47.556

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2304	9.801	9.799	9.758	8.878	9.053	9.053	8.390	8.390	8.390	8.390
2305	31.075	29.064	40.073	23.378	25.013	20.915	19.071	19.071	19.071	19.071
2306	707	732	732	678	709	709	634	634	658	634
2307	2.458	2.284	1.804	1.585	1.488	1.407	3.678	3.678	3.678	1.407
2308	28.376	31.237	34.063	23.711	26.719	29.182	22.894	22.894	22.894	21.422
2309	54.962	56.314	60.209	48.825	49.455	54.206	55.165	55.165	55.165	48.825
2310	92.313	96.135	96.135	80.984	85.732	91.924	82.852	82.852	89.887	78.246
2311	5.653	5.576	5.262	5.133	5.308	5.133	3.971	5.080	5.575	3.971
2312	1.682	1.749	1.900	1.501	1.630	1.803	3.136	3.136	3.898	1.324
2313	10.571	10.399	10.250	10.636	10.122	10.122	79.777	79.777	113.778	10.122
2314	6.623	6.129	6.129	6.389	5.123	5.123	11.051	11.051	10.329	4.620
2315	811	973	973	585	651	491	930	930	947	433
2316	17.134	18.683	17.271	16.057	17.991	13.159	12.309	12.309	12.309	12.309
2317	21.000	20.638	20.638	19.980	19.980	23.436	43.702	43.702	55.785	19.980
2318	1.966	2.004	2.004	1.903	1.903	1.903	993	1.047	1.047	991
2319	3.346	3.453	4.415	3.069	3.069	4.215	1.934	2.196	2.196	1.934
2320	3.505	3.492	3.405	3.433	3.454	3.620	4.168	4.168	4.654	3.385
2321	21.494	20.482	20.482	17.419	19.142	19.142	12.516	17.098	16.924	12.516
2322	212.471	217.185	248.145	165.729	177.768	146.673	192.444	192.444	201.260	146.673
2323	4.098	3.175	3.222	3.216	2.902	2.902	3.256	3.256	3.249	2.866
2324	7.623	8.557	8.557	6.585	7.301	7.301	5.445	5.445	4.814	4.814
2325	1.647	1.815	1.815	1.613	1.668	1.668	1.742	1.689	1.742	1.479
2326	6.387	6.010	6.379	6.555	6.194	6.339	13.686	13.686	17.942	6.007
2327	6.381	6.681	6.370	6.067	6.493	6.927	12.312	12.312	15.070	5.984
2328	4.538	5.082	5.227	4.587	4.963	5.107	18.221	18.221	38.951	4.022
2329	13.450	13.897	14.440	12.267	13.040	13.040	16.092	16.092	26.042	11.083
2330	8.527	8.682	9.825	6.723	6.723	6.723	5.905	6.943	6.943	5.249
2331	42.616	42.200	54.418	36.510	39.368	39.368	46.042	46.042	46.042	36.110
2332	21.928	25.903	25.903	22.092	24.756	24.756	32.115	32.115	41.137	20.933
2333	25.266	20.818	19.879	17.409	17.409	17.409	23.768	23.768	29.065	17.409
2334	25.814	21.594	20.958	18.341	19.717	22.685	23.180	23.180	23.180	18.239
2335	4.701	4.145	5.410	2.731	2.695	2.650	2.399	2.399	2.222	2.140
2336	15.466	11.758	11.751	9.387	9.892	9.892	8.305	6.769	6.769	6.769
2337	3.958	4.267	4.267	4.033	4.168	4.414	3.292	3.292	2.154	2.154
2338	20.346	23.158	23.158	15.795	19.453	15.795	15.499	15.499	16.942	14.781
2339	12.976	12.120	12.120	10.743	11.416	13.573	7.651	7.110	8.751	7.110
2340	26.924	21.970	20.290	17.865	17.865	17.865	12.319	12.319	12.319	10.963
2341	601	640	501	490	548	581	735	735	973	453
2342	6.259	7.365	7.365	5.938	7.067	7.067	3.496	3.496	3.188	2.553
2343	2.719	3.169	3.762	2.586	3.282	3.506	5.492	5.492	7.163	2.539
2344	5.239	4.835	5.528	3.783	3.783	4.993	2.828	2.828	3.045	2.828
2345	10.257	9.739	10.170	8.086	7.849	14.954	5.526	6.045	5.948	5.234
2346	4.000	4.061	4.493	3.487	3.863	3.487	6.149	6.149	6.154	3.481
2347	1.194	1.280	1.280	1.121	1.170	1.170	657	657	657	657
2348	20.864	20.077	17.714	16.568	17.571	21.887	13.708	13.708	13.708	13.708
2349	104.671	84.789	84.789	69.876	69.876	81.965	75.181	65.546	65.546	61.486
2350	12.260	9.722	9.389	8.945	8.230	8.045	14.425	14.425	14.425	8.045
2351	1.958	1.839	1.839	1.704	1.897	1.343	1.987	1.987	1.830	1.343
2352	1.519	1.465	1.465	1.467	1.328	1.320	1.458	1.458	1.458	1.284
2353	4.585	4.889	5.080	3.877	4.266	4.266	4.254	4.254	4.888	2.503
2354	33.596	34.493	38.531	28.307	30.862	27.271	19.897	19.897	23.807	19.897
2355	49.629	43.277	43.277	38.185	38.185	39.383	48.240	48.240	51.307	38.155
2356	53.977	60.216	60.216	41.976	45.406	36.016	31.149	31.149	31.149	30.322
2357	13.006	12.244	12.244	11.037	11.810	11.810	13.909	13.967	14.414	11.037
2358	27.281	26.076	26.613	25.302	33.592	33.592	38.407	32.969	33.796	25.302

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2359	1.850	1.708	1.708	1.319	1.319	1.319	3.406	3.424	3.636	1.266
2360	20.694	18.833	21.586	21.000	24.159	16.527	20.291	20.587	22.604	16.527
2361	25.680	25.941	29.354	21.124	23.433	27.885	27.351	27.351	32.193	19.244
2362	34.891	41.551	41.551	25.049	24.192	41.253	33.404	25.708	25.708	24.192
2363	841	771	788	833	1.188	1.267	1.338	1.338	1.672	683
2364	5.012	4.761	4.291	4.057	4.631	4.631	4.468	5.957	5.957	3.915
2365	20.019	20.465	21.514	19.791	20.187	20.187	58.974	58.974	133.170	19.701
2366	15.167	14.445	14.239	14.547	14.028	14.028	33.444	33.444	33.444	14.012
2367	20.167	22.822	22.822	19.824	20.461	16.294	12.177	12.055	11.950	10.809
2368	5.845	5.792	5.792	5.685	5.685	5.685	8.779	8.779	10.318	5.667
2369	20.752	23.337	21.889	16.865	18.330	12.475	16.507	16.507	19.807	12.475
2370	16.778	16.217	24.733	21.795	22.806	22.806	20.942	20.942	26.216	15.627
2371	1.392	1.401	1.390	1.427	1.508	1.508	2.185	2.185	4.932	1.342
2372	21.607	19.008	27.258	15.909	15.909	15.047	12.382	14.469	12.382	12.382
2373	191.064	176.108	156.127	132.977	148.724	128.041	127.639	116.406	116.406	116.406
2374	55.715	62.379	62.379	56.508	59.180	59.180	74.338	74.338	81.065	53.727
2375	6.415	6.808	8.241	5.478	5.478	7.957	10.698	10.698	12.664	5.203
2376	18.172	17.287	17.768	18.257	16.706	17.142	77.134	77.134	130.632	16.706
2377	4.424	4.424	3.678	3.665	3.843	3.843	5.849	5.624	5.624	3.245
2378	1.541	1.507	1.612	2.002	2.300	2.647	1.748	1.748	1.827	1.402
2379	2.697	2.758	2.758	2.555	2.594	2.594	2.384	2.384	2.860	2.384
2380	2.077	1.950	1.898	1.607	1.607	2.163	1.780	1.510	1.605	1.510
2381	3.368	3.293	3.293	2.815	2.967	2.413	2.224	2.224	2.361	2.224
2382	2.514	2.431	2.431	2.151	2.191	2.478	2.309	2.309	2.641	2.005
2383	19.875	20.606	20.606	19.258	19.647	19.647	17.603	17.603	52.532	17.603
2384	28.637	28.052	27.132	26.178	26.178	26.178	43.342	43.342	58.071	25.290
2385	11.192	11.175	11.192	11.113	11.113	11.113	75.451	69.014	146.834	11.113
2386	11.843	9.075	9.075	8.463	7.910	7.910	11.088	11.088	11.088	7.910
2387	76.853	72.471	76.174	76.757	81.504	81.504	159.527	159.527	221.313	66.245
2388	25.858	27.781	22.394	21.436	24.142	20.498	22.845	22.992	22.992	20.498
2389	26.737	32.409	32.409	24.686	27.583	27.583	23.793	23.793	22.250	22.250
2390	4.588	3.552	4.283	3.149	3.149	2.774	3.260	3.260	3.560	2.774
2391	12.977	16.566	16.566	10.526	13.724	13.724	8.914	8.914	6.727	6.727
2392	478	579	579	450	553	553	479	500	431	398
2393	1.204	1.205	1.205	1.053	1.124	1.124	1.055	1.055	1.055	990
2394	6.676	6.489	6.489	5.953	6.284	5.910	7.323	7.323	7.323	5.910
2395	13.274	12.437	12.437	9.630	9.698	9.698	8.346	9.397	8.346	7.634
2396	19.705	24.538	24.538	17.076	19.828	19.828	12.943	12.943	10.664	10.664
2397	3.389	3.275	3.275	2.968	3.033	3.033	3.825	3.825	3.825	2.968
2398	1.741	1.672	1.508	1.420	1.420	1.343	1.707	1.707	2.277	1.343
2399	2.494	2.345	2.372	2.226	2.226	2.226	7.448	7.448	8.207	2.226
2400	10.742	10.135	8.505	8.353	8.353	7.944	9.274	9.312	9.200	7.944
2401	8.877	10.007	6.687	7.075	8.307	8.307	9.549	9.549	10.801	6.000
2402	2.981	2.962	2.962	2.324	2.442	2.442	3.350	3.350	3.367	1.993
2403	5.202	5.536	5.536	4.904	5.403	5.403	6.173	6.173	7.593	4.378
2404	5.330	5.891	6.460	4.994	5.692	6.386	4.034	5.793	5.793	4.034
2405	1.503	1.462	1.462	1.267	1.315	1.103	1.487	1.439	1.439	1.103
2406	11.053	10.788	10.788	9.874	10.092	10.092	14.268	15.189	15.050	9.837
2407	89.615	82.220	102.061	70.262	54.146	54.146	51.988	57.446	55.705	51.988
2408	10.430	9.747	9.747	7.614	7.614	7.614	9.720	9.720	9.720	7.064
2409	559	594	594	699	699	699	360	360	360	360
2410	3.298	3.233	3.239	3.499	3.222	3.222	25.701	25.701	35.449	3.222
2411	2.879	2.919	3.192	2.720	2.714	2.714	24.148	24.148	24.148	2.714
2412	1.061	1.047	1.047	1.049	1.021	1.021	1.323	1.323	1.323	992
2413	3.466	3.709	3.709	3.227	3.428	3.428	3.109	3.567	3.567	3.109

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2414	1.501	1.533	1.533	1.504	1.502	1.638	2.374	2.374	2.737	1.477
2415	2.818	3.048	3.048	2.689	2.975	2.887	2.356	2.356	3.094	2.356
2416	885	882	977	891	891	855	1.217	1.282	1.282	855
2417	3.778	3.754	3.877	3.752	3.659	3.764	11.565	11.565	11.565	3.659
2418	10.472	10.273	10.273	9.517	9.517	9.517	6.892	6.892	7.727	6.798
2419	2.630	2.518	2.359	2.151	2.151	2.151	7.303	6.229	7.918	1.987
2420	9.861	9.242	7.540	6.981	6.981	6.981	5.609	5.609	7.137	5.545
2421	44.254	48.483	39.309	38.549	42.943	42.943	39.227	37.945	35.033	35.033
2422	54.260	58.366	58.366	48.733	53.392	53.392	49.696	48.340	48.340	45.727
2423	4.314	5.748	5.748	4.707	5.172	3.778	3.481	3.481	3.813	3.074
2424	20.041	20.774	20.774	16.340	17.730	18.983	13.495	11.661	11.323	11.323
2425	1.993	2.188	2.188	1.740	2.124	2.124	2.425	2.726	2.425	1.740
2426	14.191	15.170	15.170	13.338	14.748	14.748	22.675	22.959	23.706	13.233
2427	16.081	17.936	14.029	13.655	14.606	13.655	13.753	13.753	16.891	13.531
2428	32.932	34.927	31.276	27.609	29.410	29.410	27.697	27.697	34.953	27.401
2429	2.744	2.605	2.226	2.380	2.380	2.151	2.296	2.296	2.488	2.118
2430	7.792	10.243	10.243	9.436	9.858	9.858	11.556	11.556	19.687	7.034
2431	7.908	7.873	8.013	7.476	7.421	8.643	22.479	22.479	32.617	7.421
2432	4.662	4.977	5.429	4.075	4.288	4.288	3.954	3.954	4.774	3.580
2433	9.416	8.251	13.065	7.738	7.229	11.765	12.291	12.291	8.045	7.189
2434	4.567	4.422	4.277	4.046	4.046	3.986	4.523	4.523	5.885	3.939
2435	3.306	3.561	4.103	3.457	3.667	4.015	2.768	2.768	3.346	2.768
2436	1.950	2.107	2.174	1.806	2.000	2.086	1.198	1.198	1.198	1.198
2437	18.218	19.492	18.588	16.937	17.822	17.822	25.654	25.654	38.862	16.558
2438	150.668	159.228	132.796	124.330	138.450	124.330	124.331	135.585	135.585	118.075
2439	4.979	5.079	5.079	4.795	4.982	4.982	4.341	3.965	5.042	3.813
2440	10.974	10.922	10.922	11.266	10.478	10.478	15.615	15.615	20.735	10.478
2441	9.654	10.397	10.046	8.977	9.916	9.916	7.386	7.386	6.723	6.671
2442	1.206	1.196	1.196	1.153	1.153	1.153	698	628	1.341	628
2443	2.312	2.460	2.558	2.241	2.368	2.459	1.563	1.563	1.258	1.206
2444	8.100	8.014	11.059	7.879	7.943	7.879	57.314	57.314	308.123	7.879
2445	9.108	9.036	8.807	8.844	8.844	8.844	10.112	10.112	20.617	8.603
2446	5.912	6.703	8.594	5.366	4.645	4.810	6.558	6.558	6.272	4.645
2447	24.407	26.260	19.664	21.765	23.782	23.782	15.978	15.978	15.978	13.695
2448	3.804	3.901	3.901	3.694	3.821	3.821	3.784	3.784	4.790	3.694
2449	2.662	2.873	3.002	2.355	2.522	2.689	4.180	4.180	5.841	2.199
2450	2.844	2.877	2.877	2.594	2.817	2.817	3.028	3.028	3.811	2.378
2451	2.060	2.169	2.169	1.806	2.004	1.806	2.328	2.404	2.182	1.503
2452	6.100	6.356	7.161	5.801	6.421	6.421	6.428	6.428	7.054	4.904
2453	2.830	3.008	3.008	2.986	2.800	2.800	16.243	16.243	20.802	2.707
2454	2.059	1.842	1.984	1.823	1.823	2.132	7.457	7.457	10.154	1.776
2455	4.675	3.565	3.916	4.190	4.332	4.332	3.390	3.390	4.440	3.390
2456	2.390	2.302	2.302	2.408	2.255	2.255	2.940	2.940	4.502	2.255
2457	15.338	13.509	14.794	13.064	13.064	15.090	16.222	15.214	15.214	12.099
2458	13.741	14.336	14.336	12.992	13.927	13.927	28.411	28.411	28.411	11.911
2459	257	257	257	257	257	257	357	356	405	161
2460	18.183	18.169	18.169	18.109	18.109	18.109	24.992	22.641	24.782	18.109
2461	4.073	3.809	3.554	2.601	2.601	2.563	3.165	3.165	4.324	2.494
2462	5.773	5.373	4.878	4.064	4.215	4.215	3.850	3.850	3.986	3.850
2463	403	405	404	412	412	412	756	756	1.106	369
2464	2.534	1.926	1.926	1.775	1.775	1.650	1.509	1.577	1.577	1.509
2465	3.820	3.715	3.383	3.271	3.420	3.271	3.830	3.830	4.552	2.785
2466	3.922	3.324	3.250	3.279	2.831	4.393	2.904	2.904	3.224	2.725
2467	761	763	761	729	729	729	1.123	1.123	1.123	729
2468	482	455	562	518	386	386	697	697	982	386

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2469	21.931	19.689	19.689	15.178	15.178	17.031	17.824	18.939	17.824	15.126
2470	578	572	572	549	549	519	1.737	1.737	1.683	502
2471	4.332	4.457	4.558	4.377	4.684	4.684	4.745	4.745	4.745	4.338
2472	7.012	6.942	8.683	6.799	6.582	6.373	5.908	4.827	4.827	4.827
2473	1.756	2.022	2.012	1.717	1.717	1.717	1.578	1.578	1.578	1.578
2474	616	633	648	684	684	684	733	733	757	536
2475	1.766	1.876	1.876	2.207	2.207	2.207	17	17	20	17
2476	1.704	1.800	1.601	1.438	1.595	1.595	2.549	2.549	3.664	1.438
2477	1.854	1.847	1.689	1.573	1.636	1.448	2.361	2.361	2.361	1.448
2478	285	281	281	269	269	269	401	401	612	269
2479	5.356	4.585	4.585	4.018	3.965	3.965	5.861	5.861	6.053	3.965
2480	360	362	363	369	369	369	376	376	417	321
2481	753	760	752	673	744	779	728	728	834	673
2482	147	159	164	194	194	194	123	123	71	71
2483	7.403	7.096	7.184	6.787	6.787	6.890	7.677	7.677	7.677	6.766
2484	1.150	1.132	1.261	1.071	1.071	1.071	2.220	2.220	2.418	1.071
2485	4.668	4.990	4.066	3.428	3.624	3.624	4.445	4.445	4.445	3.428
2486	1.874	2.348	2.348	2.369	2.083	2.083	10.466	10.466	12.686	2.076
2487	2.492	2.902	2.902	2.778	2.612	2.612	10.571	10.571	11.405	2.288
2488	7.025	4.994	5.204	5.776	5.614	6.110	5.328	5.328	8.969	5.234
2489	3.056	3.382	3.382	2.891	2.842	2.925	4.644	4.644	6.510	2.842
2490	2.657	2.615	2.615	2.458	2.450	2.450	9.012	9.012	12.666	2.428
2491	974	965	1.071	929	929	918	5.183	5.183	8.048	914
2492	752	759	759	796	796	796	967	967	967	788
2493	1.058	1.051	998	1.041	1.034	1.034	9.386	9.386	13.493	919
2494	1.349	1.317	1.366	1.606	1.794	1.440	3.088	3.088	4.318	1.271
2495	10.062	10.271	9.924	9.553	9.373	9.763	21.716	21.716	21.716	9.373
2496	1.868	1.869	2.531	1.909	1.909	1.909	2.597	2.597	2.850	1.900
2497	3.102	2.868	3.098	2.903	2.903	2.903	3.560	3.560	3.744	2.895
2498	845	897	902	1.053	1.053	1.053	78	78	140	59
2499	406	421	422	467	467	467	378	377	527	330
2500	925	879	871	840	840	840	2.200	2.200	3.207	818
2501	1.037	1.030	1.030	1.014	1.014	1.014	1.621	1.621	3.385	1.014
2502	3.726	3.596	3.596	3.500	3.500	3.500	3.375	3.375	4.751	3.375
2503	22.333	25.547	25.547	20.392	22.806	22.806	19.568	19.568	16.624	16.624
2504	25.293	20.484	20.484	21.696	19.408	19.408	18.521	18.519	18.519	16.191
2505	2.751	2.473	2.978	2.238	2.342	2.626	1.550	1.550	1.550	1.550
2506	10.404	10.886	11.170	10.152	10.064	10.064	7.420	7.420	7.420	7.420
2507	204	200	200	188	187	187	237	237	232	175
2508	980	1.061	1.168	935	987	987	442	442	759	442
2509	4.661	4.933	4.933	3.756	4.069	3.701	5.569	5.569	5.364	3.612
2510	7.652	7.793	8.907	7.066	7.505	7.984	4.889	4.889	4.991	3.905
2511	22.564	23.377	22.019	21.424	22.259	22.259	18.616	18.616	18.616	18.616
2512	1.748	1.810	1.810	1.600	1.687	1.771	1.972	1.831	2.032	1.600
2513	6.082	6.554	6.554	5.303	6.016	6.016	3.211	3.211	4.191	3.211
2514	2.601	2.812	2.569	2.270	2.593	2.593	2.461	2.461	2.461	1.882
2515	1.431	1.277	1.369	1.355	1.420	1.420	1.610	1.606	1.685	1.271
2516	2.937	3.287	3.287	2.749	3.180	3.225	2.349	2.993	2.549	2.349
2517	524	436	677	484	425	451	741	741	738	414
2518	11.793	12.513	12.513	11.300	11.706	11.706	9.540	9.540	11.719	9.540
2519	60.492	63.287	57.730	50.814	54.388	46.211	36.328	36.328	44.823	35.037
2520	1.733	1.868	1.909	1.582	1.661	1.661	1.206	1.206	1.149	789
2521	1.766	1.665	1.489	1.450	1.450	1.339	1.025	1.491	1.592	1.025
2522	10.685	9.554	11.530	9.764	8.856	8.856	9.048	8.788	9.625	8.788
2523	21.309	23.827	23.827	20.387	20.989	20.989	12.454	12.454	12.454	12.230

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2524	30.973	34.606	34.606	26.647	31.057	33.141	28.072	28.072	26.200	20.894
2525	1.939	1.983	2.210	1.683	1.683	1.309	2.682	2.617	3.118	1.299
2526	10.440	10.739	10.739	8.811	10.162	10.162	11.429	14.004	13.422	7.812
2527	352	350	350	329	335	335	359	359	462	320
2528	5.073	5.031	5.634	5.183	5.101	5.354	17.066	17.066	17.066	5.089
2529	13.273	14.406	14.406	12.097	13.388	13.388	24.329	24.329	23.380	12.003
2530	9.107	9.275	11.672	8.388	8.963	10.161	17.909	17.946	20.485	8.376
2531	15.018	14.993	16.602	12.099	10.106	10.106	9.026	9.026	9.305	9.026
2532	1.493	1.544	1.544	1.334	1.440	1.440	2.066	2.050	2.050	1.248
2533	6.046	5.897	6.067	5.958	5.590	5.669	12.546	12.546	11.903	5.590
2534	236	310	310	230	268	280	309	309	333	189
2535	3.182	2.904	4.964	3.173	3.965	4.700	3.840	3.517	3.372	2.580
2536	1.931	1.953	1.916	2.073	1.946	1.946	1.778	1.681	3.073	1.681
2537	1.649	1.630	1.630	1.553	1.568	1.568	1.115	1.106	1.180	1.084
2538	14.216	14.033	14.033	14.255	13.860	14.196	18.953	18.705	19.789	13.860
2539	50.798	53.546	64.056	47.410	48.159	54.124	50.453	52.565	52.565	45.541
2540	4.107	4.109	4.345	4.094	4.101	4.190	9.755	9.755	17.664	4.060
2541	9.138	9.283	12.147	8.618	9.068	11.769	3.223	3.223	4.393	3.223
2542	10.171	9.855	10.491	9.117	9.149	9.622	10.867	10.615	10.615	9.117
2543	12.544	13.485	13.485	11.410	12.180	12.180	14.545	14.545	13.092	11.410
2544	781	785	785	657	691	657	674	674	861	596
2545	4.614	4.594	4.594	4.527	4.387	4.387	4.524	4.399	4.473	4.387
2546	334	338	333	275	275	275	335	335	410	275
2547	5.211	5.331	5.691	5.326	5.439	5.439	10.421	10.421	16.668	5.288
2548	3.982	3.860	3.860	3.819	3.805	4.247	3.512	3.678	3.512	3.512
2549	5.523	4.887	4.903	5.231	5.823	6.267	4.509	4.474	4.654	4.450
2550	1.563	1.540	1.524	1.494	1.458	1.458	2.100	2.191	2.203	1.443
2551	28.783	26.306	26.306	27.753	30.623	30.623	33.978	30.739	30.739	24.947
2552	24.639	21.703	23.196	18.656	17.365	17.434	21.728	19.303	17.073	16.866
2553	6.581	6.470	7.061	5.491	5.491	5.491	12.129	12.129	8.391	5.319
2554	16.648	16.509	22.361	13.979	13.979	13.979	11.326	11.326	23.448	10.879
2555	7.102	7.792	7.792	6.797	7.581	7.581	51.496	46.389	47.561	6.348
2556	7.669	7.810	7.928	6.647	7.136	7.136	6.908	6.908	12.114	6.578
2557	4.229	4.306	4.306	3.770	4.012	4.012	4.413	4.413	4.454	3.621
2558	193	192	192	179	179	179	252	252	252	178
2559	3.398	3.388	3.889	3.360	3.621	3.839	10.952	10.952	14.005	3.360
2560	36.304	36.803	46.112	32.238	32.238	44.211	1,444.033	1,444.033	1,444.033	32.238
2561	5.021	3.740	3.740	2.241	2.241	3.011	9.357	9.357	8.006	2.241
2562	2.278	2.545	2.549	2.089	2.597	2.597	2.763	2.789	2.762	2.089
2563	2.344	2.348	2.578	2.259	2.259	2.609	3.439	3.117	3.137	2.240
2564	2.494	2.515	2.515	2.695	2.695	2.695	4.772	4.599	5.435	2.645
2565	503	514	514	575	575	575	902	902	1,329	563
2566	4.187	3.611	3.611	3.315	3.561	3.561	14.999	14.999	18.529	3.315
2567	1.357	1.447	1.430	1.251	1.251	1.471	1.257	1.256	1.143	1.091
2568	689	596	619	640	568	577	449	449	437	437
2569	1.326	1.169	1.138	1.276	1.276	1.185	1.037	1.037	1.148	1.014
2570	130	140	161	171	171	171	25	23	144	23
2571	1.640	1.607	1.557	1.452	1.452	1.452	1.407	1.407	1.407	1.407
2572	1.408	1.212	1.358	860	860	860	2.643	2.737	2.652	855
2573	39	41	42	49	49	49	44	49	31	26
2574	178	189	189	223	223	223	36	33	129	33
2575	2.344	2.314	2.580	2.237	2.237	2.590	3.752	3.608	5.178	2.237
2576	993	981	981	926	938	938	759	759	680	680
2577	1.290	1.316	1.303	1.318	1.322	1.332	852	852	1,475	852
2578	19.420	19.348	18.809	15.265	12.495	12.495	23.629	21.312	25.076	11.620

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2579	4.212	4.255	4.140	4.211	3.742	3.419	5.791	5.791	5.325	3.395
2580	2.551	2.709	2.510	2.581	2.581	2.755	2.958	2.958	2.958	2.117
2581	1.487	1.566	1.534	1.369	1.257	1.187	1.171	1.171	1.284	1.166
2582	6.417	6.292	6.670	7.369	7.460	5.918	8.246	8.246	8.246	5.918
2583	4.384	4.380	4.746	3.308	2.972	3.012	20.115	20.115	27.613	2.855
2584	2.522	2.450	2.450	2.300	2.278	2.278	2.552	2.552	3.774	2.278
2585	1.469	1.415	1.415	1.198	1.230	1.230	2.304	2.304	2.779	1.147
2586	482	444	444	343	343	343	334	334	317	317
2587	14.885	14.913	12.129	10.194	11.307	11.307	15.045	15.045	17.414	8.220
2588	9.955	9.996	13.465	10.115	10.115	14.473	13.740	13.740	16.536	10.078
2589	3.128	2.251	2.360	2.410	2.229	1.947	1.981	1.981	2.467	1.947
2590	524	558	558	558	558	529	765	765	647	493
2591	93	98	102	117	117	117	25	25	105	25
2592	8.465	8.406	8.546	8.223	8.158	8.208	8.116	8.116	9.255	8.116
2593	943	941	964	935	935	935	1.013	972	972	935
2594	4.022	4.021	4.021	4.015	4.015	4.015	4.289	4.289	4.779	4.015
2595	3.802	4.148	4.148	3.626	4.025	4.025	4.663	4.671	4.635	3.626
2596	1.356	1.354	1.354	1.352	1.352	1.352	1.416	1.416	1.535	1.351
2597	1.389	1.407	1.365	1.265	1.335	1.335	1.473	1.406	1.406	1.234
2598	5.000	5.073	5.073	5.363	5.363	5.363	12.222	12.222	18.962	5.305
2599	1.072	1.081	1.081	879	1.006	1.006	621	513	585	513
2600	1.020	1.003	1.003	1.007	990	990	1.495	1.381	1.385	990
2601	503	490	532	467	456	452	5.361	5.361	28.529	452
2602	149.430	131.565	112.617	85.857	97.079	97.079	124.165	124.165	124.165	75.268
2603	57.299	52.640	70.917	41.679	44.459	44.459	45.104	45.104	45.104	39.028
2604	33.317	25.692	40.638	23.189	23.189	36.153	25.718	25.718	26.905	21.019
2605	36.035	38.852	38.852	36.006	34.057	38.038	58.101	58.101	77.184	34.057
2606	6.550	4.844	4.898	4.379	4.379	4.107	5.324	5.324	5.557	4.107
2607	5.686	5.625	5.625	6.051	5.192	5.869	5.527	5.527	5.305	4.965
2608	144.589	114.124	114.124	82.094	82.094	82.094	65.062	55.168	55.168	48.371
2609	65.226	65.671	44.539	42.191	36.929	36.929	33.060	33.060	33.060	27.791
2610	27.169	31.811	41.923	23.985	25.880	25.880	20.487	20.007	20.364	20.007
2611	17.105	11.124	10.910	10.417	9.067	9.067	15.167	15.167	16.566	8.629
2612	5.664	5.700	5.700	4.898	5.029	4.898	3.072	3.640	4.415	3.072
2613	3.584	3.580	3.758	3.934	3.496	3.475	4.625	4.625	4.625	3.475
2614	318.693	330.141	351.285	252.011	270.332	288.483	162.967	154.750	154.750	154.750
2615	94.013	106.072	114.514	72.505	77.243	90.562	70.685	55.585	55.585	48.103
2616	52.759	50.282	60.897	40.345	40.345	50.824	49.748	34.213	35.331	34.213
2617	25.196	27.245	27.245	20.669	21.893	21.893	20.324	20.324	20.324	19.901
2618	7.761	8.741	8.741	6.225	5.269	7.848	6.402	6.402	5.653	5.269
2619	5.442	6.401	6.401	4.984	5.966	5.966	4.433	4.433	5.349	3.254
2620	6.487	6.510	7.054	6.387	6.942	6.942	12.487	12.487	17.102	6.387
2621	183.254	158.450	240.408	126.756	117.386	117.386	100.948	100.948	105.043	100.948
2622	53.066	55.450	49.223	39.714	42.886	51.255	30.271	33.481	40.158	29.710
2623	33.381	36.219	43.011	27.998	34.086	34.086	17.624	17.335	22.457	17.335
2624	16.548	16.466	16.466	11.838	11.247	11.247	7.116	7.116	8.338	7.085
2625	4.397	3.972	3.463	2.433	2.433	2.433	3.348	3.348	3.032	2.366
2626	2.872	2.663	2.617	2.584	2.584	2.584	3.398	3.398	3.398	2.483
2627	228.453	229.667	263.404	203.699	264.873	213.655	233.528	233.528	231.697	198.696
2628	54.591	53.928	59.340	39.200	36.936	69.162	52.039	41.945	41.945	36.936
2629	48.112	46.456	46.456	47.939	47.106	45.523	20.892	20.892	21.622	20.892
2630	22.965	21.504	20.010	17.241	19.134	16.284	14.371	14.371	14.371	13.688
2631	9.353	9.826	9.826	8.178	8.684	9.285	2.990	2.990	3.352	2.990
2632	5.777	6.343	6.343	5.793	5.736	5.736	3.785	3.938	5.592	3.785
2633	136.633	122.527	207.180	103.326	103.326	108.766	87.502	87.502	84.309	84.309

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2634	48.524	46.156	56.712	39.005	42.165	53.642	31.543	31.543	31.543	27.144
2635	28.110	28.670	32.902	23.429	27.721	27.721	17.357	17.357	17.357	17.357
2636	13.720	14.322	14.322	10.657	11.568	9.865	11.173	11.173	10.079	9.555
2637	6.845	6.643	6.145	5.649	6.002	7.120	7.729	5.891	7.833	5.624
2638	106.441	97.784	129.384	73.348	80.072	80.072	61.365	61.365	61.365	57.665
2639	50.080	50.684	70.261	39.617	39.617	37.261	38.367	38.367	45.501	35.190
2640	28.542	26.828	34.132	21.900	24.779	24.779	14.828	14.828	16.655	14.549
2641	16.100	17.047	12.242	11.739	13.239	13.239	14.734	14.734	17.814	9.888
2642	4.411	4.500	5.120	3.471	3.471	4.367	3.783	3.783	3.783	2.856
2643	8.781	8.630	8.736	8.639	8.465	8.465	30.522	30.522	155.774	8.465
2644	10.763	10.614	10.627	9.989	9.989	9.989	18.518	18.518	18.518	9.989
2645	2.297	2.284	2.258	2.230	2.230	2.230	2.683	2.612	2.672	2.230
2646	11.954	11.232	10.816	10.942	11.126	10.804	11.477	11.477	15.030	10.696
2647	1.569	1.422	1.422	1.444	1.398	1.398	1.133	1.133	1.344	1.133
2648	248	231	231	177	176	175	348	461	461	167
2649	6.988	6.905	5.365	5.190	5.877	4.839	10.553	10.553	12.407	4.488
2650	6.602	6.805	6.805	5.630	5.783	4.976	8.638	8.500	9.075	4.786
2651	3.082	3.075	3.075	3.078	2.959	3.300	31.821	31.821	62.189	2.959
2652	262	279	279	333	333	333	198	193	258	193
2653	11.040	11.349	12.618	10.419	11.082	10.419	19.298	19.298	20.127	10.419
2654	3.549	3.495	3.717	3.530	3.479	3.479	36.526	36.526	36.526	3.479
2655	1.432	1.448	1.448	1.371	1.367	1.367	2.201	2.201	2.530	1.367
2656	348	356	349	323	323	323	728	728	1.094	311
2657	6.769	6.698	6.698	6.473	6.473	6.473	13.487	13.487	33.543	6.473
2658	1.328	1.311	1.428	1.229	1.250	1.356	860	1.155	999	860
2659	254	270	264	280	281	306	278	276	305	236
2660	83.990	98.109	98.109	71.218	87.643	87.643	49.143	49.143	67.565	44.913
2661	38.290	38.144	40.369	35.609	35.073	36.928	31.199	31.199	28.704	28.704
2662	17.676	19.810	21.298	15.882	17.929	19.411	11.769	11.009	14.616	11.009
2663	8.984	9.878	10.575	7.899	7.899	7.469	4.279	4.526	4.526	4.279
2664	2.931	2.815	3.298	2.528	2.756	2.528	5.775	5.775	5.775	2.528
2665	1.168	1.107	1.005	971	1.021	971	1.455	1.475	1.539	949
2666	86.171	65.732	67.347	66.827	54.374	54.374	83.483	83.483	93.024	54.374
2667	31.026	27.975	43.347	26.079	23.947	40.174	29.254	29.254	29.254	23.947
2668	16.808	16.993	21.671	14.839	16.086	12.609	16.893	16.893	16.893	12.609
2669	6.389	8.440	8.440	5.987	7.374	5.492	6.869	6.869	10.268	5.492
2670	38.514	43.369	43.369	35.806	41.430	41.430	41.262	41.846	38.171	29.456
2671	17.400	18.517	19.700	16.307	18.381	18.381	19.903	19.903	20.418	15.440
2672	7.846	8.030	9.242	7.022	8.058	8.596	8.359	10.477	10.029	6.698
2673	5.293	5.812	5.812	4.817	5.119	4.465	3.462	4.715	5.777	3.462
2674	1.024	965	965	838	907	907	941	941	1.135	811
2675	10.233	10.471	10.471	8.883	9.346	9.729	13.323	13.313	11.519	8.883
2676	8.345	8.018	8.018	6.816	6.816	6.816	11.631	11.631	12.733	6.816
2677	9.555	9.250	9.250	8.378	8.378	8.378	9.918	9.918	10.496	8.304
2678	2.782	2.727	3.138	2.417	2.515	2.714	3.189	2.611	2.508	2.384
2679	22.922	22.520	22.520	21.588	21.650	21.650	22.454	22.454	22.454	21.588
2680	3.123	3.069	3.069	2.983	2.983	2.983	3.366	3.363	3.365	2.983
2681	2.163	2.560	2.151	2.160	2.442	2.383	2.331	2.374	2.903	2.144
2682	42.384	43.425	43.425	35.319	37.757	37.757	39.971	39.775	39.775	31.973
2683	9.096	8.593	8.593	6.995	6.995	6.995	7.611	7.611	10.335	6.925
2684	8.750	9.002	8.173	7.891	8.470	8.470	7.407	7.407	9.596	7.407
2685	8.696	8.424	8.424	7.799	8.627	8.627	12.254	12.254	12.254	7.799
2686	9.015	8.565	8.565	7.693	7.693	7.693	11.435	8.846	8.846	7.693
2687	5.493	4.996	4.858	4.811	4.413	4.363	7.525	7.525	6.958	4.273
2688	2.418	2.423	2.384	2.058	2.438	2.438	1.260	1.861	1.925	1.260

APPENDIX 1: Total Error Cost of CR, SBA and HWM for RMSE, MAE and RGRMSE and Proposed Method.

Code	SBA - RMSE	SBA - MAE	SBA - RGRMSE	CR - RMSE	CR - MAE	CR - RGRMSE	HWM - RMSE	HWM - MAE	HWM - RGRMSE	PROPOSED METHOD
2689	14.575	14.618	20.516	16.050	16.050	16.050	31.441	31.441	31.441	15.620
2690	3.000	3.114	3.123	3.458	3.458	3.458	3.849	3.849	3.849	2.431
2691	38.477	42.476	42.476	33.478	39.280	39.280	27.849	27.849	27.849	27.849
2692	5.357	5.434	5.434	5.367	5.370	5.370	8.536	8.536	14.426	5.367
2693	2.950	2.738	2.821	2.407	2.346	2.825	4.859	4.859	4.859	2.316
2694	18.199	18.407	18.407	21.256	20.116	20.116	36.536	36.536	61.586	19.771
2695	14.312	11.450	11.450	15.673	11.726	11.726	13.155	11.047	22.180	11.047
2696	63.294	60.858	60.858	51.673	53.504	59.536	44.096	44.096	42.485	42.485
2697	17.527	16.824	19.966	14.634	14.634	15.556	15.477	15.477	15.477	13.404
2698	15.359	15.107	15.107	15.036	14.447	14.447	22.142	22.142	47.491	14.447
2699	7.609	8.678	7.894	7.331	8.084	8.084	6.071	6.300	10.012	6.071
2700	369.298	378.196	401.954	320.156	338.185	355.003	229.399	229.399	229.399	229.399
2701	86.776	66.151	69.208	56.689	56.689	56.689	72.509	72.509	100.742	56.689
2702	52.902	48.817	42.684	35.385	35.385	32.592	35.005	32.741	42.362	32.592
2703	57.292	53.703	48.651	45.237	50.334	45.237	43.465	43.465	72.984	43.465
2704	97.501	112.674	112.674	83.336	92.746	92.746	91.865	91.865	164.977	81.011
2705	31.913	43.375	43.375	30.292	35.662	35.662	52.000	52.000	61.703	29.600
2706	20.617	27.475	27.475	22.528	23.496	19.312	34.006	34.006	34.006	19.312
2707	15.159	15.322	15.175	16.825	17.318	17.318	26.455	26.455	31.011	14.928
2708	270.550	271.906	271.906	244.233	249.515	249.515	156.909	158.462	163.262	156.909
2709	183.334	180.193	180.193	170.776	170.776	170.776	165.812	172.103	174.651	165.812
2710	75.470	72.925	86.089	69.131	69.131	69.131	62.815	75.429	81.397	62.815
2711	20.745	21.200	21.200	17.183	18.564	18.564	4.929	4.107	5.109	4.107
2712	9.003	10.122	9.746	8.854	8.854	8.854	26.319	26.319	40.740	8.626
2713	5.036	4.947	4.947	4.423	4.632	4.632	4.626	4.626	4.808	3.943
2714	4.753	5.279	5.279	4.233	4.822	4.822	1.938	1.938	1.938	1.938
2715	2.638	2.425	2.425	2.164	2.164	2.164	8.623	8.623	12.914	2.164
2716	623	641	655	694	694	650	3.319	2.959	2.959	538
2717	309	317	297	268	268	273	526	526	644	266
2718	954	922	922	915	915	915	1.894	1.894	1.894	915
2719	1.818	1.807	1.807	1.790	1.783	1.783	2.730	2.590	2.590	1.695
2720	845	846	900	849	918	918	1.812	1.776	2.135	842
2721	11.373.623	13.075.541	16.418.823	11.119.171	11.961.830	15.981.549	6.134.259	6.458.922	6.458.922	5.774.978
2722	8.926.021	9.531.591	10.320.900	8.654.968	9.018.558	9.837.455	5.962.022	5.962.022	5.962.022	5.962.022
2723	1.060.963	1.136.395	1.477.707	1.029.700	1.364.430	1.510.834	3.856.796	3.856.796	11.834.990	965.770

RESUME

PERSONAL INFORMATION

Name and Surname : Olcay Olcayto
Date of Birth : March 03, 1984
Citizenship : Turkey

EDUCATION

2008 – 2008 : *Bachelor of Industrial Engineering.*
Kocaeli University, Turkey. (3,05/4,00)
1998 – 2002 : *Graduate from High School*
Maltepe High School, Turkey. (4,86/5,00)

WORK EXPERIENCE

2010 – Current : *VIKO Electric and Electronic*
Production Planning Engineer

- Putting in order of customer orders according to due date.
- Making ready the orders on time and in full (OTIFF).
- Managing inventory levels according to inventory turnover targets.
- Schedule master plan for annual and make capacity planning.
- Schedule master production plan for actual orders, safety stocks and demand forecasting data.

2008 – 2010 : *VIKO Electric and Electronic*
Method Engineer

- Making productivity analysis
- Making time study analysis

- Measuring non-productive time for all production lines and machines

2007 – 2008

: *VIKO Electric and Electronic*

Intern of Industrial Engineer

SEMINER AND COURSES

- Stress Management
- Statistical Process Control
- Personal Brand Image
- Improvement Persuasive Skill
- Time Management

SKILLS AND INTERESTS

- **Language** : English (Upper intermediate)
- **Computer** : MS Office (Word, Excel, Power Point, Visio)
BO (Business Object)
SPSS
Minitab
- **Hobbies** : Cooking and swimming