

## Modeling Trend in Foreign Currency Exchange Rate and Future Forecasting in Terms of Pakistani Rupees

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### Abstract

*The demonstrating monetary pattern in outside cash swapping scale is an exceptionally famous strategy in money and future anticipating of remote monetary standards is a useful method for speculators, merchants and exporters in everywhere throughout the world. Pakistan is a truly reasonable nation for the venture open doors for the financial specialists who need to gain long haul benefits from their speculations. There are numerous open doors for interest in horticultural, industry, and cultivating, lodging and the travel industry areas in Pakistan. Be that as it may, for the fascination of remote financial specialists the future anticipating of Pak-Rupee esteem is fundamental and it is likewise essential to discover answers for the swapping scale strength in the future. Our investigation discovers the rupee's conversion scale esteems in the past and furthermore foresee around thirty days future cash trade rates by utilizing the (Auto-backward Integrated Moving Average) ARIMA model. ARIMA model not just give past qualities first contrast stationary bends and furthermore give future determining conversion scale estimations of remote monetary forms. The three most significant monetary standards Dollar, Pound and Euro are used for future anticipating trade paces of Pak-Rupee.*

**Keywords:** Modeling trends, ARIMA Model, Future Forecasting Trends, Pakistani Rupee, Monetary Finance

### INTRODUCTION:

Any speculation choice by worldwide partnerships of governments depends on the trade rates. Speculators may put resources into that economy where conversion standard is steady in light of the fact that in that kind of economy where swapping scale unpredictable hazard is higher and hazard avoidance financial specialists never put resources into this sort of economy. To help up the economy conversion standard must be overseen for this reason the determinants must be engaged. Money conversion scale changes are a characteristic result of the gliding swapping scale framework, which is the standard for most significant economies. In 1973 the world's monetary standards started to be esteemed and traded dependent on a free-skin framework, a framework still set up in 2006. The distributional qualities are very extraordinary for the four monetary standards; the USD rate which is an effectively overseen drift, specifically, displays fat tails showing low ordinary unpredictability however higher outrageous instability. In surveying the adequacy of the hazard models, the models don't perform very well if there should be an occurrence of trade rates inside oversaw skin systems (JAMSHED Y. UPPAL, 2017). The free-drift framework is a default arrangement of money exchanging. It works carefully on the market interest of monetary standards. There are no restrictions on how many monetary standards can acknowledge or devalue in esteem estimated against different monetary standards. Since this can cause instability, national banks and governments have attempted to manage the estimations of their monetary forms, however it has become an undeniably expensive suggestion. The authentic examples of conversion scale practices, and accordingly being useful to foresee the future developments of swapping scale showcases, the exploration can go about as initial step to watch the instability conduct of the Pakistani trade advertise. Determined period's information can be tried by future scientists utilizing new and increasingly improved models to catch the impacts and expectations of the instability conduct (Yasir Kamal, 2012). Pakistan has a creating economy; Numerous difficulties like swelling, neediness, joblessness, and political insecurity and debasement are included for the legislature of Pakistan to be uncovered the arrangement in the future for the

advancement of the nation. Cash conversion scale steadiness is imperative to streamline the advancement of the nation. Cash rate steadiness is a major test for the present government which additionally has numerous specialized cures associated with its future determining. The swapping scale change of remote monetary forms exceptionally American Dollar, Euro, English Pound, Saudi Riyal, Chinese Yuan and Joined Middle Easterner Emirates Dirham have concentrated effect on the conversion scale of Pakistani rupee. Be that as it may, the most significant monetary standards are Dollar, English Pound and Euro which pays a lot of significant guidelines in the valuation of the swapping scale of Pakistani Rupee. In this investigation just three monetary forms trade rates impacts are considered to quantify the future conversion scale estimating of the swapping scale of Pakistani Rupee. We have determined future estimations of Dollar, Euro and Pound for around 30 days. This determining is useful the remote financial specialists for the estimation of their ventures esteem in Pakistan and furthermore for Pakistani agents who particularly bargain in import or fare organizations. This technique can likewise use for future determining of Pakistan rupee whenever by taking past perceptions. The paper has the following commitments:

- We apply an ARIMA model which is a class of measurable models for investigating and determining time arrangement information in light of the fact that different models are not giving huge outcomes for future anticipating of Dollar, Pound and Euro trade rates:
- We think about three monetary forms for future conversion scale anticipating of swapping scale valuation of Pakistani rupee and determined noteworthy outcomes.
- A new technique for future anticipating for the conversion scale of Pakistani rupee is presented and by utilizing this strategy whenever future estimations of other remote monetary standards can be determined.

#### **Related Works:**

#### **Time Series Forecasting:**

A period arrangement is where measurement is recorded over customary time interims. Contingent upon the recurrence, a period arrangement can be of yearly (ex: yearly spending plan), quarterly (ex: costs), month to month (ex: air traffic), week after week (ex: deals qty), day by day (ex: climate), hourly (ex: stock's value), minutes (ex: inbound brings in a call jog) and even seconds shrewd (ex: web traffic) (Prabhakaran, 2019)

#### **Presently estimating a period arrangement can be extensively isolated into two sorts.**

On the off chance that you utilize just the past estimations of the time arrangement to foresee its future qualities, it is called *Univariate Time Arrangement Gauging*.

What's more, on the off chance that you use indicators other than the arrangement (a.k.a exogenous factors) to figure it is called *Multi-Variate Time Arrangement Estimating*.

This post centers around a specific kind of determining strategy called ARIMA demonstrating.

#### **ARIMA MODEL;**

A well known and generally utilized factual strategy for time arrangement determining is the Autoregressive Incorporated Moving Normal (ARIMA) model. ARIMA is an abbreviation that represents Auto Backward Coordinated Moving Normal. It is a class of model that catches a suite of various standard fleeting structures in time arrangement information (Brownlee, 2019). Exponential smoothing and ARIMA models are the two most broadly utilized ways to deal with time arrangement determining, and give integral ways to deal with the issue. ARIMA models intend to depict the autocorrelations in the information (Athanasopoulos, 2018)

As per (Chen, 2019) An ARIMA model can be comprehended by plotting every one of its parts as follows:

- Auto-relapse (AR) alludes to a model that shows a changing variable that relapses without anyone else slacked, or earlier, values.
- Integrated (I) speaks to the differencing of crude perceptions to take into account the time arrangement to get stationary, i.e., information esteems are supplanted by the contrast between the information esteems and the past qualities.
- Moving normal (Mama) consolidates the reliance between a perception and a leftover blunder from a normal moving model applied to slack perceptions.

### **ARIMA (p,d,q) forecasting equation:**

By (Nau, 2019) A non-seasonal ARIMA model is classified as an "ARIMA (p,d,q)" model, where:

p is the number of autoregressive terms,

d is the number of non-seasonal differences needed for stationary, and

q is the number of lagged forecast errors in the prediction equation.

The forecasting equation is constructed as follows. First, let  $y_t$  denote the  $d$ th difference of  $Y_t$ , which means:

If  $d=0$ :  $y_t = Y_t$

If  $d=1$ :  $y_t = Y_t - Y_{t-1}$

If  $d=2$ :  $y_t = (Y_t - Y_{t-1}) - (Y_{t-1} - Y_{t-2}) = Y_t - 2Y_{t-1} + Y_{t-2}$

In terms of  $y_t$ , the general forecasting equation is:

$$\hat{y}_t = \mu + \phi_1 y_{t-1} + \dots + \phi_p y_{t-p} - \theta_1 e_{t-1} - \dots - \theta_q e_{t-q}$$

### **Swapping scale and Universal Exchange:**

Outside cash conversion scale is a monetary marker that in a roundabout way impacts even those organizations which are not legitimately associated with imports/fares of merchandise. Thus the exact expectation of the swapping scale is an issue identified with a private company just as the legislature of a nation (Muhammad Yasir, 2019). In genuine applications, retraining of a gauging model with the latest information might be important to expand the opportunity of accomplishing a superior estimate. Quick learning might be a favorable position yet it doesn't generally ensure an improved presentation (Kamruzzaman, 2004). As per (Chkili Walid, 2011), the negative impact of outside trade advertises instability on securities exchange may decrease the nation's intensity, global exchange and exchange adjusts. Along these lines, it might antagonistically influence the monetary development of the nation. The "US dollar obstruct" inside the rising and creating nation circle has over the previous decades stayed solid and significant, regardless of impermanent decoupling from the US dollar around the hour of emergencies (Bracke, 2011).

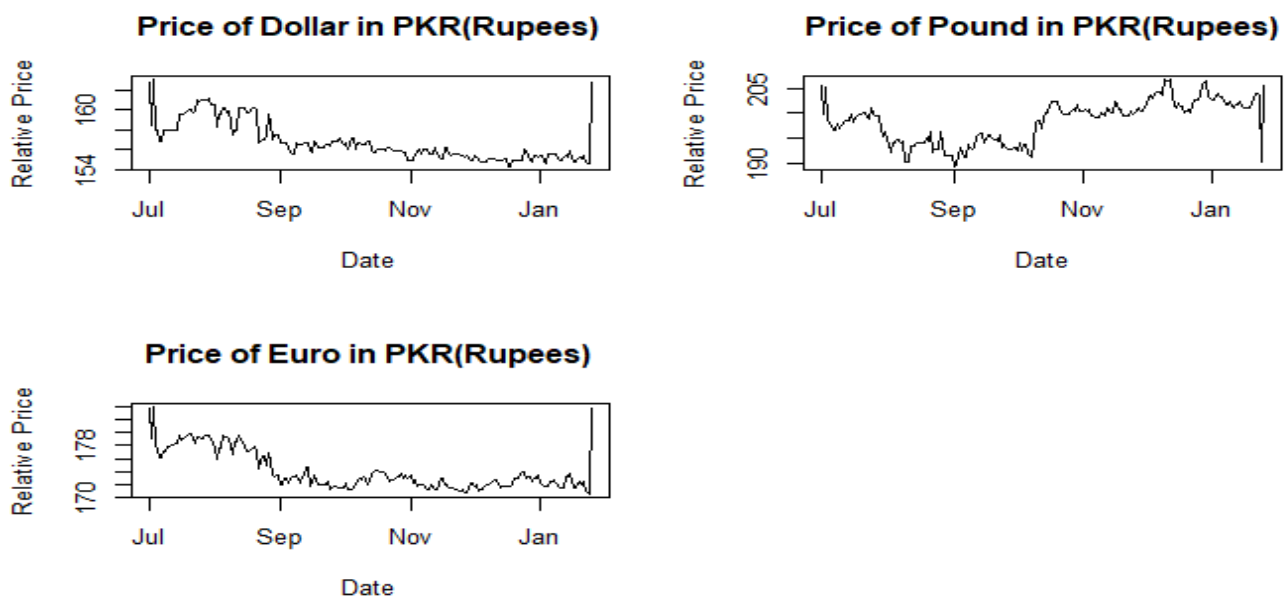
### **Swapping scale and Pakistan Exchange:**

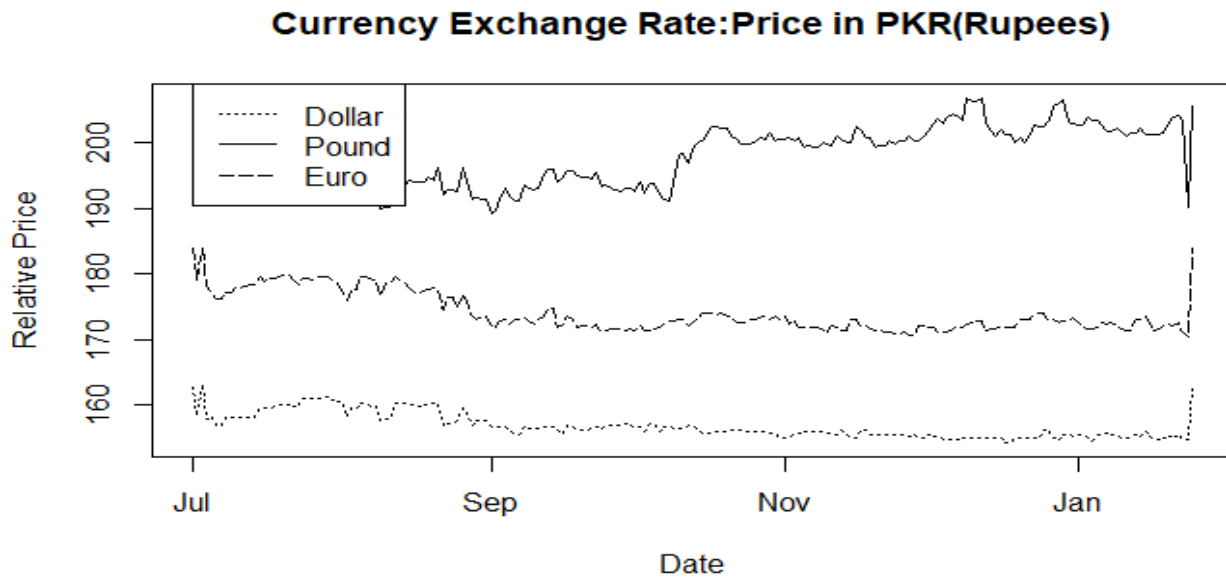
on the off chance that the genuine swapping scale goes amiss fundamentally from its harmony level, otherwise called a "misalignment", the serious position of the Pak economy would be endangered and require quick "restorative activity" by the SBP (Janjua, 2007). There is a since a long time ago run relationship between swapping scale and swelling at 10% hugeness level. The Granger-causality test recommends that the bearing of impact is more from expansion to conversion scale than from swapping scale to swelling (however both are measurably inconsequential). The outcomes from the Granger-causality test recommend that cash supply drives

conversion standard for example cash supply Granger-cause swapping scale (Rehman, 2014). High level of reconciliation between remote trade and merchandise markets unfit the fiscal position to run money related strategy autonomously, devaluation of conversion scale further debilitating the quality of Pak-rupee (QAYYUM M. A., 2007). The conversion scale of Pakistan against the US dollar is altogether controlled by yield levels, costs and loan costs. In this way, collaboration among great and capital resources advertise is required for the conduction of conversion scale elements in Pakistan (QAYYUM, 2014). Fiscal and money related order is a basic precondition for value level soundness. Autonomous and proficient conduct of State Bank of Pakistan and Administrative just as Common governments is essential so as to make a situation favorable at the cost level and to swap scale security. The political steadiness guarantees duty toward predictable arrangements (Ahmed Saeed, 2012). State Bank of Pakistan can achieve it by selling government securities or treasury protections in the open market. Offering bonds to open, money related organizations and business banks will help in pulling back a huge measure of capital from vaults and control the cash from the course (Raza, 2017). The genuine conversion scale isn't totally an arbitrary walk model and the developments are additionally clarified by different basics (Haider, 2005). To the degree that the above is accomplished, it gives the Pakistani exporters a halfway pay to misfortune in value seriousness because of a higher residential expansion (Ahmed, 2014).

### Research Methodology:

The examination received the Autoregressive Coordinated Moving Normal (ARIMA) model. This instrument helps in foreseeing the future and discovering relationships among factors. Information for this examination was acquired from "[https://www.investing.com/monetary/forms/cny-pkr-chronicled information](https://www.investing.com/monetary/forms/cny-pkr-chronicled-information)", which has to do with everyday conversion scale of monetary standards (euro, pounds, and dollar) for three distinct regions from 1st Jan. 2017 to 25th Jan. 2020. The recorded plots of dollar, euro and pound are given in supporting material figure 2.1 & 2.2. We above all else locate the stationary first contrast of every cash of 209 perceptions since all perceptions aren't given right demonstrative tests in this way, we use perceptions from first July 2019 to 25th Jan 2020, every one of the outcomes is appeared in figure 2.3 and figure 2.4 in supporting material. We have discovered the after-effects of recorded plots from first July 2019 to 25th Jan 2020 plotted independently and furthermore in a solitary diagram figure 1.1. The outcomes show steadily decline in the estimations of the dollar, Pound and Euro which shows that the Pak-Rupee esteem is slowly expanding. The AIC models are given in the figure 1.2 which shows these three monetary standards bring about a decent way.



**Figure 1.0:** 1<sup>st</sup> July 2019 to 25<sup>th</sup> Jan 2020 separate plots of Dollar, Pound and Euro**Figure 1.1:** Historical plots of Dollar, Pound and Euro in separate and combined graphs

The research adopted the Autoregressive Integrated Moving Average (ARIMA) model. The sigma estimated and log likelihood values of dollar pound and Euro are shown in the following models which also give a future estimation of three currencies. Auto-regression (AR) refers to a model that shows a changing variable that regresses on its own lagged, or prior, values. Integrated (I) represents the differencing of raw observations to allow for the time series to become stationary, i.e., data values are replaced by the difference between the data values and the previous values. A moving average (MA) incorporates the dependency between an observation and a residual error from a moving average model applied to lag observations. The results of three currencies are shown in special tables as given follows.

Table-1 Selection of Best Model Based on AIC for “Dollar”.

Table-2 Modeling Selection for Pound Currency

Table-3 Modeling Selection for Euro Currency

**Table-1 Selection of Best Model Based on AIC for “Dollar”**

S.NO.	ARMIA(p,d,q)	AIC
1	(1,1,3)	570.79
2	(2,1,2)	572.57
3	<b>(1,1,2)</b>	<b>569.88</b>
4	(2,1,0)	624.01
5	(2,1,1)	570.55

**Table-2 Modeling Selection for Pound Currency**

S.NO.	ARMIA (p,d,q)	AIC
1	(1,1,2)	200.42
2	<b>(1,1,1)</b>	<b>199.44</b>
3	(2,1,1)	200.25
4	(2,1,0)	2008.51
5	(1,0,2)	200.79

**Table-3 Modeling Selection for Euro Currency**

S.NO.	ARMIA (p,d,q)	AIC
1	<b>(1,1,1)</b>	<b>199.44</b>
2	(1,1,2)	200.42
3	(1,1,3)	2002.24
4	(1,1,4)	204.05
5	(2,1,2)	202.25
6	(2,1,1)	200.25

Figure 1.2: ARIMA selection models of AIC of Dollar, Pound and Euro

The table of coefficients of three currencies dollar, pound and Euro are shown as follows.

**Dollar**

Arima (x = Data1, order = c (1, 1, 2))

Coefficients:

```

ar1    ma1    ma2
-0.0144 -1.4658 0.4726
s.e.   0.3056 0.2946 0.2918

```

sigma^2 estimated as 0.8618: log likelihood = -280.94, aic = 569.88

[confint\(fit\)](#)

```

2.5 %   97.5 %
ar1 -0.61329970 0.5845891
ma1 -2.04319924 -0.8883276
ma2 -0.09924532 1.044509

```

**Pound**

Arima (x = Data2, order = c(1, 1, 1))

Coefficients:

```

ar1    ma1
-0.4492 -1.000
s.e.   0.1433 0.181

```

sigma^2 estimated as 2.978: log likelihood = -96.72, aic = 199.44

Training set error measures:

ME RMSE MAE MPE MAPE MASE ACF1  
 Training set 0.4546353 1.707961 1.278097 InfInf 0.6864334 0.1288445  
 confint(fit)  
 2.5 % 97.5 %  
 ar1 -0.7299874 -0.1683476  
 ma1 -1.3547147 -0.6452760

## Euro

Arima (x = Data2, order = c(1, 1, 1))

Coefficients:

ar1 ma1  
 -0.4492 -1.000  
 s.e. 0.1433 0.181

sigma^2 estimated as 2.978: log likelihood = -96.72, aic = 199.44

Training set error measures:

ME RMSE MAE MPE MAPE MASE ACF1  
 Training set 0.4546353 1.707961 1.278097 InfInf 0.6864334 0.1288445  
 confint(fit)  
 2.5 % 97.5 %  
 ar1 -0.7299874 -0.1683476  
 ma1 -1.3547147 -0.6452760

**Table 4: Thirty-day future forecasting prices of Dollar, Pound and Euro in Pakistani Rupee**

Date	USD	GBP	Euro
29-01-20	150.8341	202.9181	170.7418
30-01-20	150.9242	202.9349	170.7444
31-01-20	150.9575	202.6495	170.5978
01-02-20	150.9916	202.4999	170.5322
02-02-20	151.0256	202.2893	170.4226
03-02-20	151.0597	202.1061	170.3369
04-02-20	151.0938	201.9105	170.2383
05-02-20	151.1278	201.7206	170.1467
06-02-20	151.1619	201.5281	170.0512
07-02-20	151.1959	201.3367	169.9579
08-02-20	151.2300	201.1449	169.8634
09-02-20	151.2641	200.9532	169.7695
10-02-20	151.2981	200.7615	169.6753
11-02-20	151.3322	200.5698	169.5813
12-02-20	151.3663	200.3781	169.4871
13-02-20	151.4003	200.1864	169.3931
14-02-20	151.4344	199.9947	169.299
15-02-20	151.4684	199.803	169.2049
16-02-20	151.5025	199.6113	169.1108



17-02-20	151.5366	199.4196	169.0167
18-02-20	151.5706	199.2279	168.9226
19-02-20	151.6047	199.0362	168.8285
20-02-20	151.6388	198.8445	168.7344
21-02-20	151.6728	198.6528	168.6403
22-02-20	151.7069	198.4611	168.5462
23-02-20	151.775	198.2694	168.4521
24-02-20	151.8091	198.0777	168.358
25-02-20	151.8431	197.886	168.2639
26-02-20	151.8772	197.6943	168.1698
27-02-20	151.9113	197.5025	168.0757

The table-4 has normal assessed values determined for the sake of valuable information of 209 everyday perceptions. For the estimating of the qualities ARIMA model is well overall and great however it predicts a set a number of qualities along these lines, we have anticipated distinctly next 30 days esteems by thinking that all circumstances stay the same in future. The future determining of conversion scale of any cash is a troublesome assignment numerous individuals apply AI in addition to strategy to compute these qualities we have anticipated this incentive by utilizing ARIMA models and it gives a superior estimation of swapping scale estimations of a money if more than one cash is utilized for the future gauging conversion scale reason.

### Conclusions:

Pakistan has a very unusual economic situation in the history of 70 years but for the last three years. Its economy is going in a parallel situation and the foreign currency reserves also getting a balancing condition so, in our results of the 1st difference stationary models the dollar, pound and euro exchange rates show gradually declining values. The ARIMA model for the estimation of future exchange rates is very suitable because it first calculates the history of foreign currency and 1st difference stationary plots of those currencies than give future forecasting of exchange rate values. Our results show that by using ARIMA model foreign currencies future values can be calculated any time as we use very fresh data till the 25th of Jan. 2020. But there are also some limits of the ARIMA model we cannot calculate so, many future values by using this model and also it is necessary all the things remain the same in future those were present in the previous data collection matters.

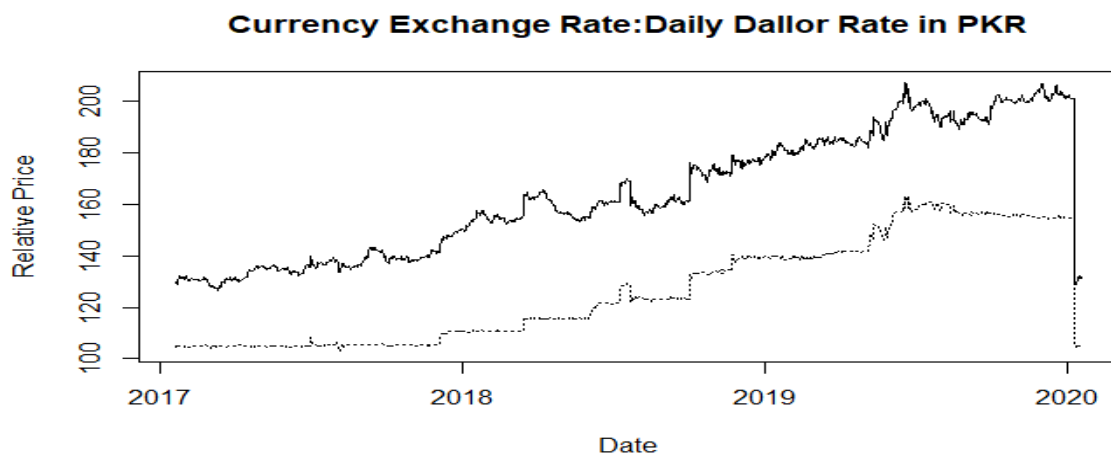
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### Supporting Materials



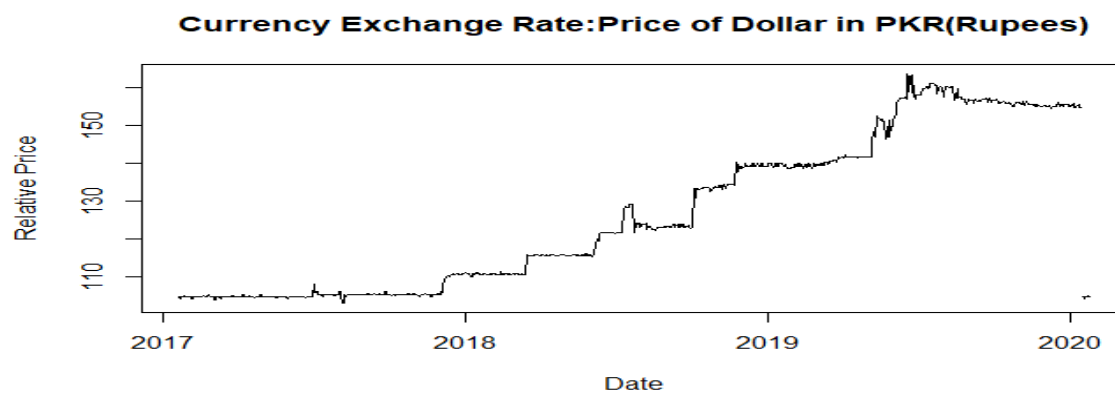


Figure 2.1: History of Dollar and Euro from 2017 to 2019

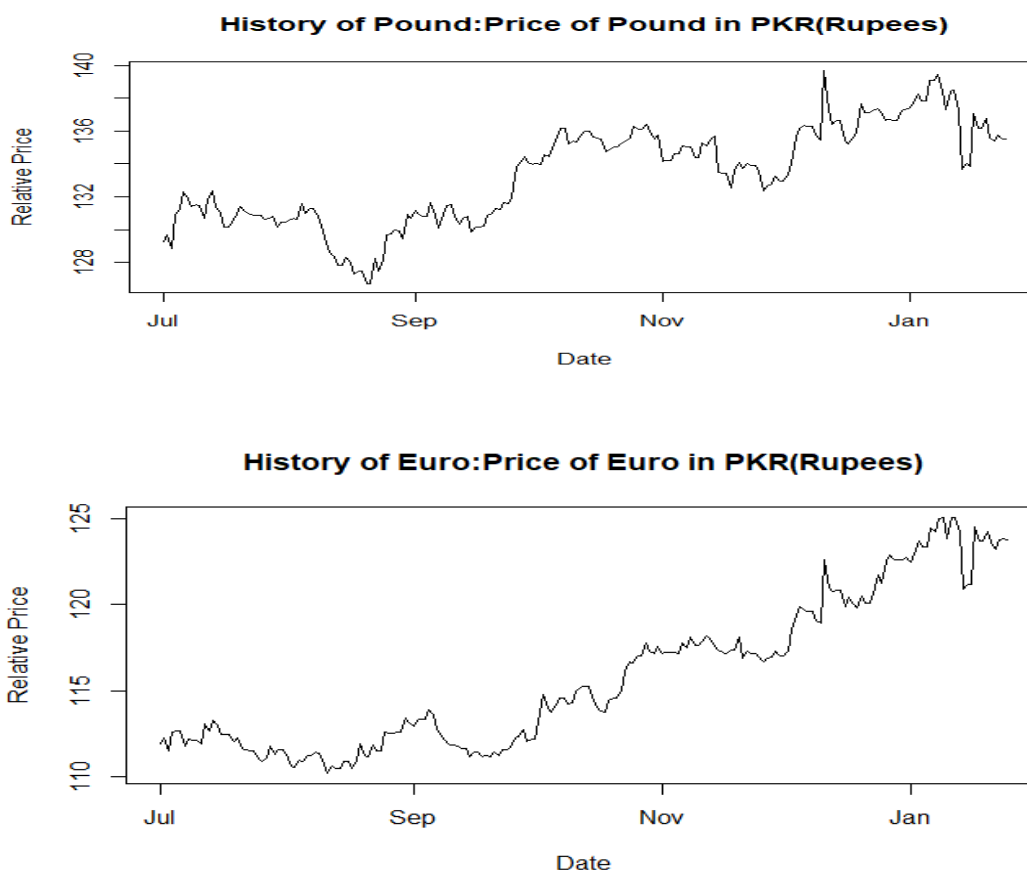


Figure 2.2: History of prices of Dollar, Pound and Euro

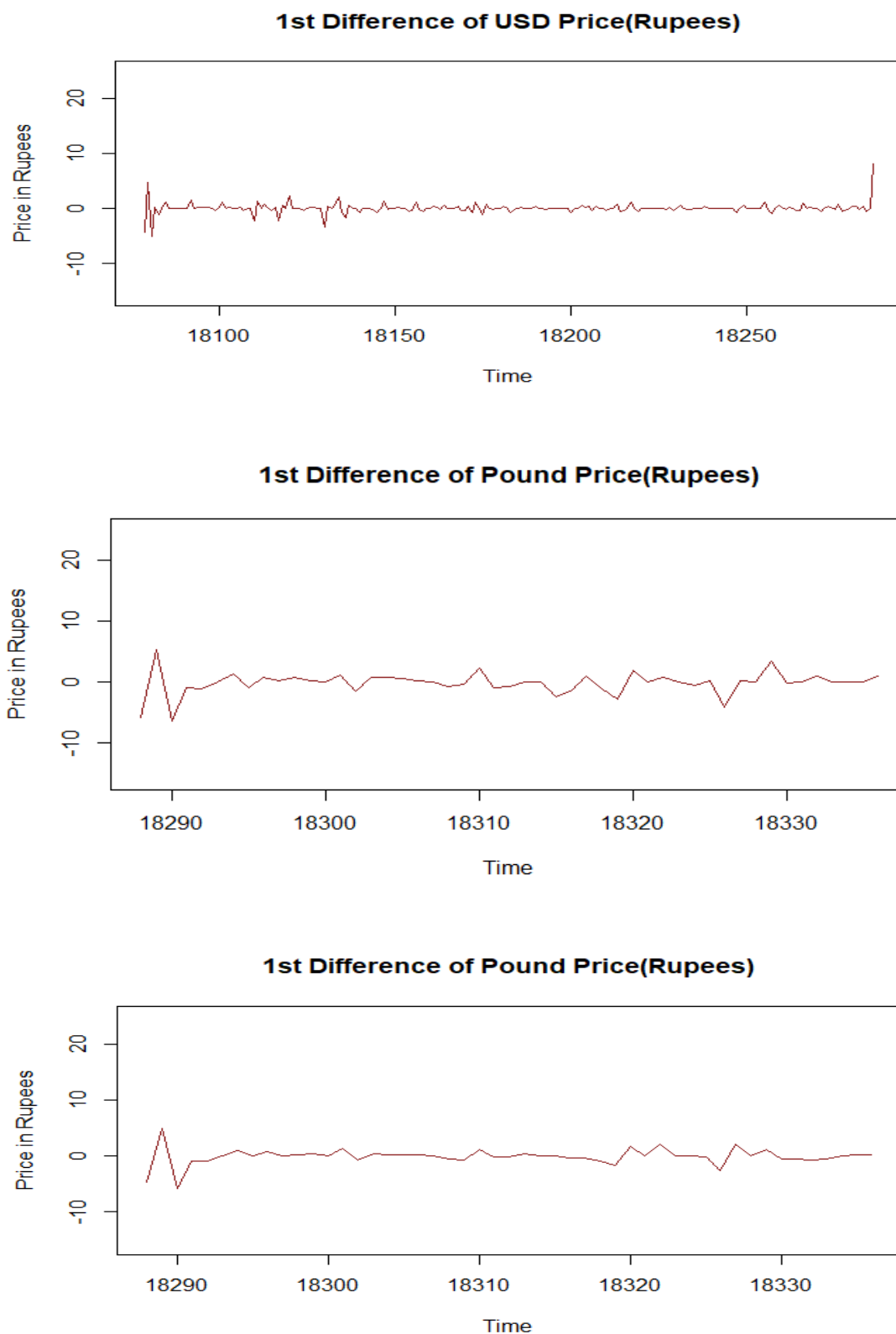
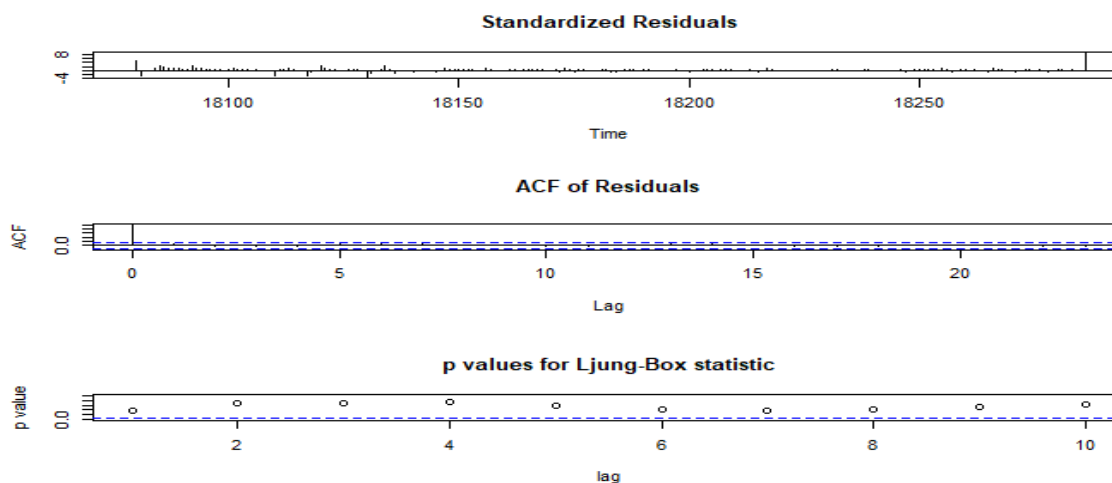
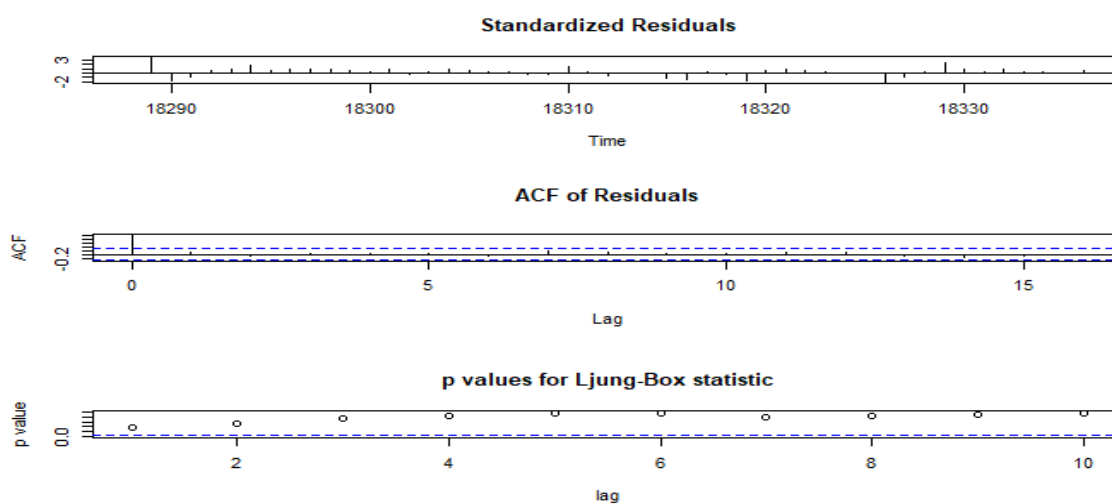


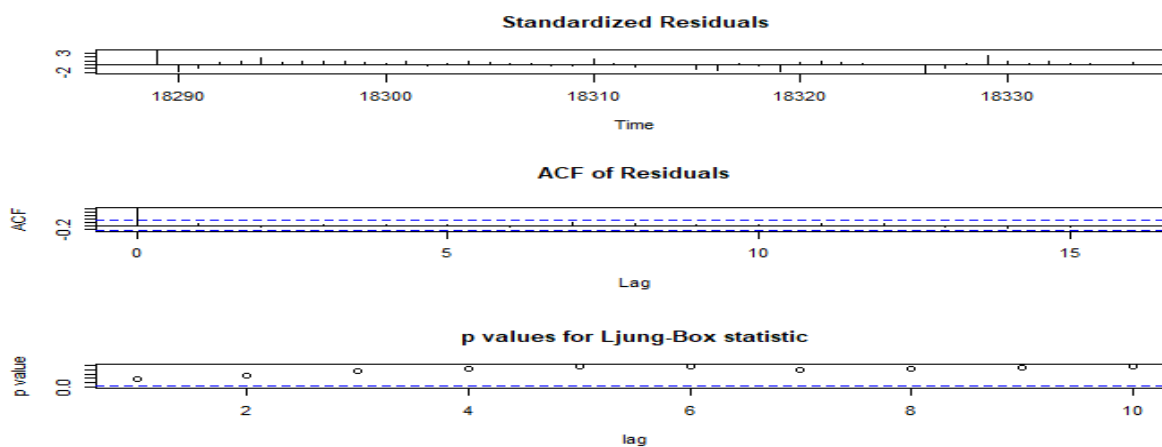
Figure 2.3: 1st Difference Stationary Curves of the dollar, Euro and Pound



### *Dollar standardized & ACF of Residuals*



### *Pound standardized & ACF of Residuals*



### *Euro standardized & ACF of Residuals*

Figure 2.4: standardized & ACF of Residuals and P values for Ljung-Box statistic