COVID-19 and equity trading decisions: A control chart analysis

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ABSTRACT

This article aims to analyze the effect of COVID-19 on stock trading decisions by using a control chart (CC). The study is focused on all the opening prices and average prices of the KSE-30 stock of the top thirty firms. ARIMA (p, d, q) modelling is applied to overcome the autocorrelation (AC) problem. Therefore, two separate stock market sessions were added to research the potential of predictive CC to ensure success. The first short-term cycle runs between January 1 2019 and December 31 2019, and the second short-term cycle runs between January 1 2020 and November 31 2020. As a result, the overall benefit figure measured using the opening price is 30 percent in 2019, 10 percent in 2020, the average price used in 2019 and 2020 is 60 percent, and the average price used in 2020 is 40 percent. This can be viewed as being very high. Portfolio profit based on the opening price is determined by the residual-based (RB) EWMA CC; the results show that the RB EWMA CC achieves the highest average price.

Keywords: KSE-30, Stock Trading, Statistical Process CC.

INTRODUCTION

The equity markets are unique, as stock investors become future stock lenders. During short-term bursts of high demand, the supply of loans is projected to increase as some new owners of indebted shares lend it. Using instrumental variables, we find that loan contracts' availability instead: in short bursts of high demand, the median purchaser loans shares at a lower cost than the average. This stunning outcome is to be clustered among closed stocks with heavy investor disagreement, high price effect measures, and lottery-like returns. Non-borrowing buyers may also feel that owning short sellers' shares will increase their planned Blocher & Zhang (2020). A significant aspect of the economy, investment, and development is called the stock market. Tachiwou (2010) claims that the stock market is a predictor of business and financial conditions. The positive impact of the stock market on economic growth has also been acknowledged by Žmuk (2016). To be able to act as investors and engage in stock trading, Almenberg & Dreber (2012) and Van Rooij, Lusardi, & Alessie (2011) and Bogan & Brenner (2008) must have the financial information and computer and internet expertise (2008).

Alexander (1964) implemented filter exchange rules; one of the first works to evaluate stock market patterns using a statistical rule is Alexander's work on filter exchange rules Yin et al., (2003). His work followed the works of Ippolito (1989) and Corrado & Lee (1992). The filter exchange rule is known as a buy-and-sell signal chain. According to mechanical principles, these signals are issued. For example, if the stock's regular closing price is detected, a rise of at least F percent from the corresponding low is given by a buy signal. Since purchasing the stock, the seller retains the stock and waits for a signal to sell. To offer, give a signal. If the closing price declines by at least F percent from the corresponding highs and lows, the F value can be determined in various ways by the size of the market law filter. It reflects the minimum reasonable percentage change in investment from the observed value of the securities of the owner Sullivan, Timmermann, & White, (1999). The behaviour of stock market returns in Norway and Sweden during the early days of the COVID-19 pandemic is examined Størdal et al., (2021). This study discusses how numerous government actions in Norway and Sweden, such as school closures and travel bans, and economic stimulus, influenced both countries' stock markets. The results indicate that, while non-pharmaceutical treatments had little to no effect on Norway's stock market returns, they positively impacted stock market returns in Sweden.

However, the extent of this effect decreased as the number of confirmed COVID-19 cases grew. According to Narayan et al., (2021), the ongoing pandemic has had a significant impact on global financial markets. In this post, we look at how COVID-19 has influenced the Australian stock market returns. The trend of the impact we uncover using a quantile regression method is that COVID-19 has had a heterogeneous effect on business segments, wellness, information technology, and consumer staples, both benefiting. Their financial attitudes influence retail investors' financial conduct. Even though existing literature has recognized and investigated this relationship, financial attitude and behaviour tests differ significantly. They are typically presented as a set of questions rather than Talwar et al., (2021). YuliWaryati, S., & Suwarni, M. G. (2021) compare the average abnormal market returns earned by investors and the average stock trading volume behaviour before and after the COVID-19 pandemic was announced in Indonesia on March 2, 2020, for companies listed on the Indonesia Stock Exchange's LQ-45. The authors show that COVID-19 has far-reaching consequences for both the stock markets' return predictability and volatility. Both the S&P 500 and the Dow Jone Industrial Average (DJIA) show a single split in return predictability and market uncertainty.

The split coincides with the COVID-19 epidemic or stock sell-offs in the United States Hong, H., Bian, Z., & Lee, C. C. (2021). Borgards et al., (2021) look at the intraday overreaction activity of 20 commodity futures from November 20, 2019, to June 3, 2020, with an emphasis on the effects of

the COVID-19 pandemic. The overreaction hypothesis is proven for the commodity futures studied, according to methodological findings. Furthermore, after the COVID-19 pandemic, both the amount and amplitude of overreactions were more significant. The fundamental question in this study is whether, by comparing the value of stocks before COVID-19 to 2020 between 2020, statistical CCs (such as statistical process control "SPC" methods can be used for stock trading and understanding COVID-19. The effect of COVID-19 is whether the CC can provide purchase signals to hold and sell stocks. COVID-19 is an infectious disease diagnosed in December 2019 in Wuhan, China, and Pharmaceutical Technology confirmed the first death on January 11 2020, (2020). The virus has spread to several other cities outside Wuhan and then spread to other parts of the world along with travellers, despite the preventive measures taken by the city authorities of Wuhan. However, the World Health Organization (WHO) proclaimed the virus a global pandemic on March 11 and alert to take preventive steps. Today, in just four months, more than 200 countries have had the virus transmitted, more than three million people have been vaccinated, and almost 200,000 people have died due to the pandemic.

Nearly all nations have banned travel to other countries in this pandemic, limited or nearly halted flight activities, placed lockdowns on regions where the virus spreads most and quarantined infectious persons to avoid the virus. As a result of these prevention steps, there is a sharp downturn in industrial activity in nearly all economic manifestations, and the pace of company closures is rising. Small companies are pursuing government bailout schemes, and big businesses face a demanding situation as they cease business to keep workers in the workplace. The downturn in economic activity affects the Sahai et al., (2020) countries' financial markets, commodity markets, and trade. COVID-2019 and 2020 are a global threat, so research has concentrated on topics such as detection, prevention, cure, and prediction around the world. Different analyzes have proposed models that can predict the evolution of this epidemic. Models that can forecast the progression of this disease have been suggested in different studies. These studies suggest models for particular geographical areas, specific countries, or global models to be created. These models give us the ability to predict the virus's behaviour, which can be used to develop future response plans. The research thesis provides an overview of the distribution of COVID-19, demonstrating diverse global views across six geographic regions (continents). It advises that relations between countries in the same geographical region be developed to forecast the virus's development. Countries/regions with identical vector values in the same regional area (quantifiable and non-quantifiable).

By proposing an algorithm in 145 countries/regions to run and test ARIMA models, which are spread in 6 regions. ARIMA parameters, population per million, number of instances, and polynomial functions are then used to construct these areas' models. With an average RMSE of 144.81, the proposal will forecast COVID-19 events. This paper's key results explain the relationship between COVID-19 behaviour and the population in an environment, and these findings provide us with opportunities to use humidity, temperature, community, and other variables to construct more behaviour prediction models—about COVID-19. Several studies have been carried out to assess the effect of COVID-19 on the stock market in Pakistan in 2020. Data on the number of positive COVID-19 cases, the number of deaths, the case fatality rate, and the closing price of the PSX 100 index in the first half of 2020 were included in the analysis. Analysis findings show that the performance of the index is influenced only by the rebound from COVID-19. Nothing has to do with results in the number of good cases and deaths every day. More research can be done internationally by including other variables (such as economic growth, interest rates, and inflation rates) and variables related to COVID-19 but still, there is a gap for an investor to More analysis can be performed globally by using other variables (such as economic growth, interest rates, and inflation rates) and variables related to COVID-19, but there is still a void for an investor to use statistical CCs to determine stock trading signals (buy and sell) and whether it is beneficial before and after covid19 for making stock trading decisions.

Shewhart (1924) suggested the CC not only have CCs, and other predictive control process approaches been commonly used in mass processing for around a year. CCs may also be used for financial reporting, for instance. Roberts (1959) used statistical quality management techniques to study market price trends and improvements before implementing filter swap regulations. From 1950 to 1967, (1967) developed a CC using logarithmic monthly values and analyzed 200 Moody's stocks' average composite index. He uses it to define price dynamics and equate them with developments in GDP, family, and commodity profits. The most critical factor is to decide if signs of retaining or purchasing value may be established. There is no apparent trend of minor price variations between the middle and centre lines in a similar Hubbard (1967) fashion. Therefore, this difference does not include information that can help investors determine whether selling or buying stocks is useful. Signals that deviate from the centerline in a related analysis suggest that the stock price is too high or too low. Fong et al., (2020) proposed a model that uses early small data sets to predict. The authors suggest the possibility of using the ARIMA model to predict the spread of world markets. Similarly, Ding et al., (2020), Bayyurt & Bayyurt (2020) suggested that the ARIMA model predicts cases and deaths in Italy, Turkey, and Spain.

Similar results were found for India (Ding et al., 2020). Perone (2020) proposed the Italian model for different regions. Duan & Zhang (2020) used the (ARIMA) model to analyze two sets of data and predict new confirmed cases every day for seven days; in Singh et al. (2020), to predict the spread of coronavirus in these countries, the author studied a wide variety of countries. The main reason that statistical CCs are rarely used in financial analysis because the manager's attitude controls the chart, according to McNeese & Wilson (2002). However, (2014) used an exponentially weighted moving average (EWMA) table to manage its cash flow control. At the same time, Gandy (2012) uses the CUSUM CC for analysis of the credit portfolio since the focus of all analysis is the exponentially weighted analysis dependent on each (I) moving average (EWMA) CC. Such CCs have been selected because their implementation is intuitive and easy to understand for ordinary investors. Three study hypotheses are established based on the above research questions and a literature review.

Hypothesis 1*: Effect of COVID-19 with the help of a control chart (CC) on a stock trading decision.*

Hypothesis 2*: The portfolio profit is higher than the profit obtained through the EWMA CC index method, based on the overall chart of individually controlled stock transactions (I).*

Hypothesis 3*: Equity trading based on the overall outcome of the opening price portfolio revenue is better than stock trading based on the average opening price.*

Use the Pakistan Stock Exchange, two parallel analyses completed, using opening prices and average prices of 2019 and 2020, to test these research hypotheses. The number of shares exchanged in the short-term KSE-30 stock index of the top thirty firms. Section 2 explains the observed data and the techniques used. The short-term research conducted is laid out in section 3. In Section 4, the findings and additional recommendations for the investigation are given.

RESEARCH METHODOLOGY

Pakistan's first and one of the oldest stock exchanges in developing markets is the Karachi Stock Exchange (KSE). On September 18, 1947, just two months after Pakistan's independence, KSE was established. The key aim of the KSE-30 index is to create a benchmark from which stock market output can be compared over time. In particular, the KSE-30 index aims to provide investors with the following information: How do large corporations

perform in the Pakistani stock market? The KSE-30 index would then be compared to other indexes that track different indicators. The KSE-30 index is computed using the process of "free-floating market capitalization" According to methodology, the degree of the measure represents the relative baseline duration at any time. The free float system applies to the creation of indexes only consider the method of floating stock value the securities of the company used to determine the index.

In two separate times, the chosen population was studied. The first phase covers the opening and average prices from January 1 to December 31 2019, and covers the period from January 1 to November 30 2020. The diagram can be seen in the second step comparison between 2019 and 2020 Average and opening price in the control's short-term stock trading capability. Average and opening prices are used in the research variables in the analysis. The variable opening price used in the study is because buyers can respond quickly to CC indications to buy and sell stocks. Therefore, the first assumption for the opening price inquiry is that the sale signal is released on the same day that buyers can sell. The second assumption is that consumers should respond quickly to ensure that the price is equal to Žmuk, (2016) opening price on the trading day. In the average price examination, investors may also respond on the day they answer as with the opening price investigation. Investors will soon trade. After the first or second opening price, customers are supposed to trade, and the average price is released. Investors should pick all trading hours. Investors will wait for the trading day's close on all trading days, meaning that the craft will be carried out at the average price cost of the transaction day. To be more specific, assume that the lender will make the last transfer of the day. It should be stressed that the primary aim is only to acquire the difference between the selling price and the sale price and that extra fees are not considered in the analysis. It is also believed that there will be no extra payments (such as dividends) charged to holders.

For this scenario, you can decide the most productive CC in the many statistical CCs given by Montgomery (2012) as follows: Personal CC Unit (I), EWMA CC. Intuitive and quick, straightforward processes, analysis, and drift sensitivity processing are the key criterion for selecting CCs. In EWMA, set the parameter "forget" to 0.3 in the control table, which is usually the value. By Lucas & Saccucci (1990), the parameter value is somewhat subjective. Although the MR CC remains, it plays only a minor role. In the current literature, the characteristics of the listed control panel have been well defined by Kovářík & Klímek (2012) and Institute (2014). AC also happens in Kovářík & Klímek (2012), which contributes to a high likelihood of detection. Financial data is very susceptible to major shifts. The

stock price knowledge is auto-correlated as well. By increasing the false alarm rate on the CC Vanbrackle III & Reynolds Jr, (1997), AC may have a substantial influence on decision-making programs Alwan, (1991). By omitting data, changing the control spectrum of existing CCs, and using Woodall & Faltin (1993) RB CC analysis, the AC problem can be solved. We use CCs based on residuals to cope with AC issues.

Short-run study of stock trading focused on Available and Average Prices and open prices

The short term for this article is described as one year. Therefore, only the 2019 and 2020 data can be considered for analysis of short-term stock trading. Analyze and analyze the opening price of the KSE-30 stock based on the average price of the KSE-30 stock. The CC is successful when the data is not essential and demonstrates Montgomery (2012) by fluid behaviour. The study indicates that the AC coefficients of all inventories observed are near 1. It is also inferred that the topic of AC has a significant impact on the CC. Use the ARIMA (p, d, q) modelling method to solve the AC problem if applying for the program with omitting data; then some trading days would be ignored. It seems illogical and safe, and it is unacceptable to investors. Skipping data processing is, therefore, not considered. In this case, the technique used to treat the AC problem is not considered because it assumes a low AC level. Similarly, adjust the controls Limitations of Existing CCs. Given the strong AC, one needs to adjust the control limit, which is unacceptable.

Use the AC function (ACF) and some AC functions to regulate p and q. (PACF). If the ACF ends after q, and the PACF displays infinite queues, restrained exponential waves, and cosine waves at the same time, select the average q model or the ARIMA model (0, 0, q). If the ACF displays an infinite tail, the damped exponential wave and the cosine wave are the determinants. Yes, after p, cut off the PACF and select as the ARIMA model the autoregressive model of p (p, 0, 0). "If the exponential wave is present and the cosine waves are present in ACF and PACF, select the appropriate ARIMA model (p, 0, q). Check the polynomial trend before influential the p and q levels, and choose accordingly. To estimate the parameters (p, d, q) of the ARIMA model, we use the approximate maximum probability method introduced by Li & McLeod (1986). Once the parameters selected have been estimated using the ARIMA model (p, d, q), check the data if the model selected is sufficient. If the correct model is sufficient, the residual should be roughly white noise, indicating that its average must be zero and is not relevant. Residual ACF and PACF are the main methods. If the model is suitable, most of the coefficients in the model ACF and PACF should be close to zero. Select the new ARIMA model (p, d, q) and determine its applicability if the coefficients of ACF and PACF are not close to zero.

Repeat the process.' The parsimony principle was adopted to find the best ARIMA model (p, d, q). In other words, if two ARIMA models (p, d, q) have similar statistical characteristics, then a simple model is Choice Hyndman (2001).

The ACF and PACF confirm the choice, verify the ARIMA model's appropriateness (p, d, q), and check the estimated parameters for statistical significance. At the 5 percent mark, all predicted parameters are statistically valid, and the final decision to adopt the chosen ARIMA (p, d, q) model is sufficient. The estimated parameters can be used to select a new ARIMA model when something is not statistically significant (p, d, q). Noskievičová (2007) recommend that after determining the initial ARIMA model (p, d, q) and estimating its parameters, outliers are identified, their causes verified, and appropriate corrective measures are taken. Outliers will not be tested further in the review due to simplifying the process and the process's design. In other words, investors are involved in quick and easy everyday use procedures. Skipping outliers or other outlier maintenance habits can also have a significant effect on activities and organization choices. The correctly selected ARIMA (p, d, q) stock opening price models for 2019 and 2020 KSE-30 summarize the exploratory study's essential findings as shown in Table 1 and Table 2, Table 3 and Table 4.

Table 1. Explorative Analysis of KSE-30 Stocks 2019 Opening Prices and Selected Adequate ARIMA(p,d,q) Models.

Open prices 2019 result							
Share	**K**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Variance**	**ARIMA(p,d,q)**
AMZN	246	62.91	90.91	75.90	5.25	27.65	(2,1,1)
BAFL	246	35.25	51	44.48	2.92	8.52	(1,0,1)
BKEQ,	246	66	87.75	78.38	4.38	19.19	(2,1,1)
BOPU	246	9.02	14.4	12.17	1.19	1.42	(2,1,3)
CHRC	246	22.32	84.08	46.70	18.20	331.46	(1,1,1)
DGKH	246	46.22	127.4	87.20	18.95	359.21	(1,2,0)
EGCH	246	255.02	316.36	289.63	14.02	196.76	(2,1,3)
ENGR	246	61.5	78.49	70.04	3.95	15.64	(2,1,2)
FAUC	246	12.5	26.66	19.14	3.79	14.37	(2,1,2)
FAUF	246	86.5	109	98.92	5.55	30.87	(2,1,2)
HASC	246	7.17	54.65	27.71	14.02	196.81	(1,1,1)
HBL	246	103.31	166.98	130.30	12.48	155.86	(2,1,1)
HPWR	246	68.03	94.71	83.66	6.50	42.36	(2,1,1)
INTE	246	28.16	77.84	50.69	13.09	171.48	(1,2,0)
LUKC	246	344	584	456.86	57.69	3328.53	(1,1,3)
MCB	246	169.05	215.4	194.33	10.61	112.76	(0,1,1)

MGAAS	246	754.71	1370	1048.52	169.34	28679.36	(1,1,3)
MPLF	246	15.48	51.84	34.33	9.10	82.89	(2,1,2)
NBPK	246	28.36	47.95	38.71	5.31	28.23	(2,2,0)
NISM	246	91	154	131.15	15.03	226.13	(0,1,1)
OGDC	246	105.5	154.7	134.80	10.86	118.03	(1,1,0)
PKEL	246	14.39	29	21.74	4.13	17.06	(1,1,0)
PKOL	246	347	523.2	424.68	40.29	1623.64	(1,1,1)
PPL	246	87.5	161.58	129.42	19.03	362.26	(3,1,1)
PSO	246	127.51	245.51	193.89	30.48	929.34	(1,1,1)
SEAR	246	113.18	268.65	178.94	43.23	1869.20	(1,1,1)
SUIN	246	55.3	106	82.37	10.55	111.36	(1,1,1)
TRGP	246	11.83	27.52	19.33	4.78	22.91	(2,1,2)
UBL	246	120.01	175	145.35	10.59	112.33	(1,1,1)
UNIT	246	7.02	17.81	2.58	2.58	6.67	(1,0,0)

Table 2. Explorative Analysis of KSE-30 Stocks 2019 Average Prices and Selected Adequate ARIMA(p,d,q) Models.

Average prices 2019 result							
Share	**K**	**Min**	**Max**	**Mean**	**Std. dev.**	**Variance**	**ARIMA(p,d,q)**
AMZN	246	94.27	134.54	113.39	7.77	60.40	(1,1,2)
BAFL	246	52.61	76.26	66.42	4.32	18.72	(2,2,0)
BKEQ,	246	98.82	130.52	117.11	6.54	42.79	(2,1,1)
BOPU	246	13.41	21.56	18.14	1.80	3.25	(2,2,0)
CHRC	246	33.45	124.62	69.54	27.17	738.38	(2,1,4)
DGKH	246	68.31	189.40	129.85	28.26	799.01	(0,2,1)
EGCH	246	379.52	473.18	432.57	21.10	445.46	(2,1,2)
ENGR	246	91.67	117.25	104.68	5.94	35.36	(1,0,0)
FAUC	246	18.61	39.40	28.52	5.67	32.17	(1,1,0)
FAUF	246	98.52	163.05	147.68	8.92	79.68	(1,0,1)
HASC	246	10.71	81.46	41.29	20.94	438.73	(1,1,0)
HBL	246	154.31	246.73	194.41	18.64	438.73	(1,1,0)
HPWR	246	102.04	141.64	124.90	9.76	95.34	(2,1,2)
INTE	246	41.96	115.2	75.46	19.55	95.34	(2,1,2)
LUKC	246	510.15	115.2	681.30	86.16	7424.42	(3,1,1)
MCB	246	253.08	321.75	290.31	15.93	253.77	(1,1,1)
MGAAS	246	1128.82	2033.05	1565.07	15.93	64099.34	(1,1,1)
MPLF	246	23.22	76.87	51.10	13.57	184.31	(1,1,1)
NBPK	246	42.54	71.55	57.74	13.57	62.77	(2,1,2)
NISM	246	136.25	230.41	195.59	22.55	508.59	(1,1,1)
OGDC	246	157.875	231	201.29	16.28	265.23	(1,1,0)
PKEL	246	21.29	42.96	32.36	6.15	37.83	(2,1,2)

PKOL	246	520.5	780.75	634.22	60.25	3631.02	(1,1,1)
PPL	246	129.23	240.79	193.11	28.52	813.89	(1,1,0)
PSO	246	190.01	365.80	289.23	45.64	2083.68	(4,1,5)
SEAR	246	169.77	398.38	266.52	64.56	4169.06	(1,1,0)
SUIN	246	81.6	156.57	122.68	15.68	245.97	(1,1,0)
TRGP	246	17.73	40.92	28.77	7.14	51.05	(4,1,4)
UBL	246	179.51	260	216.98	15.73	51.05	(1,1,1)
UNIT	246	10.43	26.17	16.30	3.85	1.48	(1,1,0)

After choosing the required ARIMA (p, d, q) formula and calculating the model parameters, the residuals of each KSE-30 stock of the top thirty companies are then determined. RB CC system used by Montgomery (2012) employs these residuals to create a CC. If it runs on the original data set, the analysis results are not as intuitive and interpretable. However, these limitations of using residuals in the CC study may be overlooked if the goal is not to interpret the effect but to observe it. At the same time, there is a substantial variation in the residuals of other residues. Suppose there is such a large disparity between other residuals' actual and model values. The distinction is that the residues breach the regulatory thresholds. In this case, if the residual crosses the upper management (control) threshold, the accurate share price is considerably higher than predicted in the formula combining all of the prices referred to above. In this case, buyers are encouraged to sell their securities because they can get substantially better rates than expected.

On the other hand, if the price is considerably lower than expected, the buyers purchase the stock. This condition, in other words, motivates buyers to buy. In this case, the residue is less constrained by regulation. CCs for every thirty KSE-30 stock firms for 2019 and 2020 were produced after selecting the RB opening rates. Investor trading was simulated based on a graphic symbol of influence. EWMA ($\lambda = 0.3$) in market simulation. Moving average CC (MR) was excluded from the study because, by necessity, it does not have a buying signal, and the range cannot be negative. The lower control limit most definitely has to be set to 0, and no data should have a value lower than this value. In this way, this condition leads to a shortage of signals for purchasing.

Table 3. An explorative study of KSE-30 Stocks 2020 opening prices and Chosen Adequate ARIMA (p,d,q) models.

Opening prices 2020 result							
Share	**K**	**Min**	**Max**	**Mean**	**Std. dev.**	**Variance**	**ARIMA(p,d,q)**
AMZN	229	50.46	98.15	76.00	13.79	190.30	(1,1,1)
BAFL	229	28.98	52.99	37.60	6.61	43.78	(2,1,2)
BKEQ,	229	50.3	83	66.4	10.39	108.14	(1,1,1)

BOPU	229	7.01	14.18	9.93	1.94	3.77	(2,1,3)
CHRC	229	31	143	80.05	31.01	963.76	(1,1,1)
DGKH	229	42.25	89.49	67.55	13.20	174.29	(1,1,1)
EGCH	229	226	368.9	298.09	33.84	1145.57	(1,0,1)
ENGR	229	50.01	75.5	63.02	4.62	21.43	(1,1,0)
FAUC	229	11.5	22	16.71	1.84	3.40	(1,0,1)
FAUF	229	77.5	112.4	99.12	6.63	43.96	(1,1,1)
HASC	229	10.5	31.13	17.29	4.21	17.79	(2,2,0)
HBL	229	93	171.9	127.01	23.39	547.09	(3,1,0)
HPWR	229	56.8	104	80.50	11.26	126.89	(1,1,0)
INTE	229	29.5	83.5	60.15	12.54	158.39	(1,1,1)
LUKC	229	310	578	419.79	54.74	2996.60	(1,1,2)
MCB	229	130.5	223.95	180.54	23.87	570.13	(1,1,2)
MGAAS	229	839	1488.5	180.54	133.89	17929.08	(1,1,1)
MPLF	229	11.69	31.9	20.99	4.80	23.04	(2,1,2)
NBPK	229	24.59	45	34.91	6.37	40.60	(1,1,0)
NISM	229	54.55	118	87.59	16.18	261.96	(2,1,2)
OGDC	229	76	153.8	111.40	16.51	272.61	(2,1,2)
PKEL	229	15.9	40.5	28.33	5.75	33.13	(2,1,2)
PKOL	229	223.03	475	380.40	60.40	3649.25	(1,1,1)
PPL	229	70	152	100.32	60.40	394.44	(1,2,0)
PSO	229	105.21	218.9	157.41	31.40	986.55	(1,1,0)
SEAR	229	138.18	272.98	207.20	35.82	1283.48	(2,1,3)
SUIN	229	35.39	83.4	64.84	11.48	131.94	(2,1,2)
TRGP	229	11.87	63.3	35.42	15.06	226.83	(1,1,0)
UBL	229	89	182.84	126.12	25.52	651.76	(3,1,3)
UNIT	229	7.19	25.2	13.90	4.15	1.72	(2,2,1)

Table 4. Explorative Analysis of Average Prices of KSE-30 Stocks 2020 and Chosen Adequate ARIMA (p,d,q) Models.

Opening prices 2020 result							
Share	**K**	**Min**	**Max**	**Mean**	**Std. dev.**	**Variance**	**ARIMA(p,d,q)**
AMZN	229	50.46	98.15	76.00	13.79	190.30	(1,1,1)
BAFL	229	28.98	52.99	37.60	6.61	43.78	(2,1,2)
BKEQ,	229	50.3	83	66.48	10.39	108.14	(1,1,1)
BOPU	229	7.01	14.18	9.93	1.94	3.77	(2,1,3)
CHRC	229	31	143	80.05	31.04	963.76	(1,1,1)
DGKH	229	42.25	89.49	67.55	13.20	174.29	(1,1,1)
EGCH	229	226	368.9	298.09	33.84	1145.57	(1,0,1)
ENGR	229	50.01	75.5	63.026	4.62	21.43	(1,1,0)
FAUC	229	11.5	22	16.71	1.84	3.40	(1,0,1)

FAUF	229	77.5	112.4	99.12	6.63	43.96	(1,1,1)
HASC	229	10.5	31.13	17.29	4.21	17.79	(2,2,0)
HBL	229	93	171.9	127.01	23.39	547.09	(3,1,0)
HPWR	229	56.8	104	80.50	11.26	126.89	(1,1,0)
INTE	229	29.5	83.5	60.15	12.58	158.39	(1,1,1)
LUKC	229	310	578	419.79	54.74	2996.60	(1,1,2)
MCB	229	130.5	223.95	180.54	23.87	570.13	(1,1,2)
MGAAS	229	839	1488.5	180.54	133.89	17929.08	(1,1,1)
MPLF	229	11.69	31.9	20.99	4.80	23.04	(2,1,2)
NBPK	229	24.59	45	34.91	6.37	40.60	(1,1,0)
NISM	229	54.55	118	87.59	16.18	261.96	(2,1,2)
OGDC	229	76	153.8	111.40	16.51	272.61	(2,1,2)
PKEL	229	15.9	40.5	28.33	5.75	33.13	(2,1,2)
PKOL	229	223.03	475	380.40	60.40	3649.25	(1,1,1)
PPL	229	70	152	100.32	60.40	394.44	(1,2,0)
PSO	229	105.21	218.9	157.41	31.41	986.55	(1,1,0)
SEAR	229	138.18	272.98	207.20	35.82	1283.48	(2,1,3)
SUIN	229	35.39	83.4	64.84	11.48	131.94	(2,1,2)
TRGP	229	11.87	63.3	35.42	15.06	226.83	(1,1,0)
UBL	229	89	182.84	126.12	25.52	651.76	(3,1,3)
UNIT	229	7.19	25.2	13.90	4.15	1.72	(2,2,1)

Based on these three options, investor transactions are also simulated by 3σ CCs based on residuals, independently regulating the limits. At the beginning of the year, investors were expected to purchase stock at the same price as the original trading price. Similarly, it was presumed that the investor did not want to have a stock at the end of the year. If the investor had stocked the portfolio at the end of the year, all the shares were sold at the last opening price in 2019 and 2020. Trade payments were not considered to make the study more accessible. Each purchasing signal from investors was given a purchase signal when the residuals declined, whether it was below the lower control cap. If the upper limit control limit has been surpassed, a sale signal is released, but there is a residual. In that case, all the securities in the fund are sold by the seller. Žmuk (2016) Provides stock trading simulation outcomes for all 10 CROBEX shares in 2012 based on opening prices.

Table 5. "Trade Simulation of KSE-30 Stocks Based on Average Prices Using the RB CC for Individual Units (I), the RB EWMA CC (λ=0.3)"

Control limits: +/- 3 std					
stock	CC	Open price 2019		Open price 2019	
		No of day trades	Investor score	No of day trades	Investor score
R-AMZN	I	1	-1.29	12	-1.49

	EWMA	39	-0.24	14	-1.20
R-BAFL	I	1	0.12	4	-1.92
	EWMA	51	0.02	4	-2.20
R-BKEQ	I	5	-0.76	9	-2.55
	EWMA	42	0.71	11	-0.75
R-BOPU	I	7	-0.09	0	-0.00
	EWMA	58	-0.07	0	-0.00
R-CHRC	I	3	-4.98	32	-2.09
	EWMA	38	-0.94	24	5.49

Table 6 presents the simulation results for 10 stocks based on the opening prices for five KSE-30 firms from 2019 to 2020. According to the results given in Table 6, the trade simulation gives a positive investor score to 3 stocks. In contrast, the 7 trade simulation gave a negative score in 2019. Similarly, it gives a positive investor score to 1 stock the trade simulation. The 7 trade simulation gave a negative score in 2019, 9 trade simulation gives a negative score in 2020. Therefore, investors will realize gains by 30 percent in 2019 and by 10 percent in 2020 using an RB CC based on the opening price and based on the given assumptions. EWMA CC based on residual is applied in some instances, investors rate the best, see the investor score basis based on the residual CC, and conclusions can be drawn. In 3 cases, the RB EWMA CC had the highest score of investors in 2019, and 1 case in 2020, 1 case in 2019, and 0 in 2020 is person regulation based on residuals. A stronger influence of COVID-19 on a stock trading judgment using average stock values is inferred using a CC.

Table 6. RB EWMA CC (λ=0.3) Exchange Simulation of KSE-30 Stocks Based on Opening Rates Using RB CC for Individual Units (I)

Control limits: +/- 3 std					
Stock	CC	Average price 2019		Average price 2020	
		No. of day trades	Investor score	No. of day trades	Investor score
R-AMZN	I	2	-2.35	1	-1.09
	EWMA	40	0.02	39	-0.05
R-BAFL	I	2	-2.36	1	-0.12
	EWMA	37	0.01	52	0.07
R-BKEQ	I	4	2.54	5	1.43
	EWMA	37	0.57	5	-0.32
R-BOPU	I	3	-0.11	7	-0.12
	EWMA	62	0.08	8	0.03
R-CHRC	I	5	-4.61	3	-5.49
	EWMA	35	1.12	3	5.30

Average pricing analysis, including opening price analysis, is also stressed, in the question of AC. Research reveals that in the observed inventory, all AC concerns remain. The ARIMA modelling approach (p, d, q) is used to address AC. The price of KSE-30 stock in 2019 and 2020 was followed by an effective ARIMA (p, d, q) model for averaging it. Results of the exploratory review in Tables 2 and 4. ARIMA (p, d, q) Modeling can predict each of the five firms' remaining stock. In the next step, these residuals are used to construct an RB CC (I and EWMA) to implement a KSE-30 stock trade simulation for investors. By taking the average of residuals over and under the control cap, investor scores can be extracted from the CC signals.

The simulation results for 10 stocks are shown in Table 6, based on the average prices of five KSE-30 firms from 2019 to 2020. The trade simulation gives a favorable investor score to six stocks, according to the results given in Table 6. In comparison, the 4 trade simulation gave a negative score in 2019. The trade simulation gives a favorable investor score to 4 stocks, while the trade simulation gave a negative score to 6 stocks in 2020. Therefore, investors will benefit by 60 percent in 2019 and 40 percent in 2020 using an RB CC based on the average price and based on the specified assumptions. EWMA CC based on residual is applied in some instances. Investors rate the best, see the investor score basis based on the residual CC, conclusions can be drawn. In three cases, the RB EWMA CC has the highest score of investors in 2019, and in 2020, there is 1 case of personal influence based on residuals in the 2019 and 2020 estimates. Using a CC, we infer that COVID-19 has a more significant impact on the stock trading decision by using averaging stock prices.

CONCLUSION AND FUTURE RECOMMENDATIONS

This essay discusses the potential to use predictive CCs in stock portfolio analysis, suggesting an AC concern in the original analysis. The study is based on all of the opening prices and average prices of the five KSE-30 stock firms. ARIMA (p, d, q) modelling is applied to solve the AC problem. The RB CC was, however, used for research. Variables in research prove it has to be analyzed based on (I and EWMA) CC. Therefore, two separate time ranges for stock trading have been added to research the potential of predictive CCs to ensure success. The first short-term period will run from January 1 until December 31 2019, and from January 1 until November 31 2020. Other stock details not included in the scheme will dramatically increase the margin of benefit. Investors are involved in reaching targets, but the most significant possible portfolio return is often achieved by stock trading. In the short term, depending on the residual EWMA CC, the analysis based on residual I CC is based on higher portfolio benefit. The EWMA CC, based on residuals, calculates the portfolio benefit based on the opening

price; results reveal that the EWMA CC, based on residuals, realizes the average price with the highest portfolio profit. I CC is, therefore, not the most acceptable alternative used during stock trading. So, the second theory for analysis was dismissed. Although the portfolio is reduced, the opening price instead of stock transactions' average price. As a result, the third research hypothesis was accepted.

Although the overall profit margin estimated using the opening price is 30 (10) percent in 2019 (2020) and the average price used in 2019 (2020) is 60 (40). This may seem very high and practical, so the first research theory to be embraced and further developed is expected to deliver a higher profit margin related stock information not included in the program can significantly increase profitability. Investors are interested in achieving their targets, but the maximum possible portfolio return is also the portfolio profit achieved by stock trading. EWMA-based CCs based on residuals contribute to higher portfolio gains in the short term and are based on the study of CC I based on residuals. The RB EWMA CC calculates the portfolio profit based on the opening price; results reveal that the RB EWMA CC receives the highest overall portfolio price profit. Therefore, for stock trading, my CC is not the most appropriate option. The second test theory was, however, denied. While the portfolio is reduced, the opening price is used instead of the actual inventory purchase price. Transactions depend on the overall higher portfolio profit. As a result, the third research hypothesis was accepted.

By taking a radically different methodology, this article analyzes the application of CCs in stock trading. There is already so much room for change. And, since this paper presents a new approach with certain clear drawbacks. Second, only very liquid inventory was observed in this situation. Potential uses of CCs with few transactions need to research inventory. Secondly, as the inventory comes from KSE-30, examine just a certain five stocks of which the most interested individual is seen by buyers. In other words, in these securities, investors conclude that the future of the businesses involved is brilliant. But it makes sense to verify the profitability of the CC for such less efficient businesses. Another big drawback in the analysis is the off-line process. Online tools are used, and because of new results, new analyses are carried out every day. Different ARIMA (p, d, q) models may be chosen, and different trading signals are therefore produced. However, if the data volume is very high, it is unlikely that a new data point would lead to the use of various ARIMA (p, d, q) models

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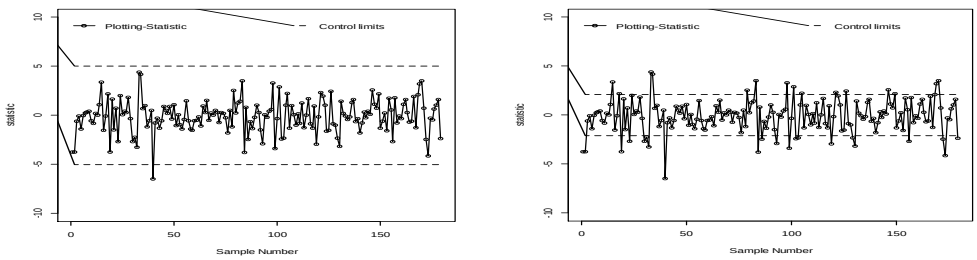
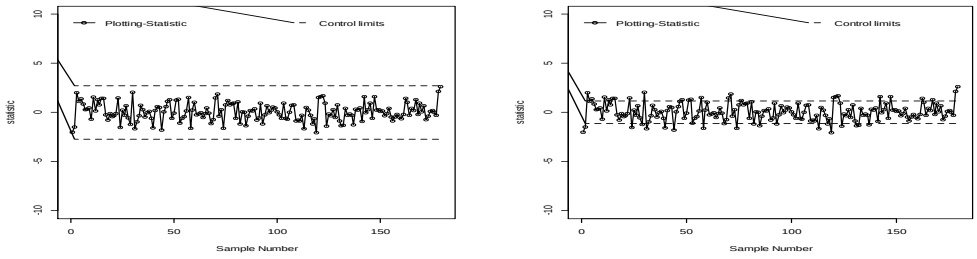
Appendix

Residuals based control charts 2019 OPENING DATA

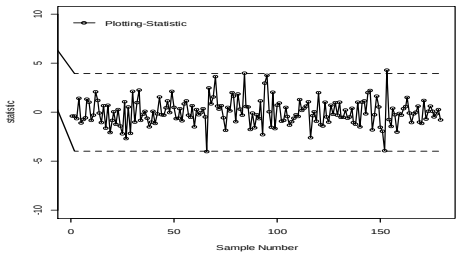
R- AMZN (Individual and EWMA)

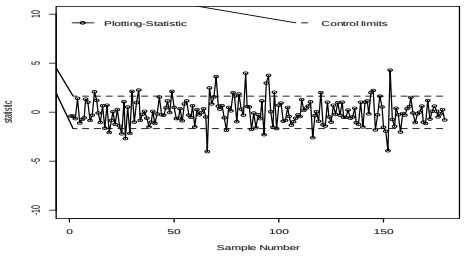


R- BAFL (Individual and EWMA)

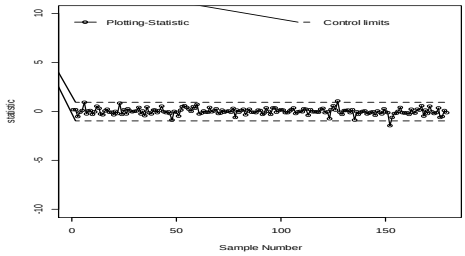


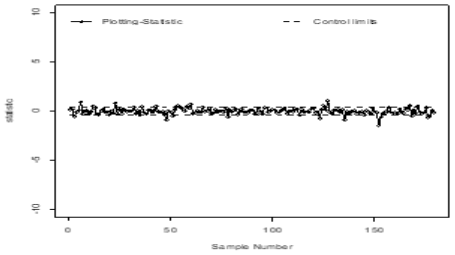
R- BKEQ (Individual and EWMA)



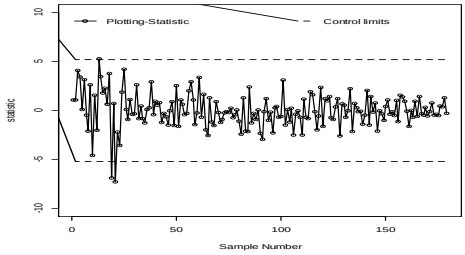


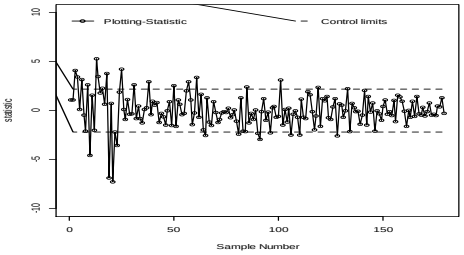
R- BOPU (Individual and EWMA





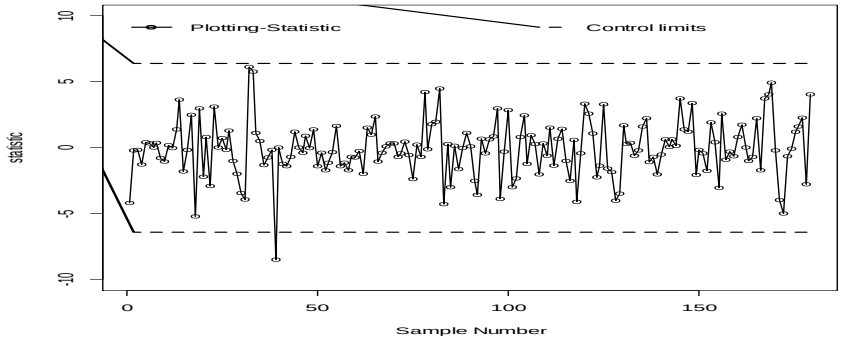
R- CHRC (Individual and EWMA)



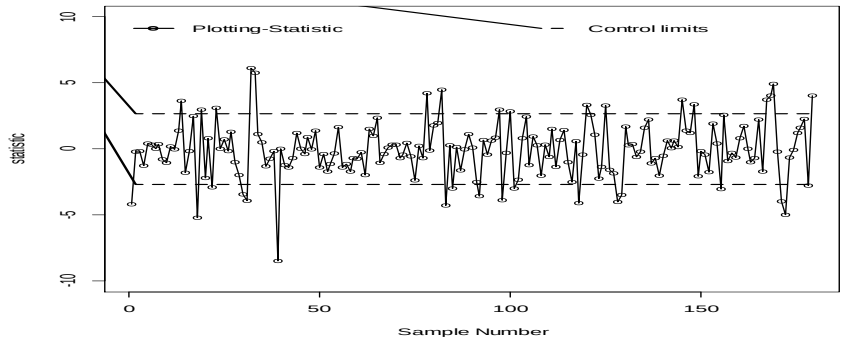


Residuals based control charts 2019 Average DATA

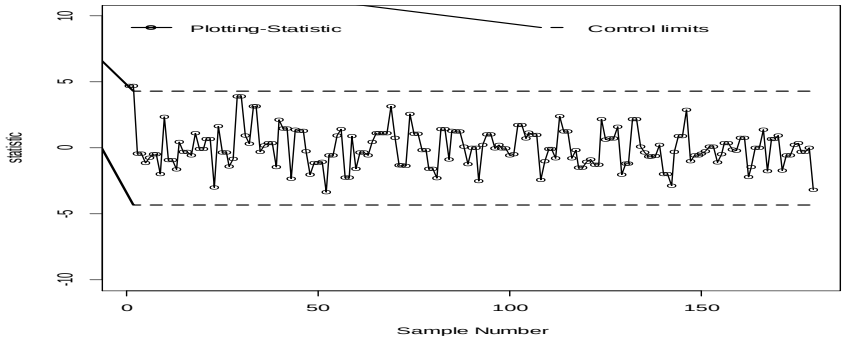
R- AMZN (Individual Control chart)



R- AMZN (EWMA Control chart)



R- BAFL (Individual Control chart)



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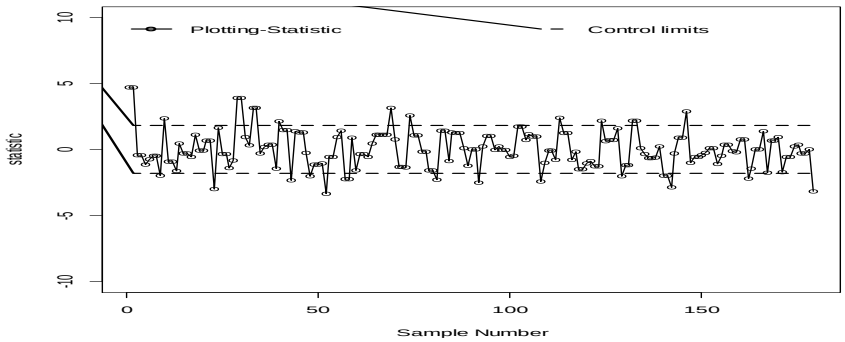
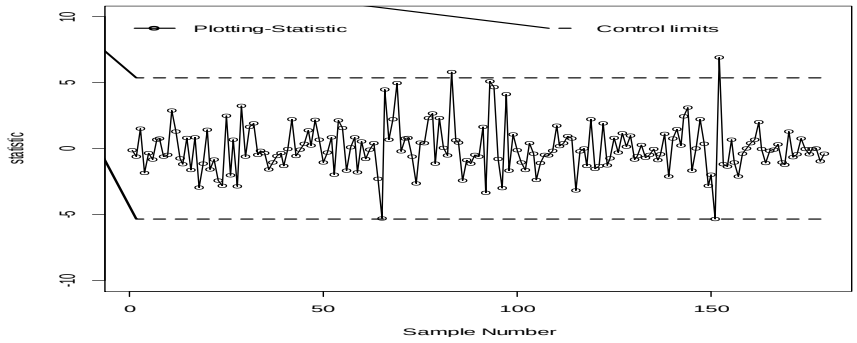
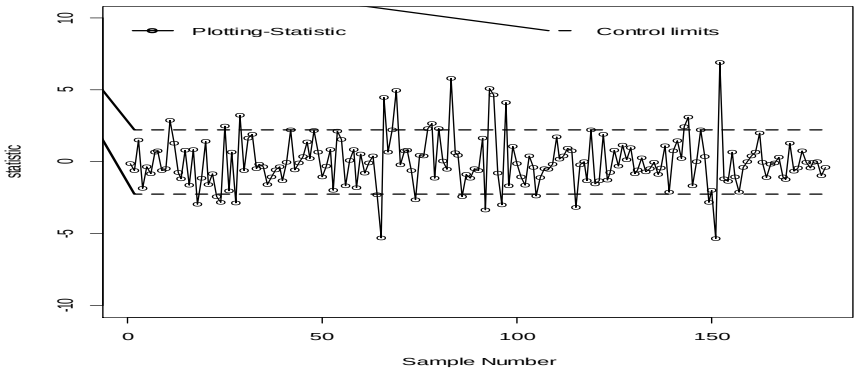


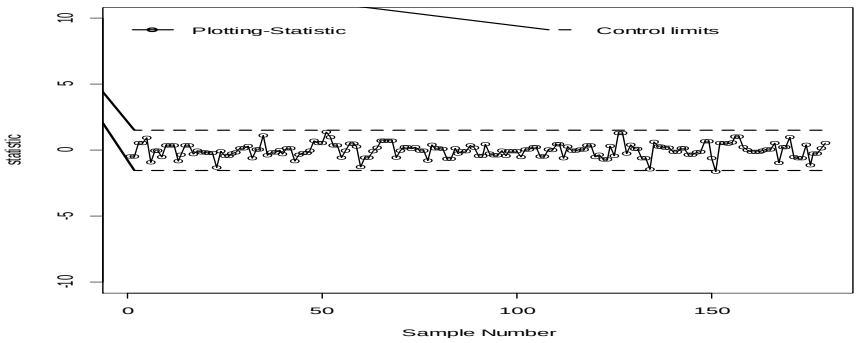
R- BKEQ (Individual Control chart)



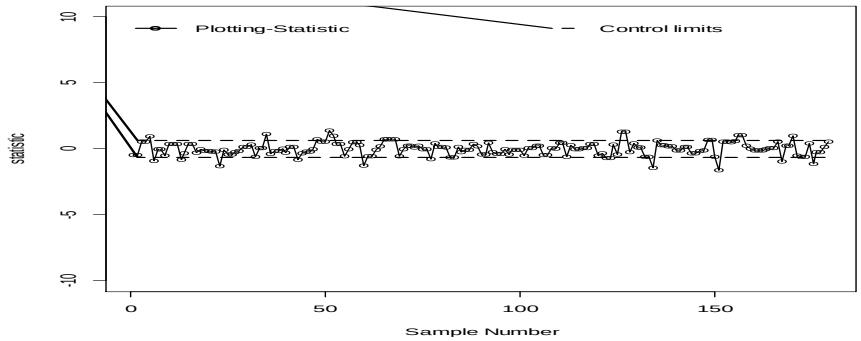
R- BKEQ (EWMA Control chart)



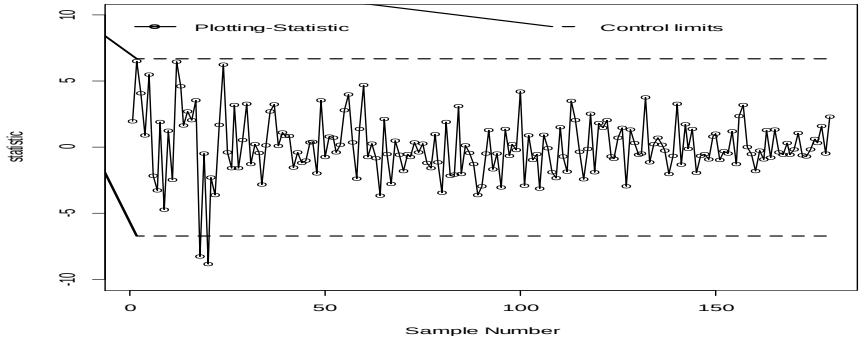
R-BOPU (Individual Control chart)



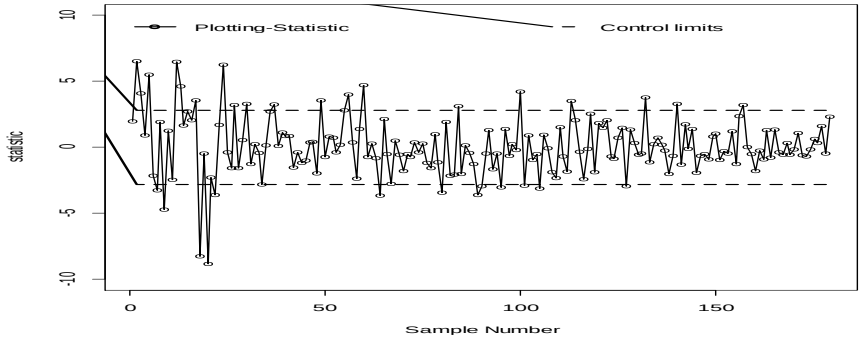
R- BOUP (EWMA Individual Control chart)



R- CHRC (Individual Control chart)

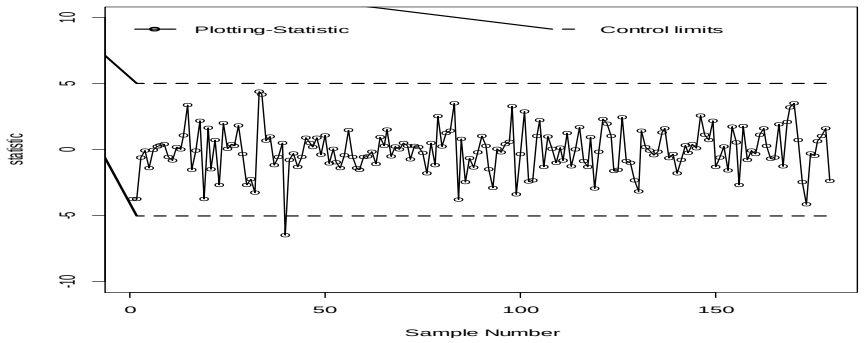


R- CHRC (EWMA Control chart)

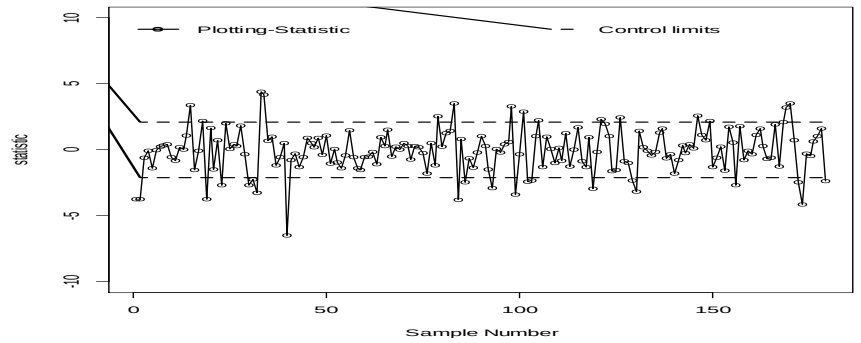


Residuals based control charts 2020 OPENING DATA

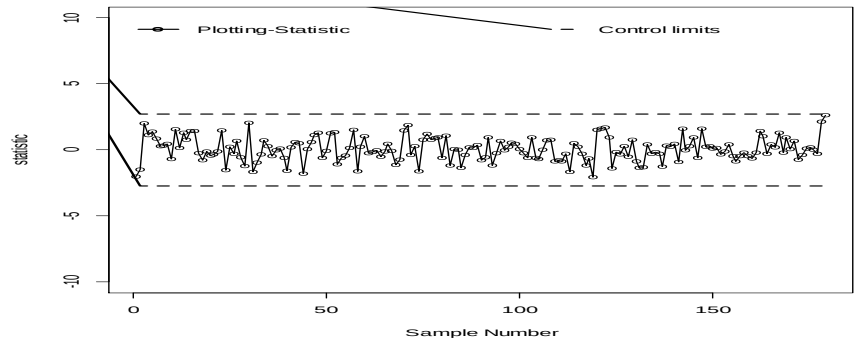
R- AAMZN (Individual Control chart)



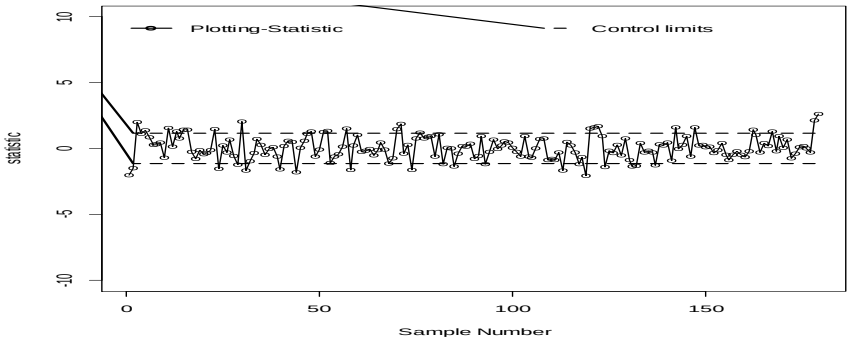
R- AAMZN (EWMA Control chart)



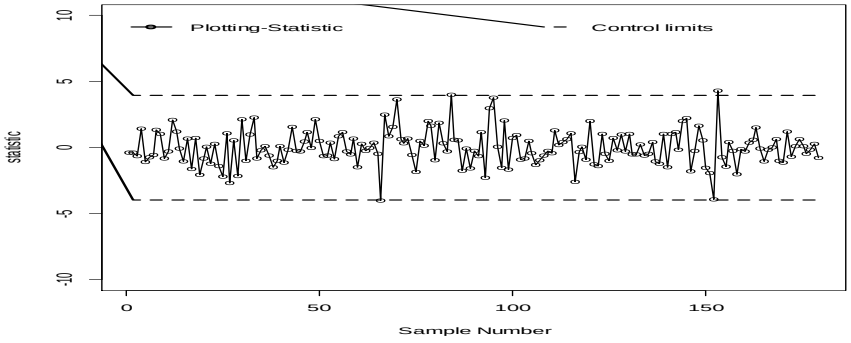
R- BAFL (Individual Control chart)



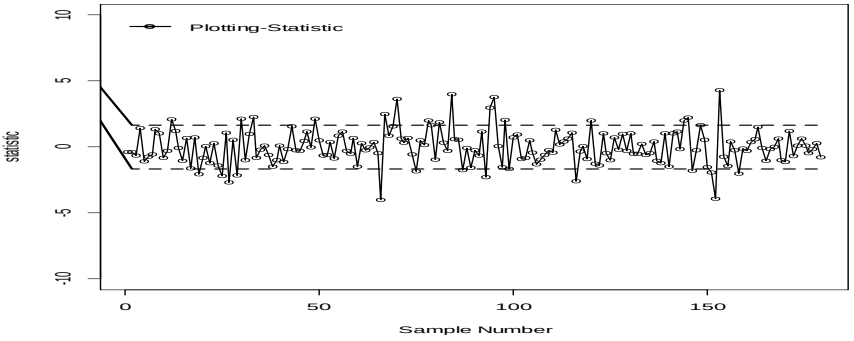
R- BAFL (EWMA Control chart*)*



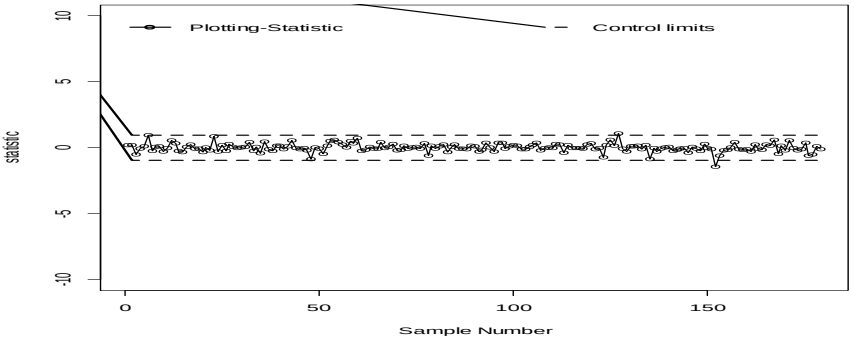
R- BKEQ (Individual Control chart)



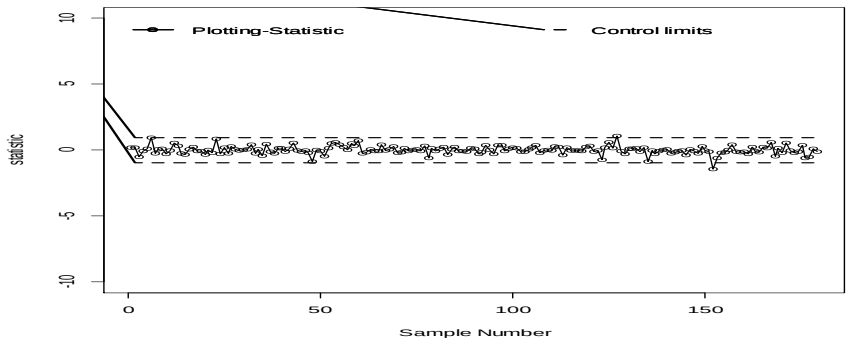
R- BKEQ (EWMA Control chart)



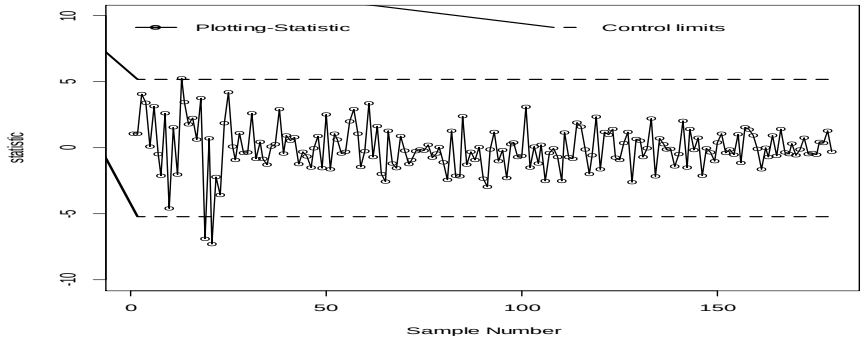
R- BOPU (Individual Control chart)



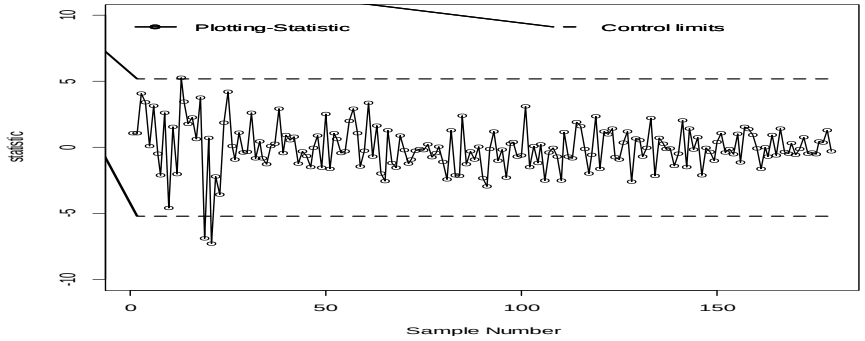
R- BOPU (EWMA Control chart)



R- CHRC (Individual Control chart)

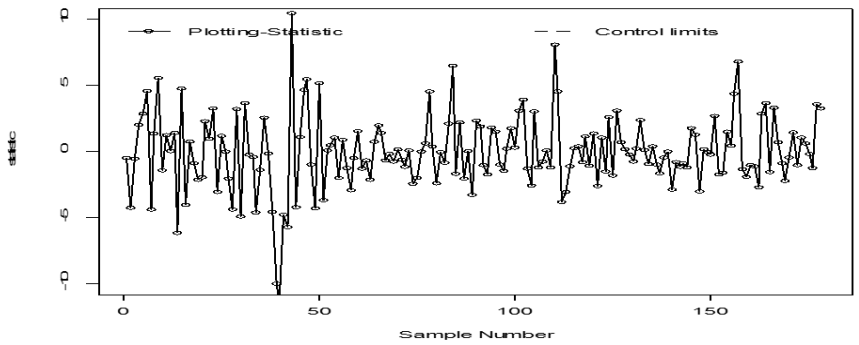


R- CHRC (EWMA Control chart)

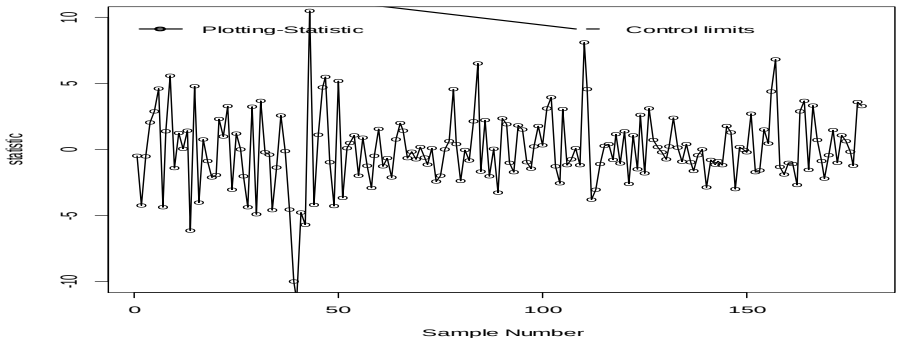


Residuals based control charts 2020 Average DATA

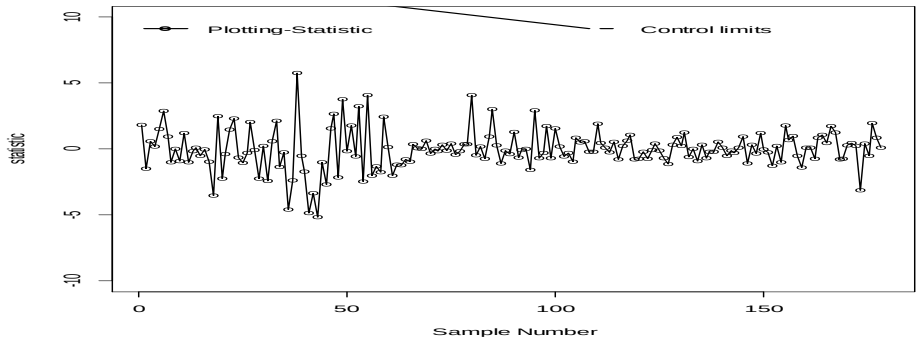
R- AMZN (Individual Control chart)



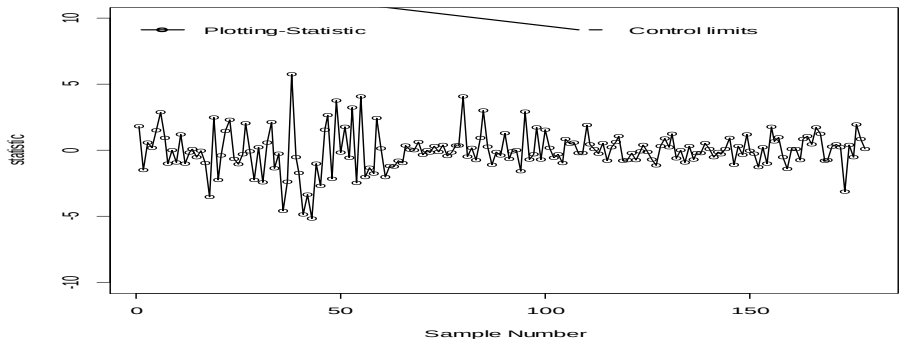
R- AMZN (EWMA Control chart)



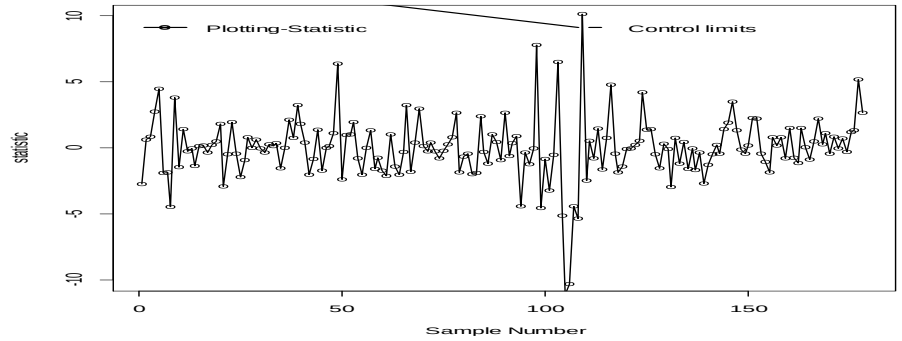
R- BAFL (Individual Control chart)



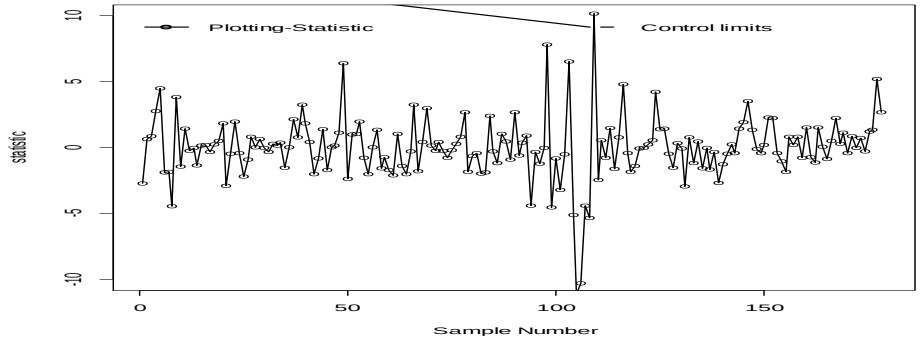
R- BAFL (EWMA Control chart)



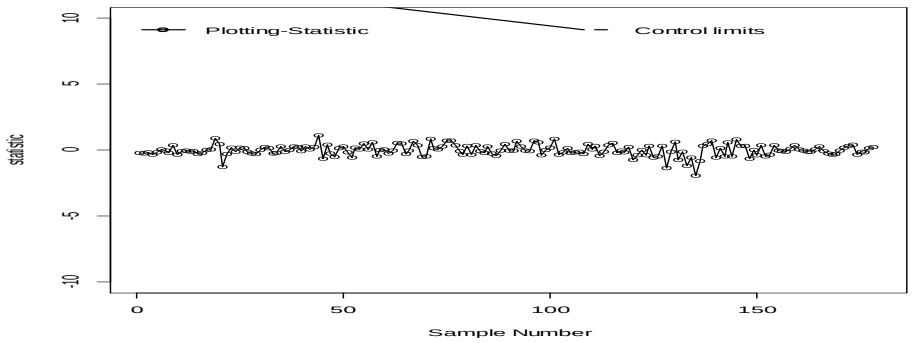
R- BKEQ (Individual Control chart)



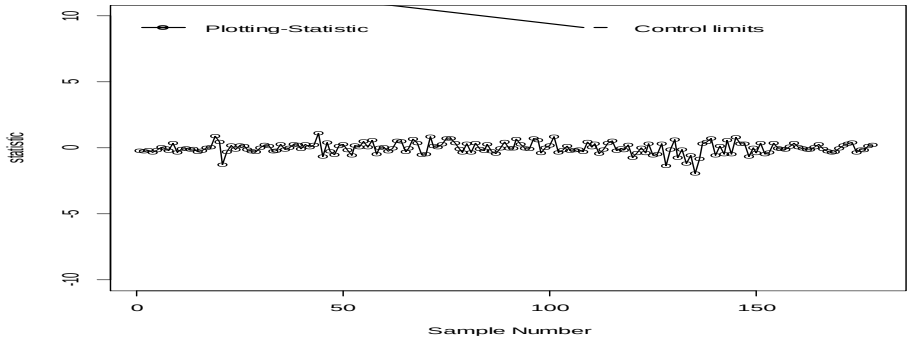
R-BKEQ (EWMA Control chart)



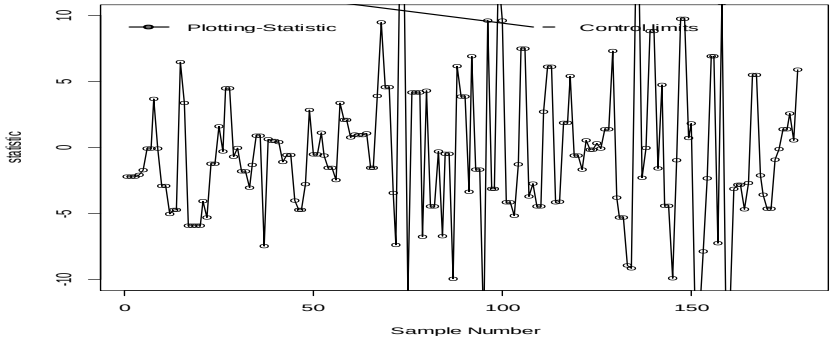
R- BOPU (Individual Control chart)



R- BOPU (EWMA Control chart)



R-CHRC (Individual Control chart)



R-CHRC (EWMA Control chart)