ISE-5133 Homework #1

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Problem 3

Total Private Employments in US

Figures from [1] to [5] are related to US employment data in RStudio. In Fig [1],we see a monthly time series with an upward trend. We can support that assumption with Fig [5], in which slowly declining auto-correlation function is obvious. In Fig [3], time series for different months looks identical to each other in a 80 years time interval. Moreover, average number of employees for each months oscillate roughly between $74,000 - 75,000$ over 80 years. This information leads us to conclude that there certainly is a monthly period and seasonal behaviour in the data. In fact, even though it is hard to see in Fig[1], in Fig[2] and [3] there is a certain pattern for a seasonal component. Next figure, Fig [4], has a noticeable linear relation appear in all lags. Even though the data slightly scatter around linear fit line with throughout the lags, this effect has no influence over the relationship. Lastly, in Fig [5], we can see very pronounced trend and slightly visible seasonal component. It is crucial to state that, 1945 in Fig [2], there is a relatively sharp drop. The reason is between August and September, which is the last month of World War II, there are many people died in the war and did not turn back from war zones. These people appeared in that plot as a decrease in number of employees.

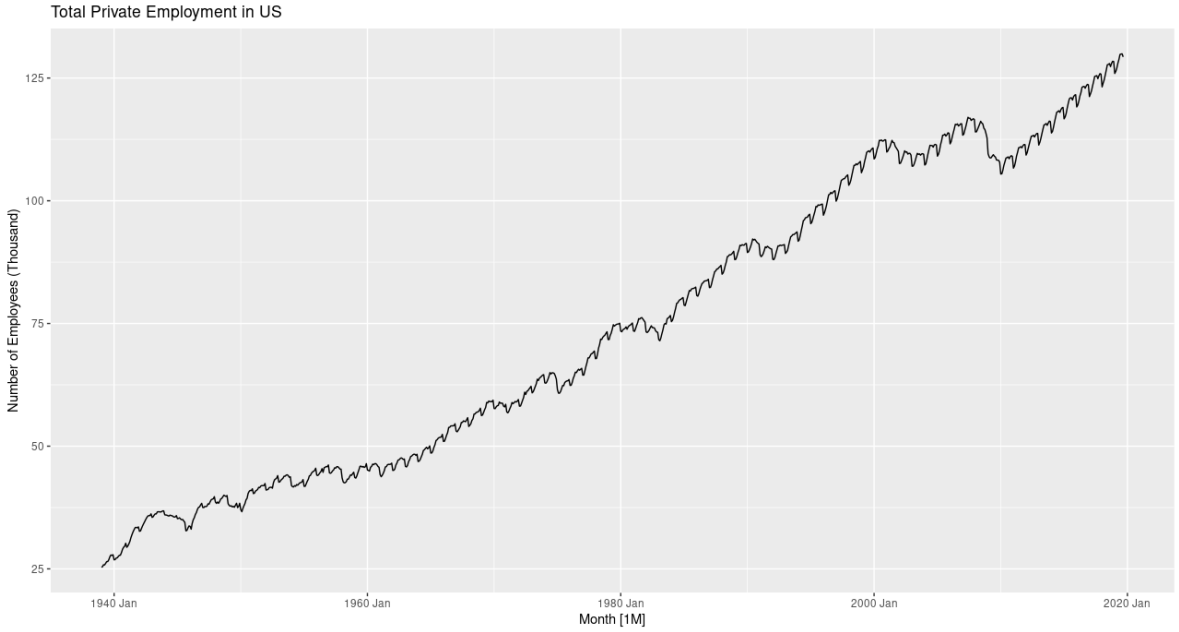

Figure 1: Total private employment in US is shown as monthly time interval in the horizontal axis and number of employees in the vertical axis. Figure clearly shows that there is an upward trend as well as a possible cyclic behaviour.

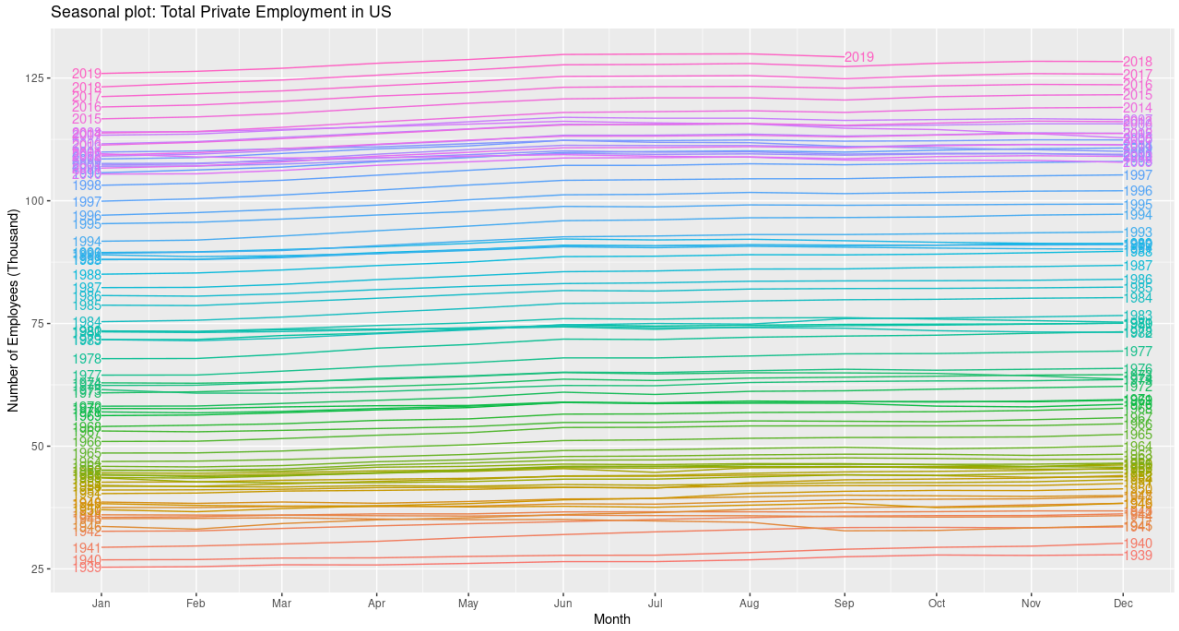

Figure 2: Seasonal plot for total private employment data. There is almost the same pattern over years for different months, which indicates that the data have seasonal behaviour.

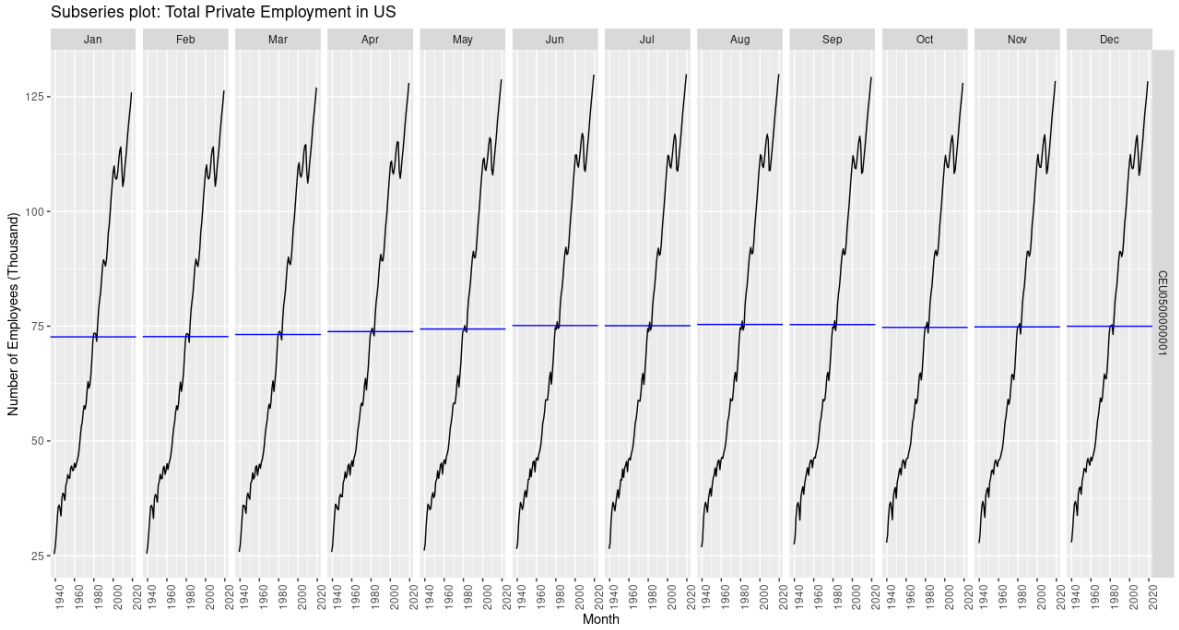

Figure 3: Subseries plot for the total private employment in US. Monthly averages of number of employees are very close each other and similar time series pattern is present for individual months over given time interval.

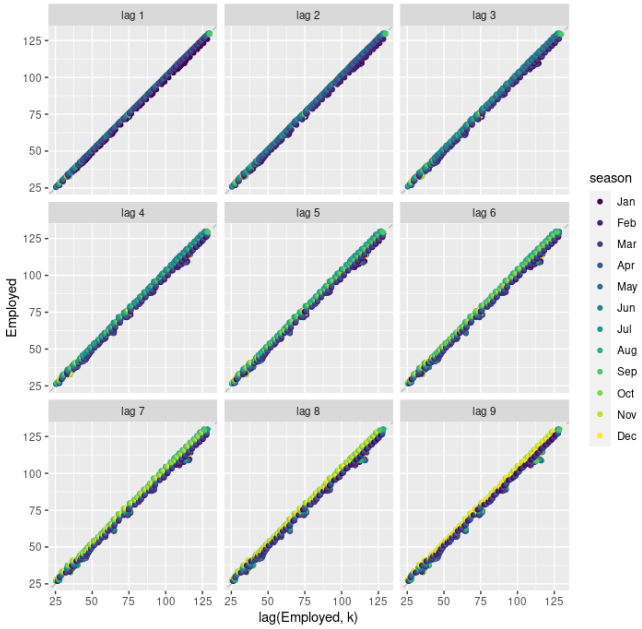

Figure 4: Lag representation for the total private employment in US. Linear relationship presents in each lag.

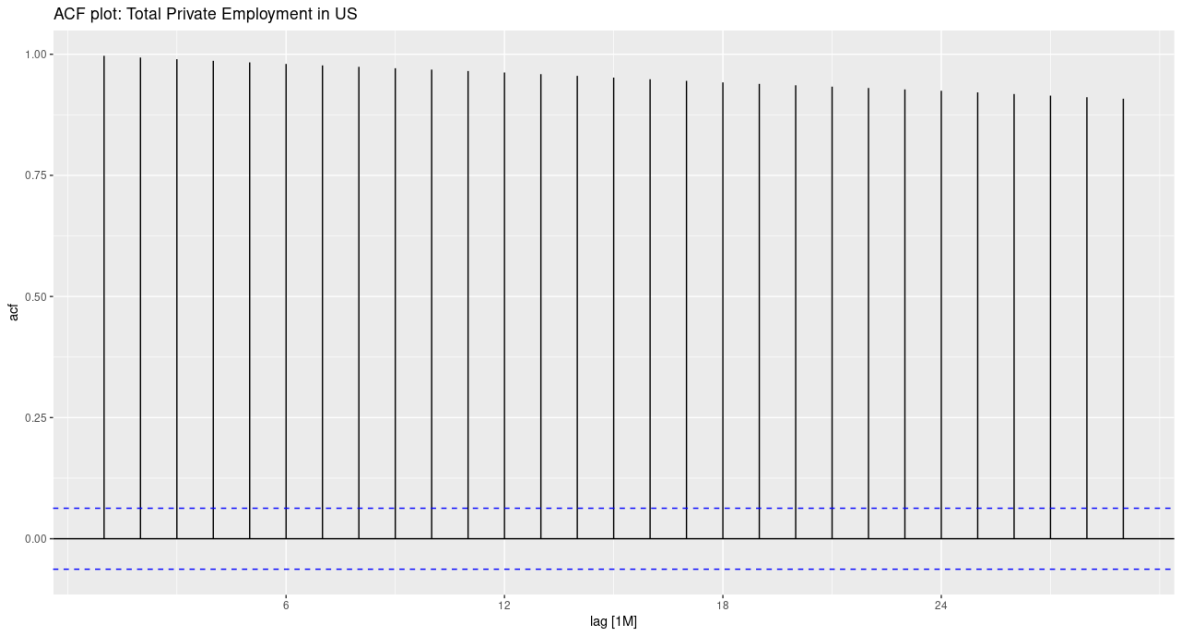

Figure 5: Auto-correlation function for the total private employment in US. All the lines are positive and there is a slowly decreasing trend in the plot with a faint seasonal effect.

"H02" Cost from PBS

Figures from [6] to [13] are related to monthly medical cost data in Australia. There are four different configurations of the data related to concession and type while ATC2 is for H02. In Fig [6], we see a clear seasonality in all time series except General/Co-payments/H02 due to its scale. Figure [7] promotes what we saw in Fig [6], again, there are seasonal behaviour in all but third one(General/Co-payments/H02) which is not clear in Fig [6]. In Fig [8], monthly averages in time series display a sub pattern over in a year scale for the same three sets with seasonality. Concessional/Safety net/H02 and General/Safety net/H02 show a solid correlation, both are increasing from February to January and suddenly drop on February again. On the other hand, Concessional/Co-payments/H02 demonstrates a reverse correlation with other two. This might show us, Safety net, which shows up in both increasing patterns, might connected to holiday season, particularly Thanksgiving and Christmas. Furthermore, Concessional/Co-payments/H02 seems like related to seasons than others. It peaks at Fall, however, unlike the other two, there are no sharp changes in monthly averages over a year. Final observation on Fig [8] is the General/Co-payments/H02 displays almost the same level of averages for each month. In fact, the pattern of monthly averages slightly looks like a multi-component sinusoidal wave.

Fig [9]-[12] exhibit lag relationships of the data. Interestingly, depending on different types, there seems like a correlation between different figures. For example, Co-payments type plots shows $50\% - 75\%$ linear correlation while Safety net types show similar "Opened Clam" or "Atoll shape" feature. The last one indicates there are two different relation in these data with different linearity percentages.

As the final analysis for this data set, we turn our attention to auto-correlation function for different Concession-type pairs. Concessional/Co-payments/H02 and General/Co-payments/H02 have trend and seasonality as Concessional/Safety net/H02 and General/Safety net/H02 have only very similar seasonality behaviours.

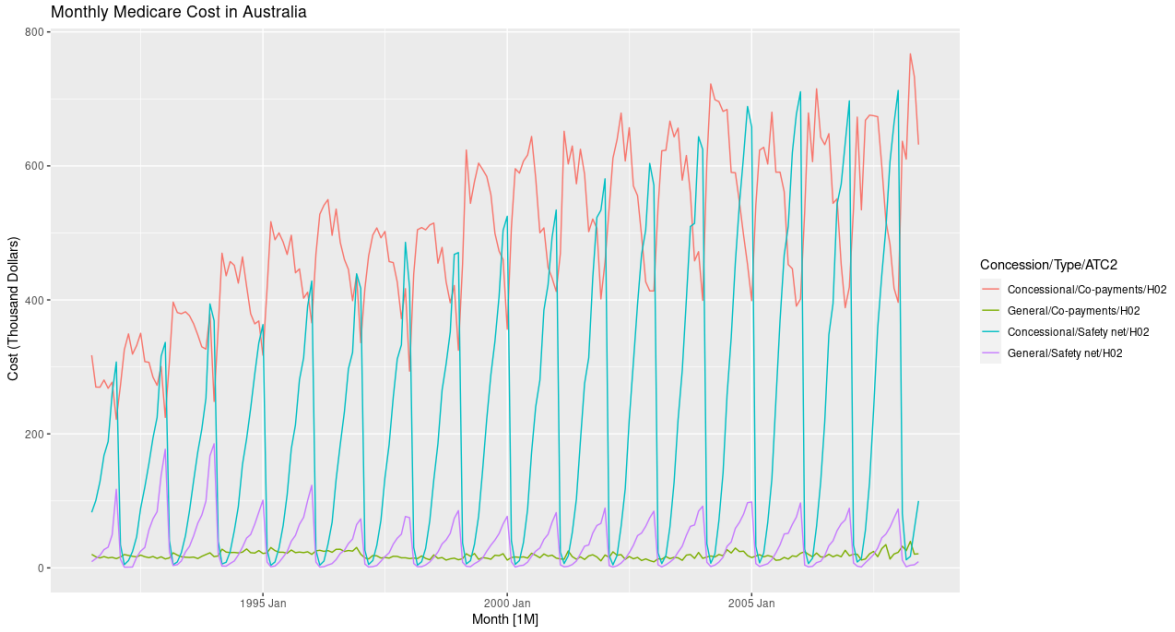

Figure 6: Autoplot time series for 4 different data set in Montly Medicare Cost in Australia for H02. Seasonal period for three sets can be seen clearly, while third one is ambiguous due to the its scale compare to others.

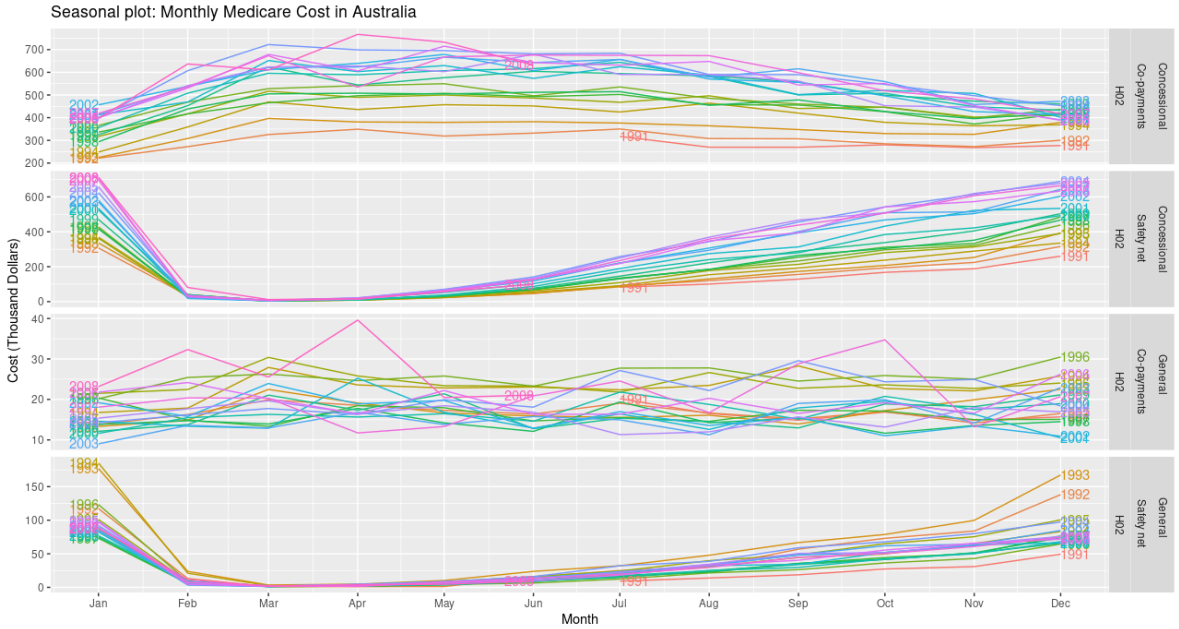

Figure 7: Season plots for the 4 different sets. Sam as the previous image all time series show a seasonal pattern except third one.

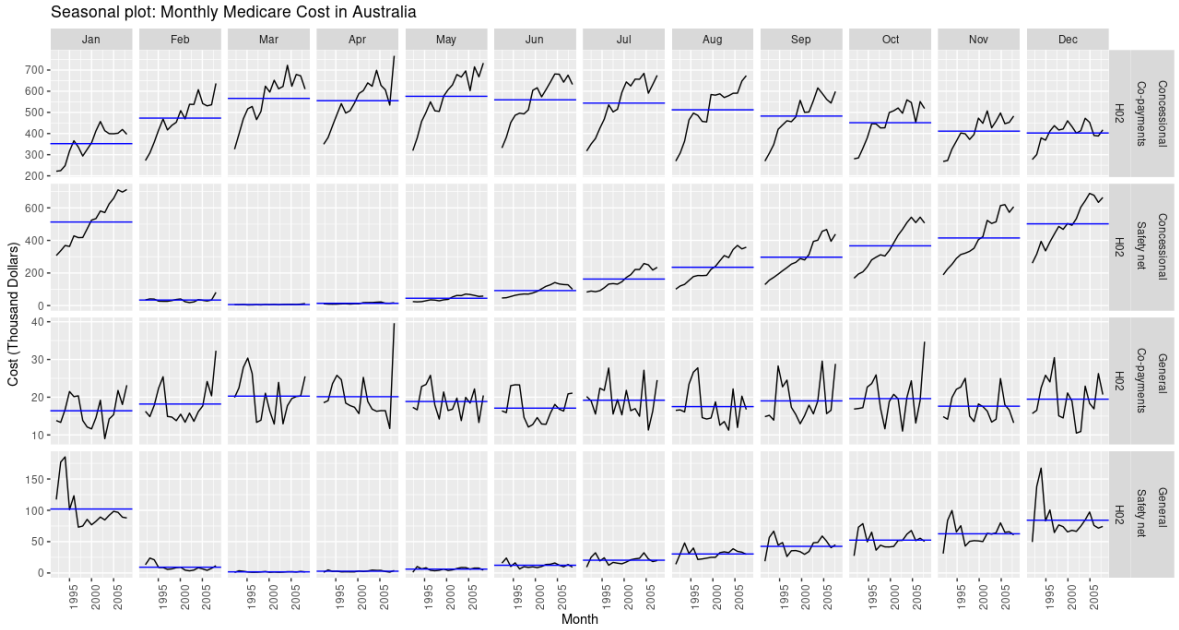

Figure 8: Subseries plots for the 4 different sets. Sets with Safety net seem to show connection to a specific season in the year. While Concessional/Co-payments set shows reverse correlation, General/Co-payments, unlike others, does not show any holiday or season related pattern. However, it would not be peculiar to say, pattern somehow looks sinusoidal.

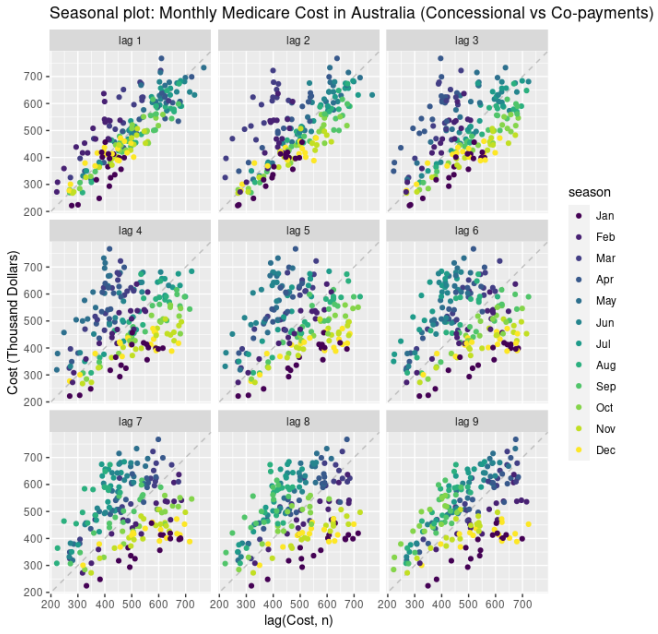

Figure 9: Lag plot for Concessional/Co-payments

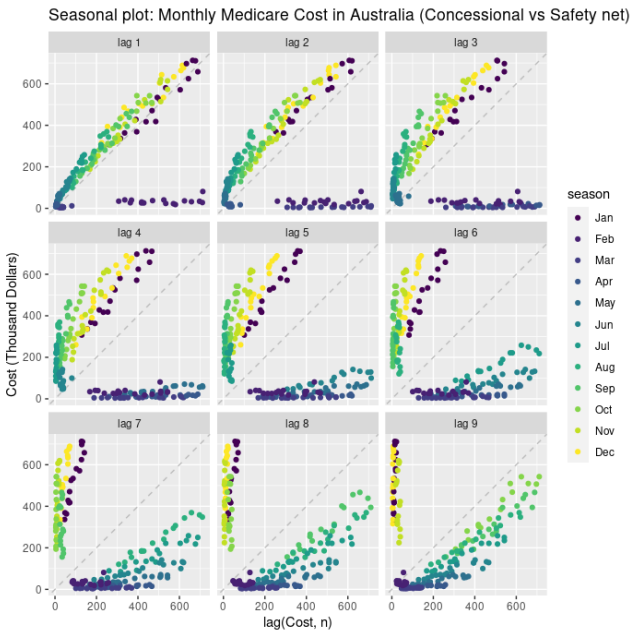

Figure 10: Lag plot for Concessional/Safety net

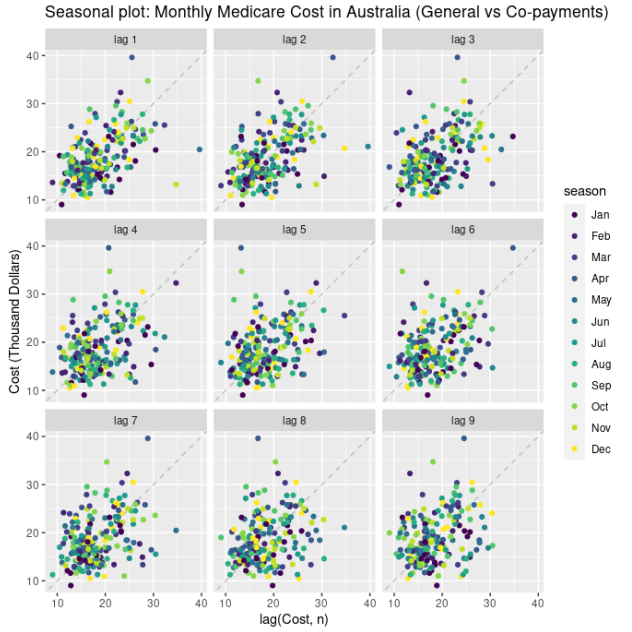

Figure 11: Lag plot for General/Co-payments.

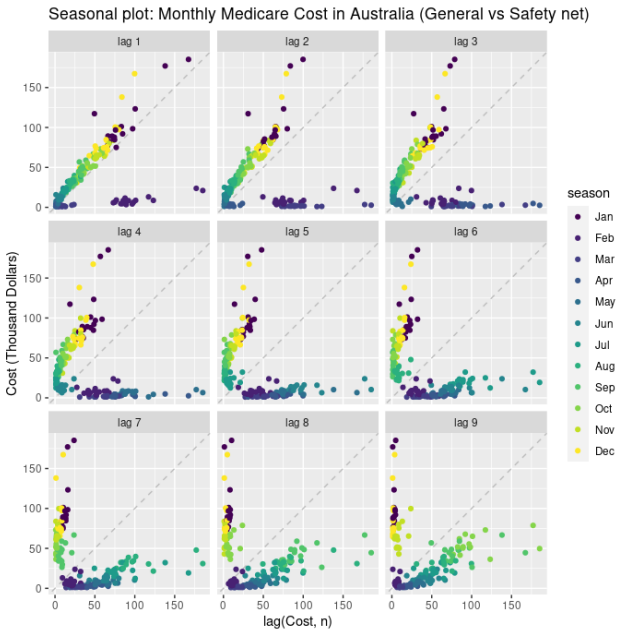

Figure 12: Lag plot for General/Safety net

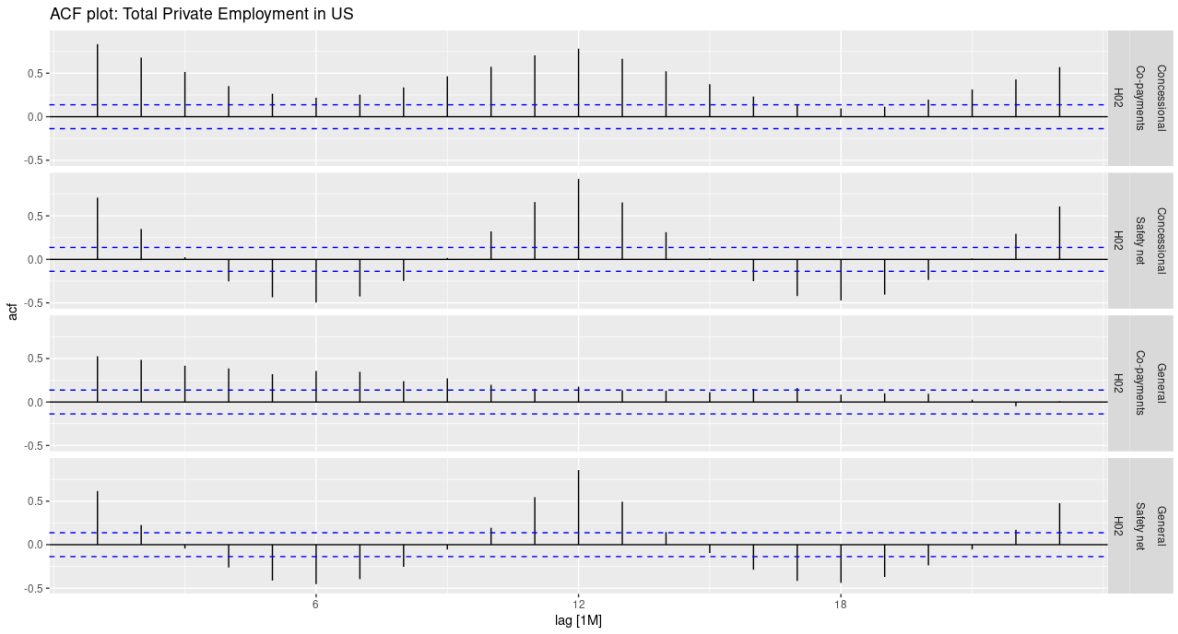

Figure 13: Auto-correlation function plots for 4 different data sets. Seasonal and trend-seasonality behaviours are clear. One also note that, Safety net component would be responsible for the same seasonality shape, with a slight amplitude difference, in second and fourth plots.

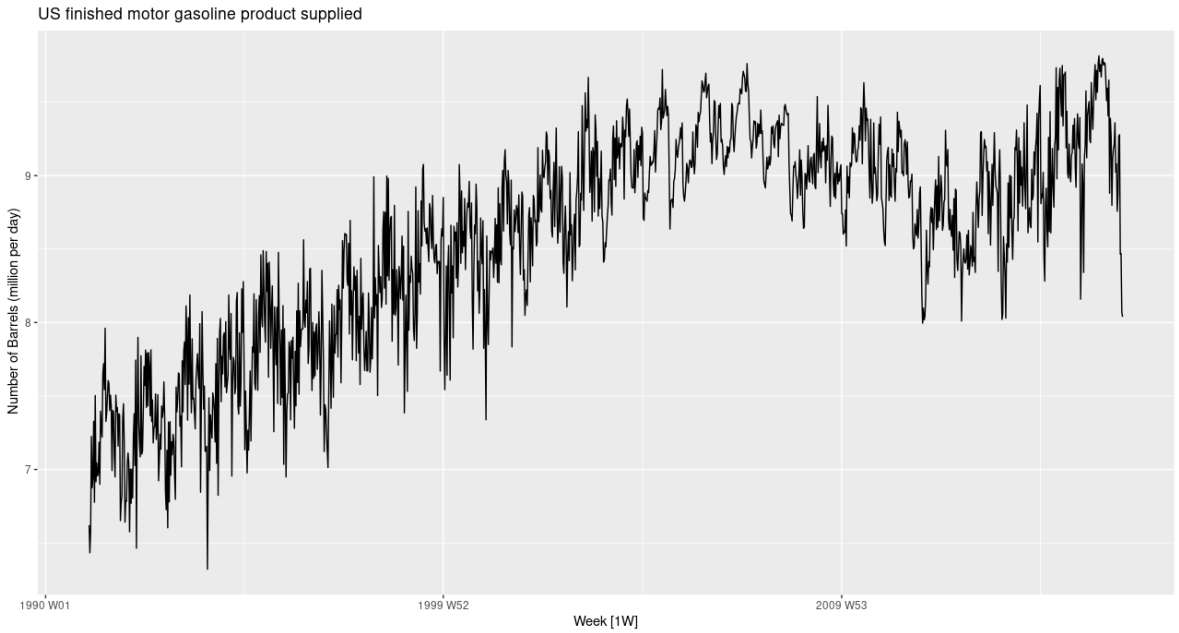

Figure 14: Autoplot time-series for US gasoline data set. Seasonal period shows itself clearly in the figure, data most probably have one year periodicity. In addition to this, there seems like a up trend, even a cyclic behaviour.

US Gasoline

Fig [14]-[18] are associated to US gasoline data set. In Fig [14], seasonality is very noticeable, there might be a possible trend, too. However, a unusual event in the data is the dip between 2009 and 2014, which shows the effect of US gas crisis in 2011. The reason is crude oil price climbed above $100/barrel due to the Arab Spring protests in the North Africa and Middle East. Lowest point around 1994 might indicates result of economic recession during George H.W. Bush's government.

In Fig [15], there are plenty of fluctuation in the data. This is expected since the gas price depends on countless of free parameters such as domestic and international political changes. Another interesting fact is, in Fig [16], besides seasonality, domestic political issues do not affect daily number of barrels as much as international crisis. In Fig[14], we mentioned that around 1993 and 2011, gas prices are very low. However, in subseries, we see any generally low averages in first month of a year and two other dips close to end of a year. In all years' weekly averages we cannot say these political events have visible effects.

The lag plot, Fig [17], shows that for different lags correlation does not change much. Along with that, Fig [18] shows very clear trend-seasonality behaviour with a high amplitude.

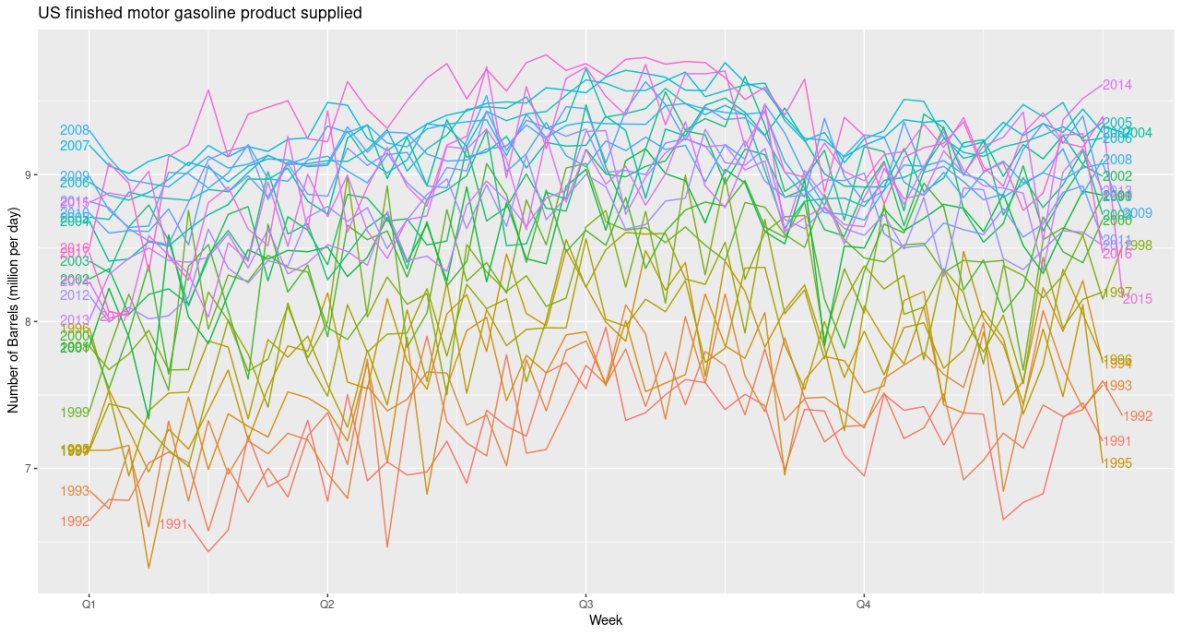

Figure 15: Season plot for US gasoline prices per barrel between 1992-20016. No apearent seasonality for the data.

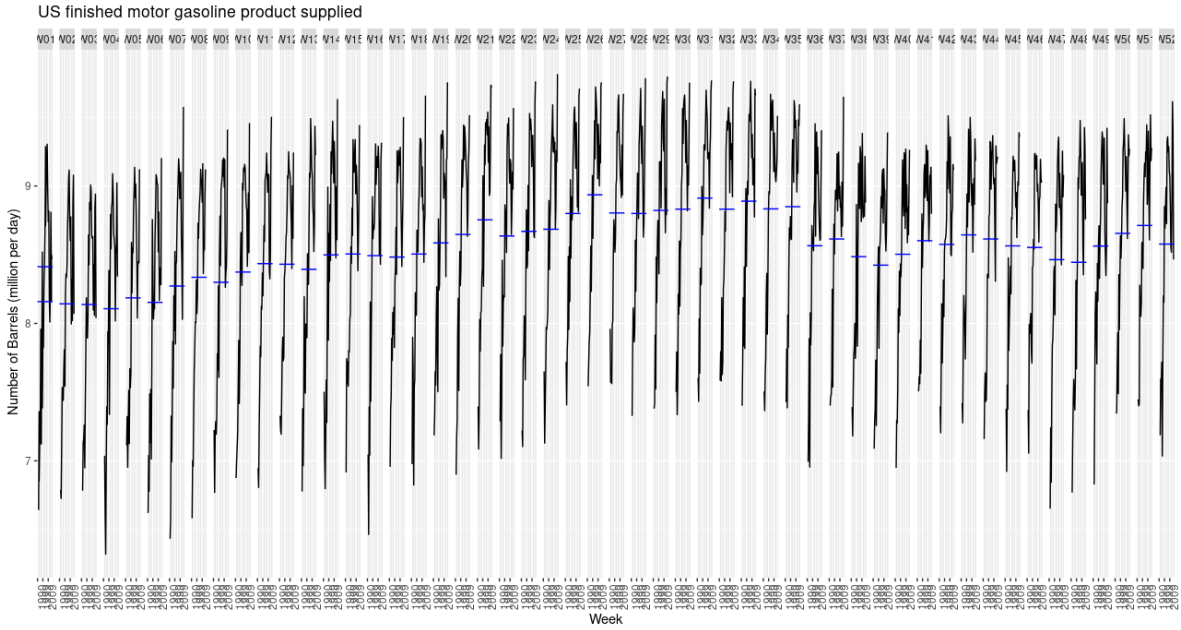

Figure 16: Subseries plot for US gasoline prices per barrel between 1992-20016.

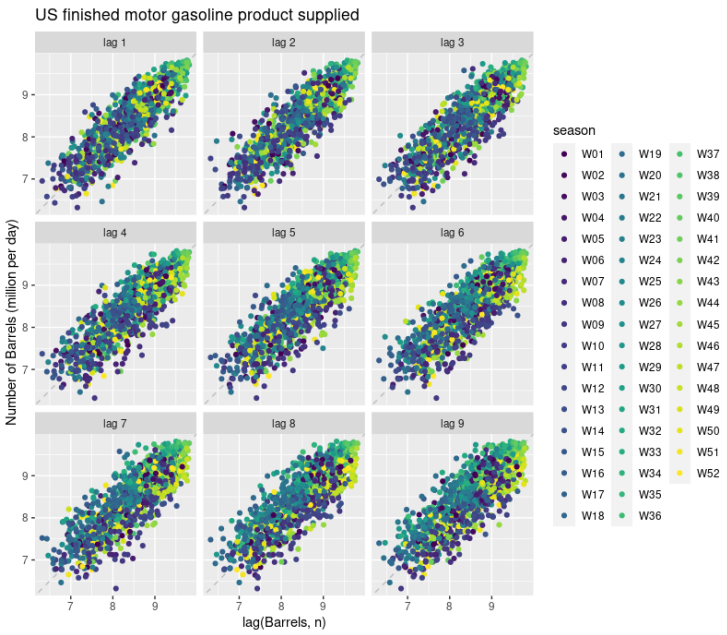

Figure 17: Lag plot the gas prices between 1991-2016. there is a consistent linear relationship (around 75%) in all lags.

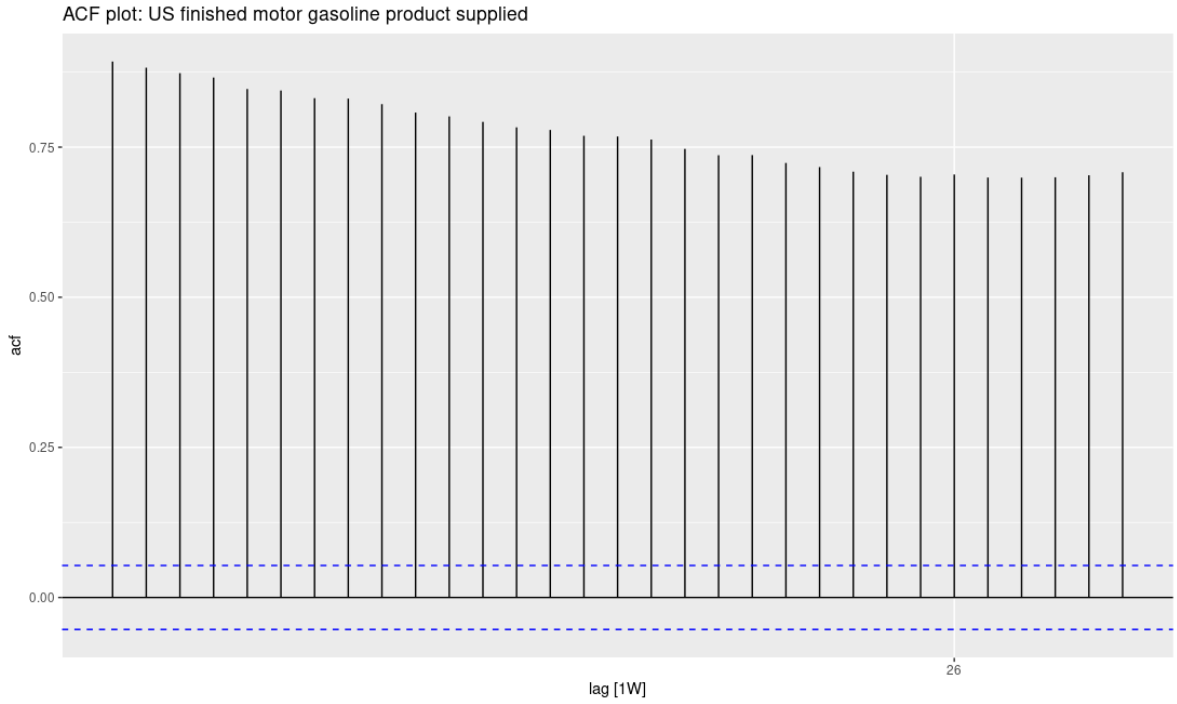

Figure 18: Auto-correlation function for the gas prices per barrel. There is an easy-to-see trend and seasonality with high amplitude.

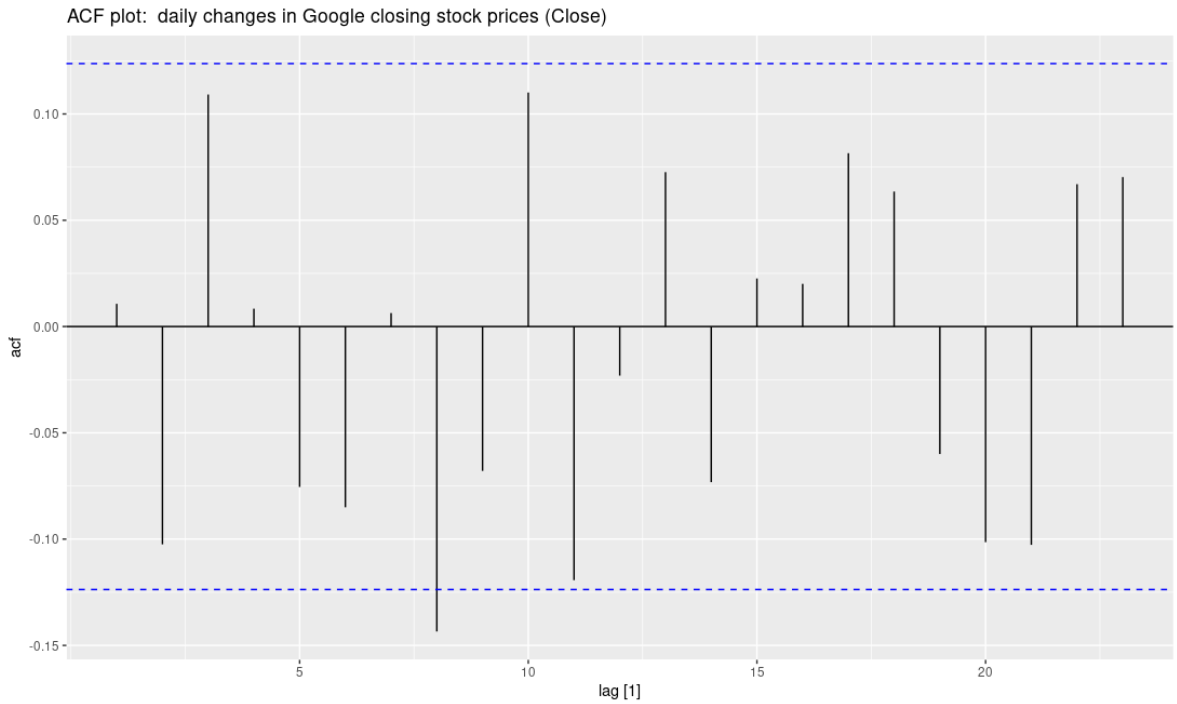

Figure 19: Auto-correlation function for the daily changes in Google closing stock prices

Problem 4

Daily changes in Google stock prices

a)

(See Q4.R file)

b)

It is necessary to re-index data since January first is the new year holiday and stock markets are not open during weekends. So, it is easier to show trading days than the calendar days. Trading days might also called as business days.

c)

See Fig [19]-[22]

d)

According to Fig[19], r8 shows some correlation, rest is white noise. In Fig[20], r1,,r2,r8 show correlation while only r20 shows a correlation in Fig [21]. In the last figure, Fig [22], r8 and r20 show some correlation. Under the light of these information, I would say r8 and r20 appeared in multiple ACFs, so I would expect some major effects from these peaks in various differences.

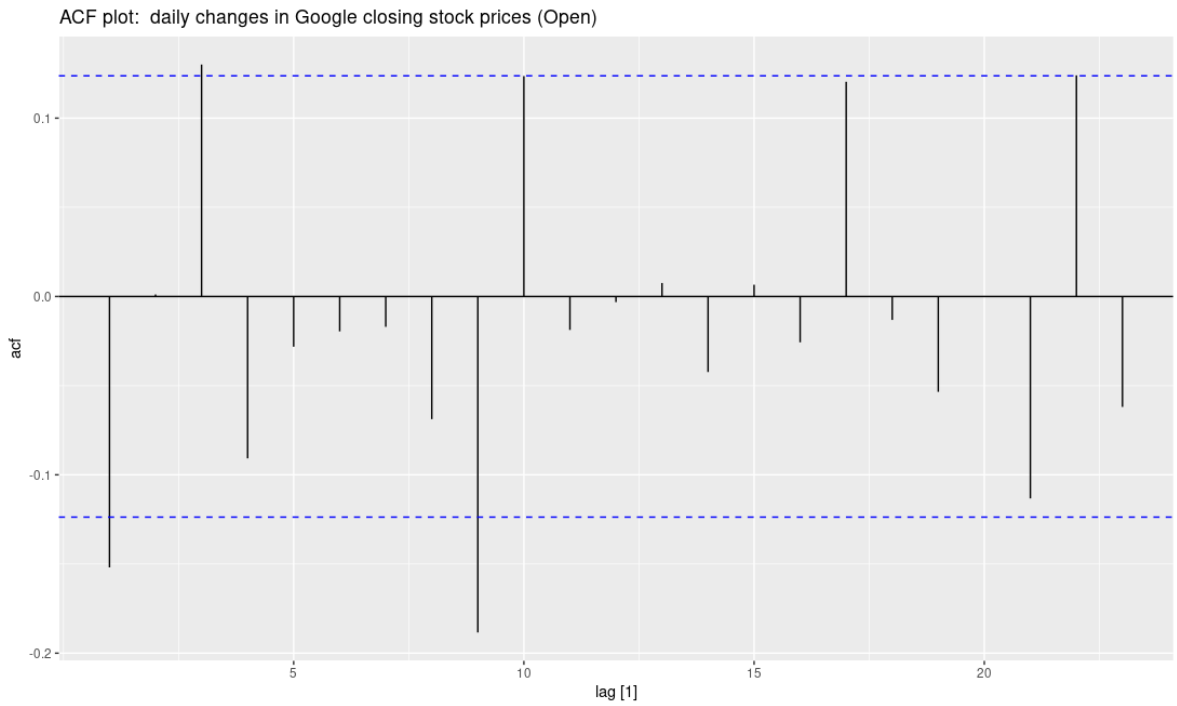

Figure 20: Auto-correlation function for the daily changes in Google opening stock prices

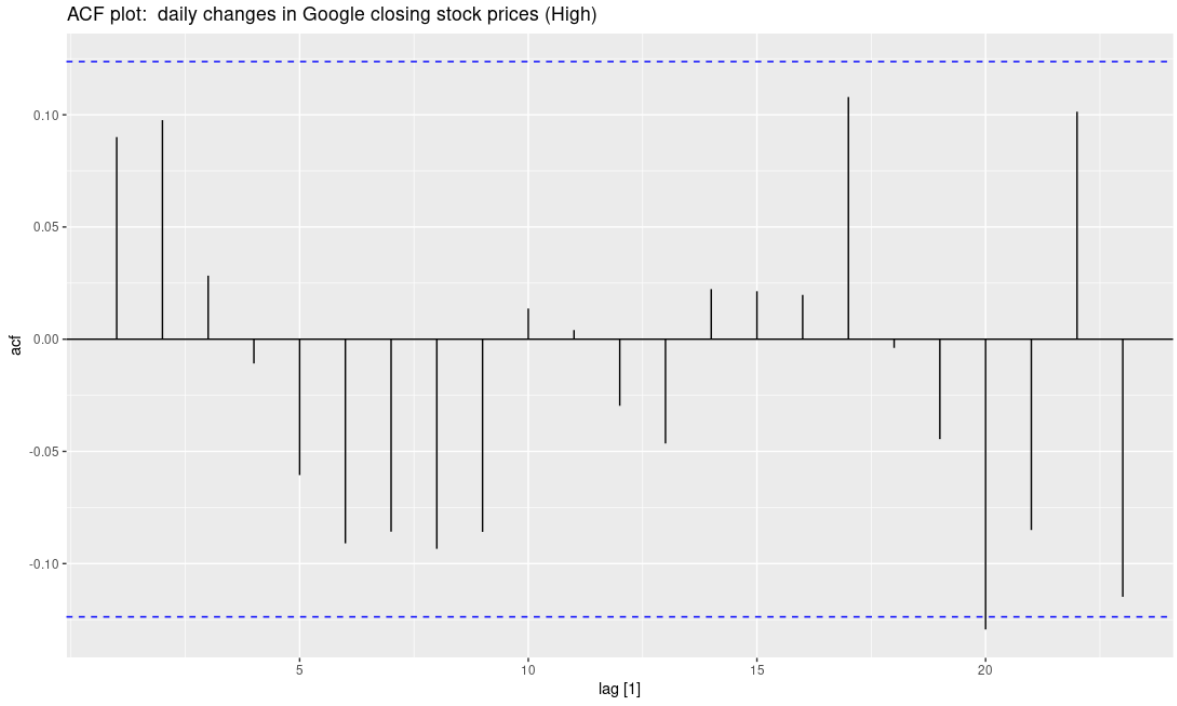

Figure 21: Auto-correlation function for the daily changes in Google highest stock prices

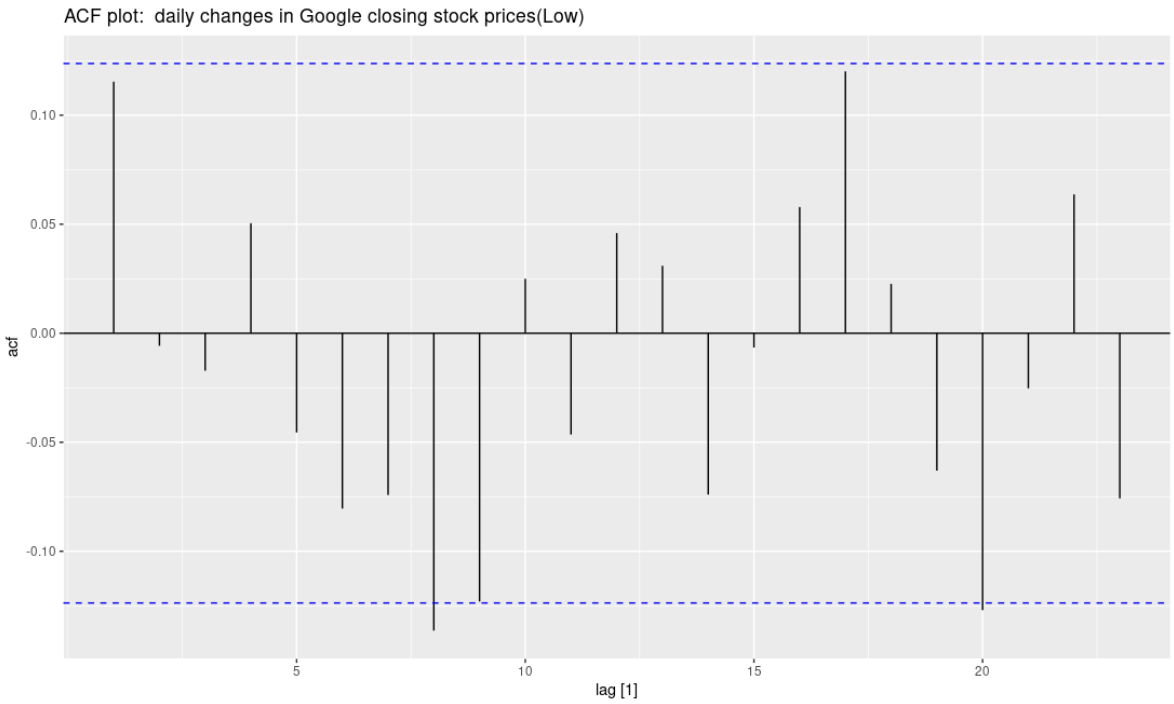

Figure 22: Auto-correlation function for the daily changes in Google lowest stock prices