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title: "STA\_6856\_Final\_Project"

format: html

title: "Forecasting"

author: "TDA"

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---

```{r set up}

library(TSA)

library(lmtest) #Testing parameters

library(itsmr)

library(tseries)

library(forecast)

options(scipen = 999)

```

```{r import}

data <- read.csv("inflation\_cpi.csv", header = FALSE, check.names = FALSE, stringsAsFactors = FALSE)

```

```{r}

head(data)

```

```{r clean up}

# Promote the 3rd row to column names

colnames(data) <- as.character(unlist(data[3, ]))

# Drop the first 3 rows (metadata + header row)

data <- data[-c(1:3), ]

# Reset row numbering

rownames(data) <- NULL

```

```{r clean\_up cont}

data <- data[,-c(3,4)] #drop columns 3 and 4

data <- data[, -ncol(data)] #drop last empty column

data <- na.omit(data)

```

```{r usa ts}

# Create a time series for United States' CPI

us\_row\_number <- which(data$`Country Name` == "United States")

usa\_cpi <- as.numeric(data[us\_row\_number, 3:ncol(data)])

usa\_cpi\_ts <- ts(usa\_cpi, start = 1960, end = 2023, frequency = 1)

```

```{r mex ts}

# Create a time series for Mexico's CPI

mex\_row\_number <- which(data$`Country Name` == "Mexico")

mex\_cpi <- as.numeric(data[mex\_row\_number, 3:ncol(data)])

mex\_cpi\_ts <- ts(mex\_cpi, start = 1960, end = 2023, frequency = 1)

```

```{r can ts}

# Create a time series for Canada's CPI

can\_row\_number <- which(data$`Country Name` == "Canada")

can\_cpi <- as.numeric(data[can\_row\_number, 3:ncol(data)])

can\_cpi\_ts <- ts(can\_cpi, start = 1960, end = 2023, frequency = 1)

```

```{r test 1}

#us\_row\_number

#class(usa\_cpi\_ts)

#str(usa\_cpi)

#data[us\_row\_number, ]

#head(usa\_cpi\_ts)

#usa\_cpi[1]

#is.numeric(usa\_cpi\_ts1)

str(usa\_cpi\_ts)

#usa\_cpi\_ts

```

```{r plot ts usa}

plot(usa\_cpi\_ts, ylab = "Consumer Price Index", xlab = "Year")

hist(usa\_cpi\_ts, xlim = range(usa\_cpi\_ts), main = "Histogram of USA's CPI", xlab = "CPI")

boxplot(usa\_cpi\_ts)

```

```{r USA acf/pacf}

#acf(usa\_cpi\_ts, main = "Consumer Price Index")

acf(usa\_cpi\_ts, main = "Consumer Price Index", lag.max = 60)

pacf(usa\_cpi\_ts, main = "Consumer Price Index")

```

```{r}

qqnorm(usa\_cpi\_ts)

```

```{r stationarity test}

#summary(usa\_cpi\_ts)

adf.test(usa\_cpi\_ts)

adf.test(can\_cpi\_ts)

adf.test(mex\_cpi\_ts)

#shapiro.test(usa\_cpi\_ts)

```

```{r}

```

```{r plot ts mexico}

plot(mex\_cpi\_ts, ylab = "Consumer Price Index", xlab = "Year")

hist(mex\_cpi\_ts, xlim = range(mex\_cpi\_ts), main = "Histogram of Mexico's CPI", xlab = "CPI")

#boxplot(usa\_cpi\_ts)

```

```{r plot ts canada}

plot(can\_cpi\_ts, ylab = "Consumer Price Index", xlab = "Year", col = "red")

par(new=TRUE)

plot(usa\_cpi\_ts, ylab = "", xlab = "", col = "blue", axes = FALSE)

par(new=TRUE)

plot(mex\_cpi\_ts, ylab = "", xlab = "", col = "green", axes = FALSE)

#hist(can\_cpi\_ts, xlim = range(can\_cpi\_ts), main = "Histogram of Canada's CPI", xlab = "CPI")

#boxplot(usa\_cpi\_ts)

```

```{r eacf}

eacf(usa\_cpi\_ts)

```

```{r modeling univariate.AR(1)}

fit.ar1=arima(usa\_cpi\_ts,order=c(1,1,0),include.mean = FALSE)

coeftest(fit.ar1)

```

```{r modeling univariate.MA(1)}

fit.ma1=arima(usa\_cpi\_ts,order=c(0,1,1),include.mean = FALSE)

coeftest(fit.ma1)

```

```{r modeling univariate.ARMA(1,2)}

fit.arma1=arima(usa\_cpi\_ts,order=c(1,1,2),include.mean = FALSE)

coeftest(fit.arma1)

```

```{r modeling univariate.MA(2)}

fit.ma2=arima(usa\_cpi\_ts,order=c(0,1,2),include.mean = FALSE)

coeftest(fit.arma2)

```

```{r auto arima}

fit.auto <- auto.arima(usa\_cpi\_ts)

summary(fit.auto)

coeftest(fit.auto)

```

```{r fitted values plot}

resid\_vals <- residuals(fit.ma2)

fitted\_vals <- usa\_cpi\_ts - resid\_vals

plot(usa\_cpi\_ts,col=1,ylab="Yt")

par(new=TRUE)

plot(fitted\_vals,type="b",col=2, axes = FALSE, ylab="Yt")

#plot(usa\_cpi\_ts,col=1,ylab="Yt")

#par(new=TRUE)

#plot(fitted.values(fit.ma1),type="b",col=2, axes = FALSE, ylab="Yt")

```

```{r residuals}

residuals.cpi=usa\_cpi\_ts-fitted.values(fit.ma1)

test(residuals.cpi)

shapiro.test(residuals.cpi)

```

```{r multivariate model}

#combine the thre series into a multivariate matrix

multi\_data <- cbind(usa\_cpi\_ts, mex\_cpi\_ts, can\_cpi\_ts)

```

```{r test block}

#summary(fit.ma1)

fvs <- fitted.values(fit.ar1)

summary(fvs)

```