Untitled

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```
library(caret)
library(tidyverse)

library(patchwork)
library(kableExtra)
library(tsibble)
library(lubridate)
library(fable)
library(fredr)
```

```
fredr_set_key("91de61ed607a6478d01c35d9a903017c")


test <- if (requireNamespace("purrr", quietly = TRUE)) {

  library(purrr)
  purrr::map_dfr(c('FLNAN', 'FLLFN', 'LREM25TTUSM156N', 'FLBPPRIV'), fredr)

  # Using purrr::pmap_dfr() allows you to use varying optional parameters
  params <- list(
    series_id = c('FLNAN', 'FLLFN', 'LREM25TTUSM156N', 'FLBPPRIV')
  )

  purrr::pmap_dfr(
    .l = params,
    .f = ~ fredr(series_id = .x)
  )

}
data <- pivot_wider(test,
            names_from = series_id,
            values_from = value)
```

```
#Reshaping and reformatting
data[2:5] <- log(data[2:5])

colnames(data)[2:5] <- c("ln_fl_nonfarm", "ln_fl_lf", "ln_us_epr", "ln_fl_bp")
data <- data[709:974,]

#now to difference the data
data <- data[order(data$date, decreasing = TRUE),]
```

```r
data['d.fl_nonfarm'] <- difference(data$ln_fl_nonfarm, differences = 1)
data['d.fl_lf'] <- difference(data$ln_fl_lf,  differences = 1)
data['d.fl_bp'] <- difference(data$ln_fl_bp, differences = 1)
data['d.us_epr'] <- difference(data$ln_us_epr, differences = 1)


#setting it back
data <- data[order(data$date, decreasing = FALSE),]
# Make Dummy Vars for Month
# data <-data %>%
#   mutate(month = month(date)) %>%
#   mutate(jan = (month == 1),
#          feb = (month == 2),
#          mar = (month == 3),
#          apr = (month == 4),
#          may = (month == 5),
#          jun = (month == 6),
#          jul = (month == 7),
#          aug = (month == 8),
#          sep = (month == 9),
#          oct = (month == 10),
#          nov = (month == 11),
#          dec = (month == 12))

# month <- yearmonth(data$date) %>%
#   format(format = "%m") %>%
#   as.factor()
# data['month'] <- month

data_ts <- data %>%
  mutate(YearMonth = yearmonth(as.character(data$date))) %>%
  as_tsibble(index = YearMonth)

# data_ts <- data  %>%
#   as_tsibble(index = month)
```

```r
train_set <- data_ts[2:252,]

test_set <- data_ts[253:264,]
```

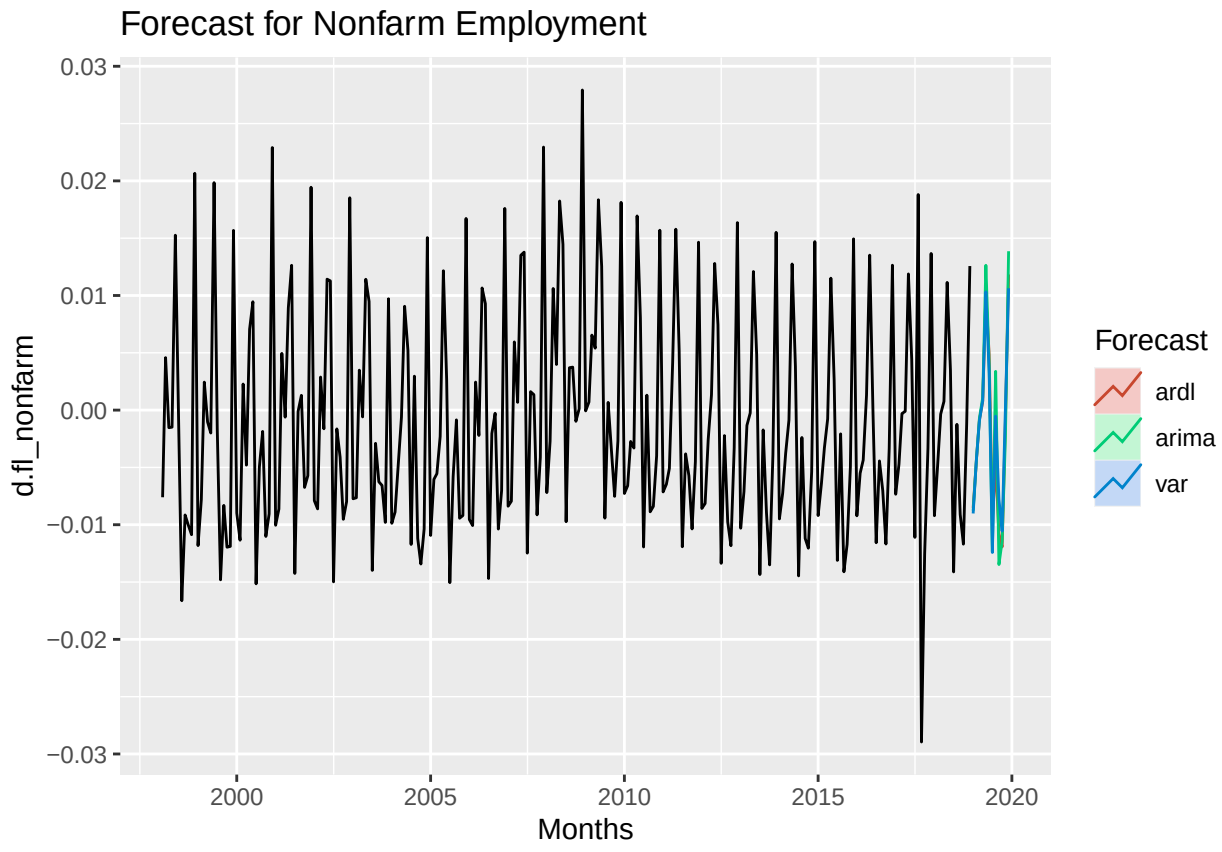
```r
#building the models

 model_1 <- train_set %>% model(
   ardl = TSLM(d.fl_nonfarm ~ lag(d.fl_nonfarm,1) + lag(d.fl_nonfarm,2) + lag(d.fl_nonfarm,3) + lag(d.fl
          lag(d.fl_nonfarm,6) + lag(d.fl_nonfarm,7) + lag(d.fl_nonfarm,8) + lag(d.fl_nonfarm,9) + lag(d
          lag(d.fl_nonfarm,12) + lag(d.fl_lf,1) + lag(d.fl_lf,2) +
          lag(d.us_epr,1) + lag(d.us_epr,2) +
          lag(d.fl_bp,1) + lag(d.fl_bp,2)  +
          YearMonth ),
   arima = ARIMA(d.fl_nonfarm),
   var = VAR(d.fl_nonfarm ~ AR(1:12), ic = "aic" )
   # levi = TSLM(d.fl_nonfarm ~ lag(d.fl_nonfarm,1) + lag(d.fl_nonfarm,2) + lag(d.fl_nonfarm,3) + lag(d
   #               lag(d.fl_nonfarm,6) + lag(d.fl_nonfarm,7) + lag(d.fl_nonfarm,8) + lag(d.fl_nonfarm,9
```

```
    #                lag(d.fl_nonfarm,11)+ lag(d.fl_nonfarm,12) + lag(d.fl_nonfarm,24)+ lag(d.fl_lf,1) +
    #                lag(d.fl_lf,4) + lag(d.fl_lf,5) + lag(d.fl_lf,6) + lag(d.fl_lf,7) + lag(d.fl_lf,8) +
    #                lag(d.fl_lf,11)+ lag(d.fl_lf,12) + lag(d.fl_lf,24) + lag(d.us_epr,1) + lag(d.us_epr,
    #                lag(d.us_epr,5) + lag(d.us_epr,6) + lag(d.us_epr,7) + lag(d.us_epr,8) + lag(d.us_epr
    #                lag(d.us_epr,12) + lag(d.us_epr,24) + lag(d.fl_bp,1) + lag(d.fl_bp,2) + lag(d.fl_bp,
    #                lag(d.fl_bp,6) + lag(d.fl_bp,7) + lag(d.fl_bp,8) + lag(d.fl_bp,9) + lag(d.fl_bp,10)
    #                lag(d.fl_bp, 24) +
    #                YearMonth)
    )

# forecasting on the test set
fc <- forecast(model_1, new_data = test_set)

#Plotting Predictions
autoplot(fc, data = train_set, level = NULL) +
  ggtitle("Forecast for Nonfarm Employment") +
  xlab("Months") +
  guides(colour = guide_legend(title = "Forecast"))
```




```
accuracy(fc, test_set) %>%  kable()
```

.model	.type	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
ardl	Test	0.0002667	0.0029508	0.0024823	85.54420	135.52831	NaN	-0.0611556
arima	Test	-0.0002020	0.0023346	0.0017801	25.51453	95.01315	NaN	0.2086950
var	Test	-0.0000420	0.0019875	0.0016801	79.81016	108.43235	NaN	-0.1163495

```r
fc_accuracy <- accuracy(fc, test_set,
  measures = list(
    point_accuracy_measures,
    interval_accuracy_measures,
    distribution_accuracy_measures
  )
)


fc_accuracy %>%
  group_by(.model) %>%
  summarise(
    RMSE = mean(RMSE),
    MAE = mean(MAE),
    MASE = mean(MASE),
    Winkler = mean(winkler),
    CRPS = mean(CRPS)
  ) %>%
  arrange(RMSE) %>% kable(format = "latex") %>% kable_styling(position = "center", latex_options = "stri
```

.model	RMSE	MAE	MASE	Winkler	CRPS
var	0.0019875	0.0016801	NaN	0.0170956	0.0013644
arima	0.0023346	0.0017801	NaN	0.0151954	0.0014090
ardl	0.0029508	0.0024823	NaN	0.0170908	0.0017490