

# UNITED NATIONS ASYLUM APPLICANTS FROM SYRIA TO GERMANY

CSC 425 Time Series Analysis and Forecasting

Final Project

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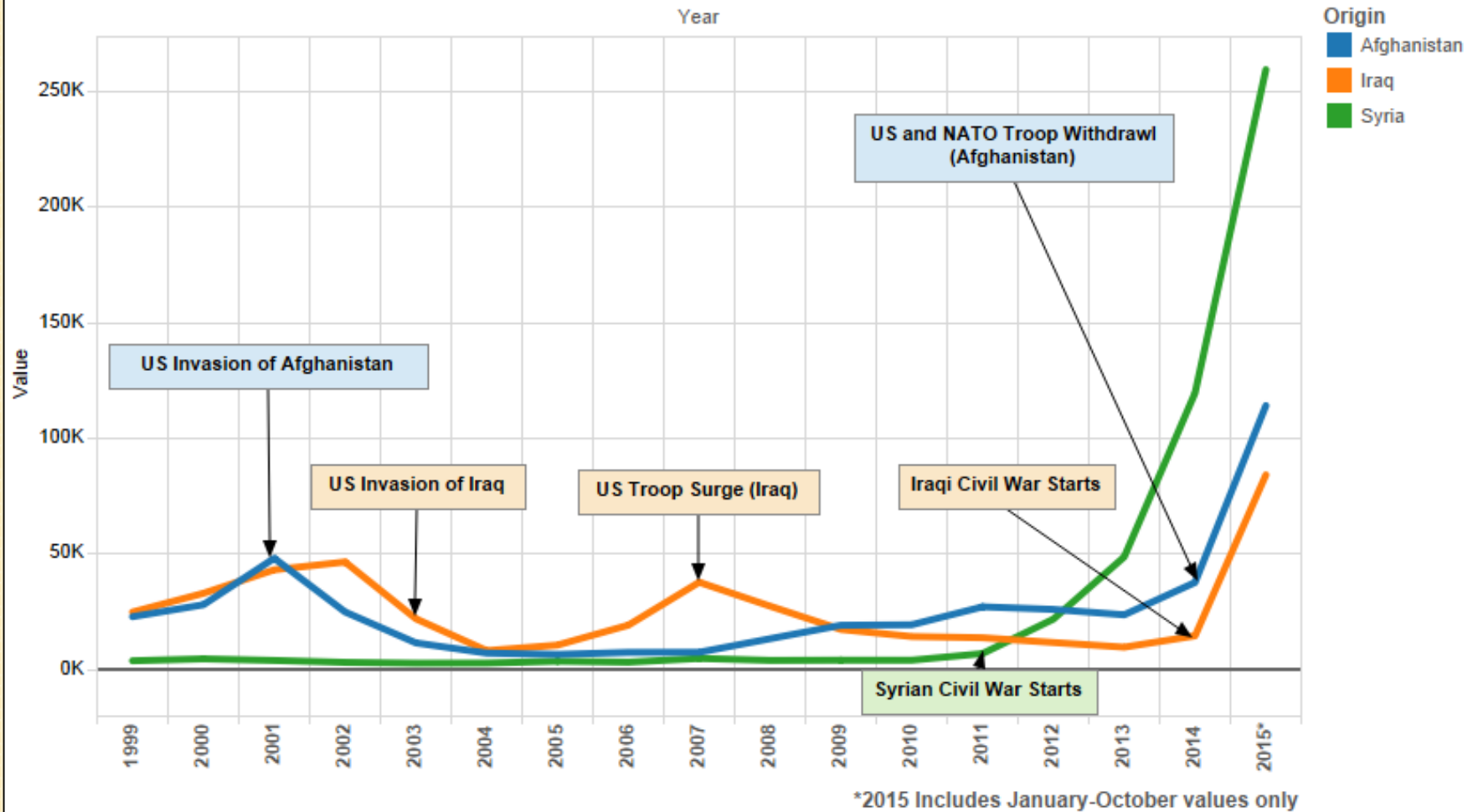
# DATASET

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- ✖ Data extracted from United Nations High Commissioner for Refugees (UNHCR) Population Statistics Reference Database on monthly asylum applicants from January 1999 through October 2015
- ✖ Includes 202 observations by country of origin and country of asylum
- ✖ Focus on applicants from Syria applying for asylum in Germany

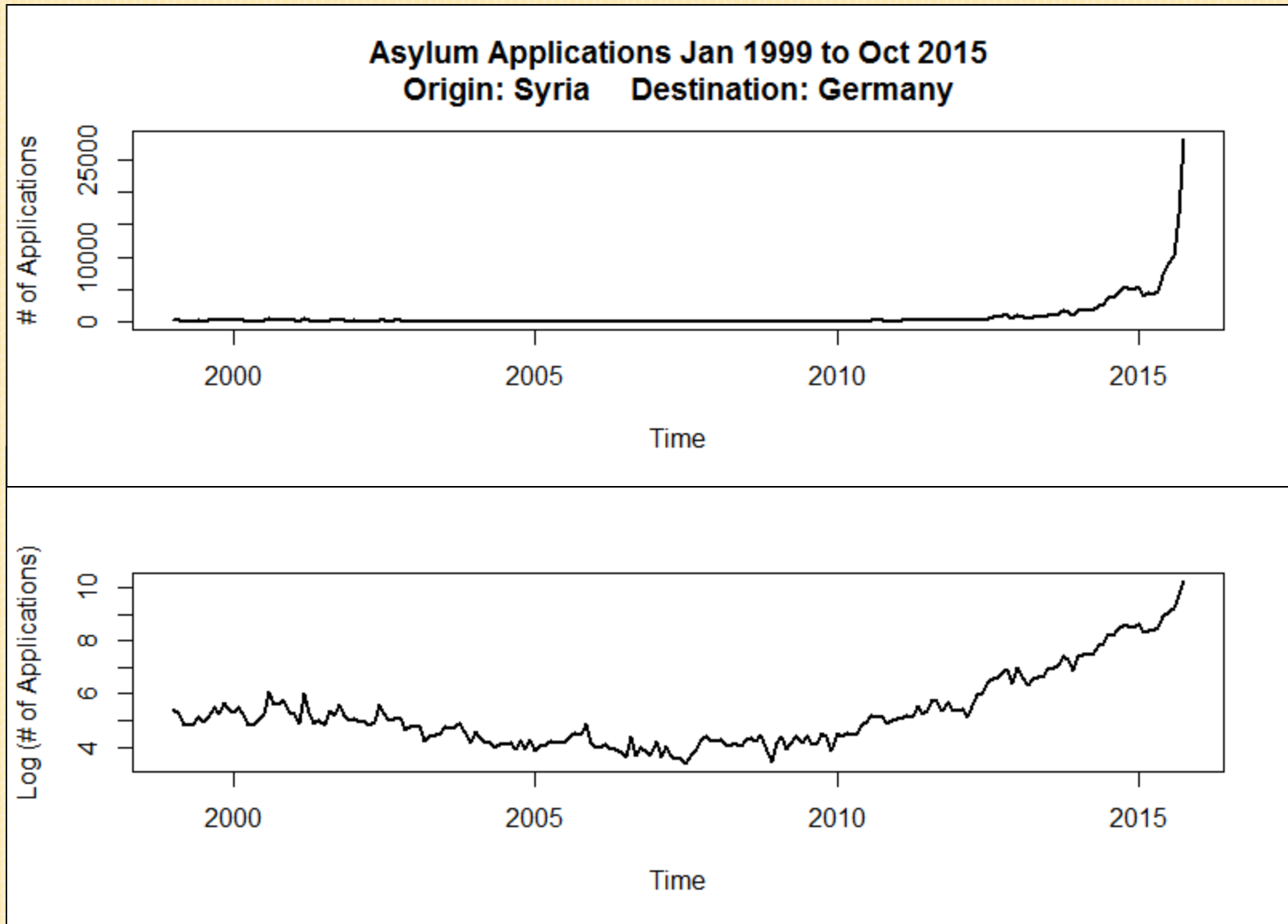
# A REFUGEE CRISIS EXPLAINED

Asylum Applicants to the European Union: 1999-2015\*



# DATA SUBSET

## ASYLUM APPLICANTS FROM SYRIA TO GERMANY



# EXPLORATORY ANALYSIS

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- ✗ Time plots and ACF of log data exhibit non-stationary behavior
- ✗ Dickey-Fuller Tests have p-values near 1
  - + Process can be considered non-stationary
- ✗ Model iterations suggest taking second difference

# MODEL FITTING

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## ✗ M1 – AutoArima Calculated

- + ARIMA(2,2,2)(0,0,1)[12]
- + BIC = 91.63
- + AR Parameters Not Significant

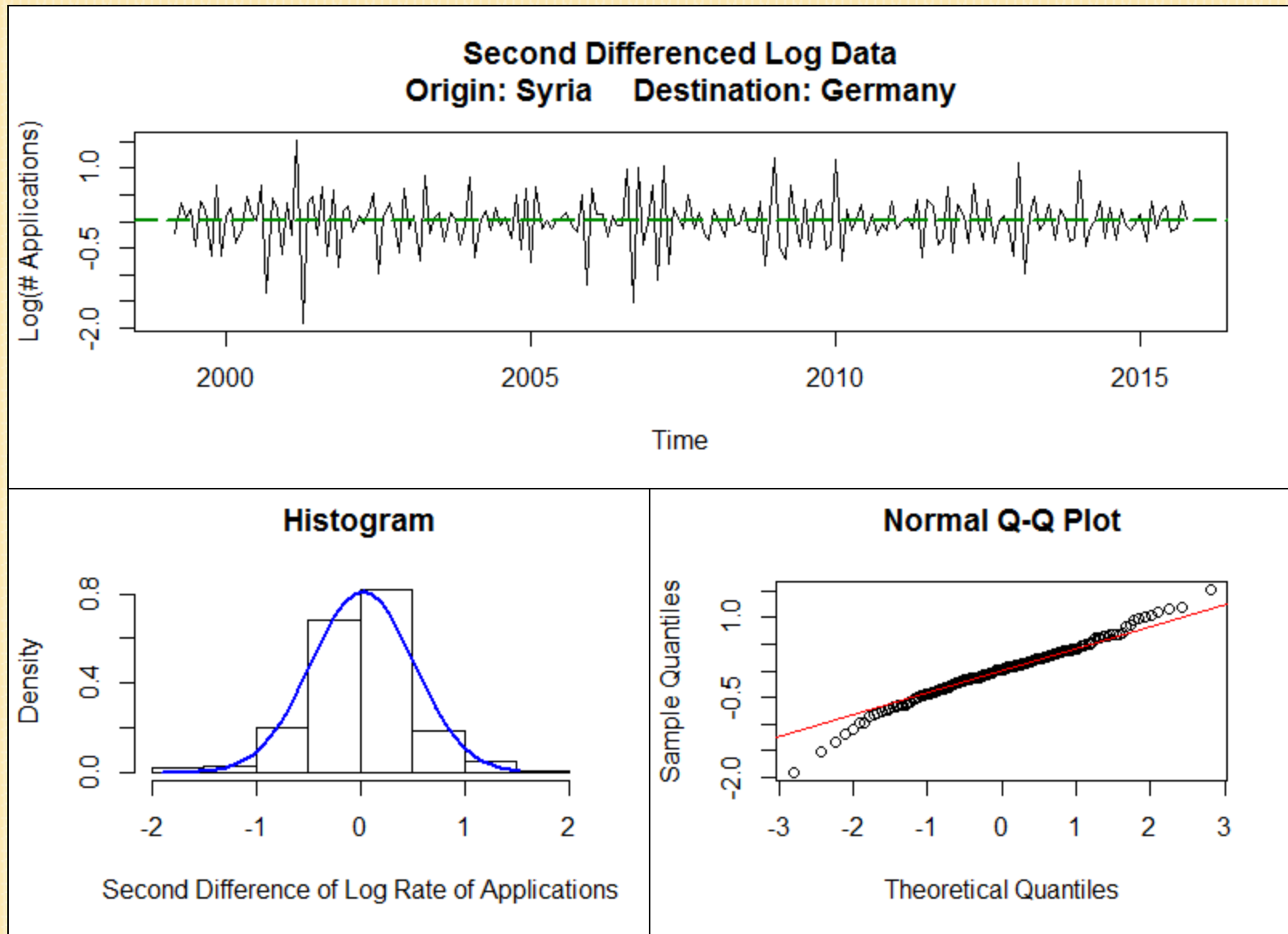
## ✗ M2 – M1 with Non-Significant AR Terms Removed

- + ARIMA(0,2,2)(0,0,1)[12]
- + BIC = 81.03

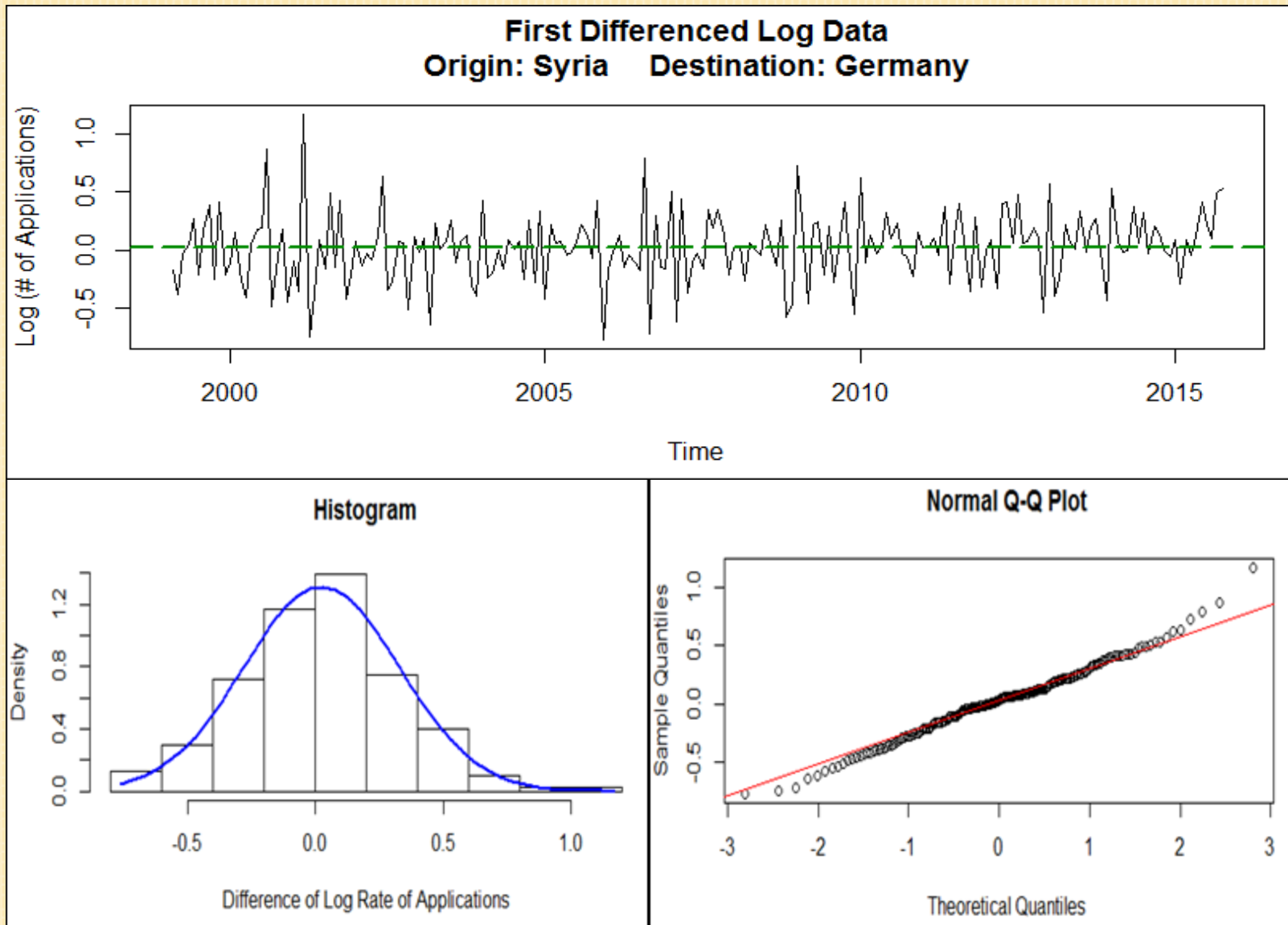
## ✗ M3 – AutoArima Calculated, Restricted to First Difference

- + ARIMA(0,1,1)(0,0,1)[12]
- + BIC = 76.34

# SECOND DIFFERENCED TIME SERIES



# FIRST DIFFERENCED TIME SERIES





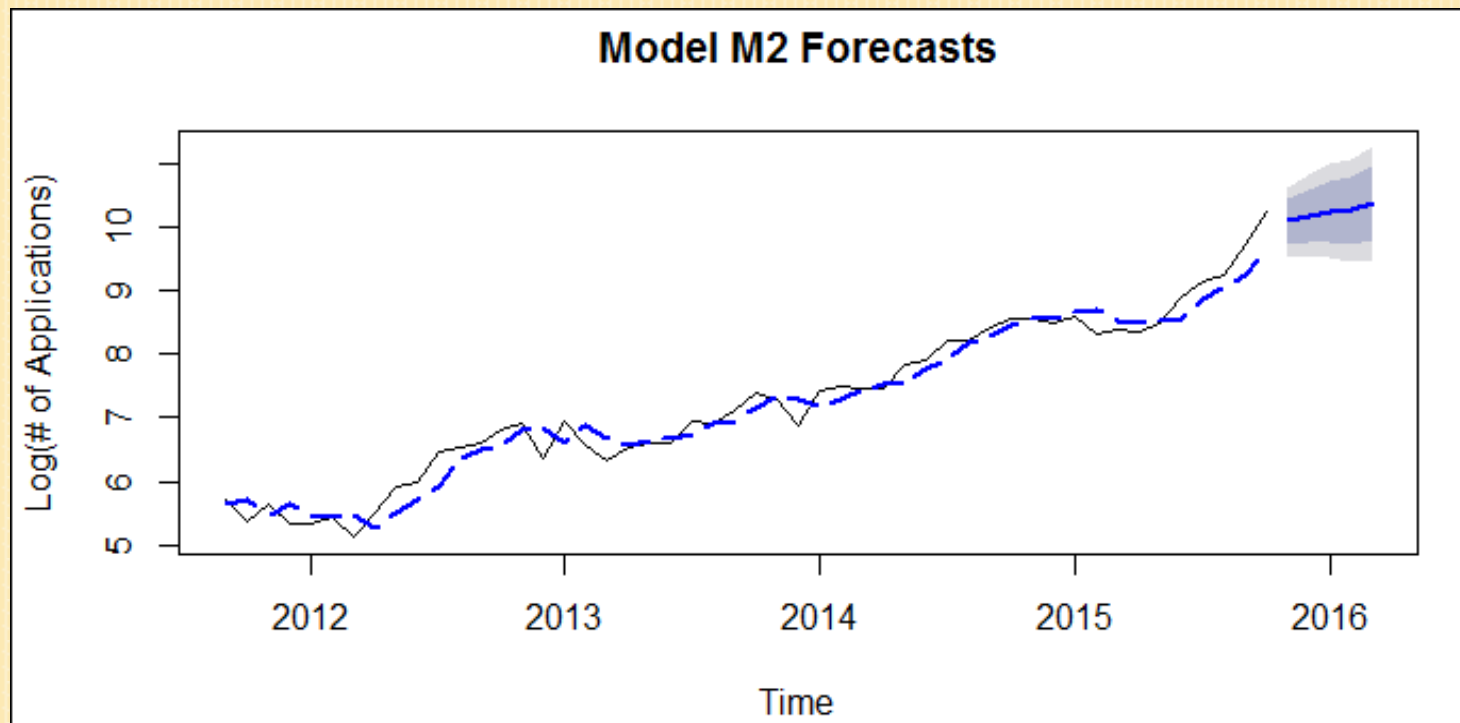
# MODEL FITTING AND FORECASTING

Model 2 - Second Differenced SARIMA

ARIMA(0,2,2)(0,0,1)[12]

BIC = 81.03

MAPE = 1.98%



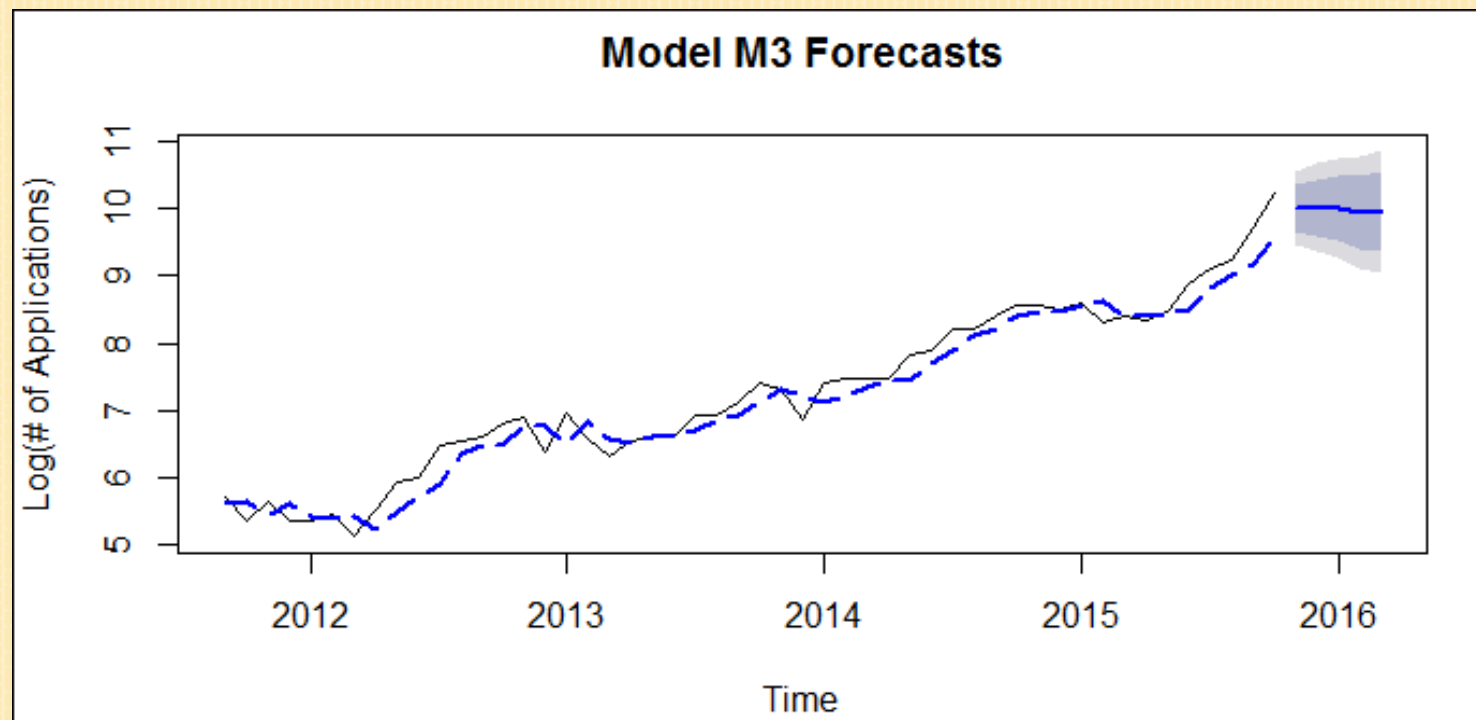
# MODEL FITTING AND FORECASTING

Model 3 - First Differenced SARIMA

ARIMA(0,1,1)(0,0,1)[12]

BIC = 76.34

MAPE = 2.25%



# CONCLUSIONS

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- ✗ Best model for forecasting: Model 2

- + Formula:

$$Y_t = \log(X_t)$$

$$(1 - B)^2 Y_t = (1 - 1.383B + 0.401B^2)(1 + 0.193B^{12})a_t$$

- + MAPE = 1.98% and follows overall trend of time series

- ✗ Series exhibits only MA type behavior

- + 2 month effect likely due to time needed for decision-making and travel between impact and application

- + Annual seasonality as travel and hostilities both affected by time of year

- ✗ Small dataset size may affect accuracy of model

- ✗ New legislative regulations can affect flow of asylum seekers at any time