

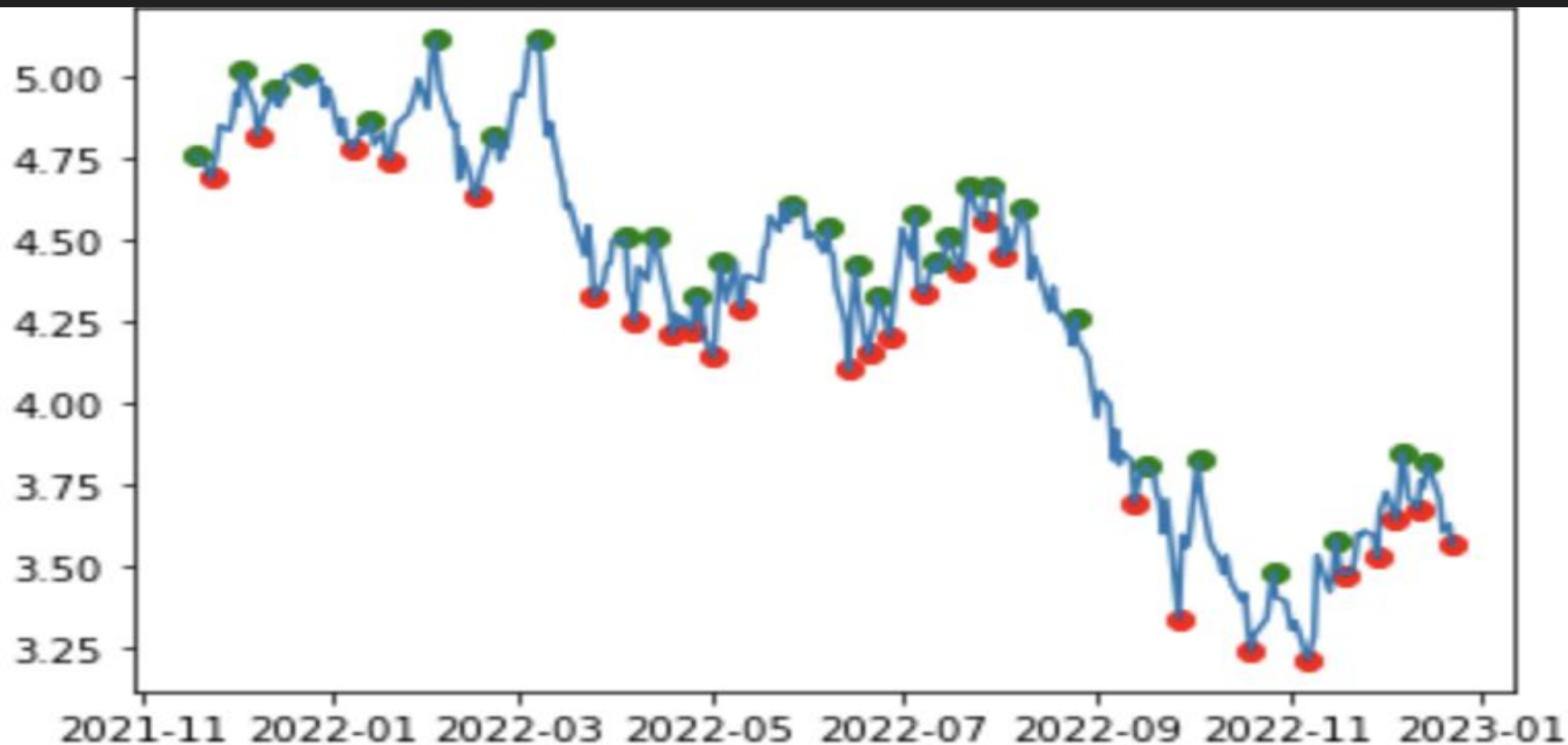
India Mexico FX Forecasting: Examining 10yr Bond Spread and use of ARIMA and GARCH to Forecast FX

Ishaan Mahadevan

Overview

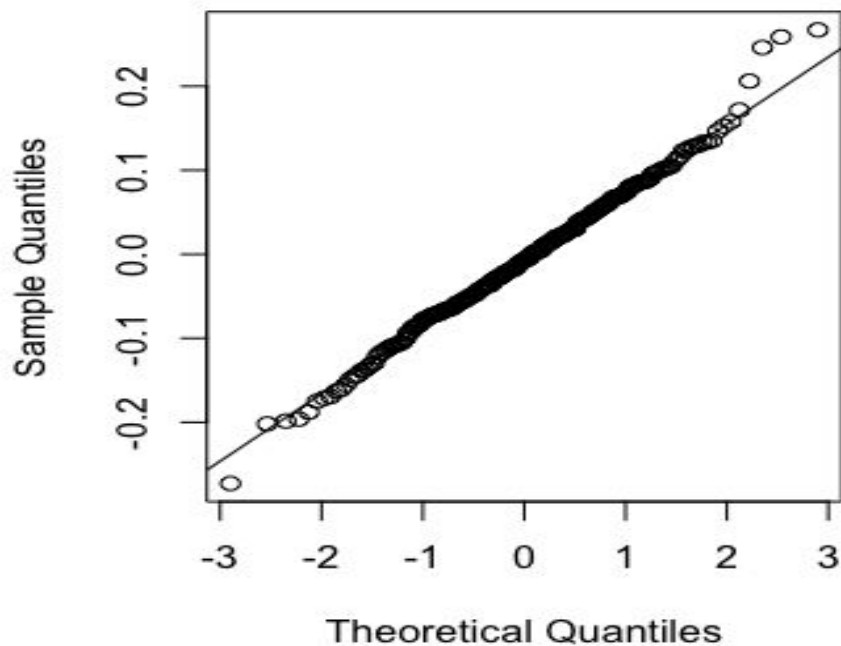
- The following time series models attempts to forecast the Indian Rupee and the Mexican Peso using the ARIMA and GARCH models
- The 10 year Bond Spread between the Indian and US 10 year bond yields, and the Mexican and US 10 year bond yields are being used as proxies to forecast the Indian Rupee and Mexican Peso, given the long term correlation between 10 year bond spreads and their respective currencies.
- ARIMA is more appropriate to use to forecast the Indian Rupee than the GARCH model. GARCH is more appropriate to use to forecast the Mexican Peso because Mexico is more vulnerable to economic developments in the United States than India. This makes the Mexican Peso more volatile than the Indian Rupee.

India 10yr Bond Spread

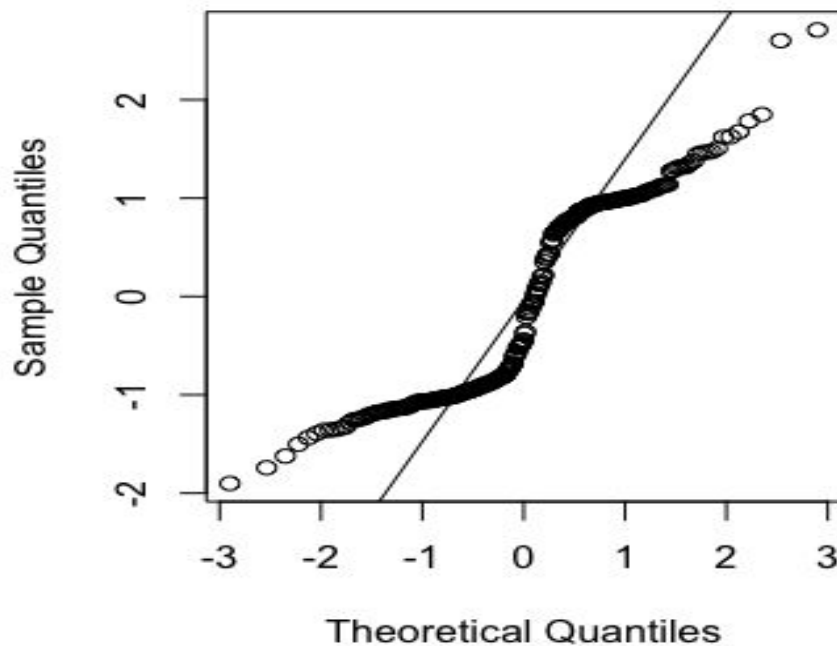


India 10yr Bond Spread QQ Plot (ARIMA More appropriate to use)

1-1 Plot of ARMA

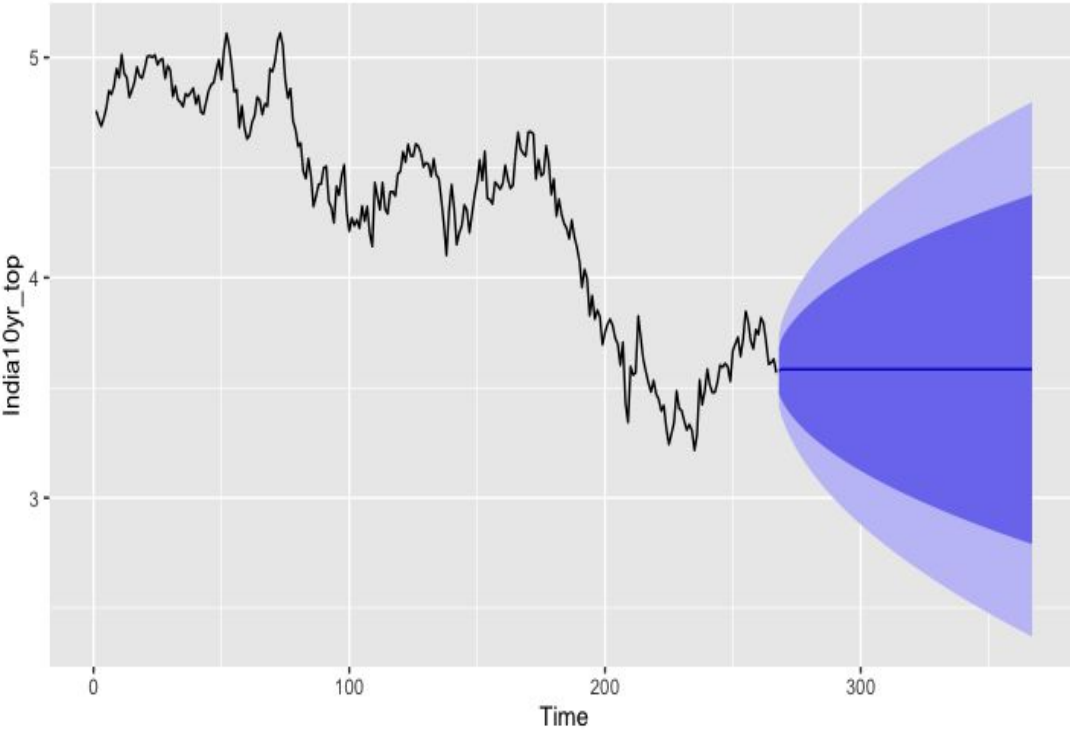


Q-Q Plot of ARMA-GARCH

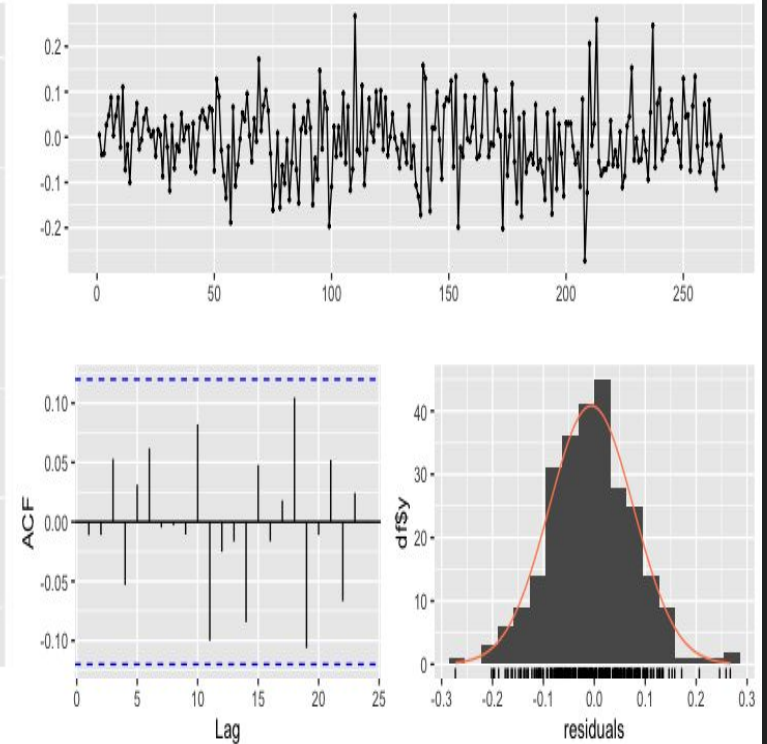


India 10 yr Bond Spread ARIMA Forecasting

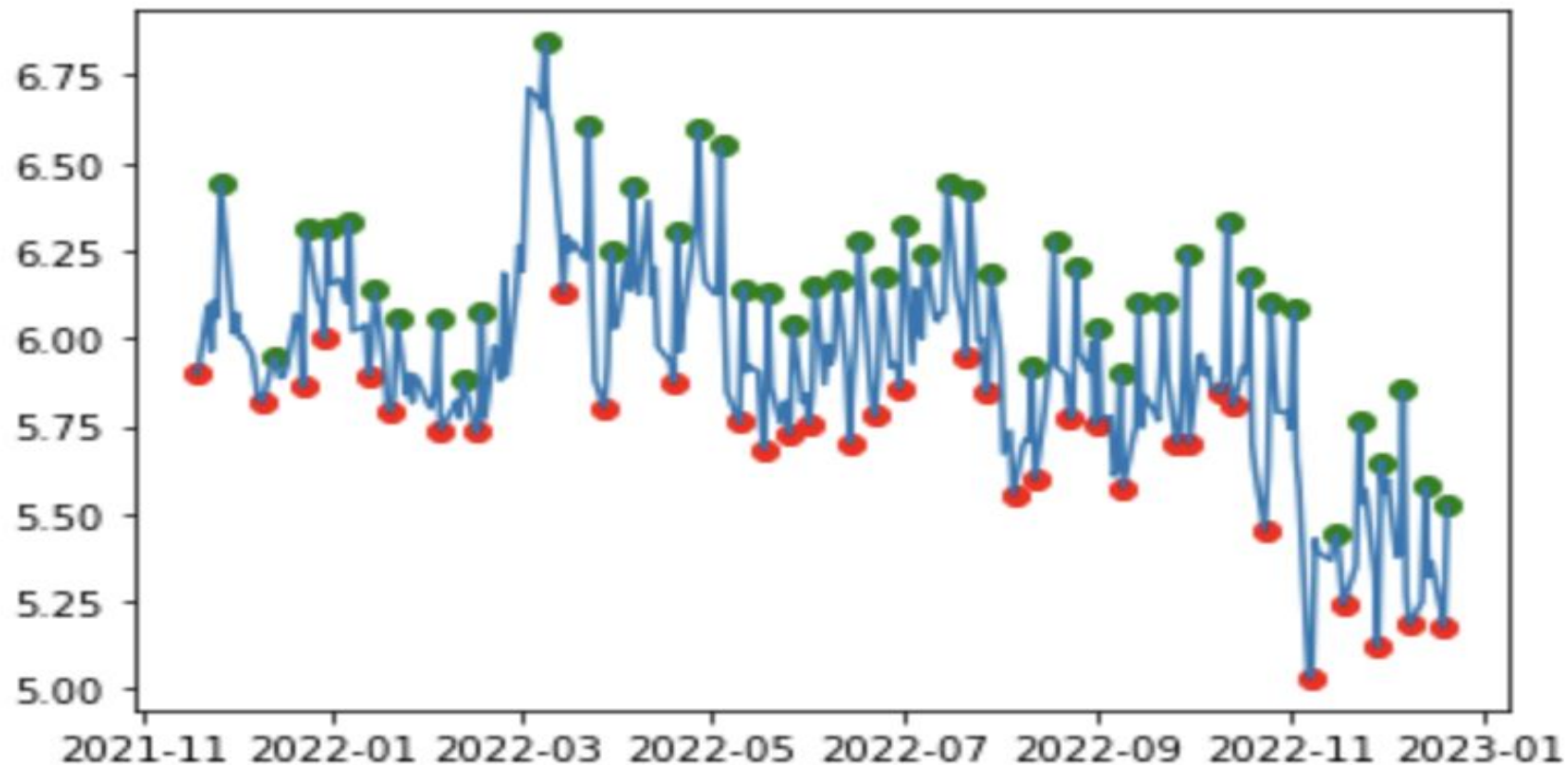
Forecasts from ARIMA(0,1,2)



Residuals from ARIMA(0,1,2)

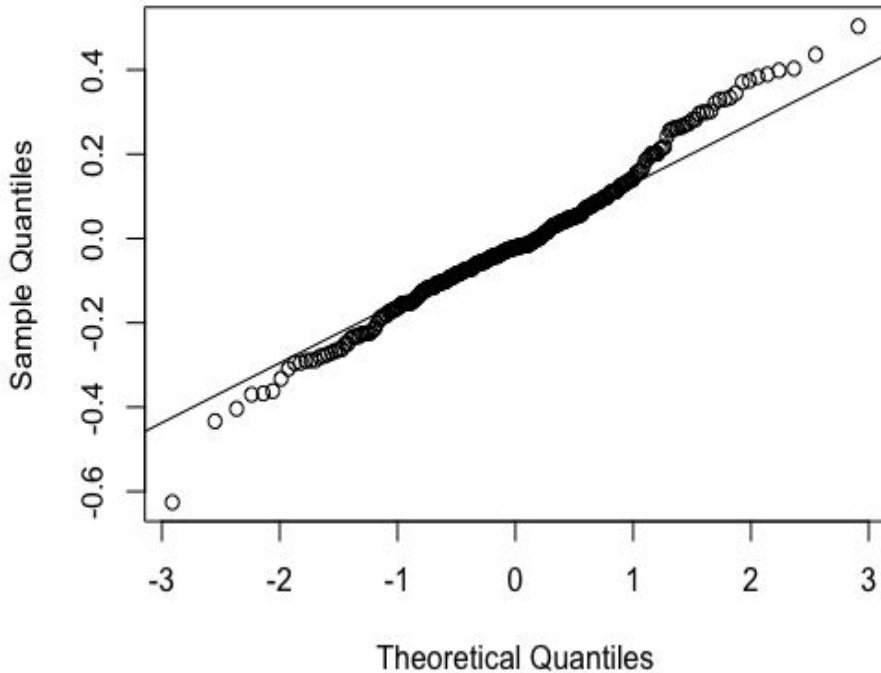


Mexico 10 yr Bond Differential

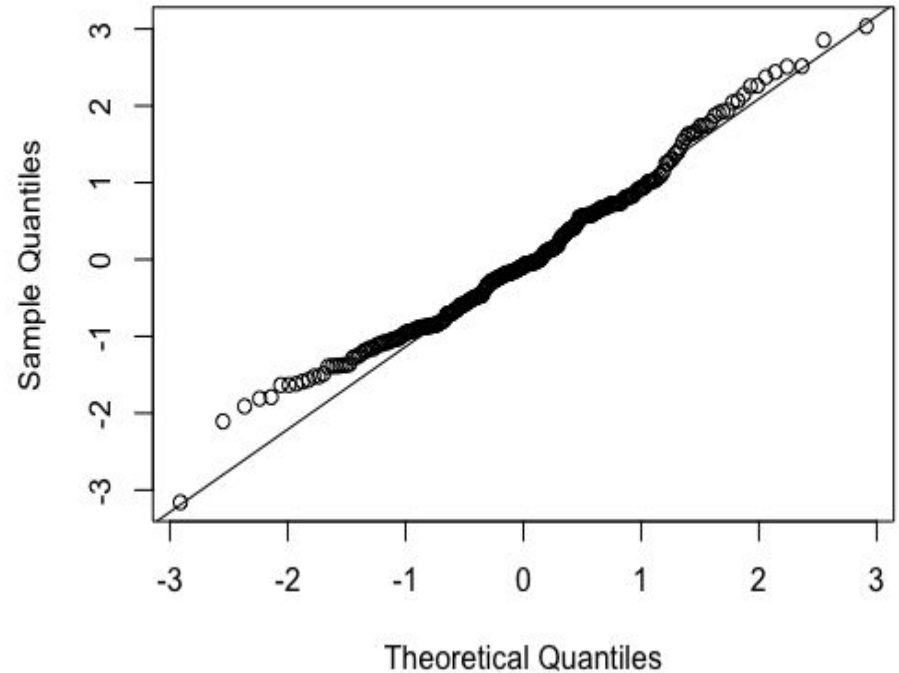


Mexico 10yr Bond Forecasting QQ Plot

1-1 Plot of ARMA

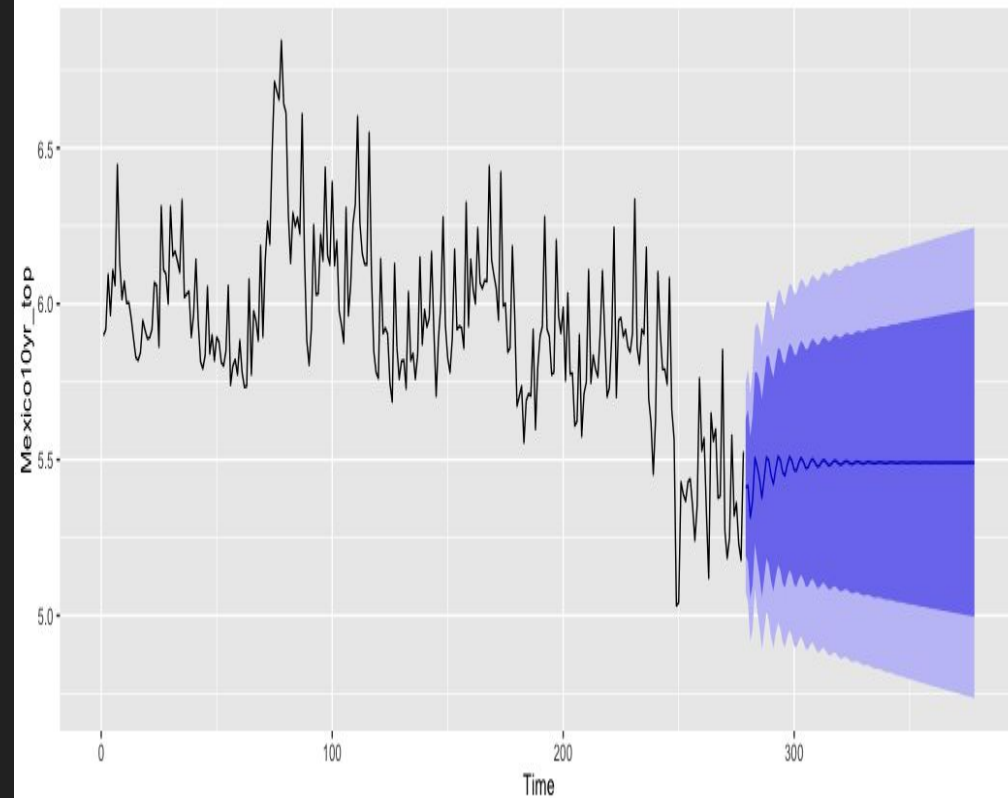


Q-Q Plot of ARMA-GARCH

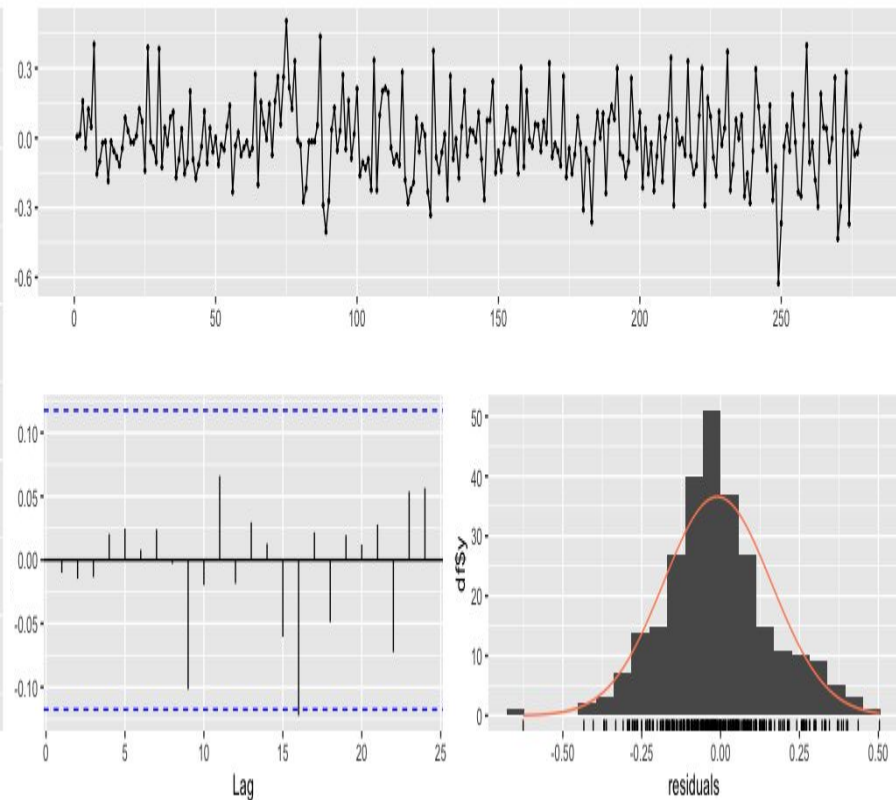


Mexico 10 yr Bond Differential forecasting-ARIMA

Forecasts from ARIMA(5,1,4)

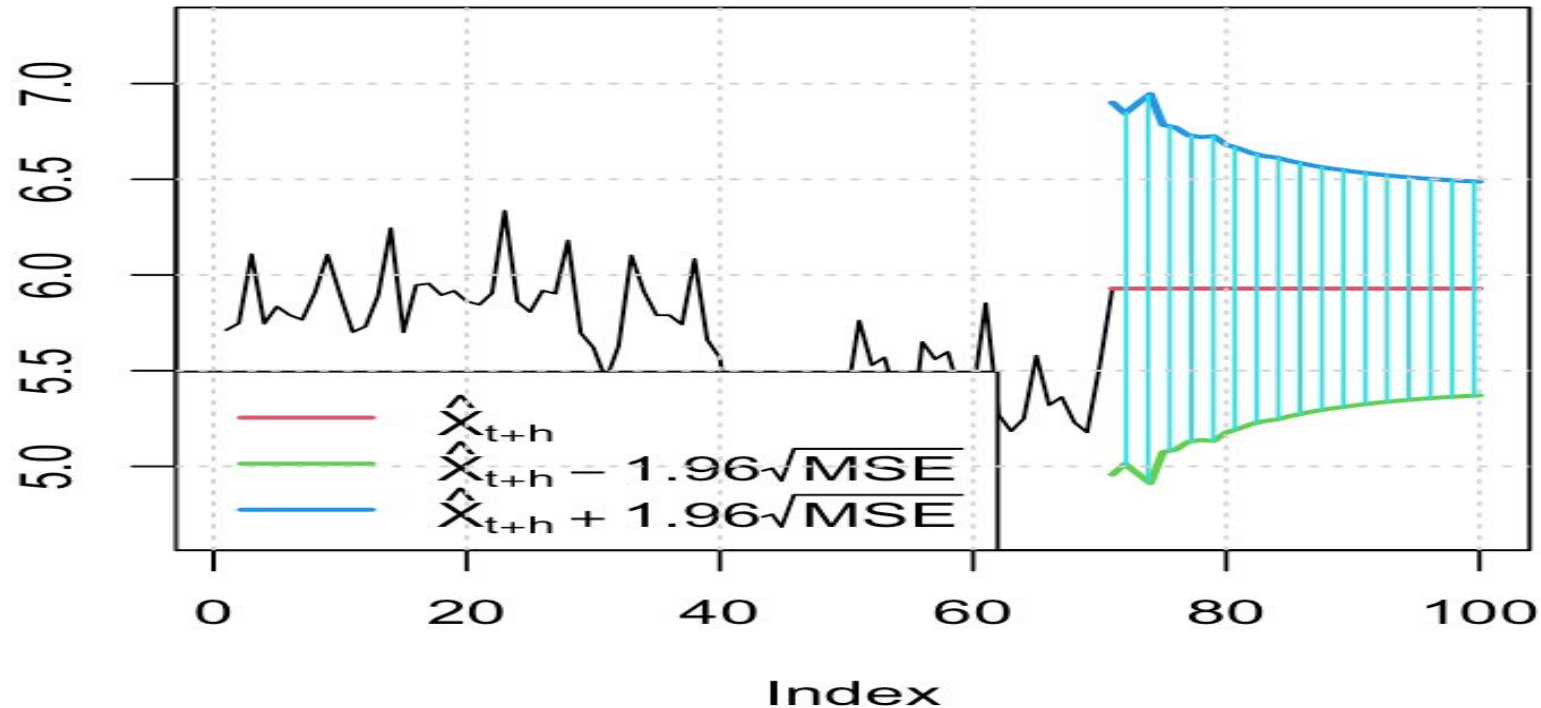


Residuals from ARIMA(5,1,4)



Mexico 10 yr Bond Differential Forecasting-GARCH

Prediction with confidence intervals

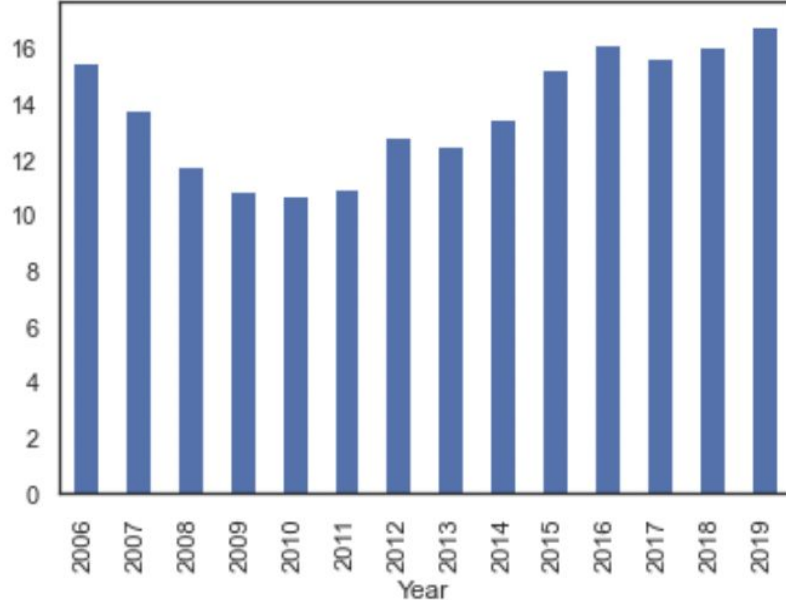


Use of Garch over ARIMA

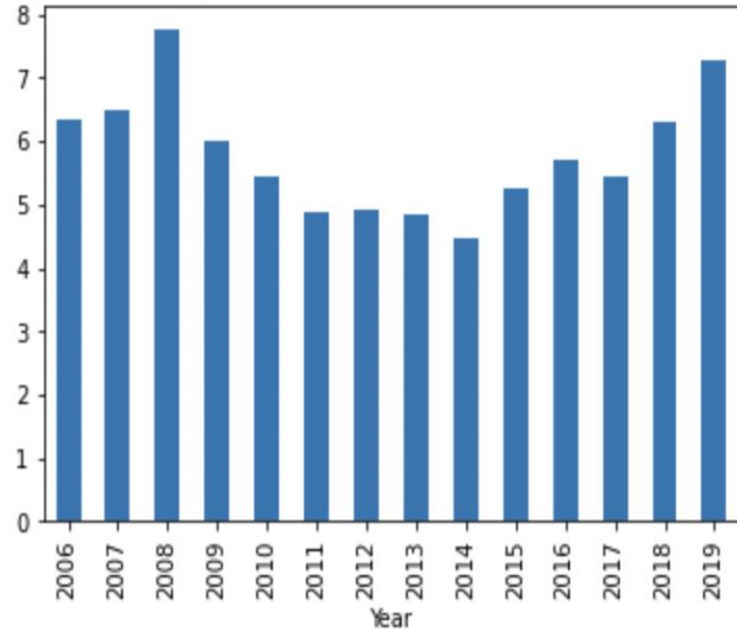
- Mexico is more vulnerable to economic developments in the United States than India, it is more appropriate to rely on the GARCH model to forecast the Mexican Peso than ARIMA.
- Such vulnerability can be measured by how the 10 year Bond Spread, or in other words the 10 year interest rate differential, is impacted by trade dynamics with the US.

India is less vulnerable to trade dynamics with the US than Mexico

India Exports from US as % of Current Account

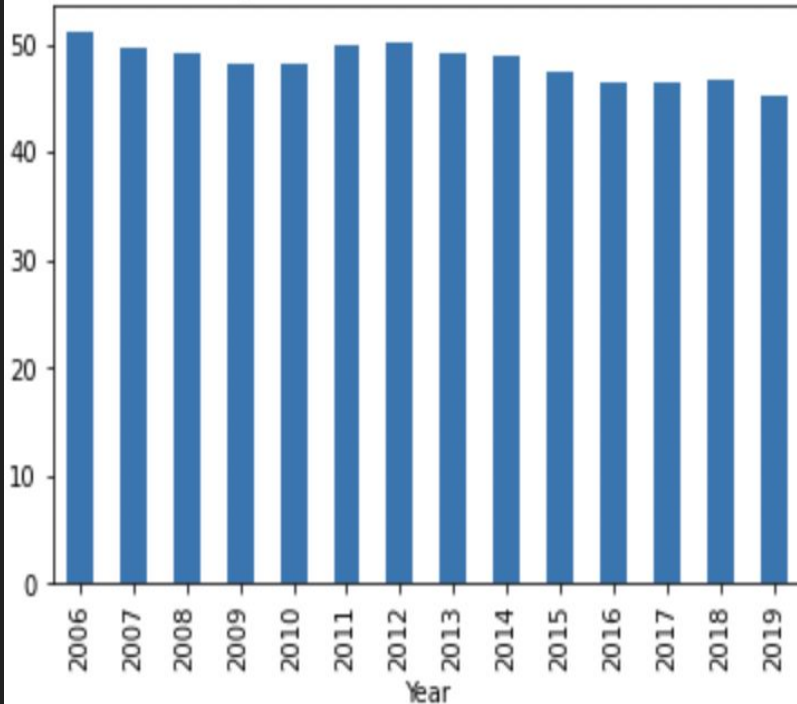


India Imports from US as % of Current Account

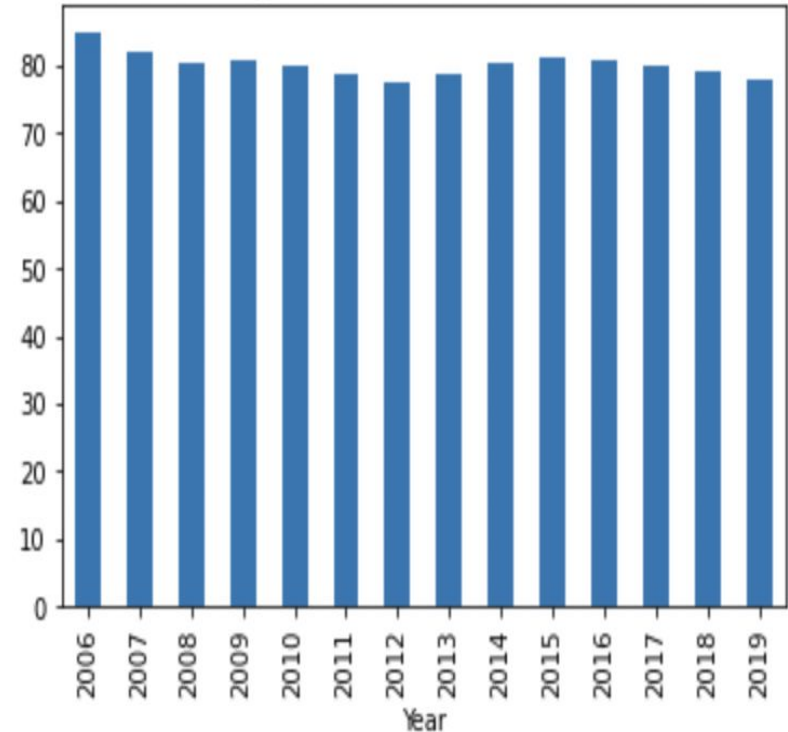


Mexico is more vulnerable to trade dynamics with the United States than India

Mexico Imports from US as % of Current Account



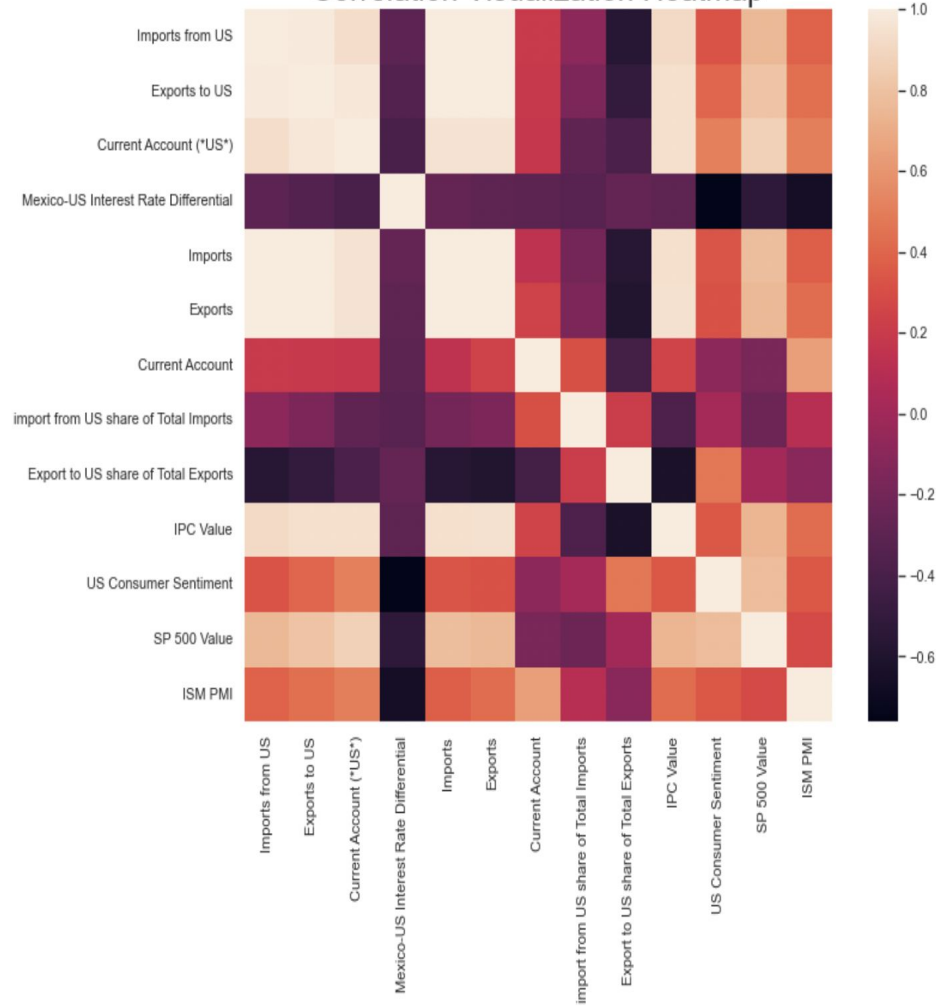
Mexico Exports to US as % of Current Account



Such trade dynamics with the United States seems to impact Mexico's interest rate differential more than India's interest rate differential.

	Imports from US	Exports to US	Current Account (*US*)	Mexico-US Interest Rate Differential	Imports	Exports	Current Account	import from US share of Total Imports	Export to US share of Total Exports		Imports from US	Exports to US	Current Account (*US*)	India-US Interest Rate Differential	Imports	Exports	Current Account	Import from US share of Total Imports	Export to US share of Total Exports
Imports from US	1.000000	0.984677	0.922690	0.298561	0.987139	0.985622	0.074582	-0.525034	-0.608972	Imports from US	1.000000	0.772573	0.281866	0.379128	0.846583	0.703648	-0.863234	0.222873	0.364609
Exports to US	0.984677	1.000000	0.975785	0.368309	0.996738	0.996428	0.088589	-0.640804	-0.564916	Exports to US	0.772573	1.000000	0.826944	0.602165	0.847642	0.894620	-0.631422	-0.211446	0.611111
Current Account (*US*)	0.922690	0.975785	1.000000	0.439797	0.965486	0.966702	0.102310	-0.758181	-0.485122	Current Account (*US*)	0.281866	0.826944	1.000000	0.574196	0.531170	0.728741	-0.189688	-0.516895	0.600572
Mexico-US Interest Rate Differential	0.298561	0.368309	0.439797	1.000000	0.404200	0.392375	-0.091367	-0.726534	-0.433472	India-US Interest Rate Differential	0.379128	0.602165	0.574196	1.000000	0.723498	0.807817	-0.484766	-0.629210	-0.059913
Imports	0.987139	0.996738	0.965486	0.404200	1.000000	0.995776	0.046314	-0.651821	-0.595741	Imports	0.846583	0.847642	0.531170	0.723498	1.000000	0.932048	-0.896068	-0.323606	0.196977
Exports	0.985622	0.996428	0.966702	0.392375	0.995776	1.000000	0.137832	-0.635398	-0.630467	Exports	0.703648	0.894620	0.728741	0.807817	0.932048	1.000000	-0.674332	-0.463973	0.208328
Current Account	0.074582	0.088589	0.102310	-0.091367	0.046314	0.137832	1.000000	0.118544	-0.432791	Current Account	-0.863234	-0.631422	-0.189688	-0.484766	-0.896068	-0.674332	1.000000	0.091061	-0.146198
import from US share of Total Imports	-0.525034	-0.640804	-0.758181	-0.726534	-0.651821	-0.635398	0.118544	1.000000	0.355595	Import from US share of Total Imports	0.222873	-0.211446	-0.516895	-0.629210	-0.323606	-0.463973	0.091061	1.000000	0.239360
Export to US share of Total Exports	-0.608972	-0.564916	-0.485122	-0.433472	-0.595741	-0.630467	-0.432791	0.355595	1.000000	Export to US share of Total Exports	0.364609	0.611111	0.600572	-0.059913	0.196977	0.208328	-0.146198	0.239360	1.000000

Correlation Visualization Heatmap



To examine how such economic developments in the US significantly impact the Bond Spread and the IPC Stock Value, US Consumer Sentiment, the SP 500, and ISM PMI were used to measure how such US economic dynamics cause volatility within the interest rate differential and IPC.

It seems that such demand and supply dynamics in the US economy causes significant volatility within IPC and 10 year bond spread.

Such volatility can be attributed to Mexico's economy being heavily manufactured oriented, and depend significantly on such manufacturing-oriented economies such as the United States.

Conclusion

- The use of the GARCH model to forecast the Mexican Peso is more appropriate to use than the ARIMA model because the Mexican Peso is more volatile than the Indian Rupee.
- It is recommended to use the GARCH model to forecast such currencies whose economies are significantly dependent on the US's economy, particularly if it involves manufacturing.