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

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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 of focus and 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 while GARCH is more appropriate to use to forecast the Mexican Peso given Mexico's relatively high vulnerability to economic developments in the United States, thus making the Mexican Peso exhibit significantly more volatility than the Indian Rupee.
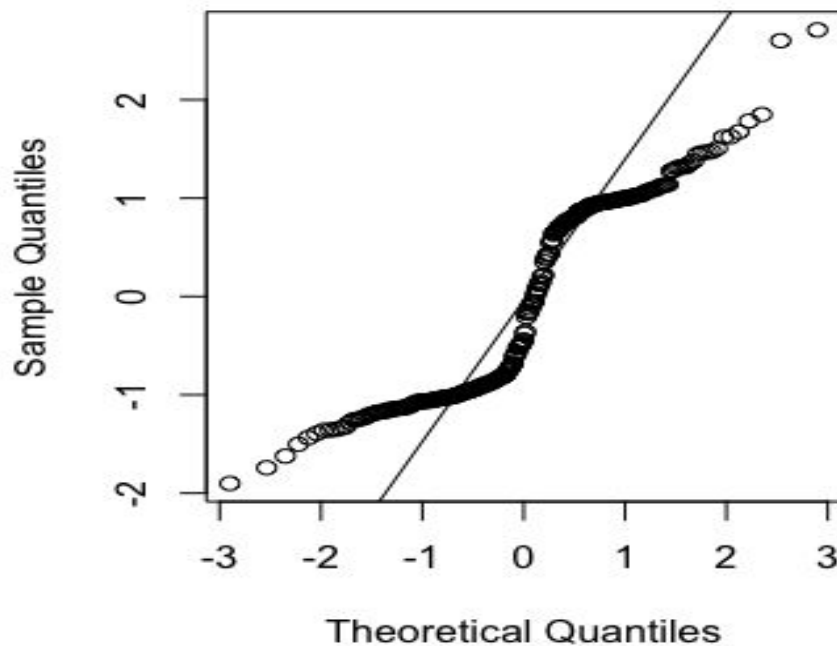
India 10yr Bond Spread
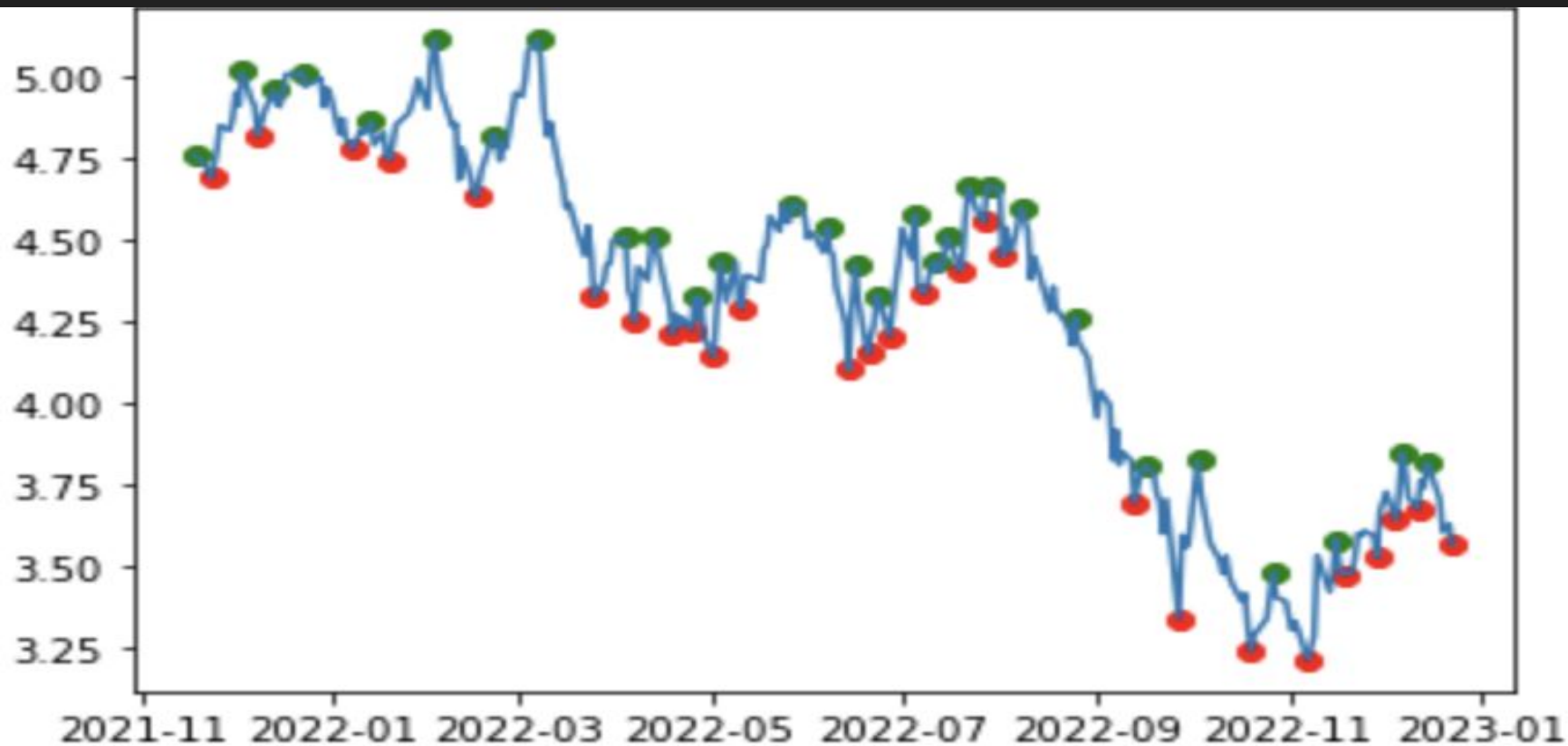
India 10yr Bond Spread QQ Plot (ARIMA More appropriate to use)
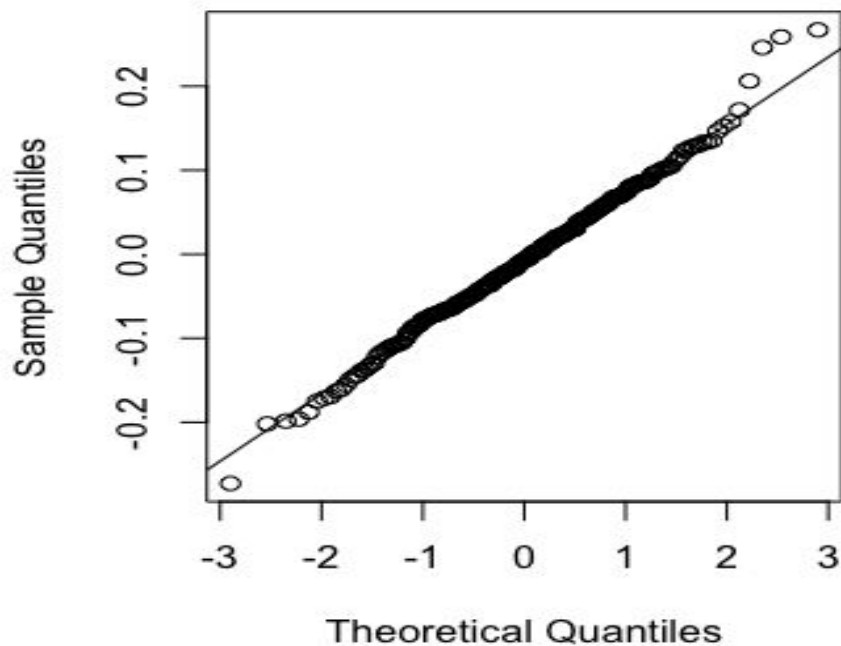
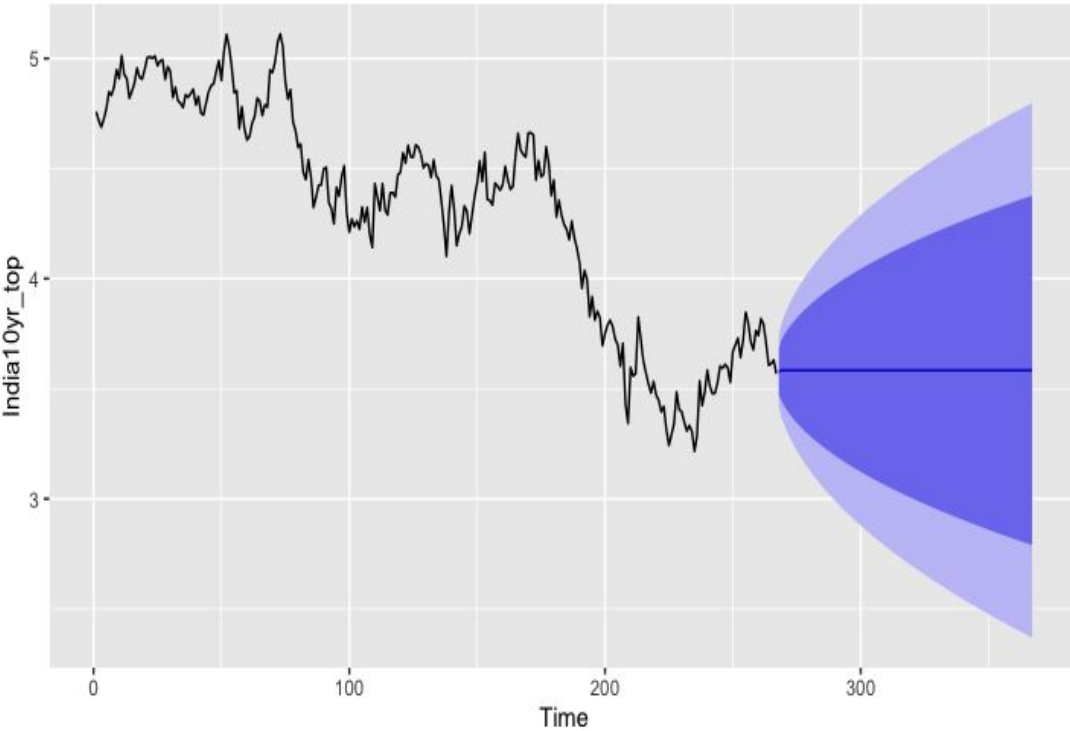# India 10 yr Bond Spread ARIMA Forecasting
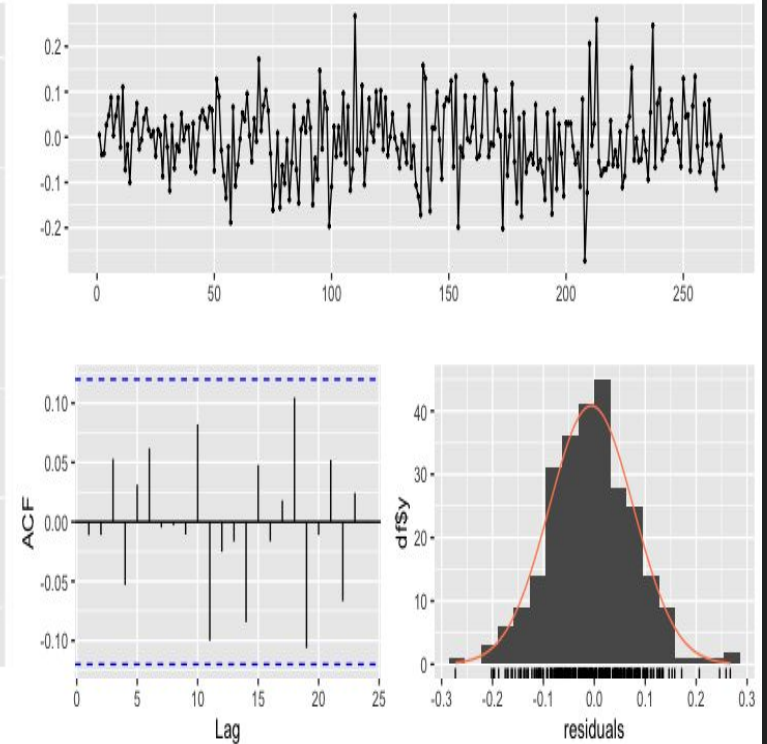
Mexico 10 yr Bond Differential
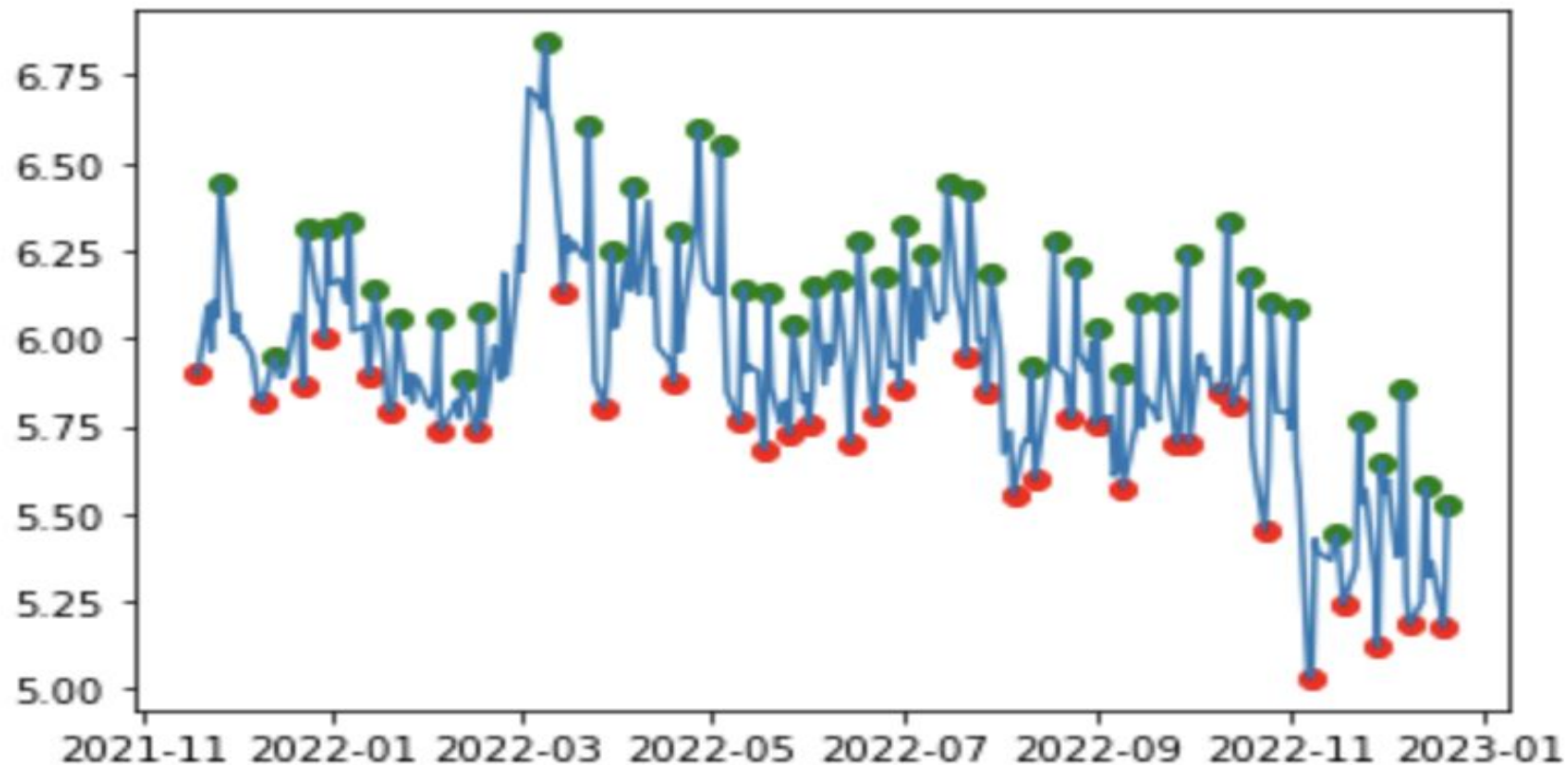
Mexico 10yr Bond Forecasting QQ Plot
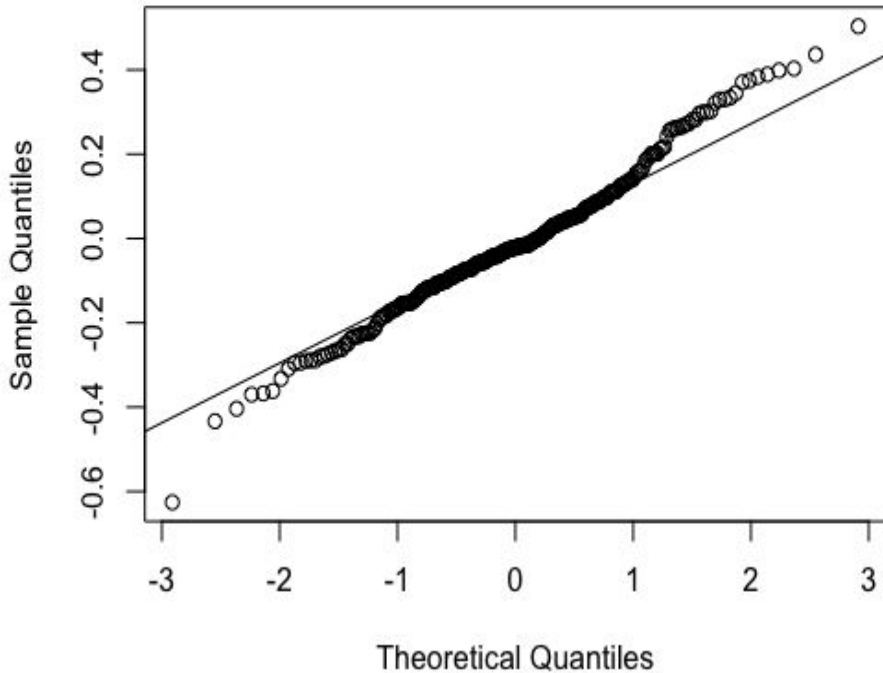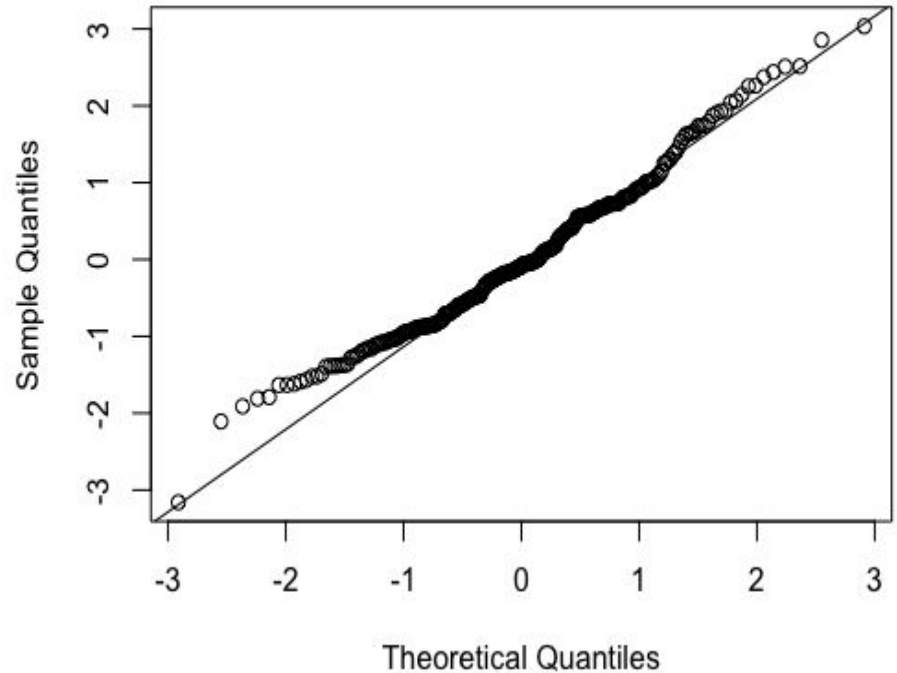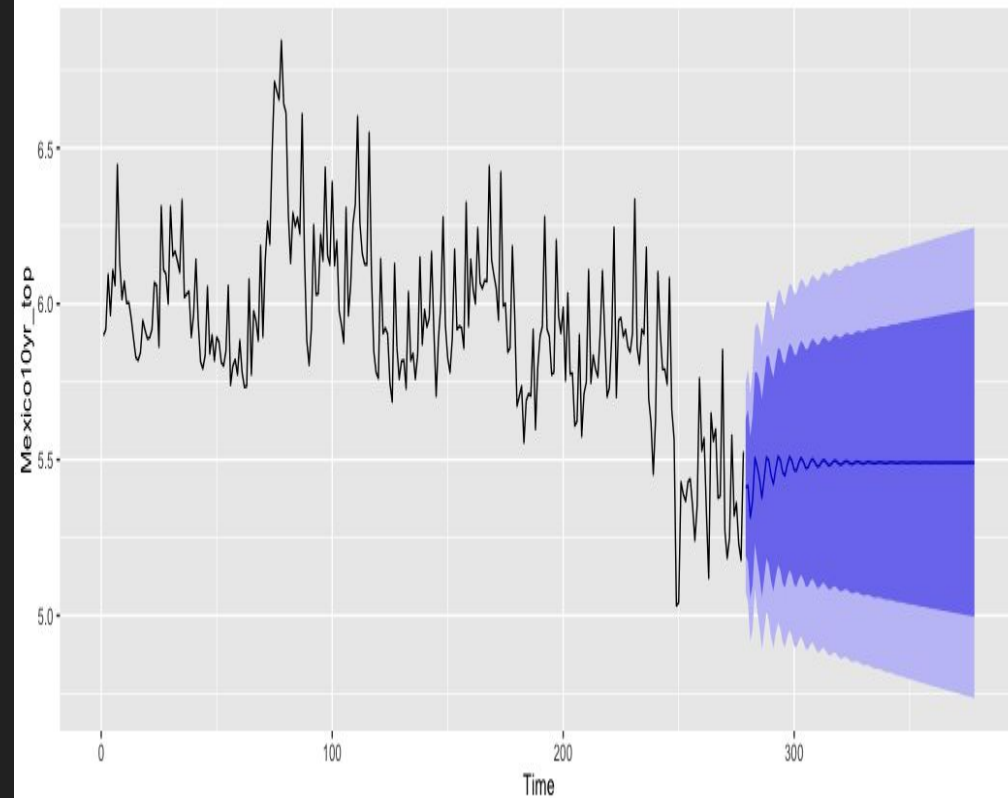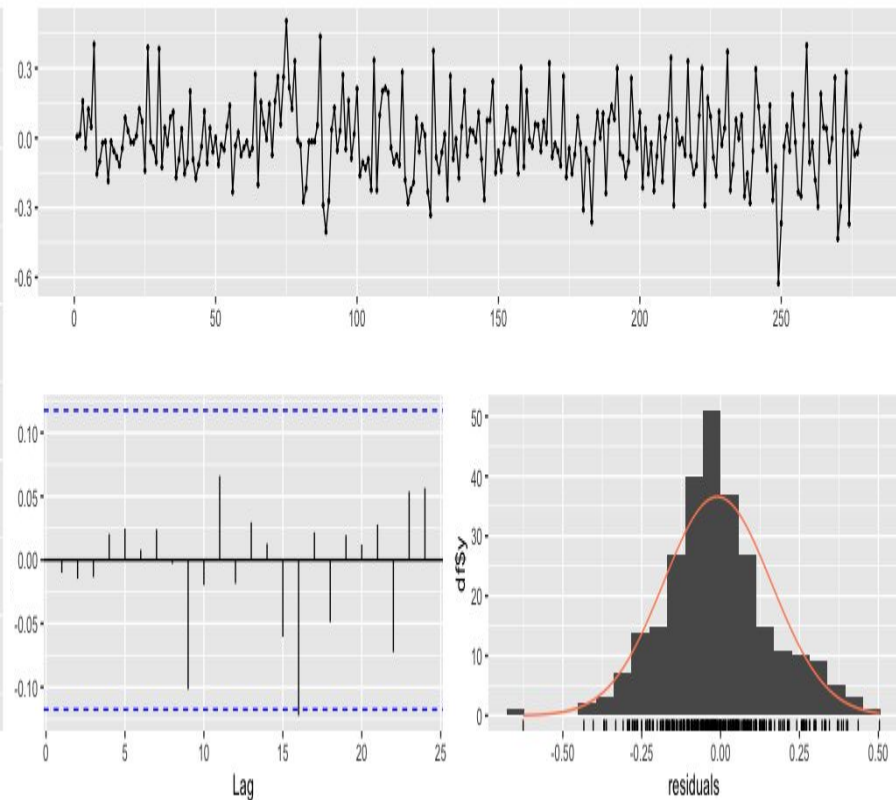
Mexico 10 yr Bond Differential forecasting-ARIMA

Mexico 10 yr Bond Differential Forecasting-GARCH
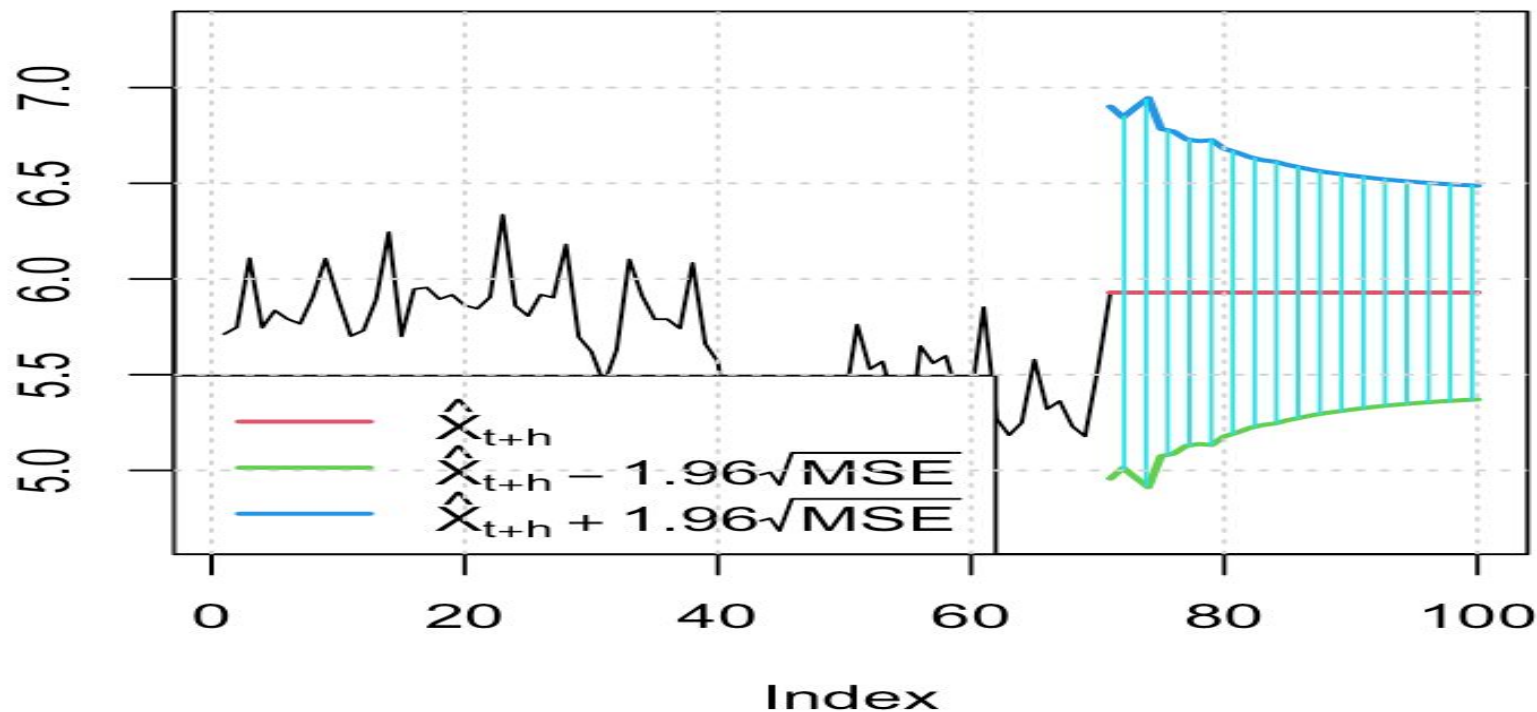
Use of Garch over ARIMA

- Given how highly vulnerable the Mexican economy is to developments in the US economy compared to the Indian Economy, it is more appropriate to rely on the GARCH model to forecast the Mexican Peso
- Such vulnerability can be measured by how 10 year Bond Spreads, or in other words 10 year interest rate differential, are impacted by trade dynamics with the US

India seemingly has less trade vulnerability with the US than Mexico
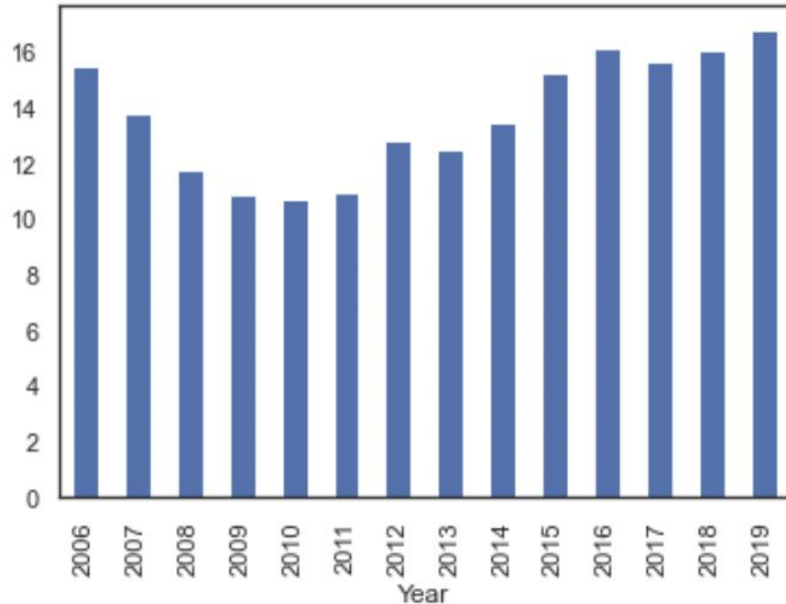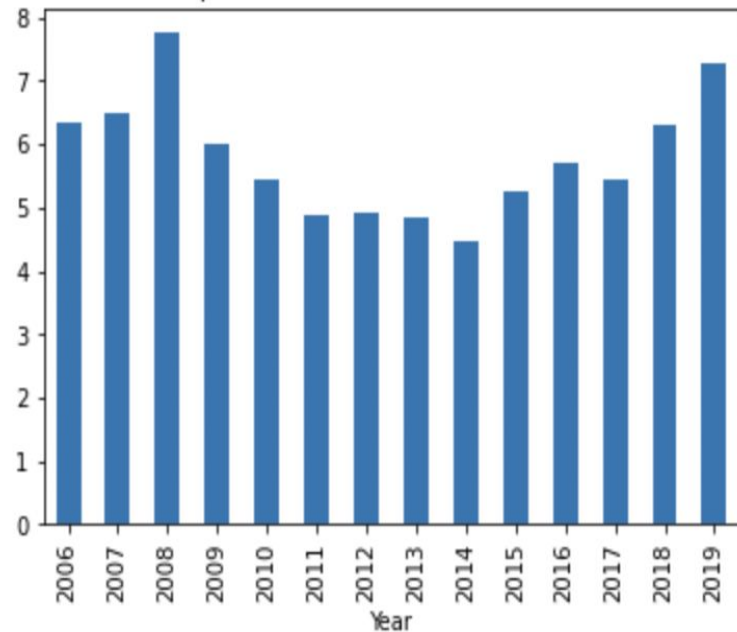
Mexico is more vulnerable to trade dynamics with the United States than India
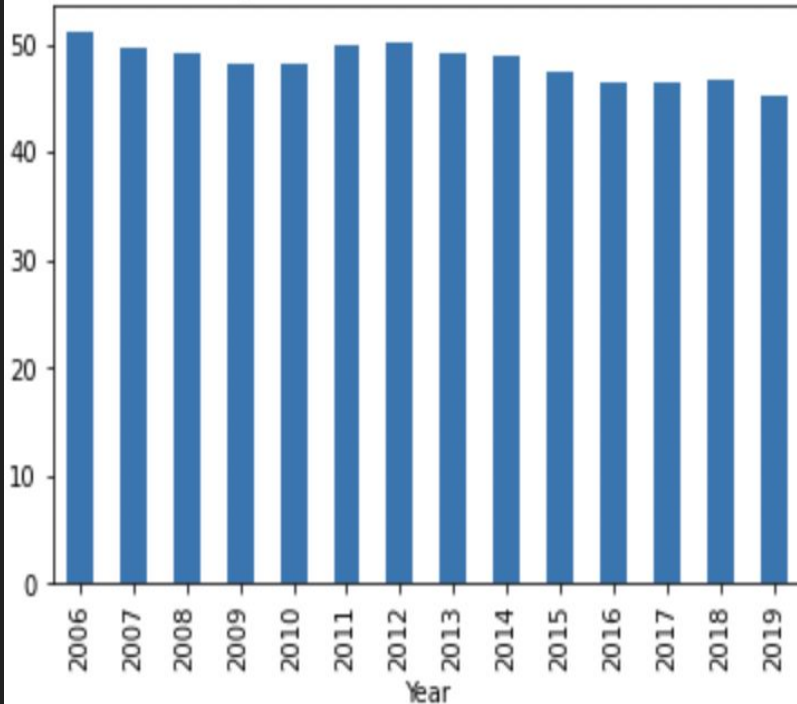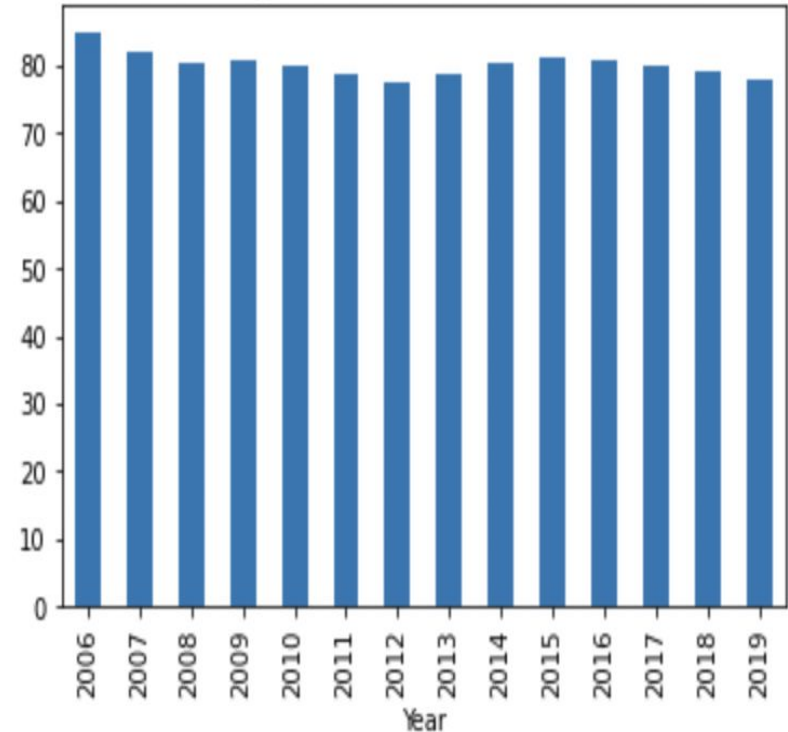
Mexico's Interest Rate Differential seems to be impacted more so by trade dynamics with the United States than India's Interest Rate Differential

	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	1.000000	0.984677	0.922690	0.298561	0.987139	0.985622	0.074582	-0.525034	-0.608972
Exports to US	0.984677	1.000000	0.975785	0.368309	0.996738	0.996428	0.088589	-0.640804	-0.564916
Current Account (*US*)	0.922690	0.975785	1.000000	0.439797	0.965486	0.966702	0.102310	-0.758181	-0.485122
Mexico-US Interest Rate Differential	0.298561	0.368309	0.439797	1.000000	0.404200	0.392375	-0.091367	-0.726534	-0.433472
Imports	0.987139	0.996738	0.965486	0.404200	1.000000	0.995776	0.046314	-0.651821	-0.595741
Exports	0.985622	0.996428	0.966702	0.392375	0.995776	1.000000	0.137832	-0.635398	-0.630467
Current Account	0.074582	0.088589	0.102310	-0.091367	0.046314	0.137832	1.000000	0.118544	-0.432791
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
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

	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	0.772573	0.281866	0.379128	0.846583	0.703648	-0.863234	0.222873	0.364609
Exports to US	0.772573	1.000000	0.826944	0.602165	0.847642	0.894620	-0.631422	-0.211446	0.611111
Current Account (*US*)	0.281866	0.826944	1.000000	0.574196	0.531170	0.728741	-0.189688	-0.516895	0.600572
India-US Interest Rate Differential	0.379128	0.602165	0.574196	1.000000	0.723498	0.807817	-0.484766	-0.629210	-0.059913
Imports	0.846583	0.847642	0.531170	0.723498	1.000000	0.932048	-0.896068	-0.323606	0.196977
Exports	0.703648	0.894620	0.728741	0.807817	0.932048	1.000000	-0.674332	-0.463973	0.208328
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	0.222873	-0.211446	-0.516895	-0.629210	-0.323606	-0.463973	0.091061	1.000000	0.239360
Export to US share of Total Exports	0.364609	0.611111	0.600572	-0.059913	0.196977	0.208328	-0.146198	0.239360	1.000000

Correlation Visualization Heatmap
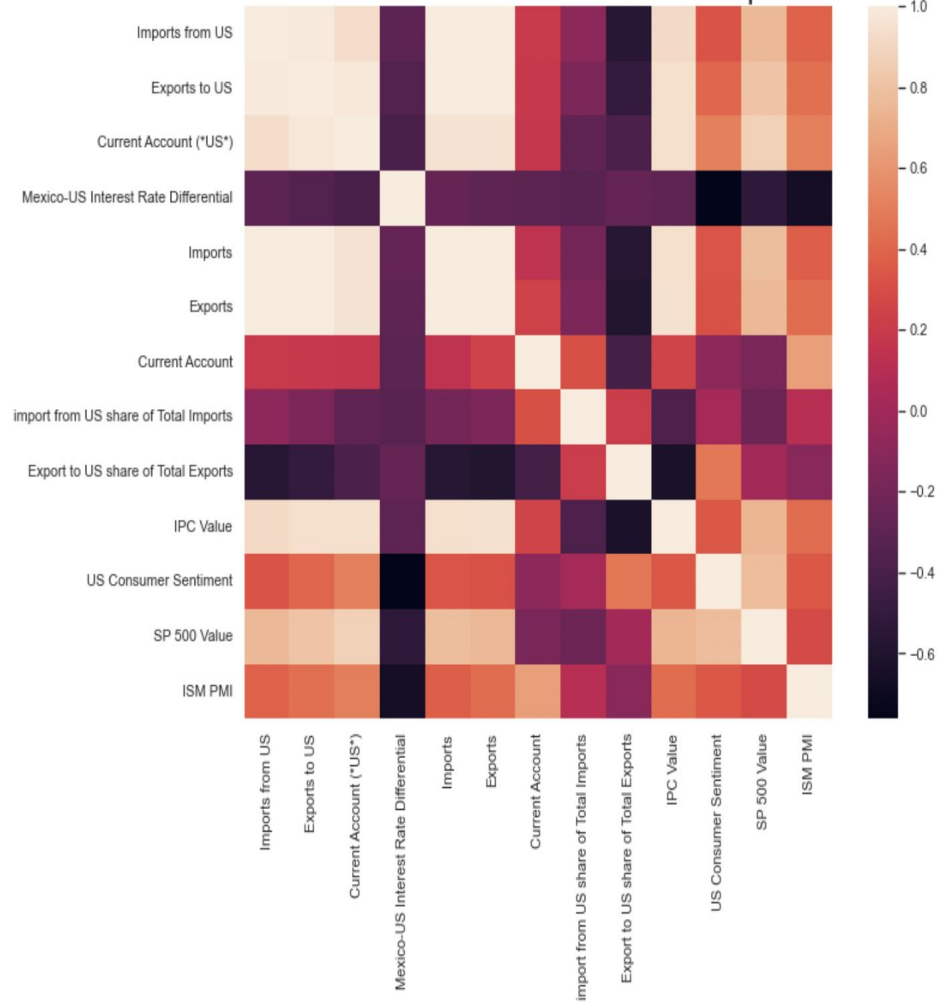
Given Mexico's high trade vulnerability with the United States, to examine more closely how such economic developments impact the Bond Spread, and the IPC Stock Market thus causing such volatility, US Consumer Sentiment, the SP 500, and ISM PMI were used to closely measure how such economic dynamics significantly affect the Mexican economy through the interest rate differential and IPC.

It seems that such Demand and Supply dynamics in the US economy, particularly US Manufacturing, does greatly cause such volatility among the IPC and 10 year bond spread given how Mexico's Economy is heavily manufactured oriented and greatly depend on such economies that are manufactured oriented to like the US

	US Consumer Sentiment	ISM PMI	US Consumer Sentiment (*w/out ISM PMI)	SP500	SP500 (*w/out ISM PMI)	SP500 squared
IPC	-548.231604	717.05242	-465.755211	27.237073	27.563201	0.008601

	US Consumer Sentiment	ISM PMI	US Consumer Sentiment (*w/out ISM PMI)
MEX_US_InterestRateDifferential_logged	-0.01142	-0.017154	-0.013393

To pinpoint the specific cause of such volatility, looking at the regression coefficients of the US Consumer Sentiment when ISM PMI is included in the regression analyses and also taken out of the regression analyses, US Manufacturing dynamics seems to have a great impact on the Mexican economy, thus greatly causing such volatility in not just the 10 year bond spread, but ultimately the Mexican Peso.

Conclusion

- The use of the GARCH model to forecast the Mexican Peso is the more appropriate to use over the ARIMA model because of such volatility that is exhibited by the Mexican Peso
- Looking at how US manufacturing greatly impact the Mexican economy, perhaps the use of the GARCH model is sensible to forecast such currencies whose economies greatly depend on such economic developments in the United States, particularly so when such dynamics significantly involves manufacturing