



TIME SERIES ANALYSIS TO PREDICT NEXT US RECESSION

METHODOLOGY

- NAÏVE PREDICTIONS
- TIME SERIES DECOMPOSITION
- EXPONENTIAL SMOOTHENING
- ARIMA
- NEURAL NETWORKS



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MARKETS

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PUBLISHED THU, MAR 21 2019 • 1:17 PM EDT | UPDATE

12:02 AM EDT

BUSINESS

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Will the U.S. face a recession in 2019? Here's what forecasters say, with a look to 2020

Martin Crutsinger, The Associated Press

Published 8:52 a.m. ET Feb. 25, 2019 | Updated

Will U.S. face a recession in 2019? Here's what forecasters say, with a look to 2020

think so. recession by the end of 2020

Nearly half of US CFOs fear a 2019 recession



By Matt Egan, CNN Business

Updated 12:46 PM ET, Wed December 12, 2018



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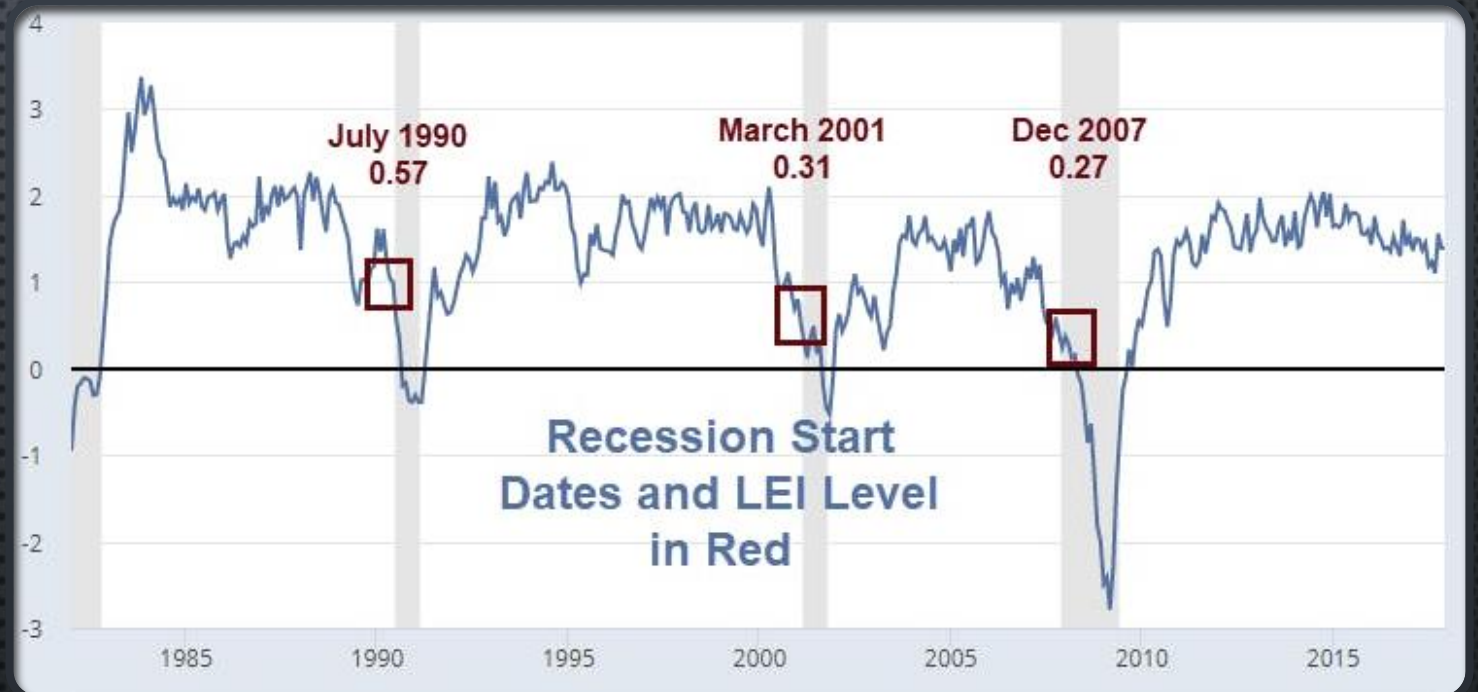
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10 years later, these 28 U.S. cities never recovered from the Great Recession

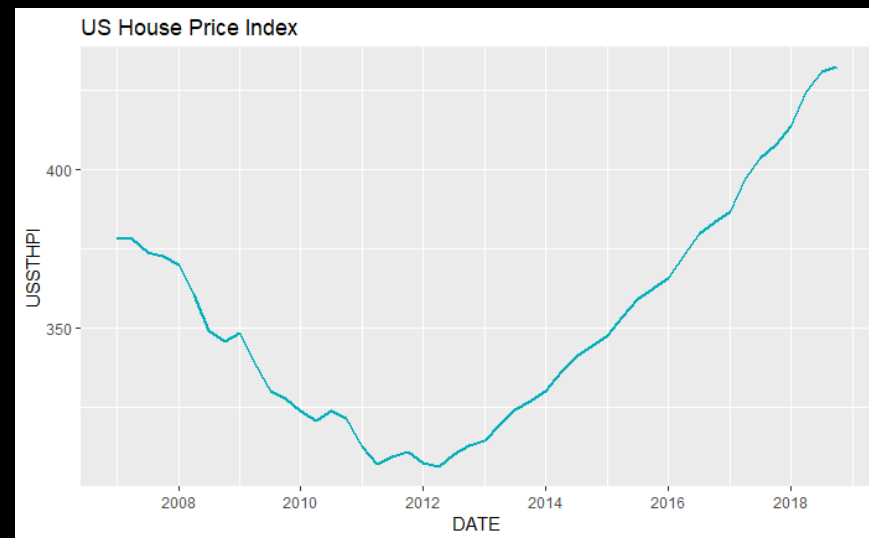
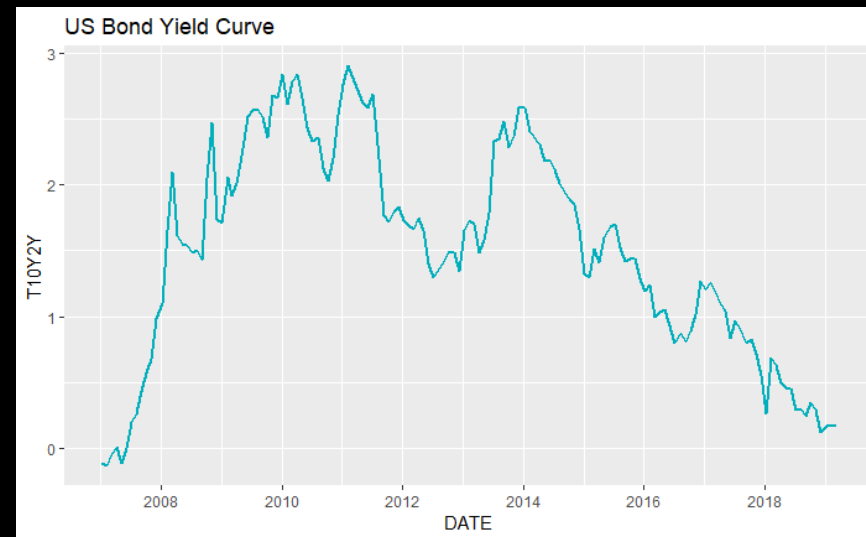
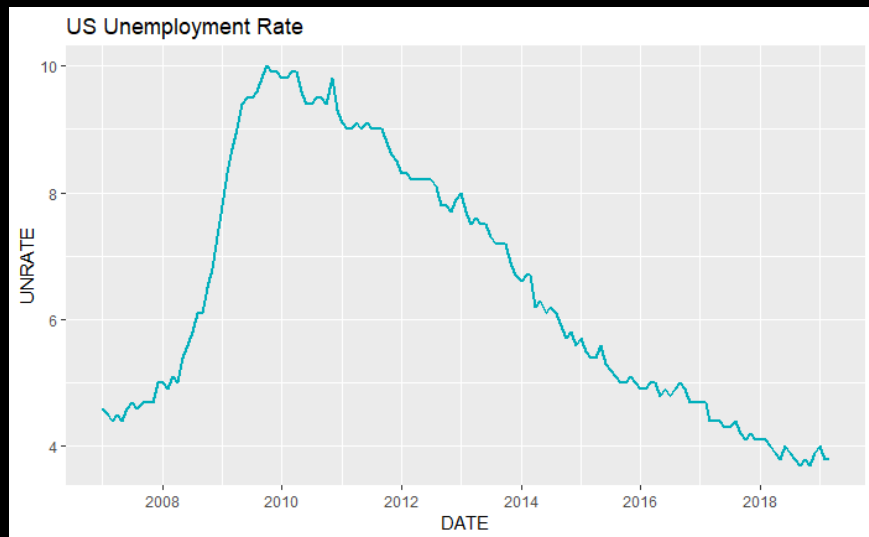
WHY?

INFLATION

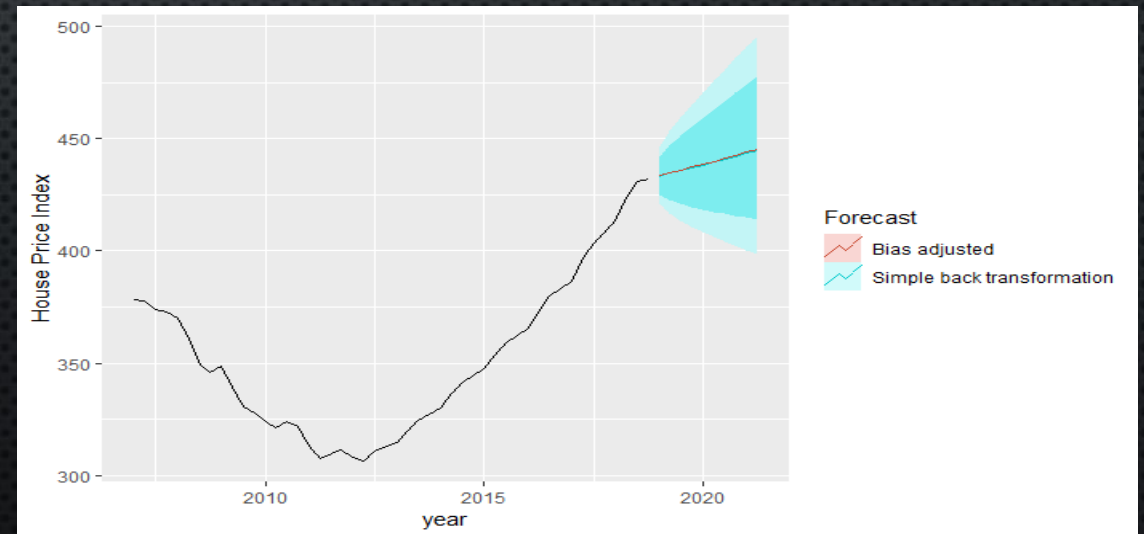
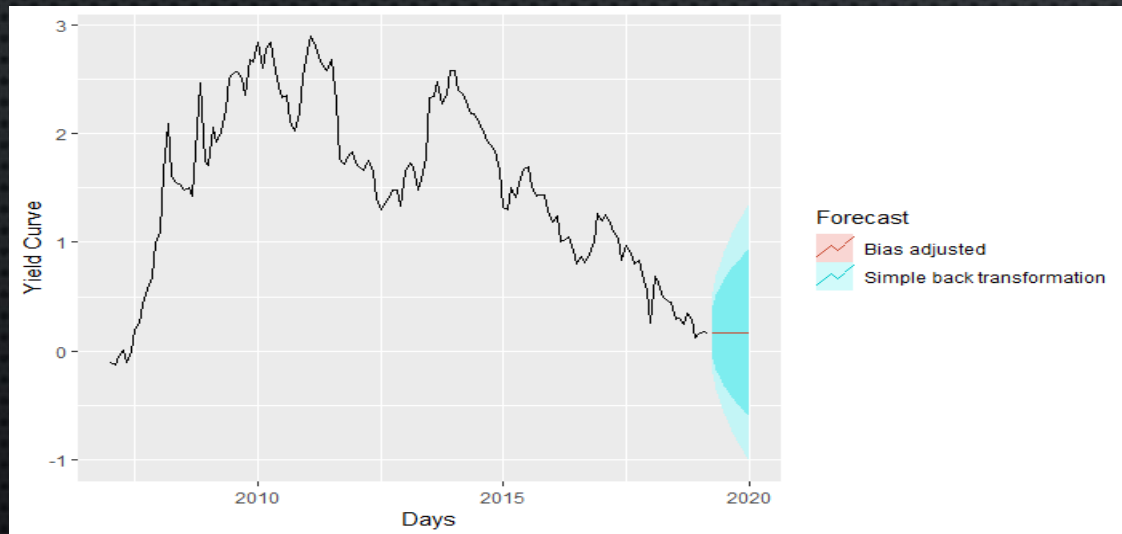
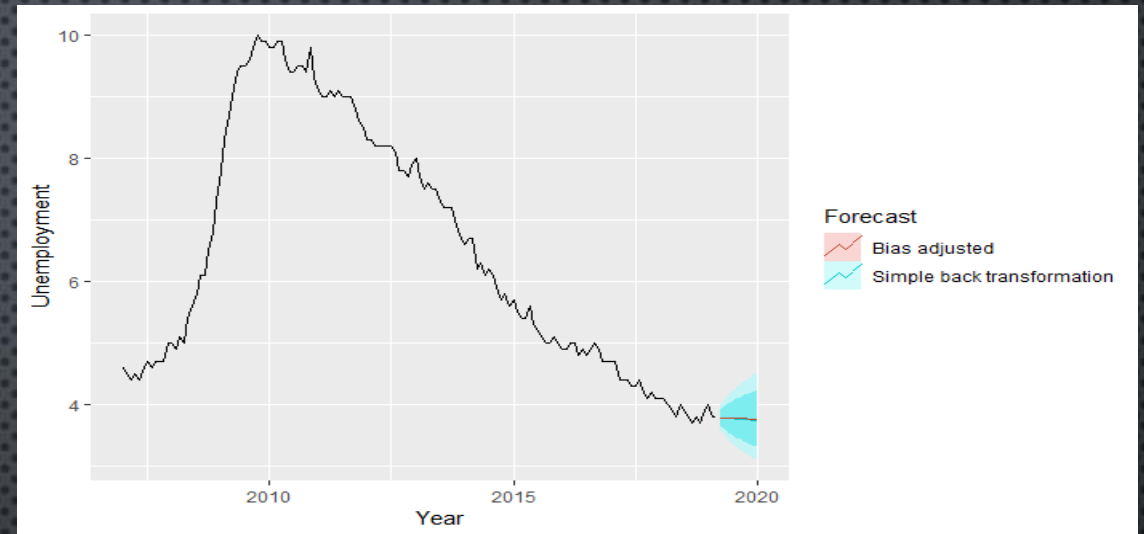
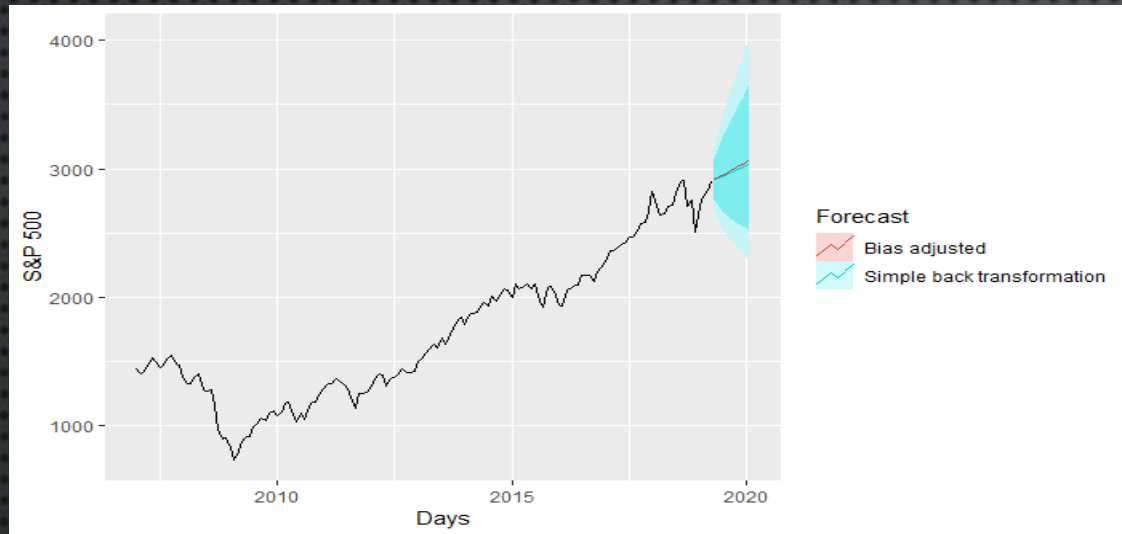
- INCREASED PRODUCTION COST
- HIGH ENERGY COST
- NATIONAL DEBT

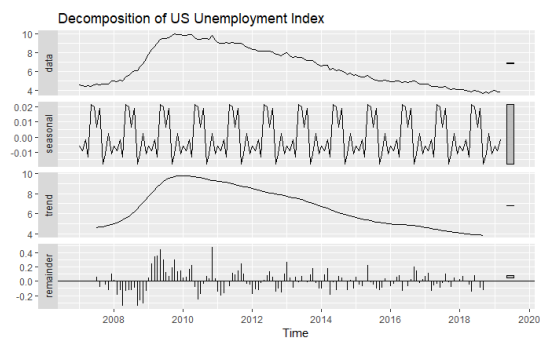
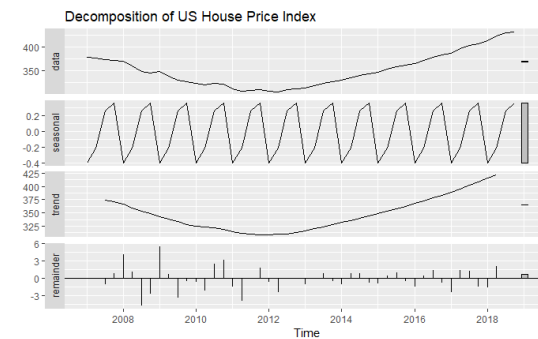
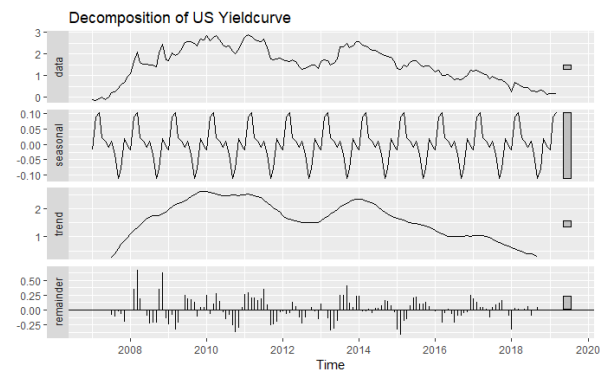
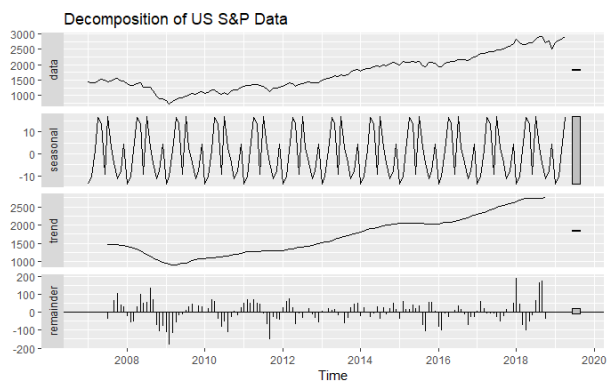


PREDICTORS



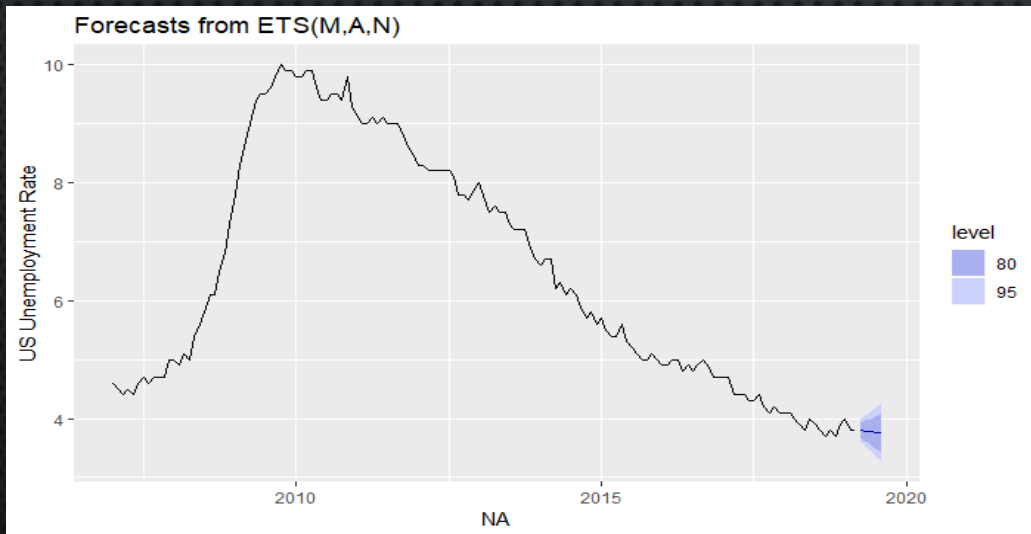
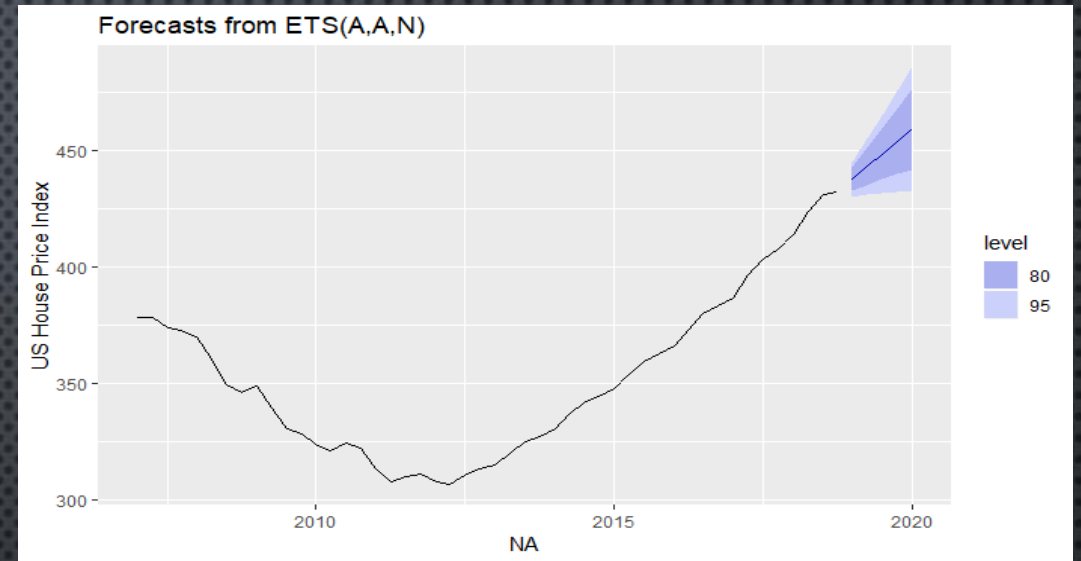
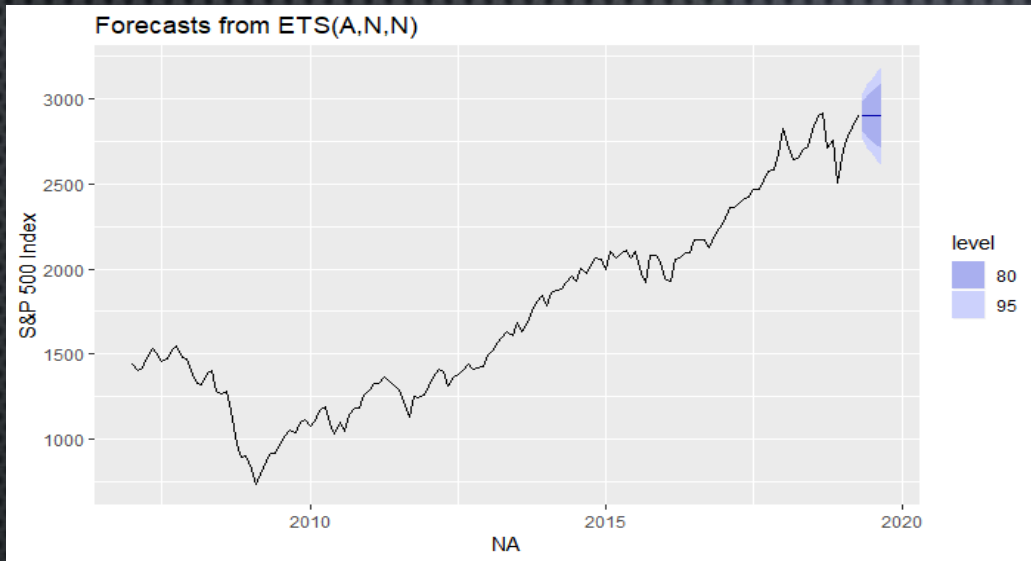
NAÏVE FORECAST



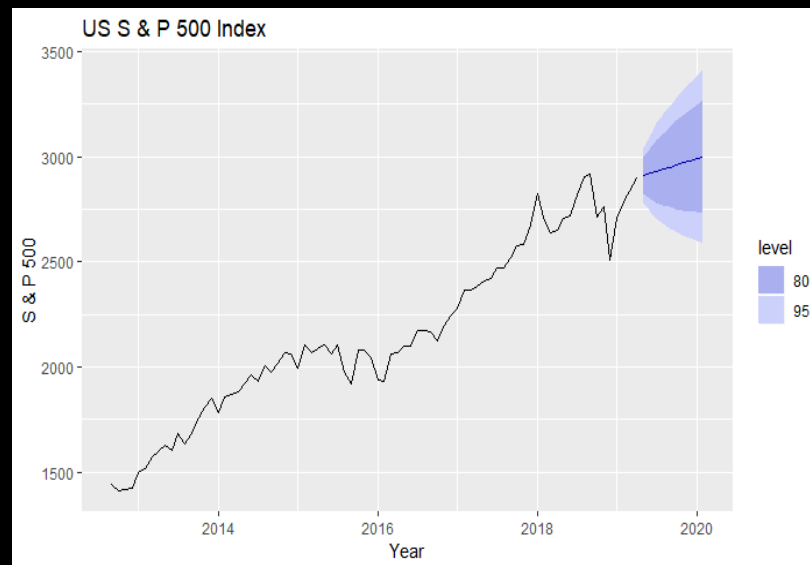
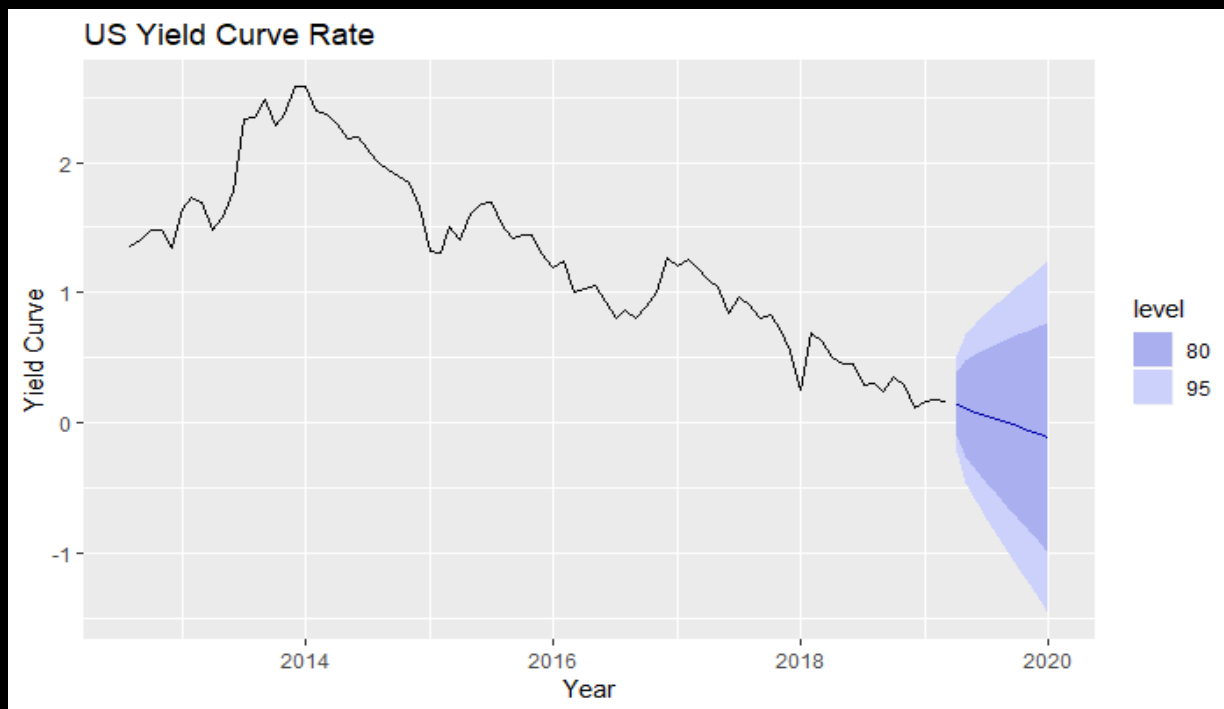
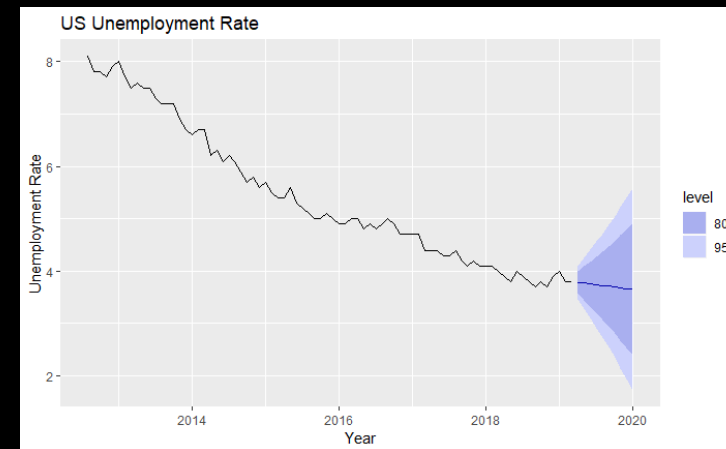
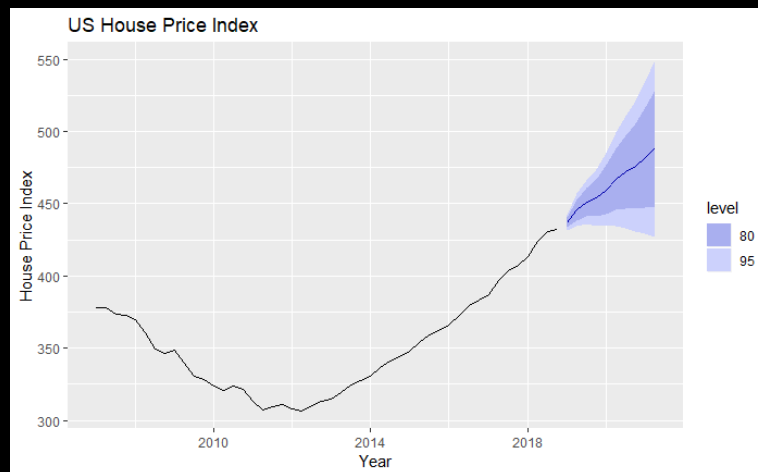


TIME SERIES DECOMPOSITION

EXPONENTIAL SMOOTHENING

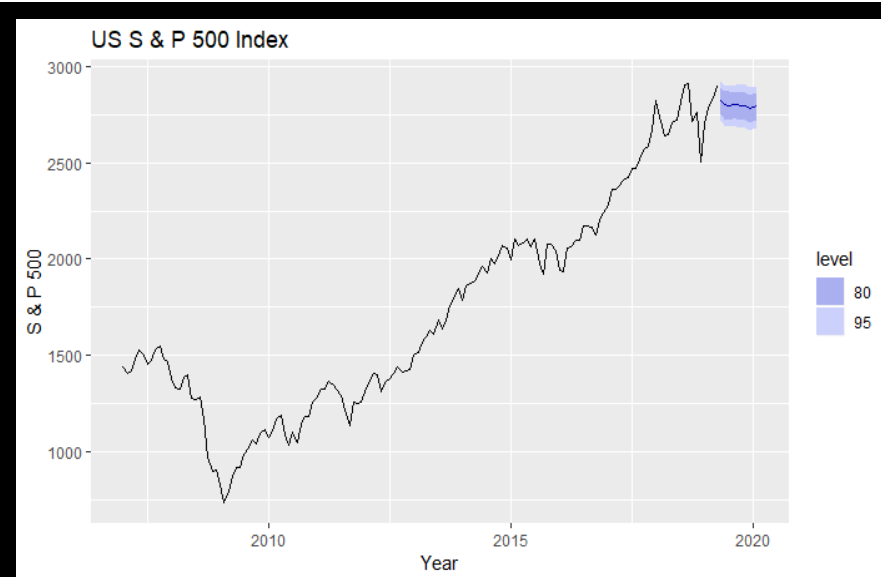
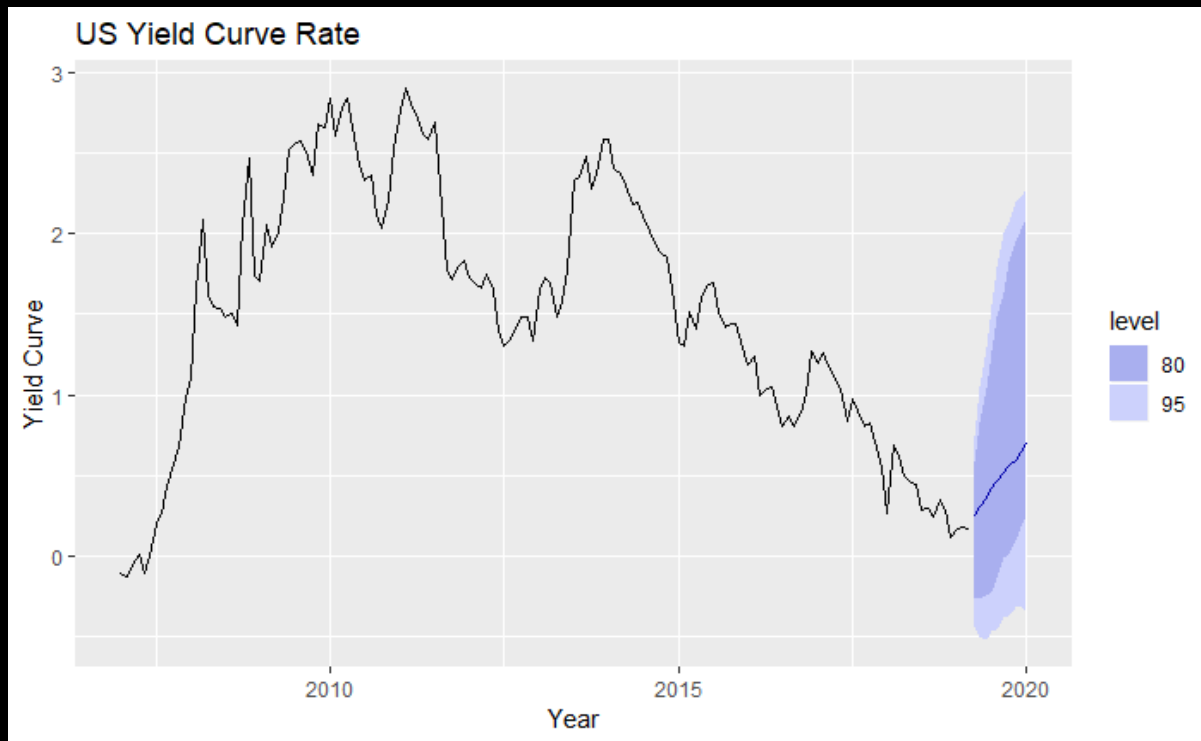
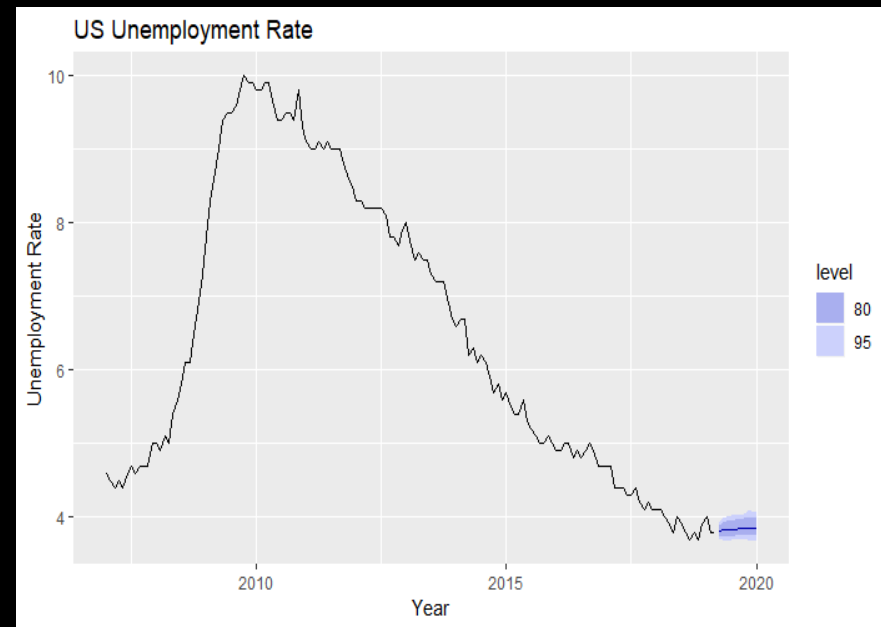
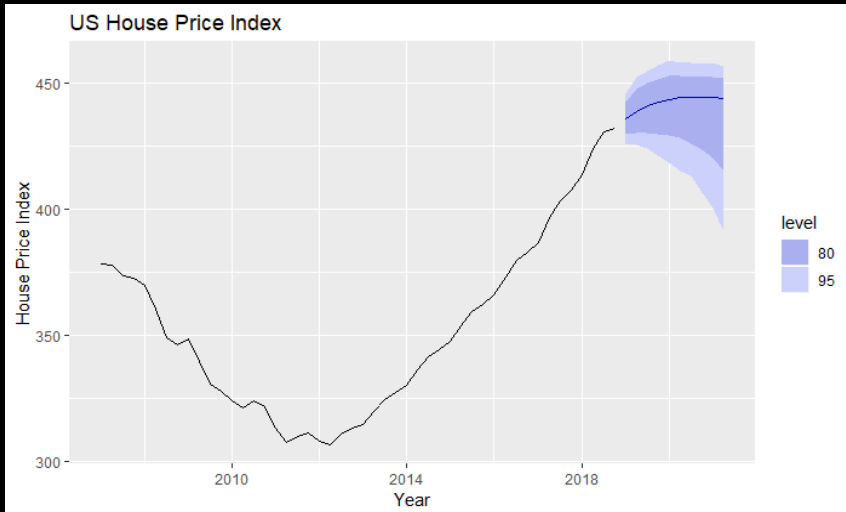
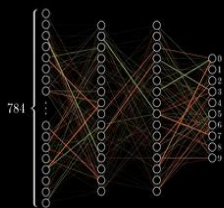


ARIMA



NEURAL NETWORK

Training in progress...



FORECASTING ERRORS

EXPONENTIAL SMOOTHENING

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	9.364321	57.51689	45.70232	0.3766103	3.215566	0.2087850	0.08332435	NA
Test set	81.660703	133.76733	109.78987	2.8175821	3.924598	0.5015605	0.37223297	1.123981
	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	9.364321	57.51689	45.70232	0.3766103	3.215566	0.208785	0.08332435	NA
Test set	-2250.867866	2250.87901	2250.86787	-532.6340976	<u>532.634098</u>	10.282791	-0.00919882	254.2074
	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	9.364321	57.51689	45.70232	3.766103e-01	3.215566	0.208785	0.08332435	NA
Test set	-2669.714532	2669.71454	2669.71453	-6.870066e+04	<u>68760.660435</u>	12.196237	0.44588015	21625.94
	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	9.364321	57.51689	45.70232	3.766103e-01	3.215566e+00	0.208785	0.08332435	NA
Test set	-2673.261199	2673.26120	2673.26120	-1.001362e+06	<u>1.001362e+06</u>	12.212439	0.61436170	20939.03

ARIMA

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	4.780965	56.67981	44.72753	0.3005813	3.195987	0.2043318	0.03925546	NA
Test set	-118.394364	179.24536	142.75094	-4.4238311	5.277764	0.6521387	0.54569862	1.596559
	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	0.2575488	2.590969	1.995721	0.08920473	0.5949802	0.1346211	0.0318574	NA
Test set	5.3867562	6.431794	5.539618	1.27940150	1.3189303	0.3736743	0.5612678	0.9334991
	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	0.000283463	0.1629713	0.1279162	0.09254736	1.990062	0.1210563	-0.08435746	NA
Test set	0.146901333	0.2154826	0.1595328	3.77307131	4.103690	0.1509774	0.63253261	1.821023
	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	-0.017720234	0.1881677	0.1381642	Inf	Inf	0.2264987	-0.01322789	NA
Test set	0.007641502	0.1032426	0.0801708	-6.478884	27.22896	0.1814275	-0.09302886	0.505827

NEURAL NETWORKS

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	-0.4747749	55.33649	43.35765	-0.2134548	3.077137	0.1980737	0.003977123	NA
Test set	-383.9520628	427.56239	394.16220	-14.0626863	14.424259	1.8006778	0.596782102	3.849401
	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	0.02999871	2.52383	2.036374	0.001716796	0.6123494	0.1378634	0.1466493	NA
Test set	20.76841209	24.45299	20.768412	4.933435536	4.9334355	1.4009309	0.6320367	3.533125
	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	0.003404204	0.1438004	0.1142808	0.003161916	1.745311	0.1081522	-0.1882119	NA
Test set	-0.341858058	0.3976822	0.3423370	-8.950812290	8.962494	0.3239782	0.6442581	3.374325
	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1	Thiel's U
Training set	-0.003162831	0.1858422	0.1399253	-1.525352	8.510704	0.2293858	0.1592319	NA
Test set	-0.316576630	0.3755954	0.3311281	-152.411835	<u>154.551920</u>	0.5428330	0.7176895	3.758735

CONCLUSIONS

- S&P 500 DATA HAVE DETERIORATING OPTIMISM AND MIGHT MEANS INVESTORS HAVE THEIR RESERVATIONS GOING FORWARD
- ARIMA SHOWS RISING HOUSE PRICE INDEX THAT MIGHT SHOW PSEUDO OPTIMISM. THIS EFFECT IS NEGATED BY NEURAL NETWORKS
- UNEMPLOYMENT RATE AGAIN SHOWS DOWNWARD TREND AND HENCE AGAIN A CASE OF PSEUDO OPTIMISM
- YIELD BOND CURVE THAT IS MOST ACCURATE RECESSION PREDICTOR SHOWS AN INVERSION IN ARIMA INDICATING RECESSION CAN BE UPON US