

Real Estate Loans Presentation 2 1975-2016

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Reintroduction

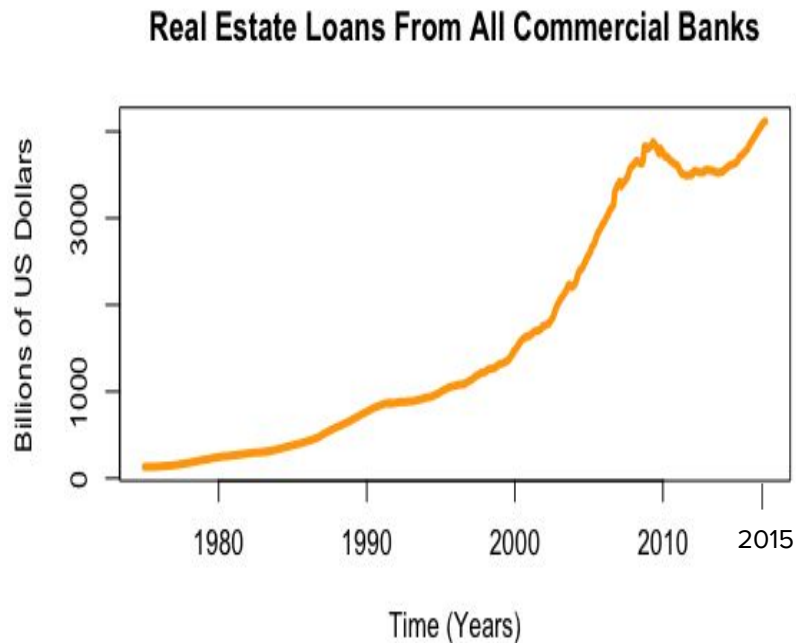
Data Set:

- United States Commercial Banking Real Estate Loans (1975- 2016)

Goals of Project:

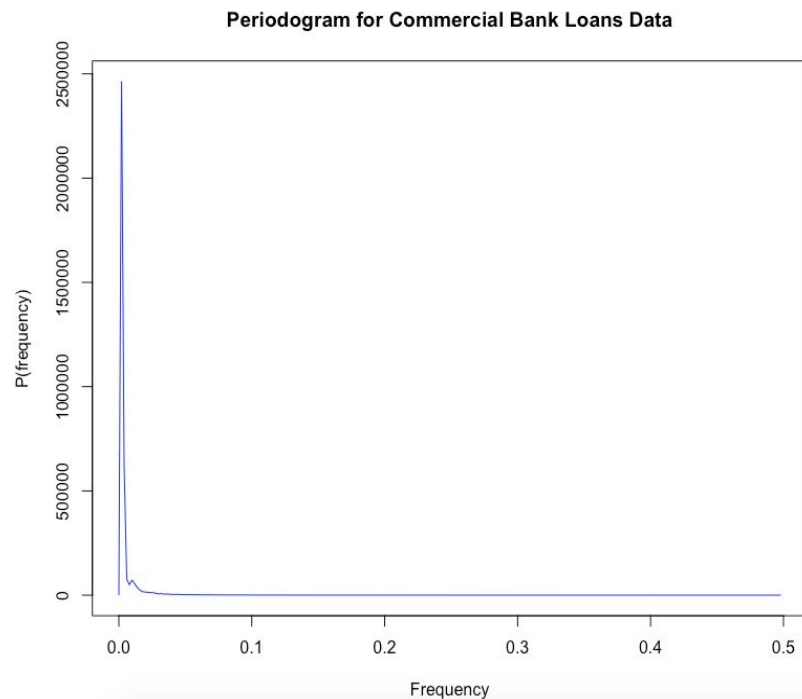
- Prove that our model's residuals resemble white noise
- To create a model that accurately forecasts our data

Data Set Time Series



- Real Estate Loans from all Commercial Banks (1975-2016)
- Monthly Data
- Range 130- 4,115 Billions

Checking Seasonality Commercial Bank Loans



Period = 504

REL Data Transformation

Our data shows very high variance so we decided to try some transformations

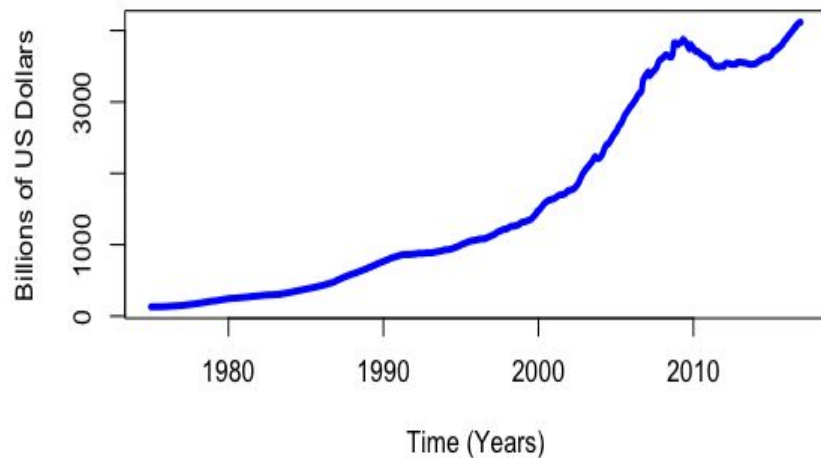
We tried:

- Log
- Log Return
- Square Root
- Reciprocal

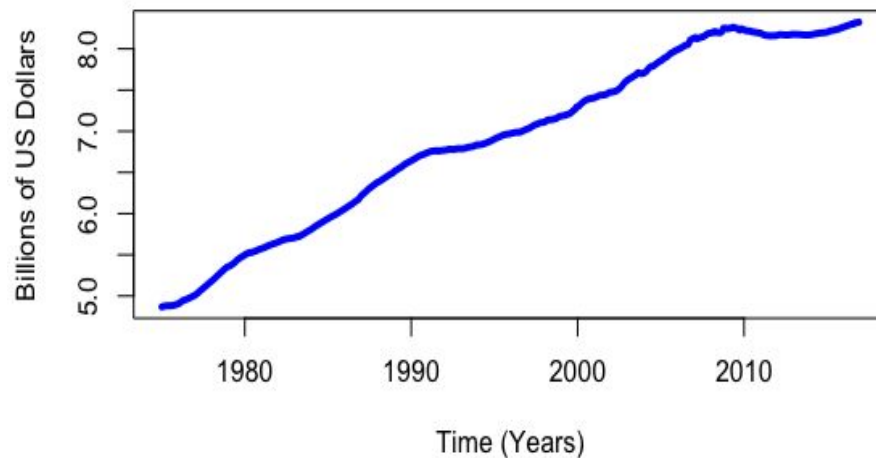
We found the log transformation was the best and seemed to fix our variance problem

Original vs. Log Transformation

Real Estate Loans - Original



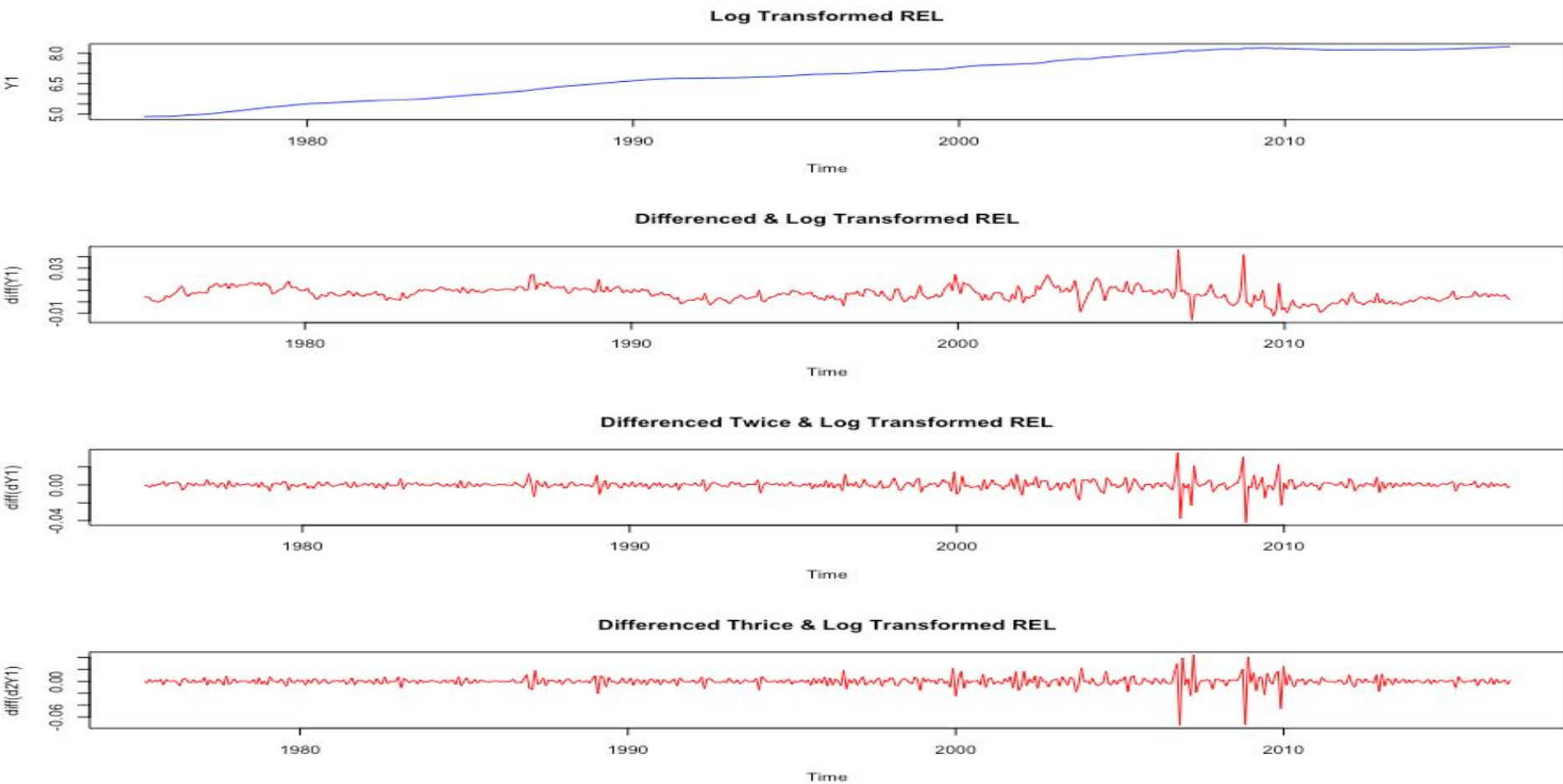
Real Estate Loans - Log Transformed



Choosing a Model

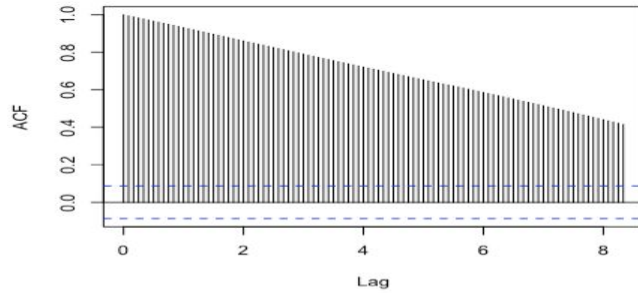
- Options
 - ARMA
 - ARIMA
 - SARMA
 - SARIMA
 - ARCH/GARCH
- We decided use an ARIMA Model
 - Differencing helps de trend our data

Differencing

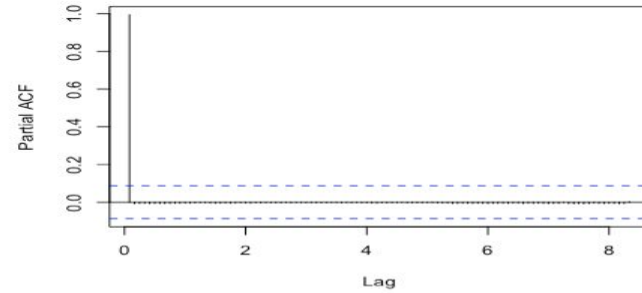


ACF & PACF Plots

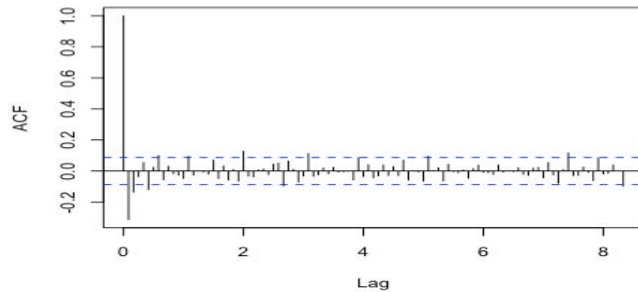
ACF of REL log transformed



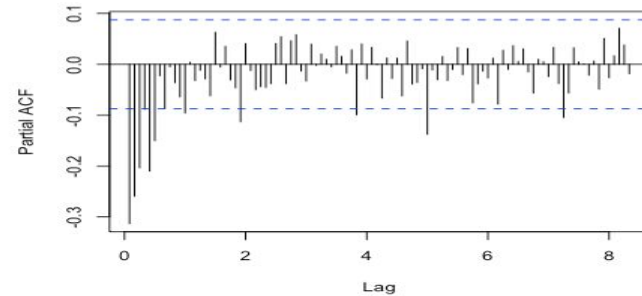
PACF of REL log transformed



ACF of Differenced twice & Log transformed REL



PACF of Differenced twice & Log transformed REL



Fitting Model

Models

Model1: ARIMA (1,2,1)

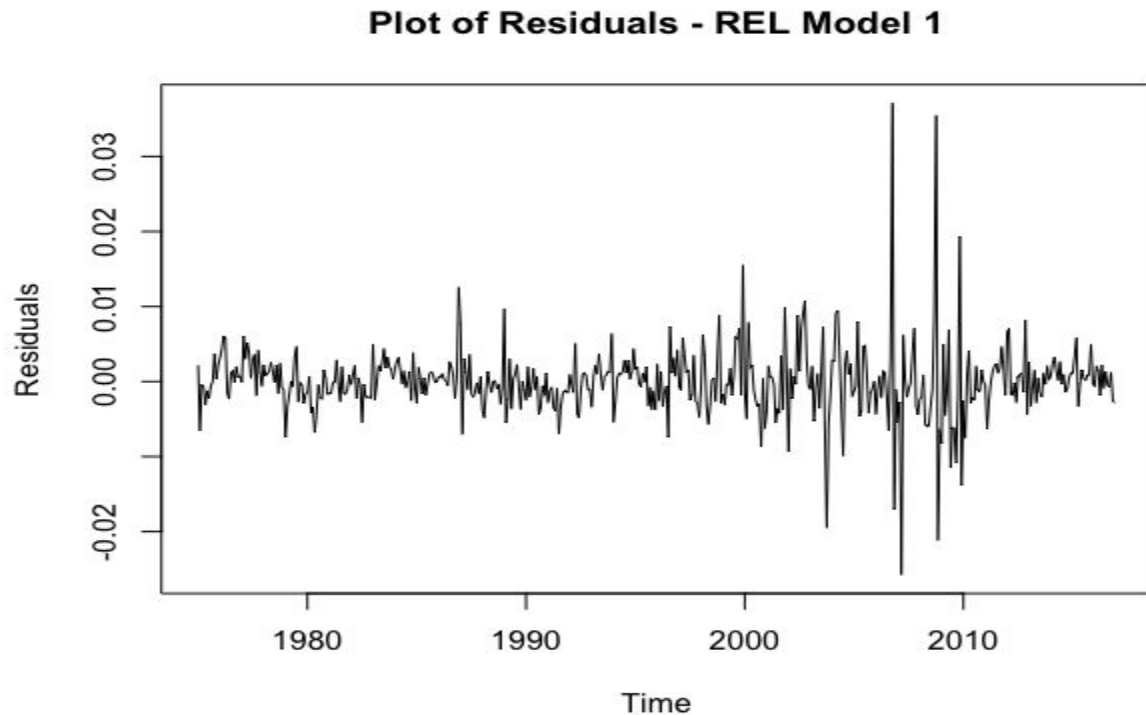
Model2: ARIMA (2,2,1)

Model3: ARIMA (3,2,1)

Model 4: ARIMA (1,2,2)

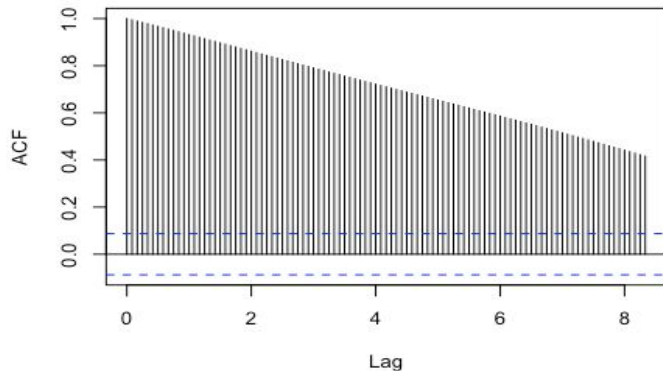
Model #	σ^2 est.	aic	# of significant predictors
1	2.153e-05	-3963.09	2
2	2.151e-05	-3961.53	2
3	2.151e-05	-3959.53	2
4	2.151e-05	-3961.52	2

Plot of Residuals- Model 1

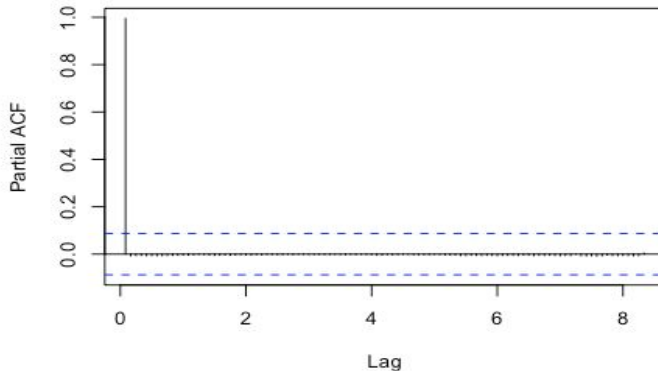


ACF/ PACF Comparison

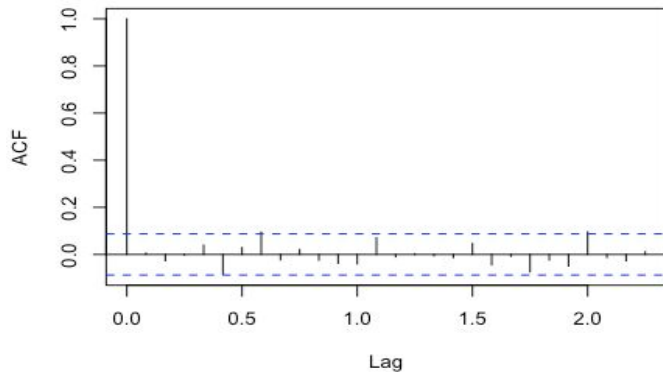
ACF Model- REL Log Transformed



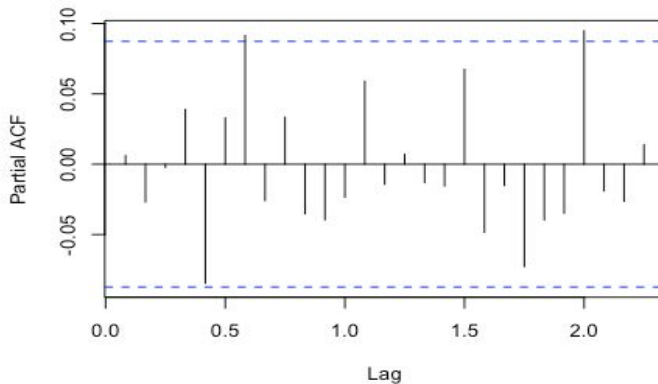
PACF Model- REL Log Transformed



ACF Model- REL Model 1



PACF Model- REL Model 1



How did we do?

R Studio

```
> auto.arima(X1)
```

Series: X1

ARIMA(2,2,3)

Coefficients:

	ar1	ar2	ma1	ma2	ma3
	-0.9044	-0.6243	0.2369	-0.2019	-0.6841
s.e.	0.0929	0.1007	0.0809	0.0869	0.0639

sigma^2 estimated as 170: log likelihood=-1999.59

AIC=4011.18 AICc=4011.35 BIC=4036.49

Our Group

```
> summary(model1)
```

Call:

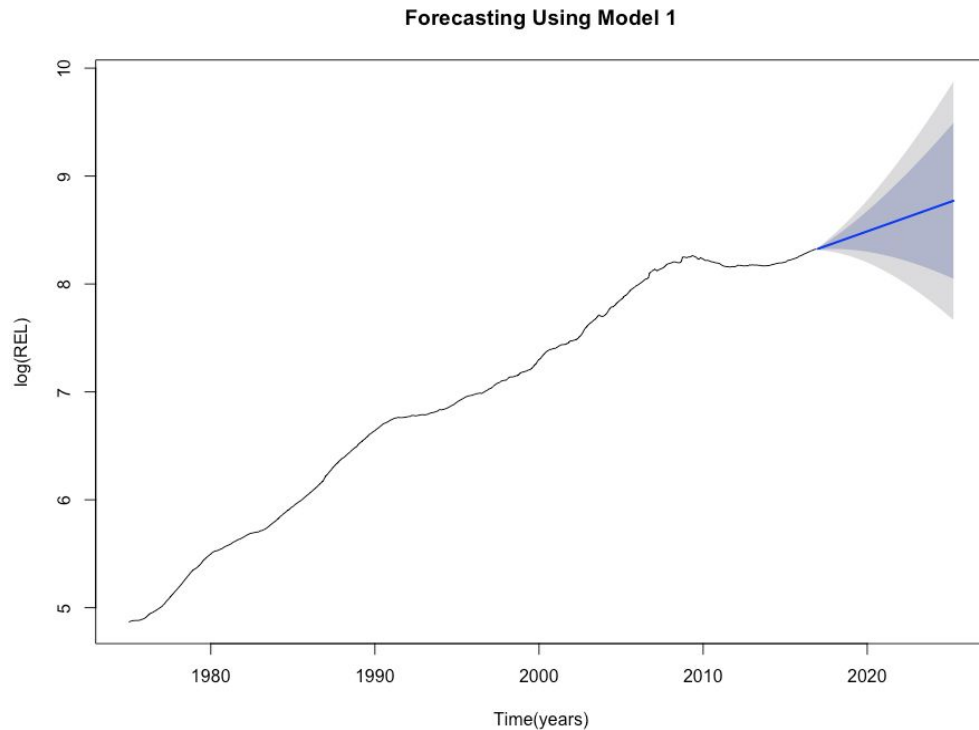
arima(x = Y1, order = c(1, 2, 1))

Coefficients:

	ar1	ma1
	0.3217	-0.8706
s.e.	0.0555	0.0291

sigma^2 estimated as 2.153e-05: log likelihood = 1984.54, aic = -3963.09

Forecast and Accuracy Statistics



Accuracy Statistics	Our Model	Model R Choose
ME	-1.320754e-06	.2561468
RMSE	0.004640708	12.94644
MAE	0.002875363	5.768789
MPE	0.0004274327	0.04381222
MAPE	0.04091886	0.3037068
MASE	0.03281393	0.05218125

All Finished Any Questions?

HPI by State Compared to 2008 Peak

