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Econ 460 Forecasting Project
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12-Step Forecast Horizon for the Midwest Economic Index

For our forecasting project, we decided to forecast the values of the Midwest Economic Index (MEI) over the course of next year. The MEI is a metric that reflects the nonagricultural economic performance of the Seventh Federal Reserve District relative to its growth trend. For example, an MEI of 1 suggests that the Seventh District is operating a full standard deviation above its long term trend; similarly, -1 would suggest that it is operating a full standard deviation below its long term trend. The MEI is released monthly by the Federal Reserve of Chicago.

Since this index uses numerous variable inputs, it is important to understand some of the nuances of these variables. Data for the MEI is collected by region and economic sector, and then aggregated to create the index. Anytime data is collected in different regions by different people, there is inherently some risk that the data is not collected consistently in terms of accuracy and thoroughness. It is therefore important to note that the aggregated data might be skewed.

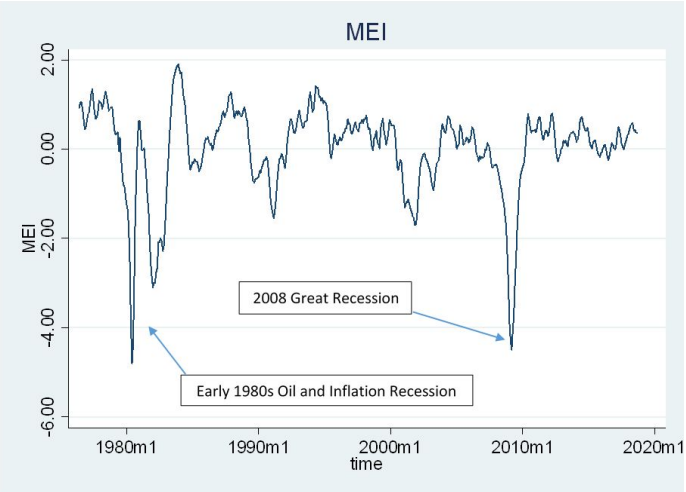

Figure-1: MEI Historical Data Series

It is also important to note the historical time period in which this dataset is available. The first date in our sample is June of 1976. Since this date, there have been two substantial recessions that appear as outliers in our sample, as shown in Figure-1. It is up to the data analyst to adjust these outliers or leave them as they are in order to best reflect the model they are trying to build. We decided to include these outliers as we believe our forecasting model should capture strong market fluctuations such as these.

Our model utilizes 8 autoregressive lags and 18 midwest unemployment lags. We decided to use midwest unemployment lags in our forecast because it has historically been a leading indicator for economic performance in the midwest. To ensure joint significance we ran a Chow-test for the 18 lags of unemployment, which proved that the regressors were jointly significant at the 1% level. We limited ourselves to using autoregressive lags and unemployment lags in order to keep the model relatively simple—by adding other regressors, we run the risk of overfitting.

To be clear, when we say “midwest unemployment,” we mean exactly that. This is not the unemployment for the same land area as the Seventh District, but instead the unemployment for the five states that are in the Seventh District. Iowa is the only state that lies entirely within the Seventh District. So four of the five states (Wisconsin, Illinois, Indiana, and Michigan) are only partially covered by the reach of the Seventh District. While this is a relatively inconsequential point to our forecast, it remains important to note the slight difference in geographic regions between our two variables. Since the

Seventh District lies completely within the area of “midwest unemployment”, we felt our unemployment variable still captures the population we were trying to model.

We chose 8 autoregressive lags and 18 midwest unemployment lags because, after checking the Akaike Information Criterion (AIC) for a number of models, this model resulted in the lowest AIC. The AIC was the best method for choosing a forecasting model because we were not trying to model the MEI itself, in which case we would have used the Bayes Information Criterion (BIC). Instead, we were looking for the best forecast. Because AIC was designed to find models with low forecast risk, it is in our best interest to use it. We cross-checked between a number of models with various AR(p) and unemployment lags to find that AR(8) and 18 unemployment lags had the lowest AIC at -478.32, as seen below in Table-1.

AIC Scores	UR_lags=0	UR_lags=1	UR_lags=6	UR_lags=8	UR_lags=12	UR_lags=18
MEI_lags=0	1391.63	1350.87	632.81	626.51	630.03	607.58
MEI_lags=1	-17.45	-30.41	-149.79	-176.13	-178.55	-212.67
MEI_lags=6	-427.46	-426.06	-446.31	-446.31	-446.25	-467.57
MEI_lags=8	626.51	-435.60	-456.82	-457.64	-459.82	-478.32
MEI_lags=12	-429.41	-427.93	-449.34	-450.01	-452.85	-471.26
MEI_lags=18	-423.86	-422.34	-445.70	-446.98	-449.29	-463.98

Table-1: AIC Figures

As you can see, our 12 month point forecast suggests that we will revert to the mean growth trend in the Midwest roughly 5 months from now before heading below the mean growth trend for the remaining 7 months of the year. Our forecast seems to be consistent with other economists, who have predicted that the general economy in the upcoming year will slow down. Our forecast intervals spread at later forecast horizons due to higher uncertainty. The MEI is autocorrelated (shown in Figure-2 below), so the

twelfth step of the forecast interval will have higher variance than the first because each of the forecast steps is a sequence of weight averages of the one-step forecast errors.

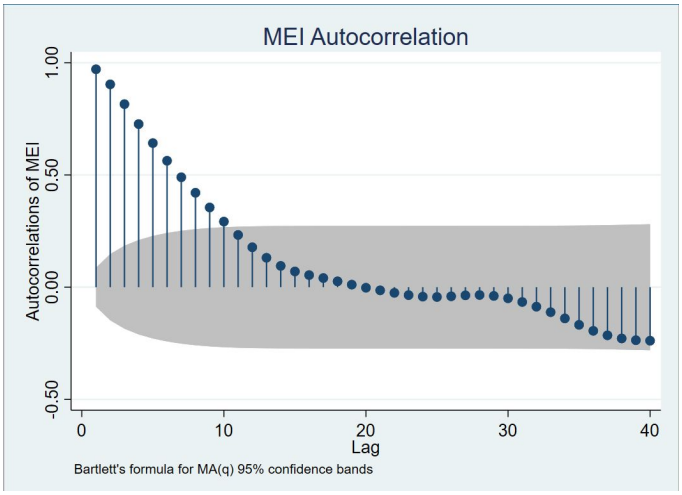

Figure-2: Autocorrelation of MEI

Below, you will find that Table-2 contains our 12-step point and interval forecasts. We forecast that the MEI for October 2018 will be 0.33 standard deviations away from the Midwest's historic growth trend. We've included September 2018, which the Chicago Fed has already released, for the sake of continuity. Figure-3 shows our forecasts graphically.

Date	Point	Lower Interval	Upper Interval
2018m9	0.42516	0.18298	0.66733
2018m10	0.32704	0.08471	0.56937
2018m11	0.24765	-0.23867	0.73398
2018m12	0.16470	-0.60316	0.93256
2019m1	0.00711	-0.97800	0.99223
2019m2	-0.07841	-1.23496	1.07815
2019m3	-0.14416	-1.42893	1.14060
2019m4	-0.14857	-1.52915	1.23201
2019m5	-0.20006	-1.65390	1.25377
2019m6	-0.17807	-1.72746	1.37132
2019m7	-0.33214	-1.88152	1.21723
2019m8	-0.35792	-1.93895	1.22311
2019m9	-0.33167	-1.93873	1.27538

Table-2: 12-step Point and Interval Forecasts

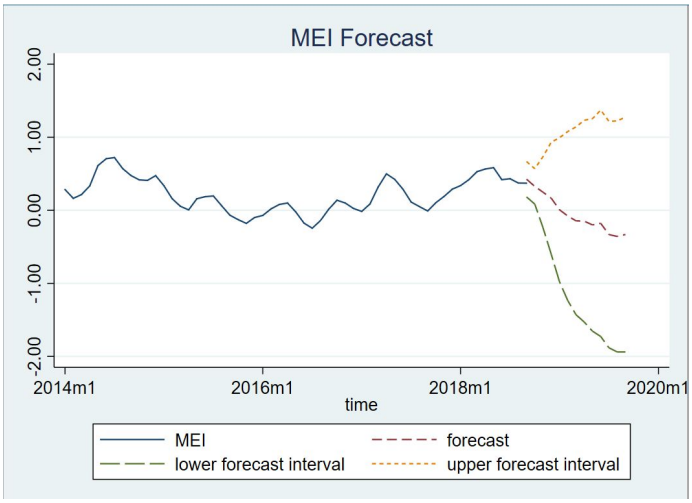

Figure-3: MEI Forecast for 12-step horizon