Take Home Exam 1

Matthew Dennahower 103728472

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1 Blanchard-Quah identification of Demand and Supply Shocks

1.1 Estimate the reduced form VAR and determine appropriate lags

The following page shows the estimated values of the reduced form VAR. GDP Growth is lagged up to 2 values along with unemployment. According to the t-statistics for the lags on GDP Growth, GDP(-1) and GDP(-2) are not rejected based on the critical value of 1.98. Therefore, it can be assumed that the values are not significant. For the lags on Unemployment, only GDP(-2) is not significant while the rest of the values are significant. This explains how the previous values of GDP growth do not affect current GDP growth, however previous values of unemployment do affect current levels of GDP growth. Previous values of unemployment are also significant for current levels of unemployment which makes sense as it the shift in unemployment will not occur in one period and the level of unemployment last period should be similar to that of the current period.

We tested for the lag selection criteria up till 12 lags first. Based on the tests above, the lag selected by the criterion was 2 lags. Therefore, considering 2 lags as the optimal value for lags we re-ran the model for 2 lags.

1.2 Granger Causality Analysis

The Granger causality is used to test whether the lags above are optimal or not. As we can see above the p-value for all values are below 0.005 making the lags significant.

1.3 Impulse Response Analysis and Variance Decomposition Analysis

To estimate the impulse response analysis, we first used the structural VAR Estimates. To get to the structural VAR estimates we did the similar Long-run response pattern applied by Blanchard-Quah in their model. By setting

2 Stock and Watson

The paper by Stock and Watson (2001) utilizes a vector autoregression approach to interpret the empirical relationship between inflation unemployment and the federal funds rate using U.S. quarterly data from 1960-2000. The authors make two identifying assumptions that will be replicated in the form of a Cholesky decomposition and a SVAR based upon the Taylor rule.

2.1 Estimate the reduced form VAR and determine appropriate lags

The first step necessary in estimating the reduced form VAR is to determine the appropriate number of lags to include which will be determined through the lag length criteria. Upon doing so, the results are provided in the following table. From here we can see that of the five criteria provided, the AIC and FPE criterion indicate that 11 should be the selected lag. Although some degrees of freedom are lost in selecting a higher lag, 11 will be utilized throughout the estimations due to its multiple criterion selection when compared with the other selected lags (2,3 or 9). In addition, the paper by Stock and Watson (2001) selected their lag as 4 and therefore it is necessary to select 11 as opposed to 2 or 3 so as to not underindentify the model. This is suppported by Liew and Khim (2004) as they explain in "Which Lag Length Selection Criteria Should We Employ?"stating, "AIC and FPE are found to produce the least probability of under estimation among all criteria under study."

2.2 Granger Causality Analysis

After estimating the Reduced form VAR and determining appropriate lags, we ran the Granger Causality test in order to determine whether each variable's lags are significant in explaining the other variable's behavior better than the selected variable's past values alone. First, it can be seen that at a 5% significance level we do not reject the null hypothesis that the Federal Funds rate does not Granger cause the Inflation rate. This result is consistent with that obtained in the Stock and Watson (2001) paper where they have a p-value of 0.27 compared with the 0.1025 that we obtained, both of which are not rejected at the 5% significance level. Second, it can be seen that at the 5% significance level we do not reject the null hypothesis that the Inflation rate does not Granger cause the Unemployment rate. This result too is consistent with that obtained in the Stock and Watson (2001) paper where they have a p-value of 0.31 compared with the 0.0766 that we obtained, both of which are not rejected at the 5% significance level. The remaining 4 null hypotheses are rejected at the 5% significance level indicating that they do Granger cause the dependent variable in question.

2.3 Impulse Response Analysis and Variance Decomposition Analysis

2.3.1 Case 1

The first case describes a Cholesky Decomposition in which the ordering is given by the matrix $\begin{bmatrix} \Pi \\ U \\ R \end{bmatrix}$ and the identifying assumption yields that matrix A = $\begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix}$. This results in the Impulse Response functions and Variance decomposition to follow. From the Impulse Response functions we can see the response of each variable to a one standard deviation change in another variable. Of note here is the response of unemployment to the federal funds rate in which we see a hump-shape response whereby unemployment rises until a peak and then drops down into a negative value. We can also see little variability in inflation due to changes in any of the variables. Upon investigating the Variance decomposition of inflation we can see that at the forecast horizon of 12, the variance is decomposed as 71.75% (Pi), 12.32% (U) and 15.93% (R). When this is compared with the results in the Stock and Watson (2001) paper at the forecast horizon of 12, the variance is decomposed as 82% (Pi), 16% (U) and 2% (R). We can see here that the variance of the Federal funds rate contributed moreso to the variance of π in our estimation which yielded a result of 15.93% as opposed to 2% from the paper. From the variance decomposition of unemployment we can see that at the forecast horizon of 12, the variance is decomposed as 19.55% (Pi), 37.38% (U) and 43.06% (R). When this is compared with the results in the Stock and Watson (2001) paper at the forecast horizon of 12, the variance is decomposed as 16% (Pi), 66% (U) and 18% (R). We can see that our estimation yielded a larger percentage of the variance due to the Federal funds rate than the unemployment rate whereas the paper's results showed that the unemployment rate had a larger percentage of the variance than the Federal funds rate. Finally, from the variance decomposition of the Federal funds rate we can see that at the forecast horizon of 12, the variance is decomposed as 3.56% (Pi), 61.43% (U) and 35.01% (R). When this is compared with the results in the Stock and Watson (2001) paper at the forecast horizon of 12, the variance is decomposed as 16% (Pi), 59% (U) and 25% (R). From this we can see that the percentage of the variance due to the unemployment rate and the federal funds rate are similar, although our estimation yielded a smaller value for the percentage of the variance due to the inflation rate.

2.3.2 Case 2

The second case describes a SVAR identification as following the Taylor Rule as described in the paper. In order to utilize this identification we created a matrix for A = $\begin{bmatrix} 1 & 0 & 0 \\ NA & 1 & 0 \\ -1.5 & 1.25 & 1 \end{bmatrix}$ and B = $\begin{bmatrix} NA & 0 & 0 \\ 0 & NA & 0 \\ 0 & 0 & NA \end{bmatrix}$. This results in the SVAR estimates, Impulse Response functions and Variance Decomposition to follow. In order to define the SVAR we used the matrices A and B as given above as the short-run matrices to identify the model. From the SVAR estimates we can see that the coefficients for C(2), C(3) and C(4) are all significant at their respective values. The value of 0.0097 for C(1) however is not signficant due to the p-value of 0.5807. From the Impulse response functions we can see that shape of most of the functions are similar to those that were obtained in Case 1 with a few exceptions. For example, the response of Unemployment to Shock 1 has a hump-shape that is much larger than that of the response of unemployment to inflation as obtained in Case 1. In general, it appears as though the variability in the Impulse response functions is greater in Case 2 than in Case 1. Upon investigating the Variance decomposition of inflation we can see that at the forecast horizon of 12, the variance is decomposed as 55.47% (Shock1), 5.41% (Shock2) and 39.12% (Shock3). From the variance decomposition of unemployment at the forecast horizon of 12, the variance is decomposed as 54.53% (Shock1), 6.70% (Shock2) and 38.77% (Shock3). Finally, from the variance decomposition of the Federal funds rate we can see that at the forecast horizon of 12, the variance is decomposed as 43.66% (Shock1), 11.44% (Shock2) and 44.90% (Shock3).