A Reproduction and Extension of “A New Measure of Monetary Shocks: Derivation and Implications” by Christina Romer and David Romer

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For my econometrics paper I will replicate “A New Measure of Monetary Shocks: Derivation and Implications” by Christina Romer and David Romer.

In this paper Romer and Romer address the difficulty in measuring the effects of monetary policy as the Federal Reserve conducts it. In part I of this paper they analyze data from 1969 to 1996, a time period in which the Federal Reserve had not been consistent in its use of policy instruments, making any measurement of the effects of policy very difficult. To combat this, the authors construct a measure of monetary policy that is based on what the authors refer to as an intended federal funds rate, which is determined by a detailed analysis of the Federal Reserve’s account of FOMC meetings. In looking at the information from every meeting, the authors construct a data point that represents the intended rate for that meeting. The hope is that the data created from this process will eliminate the effects of endogenous changes in the money supply or any changes in interest rates made by the Federal Reserve in anticipation of future events.

In part II of their paper, Romer and Romer use the new measure of monetary shocks to measure the effect of monetary policy on output and the price level. They do this by regressing the log of industrial production against the lag of itself, dummy variables and the monetary shock variable. They do the same thing for the price level.

After replicating their paper, I extend it by looking at another way in which monetary policy affects output and prices. I use the same regression as Romer and Romer, but use changes in the money supply rather than their new measure of monetary shocks.

**I. Derivation of a New Measure of Monetary Policy Shocks**

*A. Changes in the Intended Federal Funds Rate around FOMC Meetings*

To begin their analysis, Romer and Romer first derive a variable to account for the intentions of the Federal Reserve around the time of Federal Open Market Committee meetings. It is important to keep in mind that they do not use data that is reported at regular intervals such as monthly or quarterly. The time between FOMC meetings varies and so the time period between data points used in the analysis will also vary.

The authors use the intended nominal federal funds rate as an indicator of the Federal Reserve’s intentions. To construct this variable they use two sources of information: the first is a record of FOMC meetings and the second are internal memos from the Federal Reserve. The records of the FOMC meetings are obtained from *Record of Policy Actions of the Federal Open Market Committee*, the *Minutes of the Federal Open Market Committee*, the *Transcripts of the Federal Open Market Committee* and the “Bluebook” for each meeting. The internal memos are based on the *Weekly Report of the Manager of Open Market Operations* and contain information about intended rates and timing of rate changes.

*B. Controlling for the Federal Reserve’s Forecasts*

The next step in constructing their measure of monetary shocks involves eliminating any actions taken by the Federal Reserve to counteract information they have about future economic developments. All regressions in their paper use data from 1969 to 1996.

To accomplish this, Romer and Romer estimate the following equation for:

(1)

Where:

is the change in the intended funds rate around the time of FOMC meeting m.

is the level of the intended funds rate before any changes in response to FOMC m.

is the forecast of inflation.

is the forecasted real output growth.

is the unemployment rate at time m.

*Results*

In Table 1 below, the results from Romer and Romer are given along side my results from the regression equation (1). I was able to access their exact data set on Christina Romer’s website. However, given the format in which their data was provided, and the manipulation that was required to get the data into the same format that they eventually used in their regressions, my results are a bit different that what they calculated. The regression in the original paper calculated an of .28, while my calculated was .26, indicating that their regression explains a bit more of the variation in the change in the intended Federal Funds Rate. This also suggests that their residuals will be smaller. The residuals from this regression are used as the new measure of monetary shocks, and since their residuals are smaller, their monetary shocks used in the next section will be less volatile as well.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
| Table 1 - Determinants of the Change in the | | | | | | | |
| Intended Federal Funds Rate | | | | | | | |
|  |  |  | Romer and Romer Results | |  | My Results | |
|  |  |  |  |  |  |  |  |
|  |  |  | Coefficient | Standard Error |  | Coefficient | Standard Error |
| Constant |  |  | 0.171 | 0.141 |  | 0.506 | 0.191 |
| Initial level of intended funds rate | | | -0.021 | 0.012 |  | -0.018 | 0.016 |
| Forecasted output growth, | |  |  |  |  |  |  |
|  | Quarters ahead |  |  |  |  |  |  |
|  | -1 |  | 0.007 | 0.010 |  | 0.005 | 0.019 |
|  | 0 |  | 0.003 | 0.019 |  | -0.005 | 0.033 |
|  | 1 |  | 0.010 | 0.032 |  | 0.009 | 0.039 |
|  | 2 |  | 0.022 | 0.032 |  | -0.008 | 0.040 |
| Change in forecasted output | |  |  |  |  |  |  |
| growth since previous | |  |  |  |  |  |  |
| meeting, |  |  |  |  |  |  |  |
|  | Quarters ahead |  |  |  |  |  |  |
|  | -1 |  | 0.050 | 0.030 |  | 0.050 | 0.047 |
|  | 0 |  | 0.152 | 0.030 |  | 0.137 | 0.055 |
|  | 1 |  | 0.021 | 0.046 |  | 0.066 | 0.066 |
|  | 2 |  | 0.021 | 0.051 |  | 0.005 | 0.074 |
| Forecasted Inflation, | |  |  |  |  |  |  |
|  | Quarters ahead |  |  |  |  |  |  |
|  | -1 |  | 0.021 | 0.024 |  | -0.030 | 0.037 |
|  | 0 |  | -0.044 | 0.029 |  | -0.025 | 0.044 |
|  | 1 |  | 0.010 | 0.044 |  | -0.005 | 0.053 |
|  | 2 |  | 0.052 | 0.047 |  | 0.101 | 0.060 |
| Change in forecasted inflation | | |  |  |  |  |  |
| since previous meeting, | |  |  |  |  |  |  |
|  | Quarters ahead |  |  |  |  |  |  |
|  | -1 |  | 0.057 | 0.045 |  | 0.045 | 0.063 |
|  | 0 |  | 0.003 | 0.048 |  | 0.059 | 0.073 |
|  | 1 |  | 0.031 | 0.074 |  | -0.020 | 0.094 |
|  | 2 |  | -0.062 | 0.081 |  | -0.096 | 0.109 |
| Forecasted unemployment rate | | | -0.048 | 0.021 |  | -0.087 | 0.026 |
| (current quarter) | |  |  |  |  |  |  |

*C. New Measure of Monetary Shocks*

The residuals from the regression in the prior section are used as the new measure of monetary shocks and will exclude any forecast information regarding inflation and real growth. Romer and Romer provide this data in a set centered on the FOMC meetings, and also in a set where the data is aggregated into a monthly number. The monthly data is shown below, with months that included two FOMC meetings summed into one observation. It is this data that is used throughout the paper for their regressions. Table 2 shows these residuals, which are the new monetary policy shock series by month. Figure 1 plots the new series, with data being summed to show quarterly data.

*Sources of the Shocks in the New Series.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 2 - New Measure of Monetary Policy Shocks | | | | | | | | | | | | |
|  | (Percentage Points) | | | | | | | | | | | |
|  | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
| 1969 | 0.000 | 0.000 | -0.245 | 0.405 | 0.204 | -0.020 | 0.181 | 0.309 | 0.029 | 0.088 | -0.005 | 0.065 |
| 1970 | -0.160 | -0.360 | -0.140 | -0.145 | 0.300 | -0.180 | -0.243 | -0.483 | -0.272 | -0.009 | -0.346 | -0.229 |
| 1971 | -0.682 | -0.025 | -0.065 | 0.461 | 0.003 | 0.343 | -0.117 | 0.000 | 0.000 | -0.322 | -0.342 | -0.920 |
| 1972 | -0.234 | -0.086 | 0.252 | -0.104 | -0.115 | -0.050 | 0.000 | 0.000 | 0.000 | 0.000 | 0.036 | -0.027 |
| 1973 | 0.279 | 0.225 | 0.064 | -0.063 | 0.317 | 0.409 | 0.115 | 0.318 | -0.571 | -0.848 | -0.095 | -0.165 |
| 1974 | -0.206 | 0.201 | 0.733 | 0.387 | 0.392 | 0.280 | -0.091 | -0.022 | -0.430 | -0.284 | 0.336 | -0.229 |
| 1975 | -0.354 | 0.243 | -0.499 | -0.637 | 0.136 | 0.170 | 0.070 | -0.136 | -0.114 | -0.200 | -0.281 | 0.280 |
| 1976 | -0.091 | -0.469 | -0.239 | 0.139 | -0.298 | -0.038 | -0.139 | -0.044 | 0.019 | -0.041 | 0.030 | -0.131 |
| 1977 | -0.097 | -0.085 | -0.228 | -0.049 | -0.051 | -0.146 | -0.240 | 0.030 | 0.073 | -0.026 | -0.048 | -0.122 |
| 1978 | -0.205 | 0.106 | 0.042 | -0.069 | -0.216 | 0.243 | -0.142 | -0.064 | -0.156 | 0.133 | 0.168 | -0.042 |
| 1979 | 0.000 | -0.152 | 0.133 | -0.064 | 0.105 | 0.000 | 0.761 | 0.322 | -0.224 | 0.000 | 0.045 | 0.000 |
| 1980 | -0.011 | 0.197 | 1.422 | -3.221 | -0.764 | 0.000 | 0.403 | -0.198 | 0.771 | 1.218 | 1.871 | -0.634 |
| 1981 | 0.000 | -0.783 | 0.307 | 0.000 | 1.515 | 0.000 | -0.611 | -0.041 | 0.000 | -0.574 | -0.356 | 0.100 |
| 1982 | 0.000 | 1.021 | -0.435 | 0.000 | -0.056 | 0.000 | -0.196 | -0.211 | 0.000 | -0.242 | 0.125 | 0.651 |
| 1983 | 0.000 | 0.185 | 0.145 | 0.000 | -0.019 | 0.000 | -0.008 | -0.234 | 0.000 | 0.282 | -0.172 | 0.217 |
| 1984 | 0.257 | 0.000 | -0.101 | 0.000 | 0.173 | 0.000 | 0.327 | -0.061 | 0.000 | 0.035 | -0.546 | -0.144 |
| 1985 | 0.000 | -0.158 | 0.201 | 0.000 | -0.104 | 0.000 | 0.060 | 0.186 | 0.000 | 0.104 | 0.021 | -0.069 |
| 1986 | 0.000 | -0.110 | 0.000 | 0.207 | 0.076 | 0.000 | -0.168 | -0.234 | 0.001 | 0.000 | 0.021 | -0.082 |
| 1987 | 0.000 | 0.176 | 0.191 | 0.000 | 0.238 | 0.000 | -0.041 | -0.021 | -0.147 | 0.000 | -0.085 | -0.180 |
| 1988 | 0.000 | -0.224 | 0.018 | 0.000 | 0.188 | 0.308 | 0.000 | -0.182 | -0.067 | 0.000 | -0.009 | 0.446 |
| 1989 | 0.000 | 0.297 | 0.061 | 0.000 | 0.153 | 0.000 | 0.075 | -0.139 | 0.000 | -0.087 | 0.108 | -0.067 |
| 1990 | 0.000 | 0.313 | -0.094 | 0.000 | 0.044 | 0.000 | -0.066 | 0.150 | 0.000 | -0.119 | -0.018 | -0.159 |
| 1991 | 0.000 | -0.251 | 0.227 | 0.000 | 0.262 | 0.000 | -0.077 | 0.140 | 0.000 | -0.035 | -0.121 | 0.113 |
| 1992 | 0.000 | -0.004 | -0.126 | 0.000 | 0.148 | 0.000 | -0.088 | -0.003 | 0.000 | -0.175 | -0.029 | -0.237 |
| 1993 | 0.000 | 0.094 | -0.063 | 0.000 | 0.335 | 0.000 | 0.009 | 0.044 | 0.159 | 0.000 | -0.087 | -0.163 |
| 1994 | 0.000 | 0.224 | 0.313 | 0.000 | 0.287 | 0.000 | 0.070 | 0.417 | 0.041 | 0.000 | 0.549 | -0.248 |
| 1995 | 0.000 | 0.501 | 0.241 | 0.000 | 0.209 | 0.000 | -0.006 | -0.091 | 0.025 | 0.000 | 0.052 | -0.171 |
| 1996 | 0.073 | 0.000 | 0.056 | 0.000 | -0.027 | 0.000 | -0.040 | -0.065 | -0.042 | 0.000 | 0.048 | -0.029 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |

Figure 1: Measures of Monetary Policy

The monthly monetary shock series reported in Table 2 is presented above in Figure 1. In the top panel the shock series has been added together to form quarterly observations. These are compared with changes in the actual Federal Funds rate in the lower panel.

**II. Implications of the New Measure**

In this section, the new measure of monetary shocks is used to predict the effect of policy on both output and the price level.

*A. Output*

In this section, the authors explore the effect of policy on output. To do this, they regress the change in the log of industrial production on its own lagged variables, the new monetary shock variable, and monthly dummy variables. Since other variables that might affect output are controlled for in equation (1), those variables are not included in equation (2).

(2)

Where:

is the log of industrial production

is the new measure of monetary shocks

are the monthly dummy variables

The estimated effect of the new monetary shock on output is given in the graph and table below. My results in this, and the following regression match Romer and Romer’s results exactly. The graph shows the response of the log of output to a change in the new measure of monetary shocks of one percent. Initially, the effect is positive and becomes negative after about four months. It bottoms out after 22 months where the cumulative effect of monetary policy is approximately -4.3 percent, at which time output begins to rebound. We can see the same results given in Table 3, where the cumulative response is positive until month four and the maximum cumulative effect occurs after 22 months. Romer and Romer mention that the positive coefficients on the first few lags are not what they expected and are most likely due to sampling error caused by a single extreme observation.

Figure 2. The Effect Of Monetary Policy on Output as measured by

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 3 - The Impact of Monetary Policy Shocks on Industrial Production | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  |
| Monetary Policy Shock | | | | |  | Change in industrial production | | | | |
| Lag |  | Coefficient |  | Standard Error |  | Lag |  | Coefficient |  | Standard Error |
| 1 |  | 0.0038 |  | 0.0018 |  | 1 |  | 0.063 |  | 0.064 |
| 2 |  | 0.0026 |  | 0.0018 |  | 2 |  | -0.013 |  | 0.063 |
| 3 |  | -0.0038 |  | 0.0018 |  | 3 |  | 0.107 |  | 0.063 |
| 4 |  | -0.0012 |  | 0.0018 |  | 4 |  | 0.048 |  | 0.063 |
| 5 |  | -0.0039 |  | 0.0018 |  | 5 |  | 0.028 |  | 0.063 |
| 6 |  | -0.0001 |  | 0.0018 |  | 6 |  | -0.005 |  | 0.063 |
| 7 |  | -0.0008 |  | 0.0019 |  | 7 |  | 0.018 |  | 0.063 |
| 8 |  | -0.0029 |  | 0.0019 |  | 8 |  | 0.008 |  | 0.063 |
| 9 |  | -0.0021 |  | 0.0019 |  | 9 |  | 0.040 |  | 0.062 |
| 10 |  | -0.0047 |  | 0.0018 |  | 10 |  | -0.043 |  | 0.061 |
| 11 |  | -0.0025 |  | 0.0019 |  | 11 |  | 0.071 |  | 0.059 |
| 12 |  | -0.0035 |  | 0.0019 |  | 12 |  | 0.287 |  | 0.060 |
| 13 |  | -0.0021 |  | 0.0019 |  | 13 |  | 0.023 |  | 0.061 |
| 14 |  | -0.0007 |  | 0.0018 |  | 14 |  | -0.196 |  | 0.060 |
| 15 |  | -0.0003 |  | 0.0019 |  | 15 |  | -0.151 |  | 0.061 |
| 16 |  | 0.0019 |  | 0.0018 |  | 16 |  | -0.128 |  | 0.062 |
| 17 |  | -0.0009 |  | 0.0018 |  | 17 |  | 0.078 |  | 0.063 |
| 18 |  | -0.0024 |  | 0.0018 |  | 18 |  | 0.085 |  | 0.063 |
| 19 |  | -0.0023 |  | 0.0019 |  | 19 |  | 0.056 |  | 0.063 |
| 20 |  | -0.0007 |  | 0.0019 |  | 20 |  | 0.081 |  | 0.063 |
| 21 |  | -0.0011 |  | 0.0019 |  | 21 |  | -0.060 |  | 0.063 |
| 22 |  | -0.0032 |  | 0.0018 |  | 22 |  | -0.017 |  | 0.063 |
| 23 |  | 0.0015 |  | 0.0019 |  | 23 |  | -0.068 |  | 0.063 |
| 24 |  | 0.0000 |  | 0.0019 |  | 24 |  | 0.086 |  | 0.063 |
| 25 |  | -0.0001 |  | 0.0019 |  |  |  |  |  |  |
| 26 |  | 0.0000 |  | 0.0019 |  |  |  |  |  |  |
| 27 |  | -0.0007 |  | 0.0019 |  |  |  |  |  |  |
| 28 |  | 0.0038 |  | 0.0019 |  |  |  |  |  |  |
| 29 |  | 0.0013 |  | 0.0019 |  |  |  |  |  |  |
| 30 |  | 0.0035 |  | 0.0019 |  |  |  |  |  |  |
| 31 |  | 0.0018 |  | 0.0019 |  |  |  |  |  |  |
| 32 |  | 0.0009 |  | 0.0018 |  |  |  |  |  |  |
| 33 |  | 0.0014 |  | 0.0018 |  |  |  |  |  |  |
| 34 |  | 0.0047 |  | 0.0018 |  |  |  |  |  |  |
| 35 |  | 0.0011 |  | 0.0018 |  |  |  |  |  |  |
| 36 |  | 0.0024 |  | 0.0018 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

*B. Prices*

The new measure of monetary shocks can also be used to estimate the effect of monetary policy on the price level.

(3)

Where:

is the log of the producer price index

is the new measure of monetary shocks

are the monthly dummy variables

The graph shows the response of the change in the log of the Producer Price Index to a change in the new measure of monetary shocks of one percent. The shock does not have a statistically significant effect on the price level until two years after the shock. At this time, the price level decreases markedly to a maximum effect of -5.9 percent after 48 months. Although the effects are not statistically significant to begin with, they do get progressively more significant as time progresses. Romer and Romer suggest that the delays in the effects of monetary policy might be caused my some additional anticipatory actions by the Federal Reserve that have not been controlled for, but that it is plausible that the effect of monetary policy on inflation does indeed take an extended period of time as shown below.

Figure 3. The Effect Of Monetary Policy on the Price Level

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 4 - The Impact of Monetary Policy Shocks on Prices | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  |
| Monetary Policy Shock | | | | |  | Change in producer prices | | | | |
| Lag |  | Coefficient |  | Standard Error |  | Lag |  | Coefficient |  | Standard Error |
| 1 |  | 0.0006 |  | 0.0009 |  | 1 |  | 0.192 |  | 0.065 |
| 2 |  | 0.0001 |  | 0.0009 |  | 2 |  | 0.002 |  | 0.065 |
| 3 |  | -0.0005 |  | 0.0009 |  | 3 |  | -0.038 |  | 0.065 |
| 4 |  | 0.0010 |  | 0.0009 |  | 4 |  | -0.098 |  | 0.065 |
| 5 |  | 0.0014 |  | 0.0009 |  | 5 |  | 0.009 |  | 0.066 |
| 6 |  | -0.0006 |  | 0.0009 |  | 6 |  | 0.107 |  | 0.065 |
| 7 |  | 0.0001 |  | 0.0009 |  | 7 |  | -0.056 |  | 0.065 |
| 8 |  | 0.0005 |  | 0.0009 |  | 8 |  | 0.050 |  | 0.065 |
| 9 |  | -0.0013 |  | 0.0009 |  | 9 |  | 0.074 |  | 0.065 |
| 10 |  | 0.0009 |  | 0.0009 |  | 10 |  | -0.049 |  | 0.065 |
| 11 |  | -0.0016 |  | 0.0009 |  | 11 |  | 0.087 |  | 0.065 |
| 12 |  | -0.0003 |  | 0.0009 |  | 12 |  | 0.127 |  | 0.065 |
| 13 |  | 0.0001 |  | 0.0009 |  | 13 |  | -0.071 |  | 0.065 |
| 14 |  | -0.0002 |  | 0.0009 |  | 14 |  | -0.020 |  | 0.064 |
| 15 |  | 0.0010 |  | 0.0009 |  | 15 |  | -0.019 |  | 0.064 |
| 16 |  | -0.0004 |  | 0.0009 |  | 16 |  | -0.018 |  | 0.063 |
| 17 |  | 0.0003 |  | 0.0009 |  | 17 |  | 0.056 |  | 0.063 |
| 18 |  | -0.0012 |  | 0.0009 |  | 18 |  | 0.029 |  | 0.063 |
| 19 |  | 0.0005 |  | 0.0009 |  | 19 |  | 0.009 |  | 0.062 |
| 20 |  | -0.0020 |  | 0.0009 |  | 20 |  | 0.093 |  | 0.063 |
| 21 |  | 0.0002 |  | 0.0009 |  | 21 |  | 0.004 |  | 0.063 |
| 22 |  | -0.0001 |  | 0.0009 |  | 22 |  | -0.004 |  | 0.063 |
| 23 |  | -0.0013 |  | 0.0009 |  | 23 |  | -0.057 |  | 0.062 |
| 24 |  | -0.0019 |  | 0.0009 |  | 24 |  | 0.045 |  | 0.061 |
| 25 |  | -0.0024 |  | 0.0009 |  |  |  |  |  |  |
| 26 |  | -0.0025 |  | 0.0010 |  |  |  |  |  |  |
| 27 |  | -0.0017 |  | 0.0010 |  |  |  |  |  |  |
| 28 |  | -0.0002 |  | 0.0010 |  |  |  |  |  |  |
| 29 |  | -0.0022 |  | 0.0010 |  |  |  |  |  |  |
| 30 |  | -0.0033 |  | 0.0010 |  |  |  |  |  |  |
| 31 |  | -0.0031 |  | 0.0010 |  |  |  |  |  |  |
| 32 |  | -0.0006 |  | 0.0010 |  |  |  |  |  |  |
| 33 |  | -0.0013 |  | 0.0010 |  |  |  |  |  |  |
| 34 |  | -0.0010 |  | 0.0010 |  |  |  |  |  |  |
| 35 |  | -0.0015 |  | 0.0010 |  |  |  |  |  |  |
| 36 |  | -0.0033 |  | 0.0010 |  |  |  |  |  |  |
| 37 |  | -0.0019 |  | 0.0010 |  |  |  |  |  |  |
| 38 |  | -0.0016 |  | 0.0010 |  |  |  |  |  |  |
| 39 |  | 0.0001 |  | 0.0010 |  |  |  |  |  |  |
| 40 |  | -0.0017 |  | 0.0010 |  |  |  |  |  |  |
| 41 |  | -0.0007 |  | 0.0010 |  |  |  |  |  |  |
| 42 |  | -0.0029 |  | 0.0010 |  |  |  |  |  |  |
| 43 |  | -0.0013 |  | 0.0010 |  |  |  |  |  |  |
| 44 |  | -0.0003 |  | 0.0009 |  |  |  |  |  |  |
| 45 |  | -0.0014 |  | 0.0009 |  |  |  |  |  |  |
| 46 |  | 0.0001 |  | 0.0009 |  |  |  |  |  |  |
| 47 |  | -0.0015 |  | 0.0009 |  |  |  |  |  |  |
| 48 |  | -0.0008 |  | 0.0009 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

**III. Expanding the Model**

Romer and Romer declare that their new monetary measure is better than the actual Federal Funds rate at predicting changes in the price level and output. They do not compare the predictive capacity of the new monetary measure with that of changes in the money supply so I will do that here. To do this, I obtained money supply data for the period of the first quarter of 1970 to the last quarter of 2000 from the Federal Reserve website. I then took the difference in the logs from one period to the next to get my measure of money supply change for use in equations 4 and 5 below. The natural log of the money supply is used in equations 6 and 7 below.

*A. Output*

In this equation I explore whether or not changes in the money supply will give information regarding the future value of output, given past values of output. I do this using the same basic format as was used by Romer and Romer, only replacing their new measure of monetary shocks with the difference in the log of M2. I also decrease the number of lags used.

(4)

Where:

is the log of industrial production

is the difference of the natural log of M2

are the monthly dummy variables

Test:

F( 24, 288) = 1.18

Prob > F = 0.2571

We fail to reject because our test statistic is greater than .05. The individual coefficients are also statistically insignificant. The results are shown below. The graph shows the response of the change in the log of industrial production to a change in the natural log of M2. The shock does not have a statistically significant effect on industrial production as show, according to a Wald test. The effect of the change in money supply varies wildly. This, in addition to the hypothesis test, indicates a probable mis-specification of the model that I will try to remedy in section III-C.

Figure 4. The Effect Of Monetary Policy on Output

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 5 - The Impact of Monetary Policy Shocks on Output | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  |
| Money Supply Changes | | | | |  | Change in Producer Prices | | | | |
| Lag |  | Coefficient |  | Standard Error |  | Lag |  | Coefficient |  | Standard Error |
| 1 |  | 1.4193 |  | 0.9891 |  | 1 |  | 0.1252 |  | 0.0585 |
| 2 |  | -0.6319 |  | 1.3468 |  | 2 |  | 0.0152 |  | 0.0583 |
| 3 |  | -2.2255 |  | 1.3623 |  | 3 |  | 0.0936 |  | 0.0586 |
| 4 |  | 1.4488 |  | 1.3600 |  | 4 |  | 0.0822 |  | 0.0580 |
| 5 |  | -0.3942 |  | 1.3618 |  | 5 |  | 0.0217 |  | 0.0578 |
| 6 |  | 0.6728 |  | 1.3590 |  | 6 |  | -0.0003 |  | 0.0573 |
| 7 |  | -0.0147 |  | 1.3578 |  | 7 |  | 0.0075 |  | 0.0573 |
| 8 |  | 0.6915 |  | 1.3543 |  | 8 |  | -0.0308 |  | 0.0562 |
| 9 |  | 1.0453 |  | 1.3553 |  | 9 |  | 0.0289 |  | 0.0561 |
| 10 |  | -2.0562 |  | 1.3494 |  | 10 |  | -0.0659 |  | 0.0556 |
| 11 |  | -0.0922 |  | 1.3561 |  | 11 |  | 0.0075 |  | 0.0554 |
| 12 |  | 1.2671 |  | 1.3518 |  | 12 |  | 0.2206 |  | 0.0557 |
| 13 |  | -0.5055 |  | 1.3508 |  | 13 |  | -0.0328 |  | 0.0559 |
| 14 |  | -0.9007 |  | 1.3632 |  | 14 |  | -0.1608 |  | 0.0558 |
| 15 |  | -1.7695 |  | 1.3626 |  | 15 |  | -0.1084 |  | 0.0561 |
| 16 |  | -0.8653 |  | 1.3674 |  | 16 |  | -0.0713 |  | 0.0559 |
| 17 |  | 1.9359 |  | 1.3612 |  | 17 |  | 0.1531 |  | 0.0566 |
| 18 |  | 1.3612 |  | 1.3685 |  | 18 |  | 0.0430 |  | 0.0572 |
| 19 |  | 0.7416 |  | 1.3696 |  | 19 |  | 0.0230 |  | 0.0575 |
| 20 |  | 1.3628 |  | 1.3724 |  | 20 |  | -0.0047 |  | 0.0575 |
| 21 |  | -1.6926 |  | 1.3745 |  | 21 |  | -0.1397 |  | 0.0573 |
| 22 |  | -1.3607 |  | 1.3712 |  | 22 |  | -0.0841 |  | 0.0577 |
| 23 |  | -0.9968 |  | 1.3530 |  | 23 |  | -0.1252 |  | 0.0578 |
| 24 |  | 1.5677 |  | 0.9524 |  | 24 |  | 0.1100 |  | 0.0577 |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

*B. Prices*

In this equation I explore whether or not changes in the money supply will give information regarding future price levels, given past values of the price level. I do this using the same basic format as was used by Romer and Romer, only replacing their new measure of monetary shocks with the difference in the log of M2. I also decrease the number of lags used.

(5)

Where:

is the log of the producer price index

is the difference of the natural log of M2

are the monthly dummy variables

Test:

F( 1, 288) = 0.31

Prob > F = 0.5770

With this regression I was trying to use the format that Romer and Romer introduced, while using the money supply instead of their new monetary shock. We fail to reject because our test statistic is greater than .05. The individual coefficients, given in Table 6 below are insignificant as well. Figure 5 below shows the cumulative percentage change in price level after a money supply shock, and it shows no trend or convergence to a steady state. While still keeping to Romer’s format, I change this model in section III-D to see if I can get a better fit.

Figure 5. The Effect Of Monetary Policy on the Price Level

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 6 - The Impact of Monetary Policy Shocks on Prices | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  |
| Money Supply Changes | | | | |  | Change in Producer Prices | | | | |
| Lag |  | Coefficient |  | Standard Error |  | Lag |  | Coefficient |  | Standard Error |
| 1 |  | 0.2125335 |  | 0.4753978 |  | 1 |  | 0.2338499 |  | 0.0587823 |
| 2 |  | 0.2662974 |  | 0.6555919 |  | 2 |  | 0.0821793 |  | 0.0594383 |
| 3 |  | -0.6387066 |  | 0.6576344 |  | 3 |  | -0.0379855 |  | 0.0590891 |
| 4 |  | 0.3149748 |  | 0.6561464 |  | 4 |  | -0.0114856 |  | 0.0589957 |
| 5 |  | -0.3748317 |  | 0.6559484 |  | 5 |  | 0.0935221 |  | 0.0589325 |
| 6 |  | 0.351792 |  | 0.655689 |  | 6 |  | 0.163271 |  | 0.0590785 |
| 7 |  | -0.4067632 |  | 0.6580804 |  | 7 |  | -0.0107273 |  | 0.0601679 |
| 8 |  | 0.0898329 |  | 0.6583714 |  | 8 |  | 0.0445248 |  | 0.0601634 |
| 9 |  | -0.1956109 |  | 0.6580577 |  | 9 |  | 0.0830235 |  | 0.060175 |
| 10 |  | 0.6291185 |  | 0.6563909 |  | 10 |  | -0.0522184 |  | 0.0606657 |
| 11 |  | -0.4547817 |  | 0.6573872 |  | 11 |  | 0.1188615 |  | 0.0598515 |
| 12 |  | 1.34099 |  | 0.6539194 |  | 12 |  | 0.1314924 |  | 0.0597912 |
| 13 |  | 0.1748236 |  | 0.6561817 |  | 13 |  | -0.1098675 |  | 0.0597516 |
| 14 |  | -1.439924 |  | 0.6598217 |  | 14 |  | -0.0169544 |  | 0.059751 |
| 15 |  | 0.5487263 |  | 0.6662921 |  | 15 |  | 0.0321482 |  | 0.0595762 |
| 16 |  | -0.2931077 |  | 0.6668876 |  | 16 |  | -0.0102447 |  | 0.0589316 |
| 17 |  | -0.8635072 |  | 0.6688868 |  | 17 |  | 0.0627761 |  | 0.0588234 |
| 18 |  | 1.007333 |  | 0.6709311 |  | 18 |  | 0.0731507 |  | 0.0588274 |
| 19 |  | -0.8693363 |  | 0.6635634 |  | 19 |  | -0.0319439 |  | 0.0580732 |
| 20 |  | 0.2563604 |  | 0.6662745 |  | 20 |  | 0.0450368 |  | 0.0578774 |
| 21 |  | 1.405199 |  | 0.6650782 |  | 21 |  | -0.0379239 |  | 0.0578969 |
| 22 |  | -0.4075837 |  | 0.6669574 |  | 22 |  | -0.0225357 |  | 0.0578155 |
| 23 |  | -0.9097522 |  | 0.6624083 |  | 23 |  | -0.1565831 |  | 0.057568 |
| 24 |  | 0.2611272 |  | 0.4676439 |  | 24 |  | 0.0333206 |  | 0.0569613 |
|  |  |  |  |  |  |  |  |  |  |  |

*C. Output*

In this equation I explore whether or not changes in the money supply will give information regarding the future value of output, given past values of output. I do this using the same basic format as was used by Romer and Romer, only replacing their new measure of monetary shocks with the log of M2. I also decrease the number of lags used. The formula used in this section differs slightly from that used in section IIIA, where I used the difference in the logs of M2.

(6)

Where:

is the log of industrial production

is the log of M2

are the monthly dummy variables

Test:

F( 24, 288) = 1.75

Prob > F = 0.0177

We reject because our test statistic is less than .05. However, in looking at the hypothesis tests for the individual coefficients, we see that they are all insignificant at the 5% level. This indicates multicoliniarity in the model.

The results are shown below. The graph shows the response of the change in the log of industrial production to a change in the natural log of M2. The effect of the change in money supply varies wildly. This, in addition to the hypothesis test results indicate that the probable mis-specification of the model encountered in section III-A has not been remedied.

Figure 6. The Effect Of Monetary Policy on Output

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 7 - The Impact of Monetary Policy Shocks on Output | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  |
| Money Supply Changes | | | | |  | Change in Output | | | | |
| Lag |  | Coefficient |  | Standard Error |  | Lag |  | Coefficient |  | Standard Error |
| 1 |  | 0.4070859 |  | 0.234423 |  | 1 |  | 0.1211353 |  | 0.0584738 |
| 2 |  | -0.5142769 |  | 0.4498403 |  | 2 |  | 0.0175996 |  | 0.0586416 |
| 3 |  | -0.1285572 |  | 0.4830636 |  | 3 |  | 0.1107118 |  | 0.0582021 |
| 4 |  | 0.3689134 |  | 0.4834395 |  | 4 |  | 0.0984258 |  | 0.0580999 |
| 5 |  | -0.5564354 |  | 0.4835274 |  | 5 |  | 0.0016618 |  | 0.0576026 |
| 6 |  | 0.8675881 |  | 0.4867082 |  | 6 |  | 0.0178877 |  | 0.0573368 |
| 7 |  | -0.7082929 |  | 0.4920682 |  | 7 |  | 0.0201541 |  | 0.057361 |
| 8 |  | 0.5326042 |  | 0.5049709 |  | 8 |  | -0.0437719 |  | 0.0560545 |
| 9 |  | 0.0753774 |  | 0.5282308 |  | 9 |  | 0.0150559 |  | 0.0556409 |
| 10 |  | -0.4126972 |  | 0.5343691 |  | 10 |  | -0.0891197 |  | 0.0551587 |
| 11 |  | -0.0585001 |  | 0.5343561 |  | 11 |  | 0.005314 |  | 0.0549749 |
| 12 |  | 0.3079646 |  | 0.5336649 |  | 12 |  | 0.2407395 |  | 0.0555689 |
| 13 |  | -0.0249797 |  | 0.5294028 |  | 13 |  | -0.0447603 |  | 0.0568125 |
| 14 |  | 0.0682276 |  | 0.5237032 |  | 14 |  | -0.1493188 |  | 0.0570389 |
| 15 |  | -0.8550317 |  | 0.5232788 |  | 15 |  | -0.0961636 |  | 0.057064 |
| 16 |  | 0.1973581 |  | 0.5257727 |  | 16 |  | -0.0689915 |  | 0.0566462 |
| 17 |  | 0.5007682 |  | 0.5207102 |  | 17 |  | 0.142555 |  | 0.0567653 |
| 18 |  | -0.3101217 |  | 0.5189464 |  | 18 |  | 0.0511222 |  | 0.0570885 |
| 19 |  | 0.9200421 |  | 0.5176759 |  | 19 |  | 0.0047309 |  | 0.0573728 |
| 20 |  | -0.455379 |  | 0.5200655 |  | 20 |  | 0.0082261 |  | 0.0572788 |
| 21 |  | -0.4982836 |  | 0.5203624 |  | 21 |  | -0.1398349 |  | 0.0569814 |
| 22 |  | 0.633244 |  | 0.5212785 |  | 22 |  | -0.0811115 |  | 0.0571336 |
| 23 |  | -0.8008579 |  | 0.4770412 |  | 23 |  | -0.1405082 |  | 0.0571822 |
| 24 |  | 0.4450874 |  | 0.2366849 |  | 24 |  | 0.1113859 |  | 0.0570632 |
|  |  |  |  |  |  |  |  |  |  |  |

*D. Prices*

In this equation I explore whether or not changes in the money supply will give information regarding future price levels, given past values of the price level. I do this using the same basic format as was used by Romer and Romer, only replacing their new measure of monetary shocks with the difference in the log of M2. I also decrease the number of lags used. The formula used in this section differs slightly from that used in section IIIA, where I used the difference in the logs of M2.

(7)

Where:

is the log of the producer price index

is the log of M2

are the monthly dummy variables

Test:

F( 24, 288) = 1.45

Prob > F = 0.0816

We fail to reject because our test statistic is greater than .05. The individual coefficients, given in Table 8 below are insignificant as well. Figure 7 below shows the cumulative percentage change in price level after a money supply shock, and it shows no trend or convergence to a steady state. The goal here was to determine if the format used by Romer and Romer could be used with money supply changes instead of their new measure of monetary shocks.

Figure 7. The Effect Of Monetary Policy on Output

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |
| Table 8 - The Impact of Monetary Policy Shocks on Prices | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  |
| Money Supply Changes | | | | |  | Change in Producer Prices | | | | |
| Lag |  | Coefficient |  | Standard Error |  | Lag |  | Coefficient |  | Standard Error |
| 1 |  | 0.0180138 |  | 0.1111724 |  | 1 |  | 0.2572195 |  | 0.0588208 |
| 2 |  | 0.0499193 |  | 0.2147595 |  | 2 |  | 0.0621388 |  | 0.0599198 |
| 3 |  | -0.1142452 |  | 0.2298794 |  | 3 |  | -0.0477995 |  | 0.0600388 |
| 4 |  | 0.0901149 |  | 0.2294678 |  | 4 |  | 0.0082951 |  | 0.0598888 |
| 5 |  | -0.1363823 |  | 0.2291777 |  | 5 |  | 0.0875764 |  | 0.0592372 |
| 6 |  | 0.2971186 |  | 0.2294277 |  | 6 |  | 0.1548754 |  | 0.0594678 |
| 7 |  | -0.4257466 |  | 0.2307458 |  | 7 |  | -0.0156552 |  | 0.0602487 |
| 8 |  | 0.2740455 |  | 0.2366739 |  | 8 |  | 0.0515943 |  | 0.0597648 |
| 9 |  | -0.1570486 |  | 0.2472231 |  | 9 |  | 0.0949473 |  | 0.0598074 |
| 10 |  | 0.2107778 |  | 0.2501873 |  | 10 |  | -0.061199 |  | 0.0601324 |
| 11 |  | -0.2725543 |  | 0.2507668 |  | 11 |  | 0.127978 |  | 0.0602789 |
| 12 |  | 0.4882659 |  | 0.2516079 |  | 12 |  | 0.1192939 |  | 0.0599004 |
| 13 |  | -0.2153436 |  | 0.2532941 |  | 13 |  | -0.0982857 |  | 0.0598998 |
| 14 |  | -0.2744812 |  | 0.2531674 |  | 14 |  | -0.0284276 |  | 0.0596367 |
| 15 |  | 0.4870174 |  | 0.2538293 |  | 15 |  | 0.0296764 |  | 0.059259 |
| 16 |  | -0.5209846 |  | 0.2559204 |  | 16 |  | -0.0211506 |  | 0.0583952 |
| 17 |  | 0.1130449 |  | 0.2574885 |  | 17 |  | 0.0732524 |  | 0.0583047 |
| 18 |  | 0.3848438 |  | 0.2569594 |  | 18 |  | 0.0581746 |  | 0.0585099 |
| 19 |  | -0.6216451 |  | 0.2579369 |  | 19 |  | -0.0250665 |  | 0.0574888 |
| 20 |  | 0.3613321 |  | 0.2599615 |  | 20 |  | 0.0524553 |  | 0.0571891 |
| 21 |  | 0.1392277 |  | 0.2610594 |  | 21 |  | -0.0367052 |  | 0.0572709 |
| 22 |  | -0.2748671 |  | 0.2622762 |  | 22 |  | -0.0264287 |  | 0.0572612 |
| 23 |  | 0.1934988 |  | 0.2382831 |  | 23 |  | -0.145086 |  | 0.0570185 |
| 24 |  | -0.0936482 |  | 0.1166664 |  | 24 |  | 0.0187489 |  | 0.0558618 |
|  |  |  |  |  |  |  |  |  |  |  |

Again, this paper duplicated the work of Romer and Romer and expanded on it to include the effects of changes in the money supply on measures of output and the price level. Romer’s work found that their new measure of monetary shocks was a better predictor of changes in output and the price level than were interest rates. They found that a one percent change in their monetary shock was associated with an initial positive and then substantially negative impact on output. A one percent change in the monetary shock measure did not affect the price level for two years, at which time the negative effect was substantial.

In expanding on their subject matter, I started by using their formula exactly to explore the effect of a change in the money supply on output and the Producer Price Index. My results did not show a clear, long-term effect like Romer and Romer discovered. I then used the log of the money supply to try again, and again the results did not show a clear pattern.

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