Econometrics Paper Requirement

Daniel T. Brown*

1 Forecasting with Asymmetric Information

I replicate and extend some of the results in Romer and Romer's "Federal Reserve Information and the Behavior of Interest Rates." I also show that, with a different specification of Monetary Policy dummy variables, some of the Romers' results are weaker. It is difficult to determine how forecasters respond to the Federal Reserve's actions and whether their response is due to the revelation of superior information.

1.1 Data

I use data from Romer and Romer's *Federal Reserve Information and the Behavior of Interest Rates.* American Economic Review, June 2000. I obtained Forecast Data (inflation, and GNP) from the Federal Reserve and the Survey of Private Forecasters (SPF) along with other macroeconomic data used in the paper. I did not have access to forecast data from DRI and BlueChip, which are also used in the paper. This Data roughly spans 1966-1991. I obtained this quarterly and monthly data in various Excel sheets and then merged it together in STATA. The Federal Reserve's forecasts were usually monthly while the SPF's forecasts were released at the end of the second month of each quarter. The percent change in the GNP deflator was used for actual inflation.

1.2 Regressions

The Romers' first check whether or not inflation forecasts contain information about actual inflation.

$$\pi_{ht} = \alpha + \beta\hat{\pi}_{ht} + \epsilon_{ht} \tag{1}$$

Note that π_{ht} is actual inflation h quarters after month t and $\hat{\pi}_{ht}$ is the forecast in month t. Table 1 and 2 gives the results of this rationality check and they are identical to Romers' results, except for small differences in the standard error. These difference's arise since I use Newey-West standard errors to correct for serial correlation, while they use a Hansen Hodrick procedure for most of the point estimates in Table 1-3 (and Newey-West when

*I am grateful to Justin Smith for his help with STATA and LaTeX.

above method has undefined standard errors). $\hat{\pi}^C_{ht}$ and $\hat{\pi}^F_{ht}$ are the commercial and Fed Reserve forecast. The horizon refers to how many quarters ahead the Fed or SPF are forecasting. For all horizons of the Fed's forecast and most horizons of the SPF's, β is close to one and significant, indicating forecast rationality.

The Romer's then check for the existence of asymmetric information between the Federal Reserve and the public by comparing forecasts of inflation to actual inflation. Commercial forecasts (SPF) represent information available to market participants or the the public.

$$\pi_{ht} = \delta + \gamma_C \hat{\pi}^C_{ht} + \gamma_F \hat{\pi}^F_{ht} + \upsilon_{ht} \tag{2}$$

Table 3 gives the results and they are identical to Romer's except for small differences in the standard error. Point estimates for γ_F are close to one and highly significant. The Fed has valuable information not contained in the commercial forecasts.

Table 1: Rationality Tests for Inflation Forecasts (SPF)

$$\pi_{ht} = \alpha + \beta \hat{\pi}^C_{ht} + \epsilon_{ht}$$

horizon	0	1	2	3	4
β	1.051	0.973	0.895	0.714	0.649
	(0.087)	(0.112)	(0.156)	(0.217)	(0.260)
α	-0.116	0.423	0.878	1.757	2.078
	(0.421)	(0.572)	(0.860)	(1.228)	(1.426)
R^2	0.706	0.500	0.328	0.199	0.162
N	93	93	93	93	88

Table 2: Rationality Tests for Inflation Forecasts (Fed)

$$\pi_{ht} = \alpha + \beta \hat{\pi}^F_{ht} + \epsilon_{ht}$$

horizon	0	1	2	3	4	5	6	7
β	1.025	1.001	0.950	1.028	1.053	1.063	1.094	1.028
	(0.051)	(0.078)	(0.102)	(0.108)	(0.130)	(0.191)	(0.247)	(0.271)
α	0.033	0.342	0.736	0.339	0.119	-0.164	-0.801	-1.195
	(0.246)	(0.358)	(0.477)	(0.559)	(0.752)	(1.066)	(0.950)	(1.050)
R^2	0.783	0.600	0.440	0.428	0.384	0.341	0.470	0.527
N	251	242	224	207	177	118	61	38

The Romer's then use the following regression to show that the Fed's monetary actions can reveal information about how their forecast is systematically different than commercial

forecasts.

$$\hat{\pi}^F_{ht} = \psi + \theta M_t + \phi \hat{\pi}^C_{ht} + \omega_{ht} \tag{3}$$

Note that M_t is the Fed's monetary action at date t. It is measured by a dummy for Fed action, where it is +1 when the Fed tightened in a given month, -1 when it loosened and zero in other months. Table 4 gives the results and they are identical to Romers'. Robust standard errors are given in parentheses. The Romers claim that since all the estimates of θ are positive, and some significant, "The results support the hypothesis that shifts to tighter policy signal that the Federal Reserves Forecasts are unusually high given the commercial forecasts." To explore these results further, I consider a similar regression, with different MP dummy variables.

$$\hat{\pi}^F_{ht} = \psi + \theta_1 M^T_t + \theta_2 M^L_t + \phi \hat{\pi}^C_{ht} + \omega_{ht} \tag{4}$$

M^T_t is +1 for tightening and zero otherwise and M^L_t is +1 for loosening and zero otherwise. Table 5 gives the results. While the Romer's results were marginally significant concerning MP; with these new dummy variables, all significance is lost. While the ψ and ϕ estimates change relatively little, it is suprising that the estimated coefficients on the new dummies differ so much in terms of both magnitude and sign. This suggests that Romer's Monetary Policy dummy specification is not appropriate.

Next, the Romers' try to understand how commercial forecasters respond to MP actions taken by the Fed that may reveal some of their additional information. Given the last regression, they are interested in showing whether commercial forecasters increase their inflation forecasts as a response to the Fed tightening. They consider the following regression.

$$\hat{\pi}^C_{h,t+1} = \eta + \lambda M_t + \kappa \hat{\pi}^C_{ht} + \rho(\hat{\pi}^F_{h,t+1} - \hat{\pi}^F_{ht}) + \nu_{h,t+1} \tag{5}$$

Table 3: Tests of Fed Reserve Additional Information for Inflation

$$\pi_{ht} = \delta + \gamma_c \hat{\pi}^C_{ht} + \gamma_f \hat{\pi}^F_{ht} + \nu_{ht}$$

horizon	0	1	2	3	4
γ_f	0.882	1.445	1.568	1.697	1.894
	(0.179)	(0.211)	(0.374)	(0.288)	(0.276)
γ_c	0.147	-0.469	-0.779	-0.831	-0.932
	(0.197)	(0.212)	(0.417)	(0.302)	(0.303)
δ	-0.004	0.462	1.547	1.272	0.725
	(0.389)	(0.476)	(0.648)	(0.688)	(0.766)
R^2	0.765	0.642	0.486	0.457	0.480
N	79	79	78	73	64

Table 4: Estimates of Information Revelation About Inflation

$$\hat{\pi}^F_{ht} = \psi + \theta M_t + \phi \hat{\pi}^C_{ht} + \omega_{ht}$$

horizon	0	1	2	3	4
θ	0.128	0.118	0.289	0.198	0.267
	(0.194)	(0.188)	(0.176)	(0.107)	(0.125)
ϕ	1.128	1.091	1.082	1.058	0.924
	(0.087)	(0.083)	(0.100)	(0.066)	(0.083)
ψ	-0.567	-0.519	-0.417	-0.471	0.355
	(0.420)	(0.398)	(0.465)	(0.371)	(0.379)
R^2	0.883	0.860	0.804	0.855	0.807
N	47	47	47	47	46

Table 5: Estimates of Information Revelation About Inflation with Different MP Dummies

$$\hat{\pi}^F_{ht} = \psi + \theta_1 M^T_t + \theta_2 M^L_t + \phi \hat{\pi}^C_{ht} + \omega_{ht}$$

horizon	0	1	2	3	4
θ_1	-0.037	-0.057	0.383	0.119	0.291
	(0.301)	(0.364)	(0.276)	(0.236)	(0.223)
θ_2	-0.263	-0.260	-0.215	-0.260	-0.246
	(0.278)	(0.247)	(0.288)	(0.199)	(0.233)
ϕ	1.139	1.105	1.075	1.064	0.923
	(0.086)	(0.088)	(0.101)	(0.070)	(0.085)
ψ	-0.548	-0.508	-0.423	-0.468	0.350
	(0.431)	(0.401)	(0.471)	(0.374)	(0.388)
R^2	0.884	0.862	0.804	0.856	0.807
N	47	47	47	47	46

Note that $\hat{\pi}^F_{h,t+1} - \hat{\pi}^F_{ht}$ is a proxy for recent news about inflation. The Romers' results from this regression are much weaker, but they suggest that λ is positive, which indicates that forecasters expectations respond to monetary actions as if the Fed's actions are revealing additional information. I was unable to reproduce their exact results. My results are given in Table 6. There were some delicate timing issues with the variables, but I precisely following the description given in Romers' paper. Between my results and Romer's... λ and κ are similar, while my η is positive and large and his is negative, and ρ appears to differ in a random manner. The R^2 is also different. This suggests that the data used in our regressions is different. Nonetheless, my results and Romer's suggest that λ is positive and significant (especially for higher forecast horizons). Next, I consider the same regression with the new MP policy dummy variables defined previously. The results are given in Table 7. Once again, the results regarding MP dummies are weird and do not support Romer's hypothesis about how forecasters should respond to the Fed's actions. In some cases both estimated coefficients are negative (given Romer's specification, one would expect the coefficients to be similar in magnitude and have opposite signs), although the results are hardly significant.

Table 6: Response of Inflation Forecasts to MP Actions

$$\hat{\pi}^C_{h,t+1} = \eta + \lambda M_t + \kappa \hat{\pi}^C_{ht} + \rho(\hat{\pi}^F_{h,t+1} - \hat{\pi}^F_{ht}) + \nu_{h,t+1}$$

horizon	1	2	3	4
λ	0.302	0.080	0.270	0.445
	(0.193)	(0.163)	(0.120)	(0.151)
κ	0.906	0.925	0.881	0.822
	(0.095)	(0.090)	(0.052)	(0.072)
ρ	0.036	-0.022	0.090	0.275
	(0.096)	(0.143)	(0.089)	(0.200)
η	0.466	0.360	0.645	0.857
	(0.466)	(0.448)	(0.285)	(0.370)
R^2	0.845	0.796	0.870	0.743
N	40	40	40	39

Finally, I consider the following new regressions that are similar to the previous ones. They use recent forecast error as an independent variable. Note that $\hat{\pi}^F_{h,t+1} - \hat{\pi}^F_{ht}$ is really a proxy for recent forecast error in this regression because the actual inflation data here was taken from revisions that occurred less than a month after the SPF's *new* forecast. However, in most instances, the actual inflation data (which was continuously revised) would not have changed that much over a few weeks time span, or at least is highly

correlated with the revision that would have been available to the forecaster before his new forecast.

$$\hat{\pi}^C_{h,t+1} = \eta + \lambda M_t + \kappa^*(\hat{\pi}^C_{ht} - \pi_{ht}) + \rho(\hat{\pi}^F_{h,t+1} - \hat{\pi}^F_{ht}) + \nu_{h,t+1} \tag{6}$$

$$\hat{\pi}^C_{h,t+1} = \eta + \lambda_1 M^T_t + \lambda_2 M^L_t + \kappa^*(\hat{\pi}^C_{ht} - \pi_{ht}) + \rho(\hat{\pi}^F_{h,t+1} - \hat{\pi}^F_{ht}) + \nu_{h,t+1} \tag{7}$$

I am interested in the extent to which forecasters consider their recent track record when making a new forecast, although these regressions don't address this directly. The results are given in Tables 8 and 9. Although not significant, it is interesting that the estimates for λ_1 are so much larger than λ_2 (and both positive) suggesting that forecasters respond much more to tightening than loosening of Monetary Policy. It is also worthwhile to compare the results from Table 6 to Table 8 and Table 7 to 9. The estimated coefficients do not change much (except for ρ). However, the R^2 decreases a lot which suggests that this new regression is not a very good fit. Perhaps, forecasters do not respond much to recent forecast error when making a new forecast. It would be interesting to explore this further. Is it useful to consider one's past forecast error along with the Fed's MP in order to determine an optimal forecast?

Table 7: Response of Inflation Forecasts to MP Actions with Different MP Dummies

$$\hat{\pi}^C_{h,t+1} = \eta + \lambda_1 M^T_t + \lambda_2 M^L_t + \kappa\hat{\pi}^C_{ht} + \rho(\hat{\pi}^F_{h,t+1} - \hat{\pi}^F_{ht}) + \nu_{h,t+1}$$

horizon	1	2	3	4
λ_1	-0.348	-0.111	0.097	0.499
	(0.271)	(0.273)	(0.204)	(0.289)
λ_2	-0.825	-0.231	-0.412	-0.405
	(0.230)	(0.248)	(0.184)	(0.269)
κ	0.973	0.943	0.897	0.818
	(0.095)	(0.093)	(0.056)	(0.076)
ρ	0.049	-0.026	0.082	0.270
	(0.089)	(0.135)	(0.092)	(0.207)
η	0.414	0.349	0.637	0.852
	(0.453)	(0.452)	(0.284)	(0.377)
R^2	0.875	0.800	0.874	0.743
N	40	40	40	39

Table 8: Response of Inflation Forecasts to MP Actions with Recent Forecast Error

$$\hat{\pi}^C_{h,t+1} = \eta + \lambda M_t + \kappa^*(\hat{\pi}^C_{ht} - \pi_{ht}) + \rho(\hat{\pi}^F_{h,t+1} - \hat{\pi}^F_{ht}) + \nu_{h,t+1}$$

horizon	1	2	3	4
λ	0.349	0.148	0.198	0.257
	(0.382)	(0.320)	(0.283)	(0.318)
κ^*	-0.266	-0.169	-0.091	-0.257
	(0.177)	(0.142)	(0.106)	(0.101)
ρ	-0.129	-0.145	0.251	0.220
	(0.239)	(0.287)	(0.392)	(0.379)
η	5.055	5.039	5.123	4.865
	(0.239)	(0.213)	(0.188)	(0.199)
R^2	0.118	0.062	0.072	0.217
N	40	40	40	39

Table 9: Response of Inflation Forecasts to MP Actions with Recent Forecast Error and Different MP Dummies

$$\hat{\pi}^C_{h,t+1} = \eta + \lambda_1 M^T_t + \lambda_2 M^L_t + \kappa^*(\hat{\pi}^C_{ht} - \pi_{ht}) + \rho(\hat{\pi}^F_{h,t+1} - \hat{\pi}^F_{ht}) + \nu_{h,t+1}$$

horizon	1	2	3	4
λ_1	0.906	0.729	0.655	0.876
	(0.615)	(0.531)	(0.504)	(0.601)
λ_2	0.112	0.332	0.182	0.302
	(0.589)	(0.532)	(0.457)	(0.479)
κ^*	-0.267	-0.171	-0.093	-0.289
	(0.169)	(0.141)	(0.106)	(0.115)
ρ	-0.124	-0.128	0.263	0.173
	(0.231)	(0.293)	(0.380)	(0.376)
η	4.805	4.780	4.918	4.578
	(0.289)	(0.294)	(0.230)	(0.300)
R^2	0.145	0.100	0.102	0.266
N	40	40	40	39