Fall Semester '04-'05
Akila Weerapana

Lecture 17: Monetary Policy Rules for Inflation Targeting

I. OVERVIEW

- In the last lecture, we looked at the paper by Sharon Kozicki that introduced us to simple monetary policy rules, in particular the Taylor Rule and other Taylor-type rules. These policy rules were described as being of interest to both monetary policy makers and academics because they combined the best features of systematic policy making with an intuitive reaction to macroeconomic variables.
- Taylor type rules are now widely used in research on monetary policy. There are three primary areas of applications of monetary policy rules in the literature. These areas of research are
  1. Examining how different Taylor type rules perform in a macroeconomic model.
  2. Estimating Taylor-type rules that describe the monetary policy maker's behavior in different countries.
  3. Examining the historical conduct of monetary policy in an economy, using a Taylor Rule to identify the behavior of different policy regimes.
- The paper by Rudebusch and Svensson we will discuss today falls into the first category. This paper looks at the how the choice of simple monetary policy rules under different policy maker preferences in the context of an econometric model of the U.S. economy.

II. INTRODUCTION TO THE RUDEBUSCH/SVENSSON PAPER

- The paper by Rudebusch and Svensson(RS) is a good example of the coalescence of the different topics we have studied in class, in this case the topics of simple monetary rules and inflation targeting.
- In particular, RS look at the performance of monetary rules in the context of an econometric model of the U.S. economy. The paper sets the stage for assessing how the U.S. economy would have performed if policy makers had followed either the Taylor Rule or various other Taylor-type rules instead of the policy they actually followed.
- RS look at the performance of several different types of policy rules
  1. The optimal policy: the best possible monetary policy, given the macroeconomic model.
  2. Optimal Taylor-type rules: policy rules where the policy maker reacts to inflation and output gap fluctuations in the best possible fashion.
  3. Optimal Taylor-type rules with smoothing: policy rules like 2) but which include interest rate smoothing.
  4. Inflation Forecast Policy Rules: policy rules where the policy maker reacts to the forecasted value of inflation rather than to current inflation.

- RS basically present two sets of results: the first set of results compares the performance of these different rules for a given set of policy maker preferences. A
- The second set of results examines how the performance of these policy rules varies according to the preferences of the policy maker. These results are intuitive confirm that the model is also very useful for simulating what different monetary policy makers would do to the economy.
- Basically, RS's paper is a descriptive one: one that sets out to examine how the economy performs under a variety of different policy rules and policy makers.

III. THE MODEL USED BY RUDEBUSCH AND SVENSSON

- RS estimate a small backward looking model of the U.S. economy. Basically, inflation and output are assumed to depend on lagged values of each other and on the current and lagged values of the interest rate. The two equations in the RS model are

$$\begin{aligned} y_t &= \beta_{y1} y_{t-1} + \beta_{y2} y_{t-2} - \beta_r(\bar{i}_t - \bar{\pi}_t) + \eta_t \\ \pi_t &= \alpha_{\pi_1}\pi_{t-1} + \alpha_{\pi_2}\pi_{t-2} + \alpha_{\pi_3}\pi_{t-3} + \alpha_{\pi_4}\pi_{t-4} + \alpha_y y_{t-1} + \epsilon_t \end{aligned}$$

- In the above equation, y_t is the output gap (GDP-potential GDP),$\bar{i}_t$ is the 4 quarter average nominal interest rate $\bar{i}_t = \frac{1}{4}\sum_{j=1}^{4} i_{t-j}$ and $\bar{\pi}_t$ is the 4 quarter average inflation rate $\bar{\pi}_t = \frac{1}{4}\sum_{j=1}^{4} \pi_{t-j}$
- If you look closely, the first equation is essentially an AD curve, with a couple of exceptions. First, the negative relationship is between the real interest rate and the *output gap*, not a negative relationship is between the real interest rate and output. Second, some lagged output terms are also used to describe its behavior because serial correlation in output may be high in the short run (a recession/boom last period may still linger this period).
- The second equation is a Phillips Curve with expected inflation expressed as the weighted sum of inflation in the last four periods. RS then estimate the model using quarterly U.S. data for the period 1961:1 to 1996:2. They find the following parameter estimates

$$\begin{aligned} y_t &= 1.16 y_{t-1} - 0.25 y_{t-2} - 0.10(\bar{i}_t - \bar{\pi}_t) + \eta_t \\ \pi_t &= 0.7\pi_{t-1} - 0.10\pi_{t-2} + 0.28\pi_{t-3} + 0.12\pi_{t-4} + 0.14 y_{t-1} + \epsilon_t \end{aligned}$$

- The shocks to inflation (ϵ) have a standard deviation of 1% and the shocks to the output gap (η) have a standard deviation of 0.82%.
- Since the model is a backward looking model, it is vulnerable to the Lucas Critique: changes in monetary policy may affect the parameter estimates of the model and make it less suitable for the type of exercise that RS carry out here. However, as RS point out in the paper, the parameters of the model are robust across different sub-samples, so that actual changes in policy regimes do not shift the parameters of the model around too much.
- RS also present an exhaustive comparison of their model to other VAR and non-VAR models to show that the parameter values are reasonable. This is presented in section 2.3 in the paper. Basically, the authors show that their model is similar to much larger econometric models used by the Federal Reserve Board's economists.

- The next step before using the model to analyze policy rules is to describe the policy maker's behavior. RS use a loss function of the form

$$L_t = \bar{\pi}_t^2 + \lambda y_t^2 + \nu(i_t - i_{t-1})^2$$

- In this loss function, λ is the weight on output fluctuations relative to inflation fluctuations, for example, a value of $\lambda = 2$ means that the policy maker cares twice as much about output fluctuations than about inflation fluctuations while a value of $\lambda = 0.2$ means that the policy maker cares only 1/5th as much about output fluctuations as she does about inflation fluctuations.
- Accordingly, ν is the weight on interest rate fluctuations relative to inflation fluctuations.
- The policy maker's task is to pick policy so as to minimize the above loss function given that the economy is described by the two equations we estimated before. You can skip over the section that describes how to calculate the solutions under different policy scenarios; basically the parts in section 3 including and following section 3.3.
- The rest of the analysis that matters to you appears in Section 4, and in particular in Tables 3 through 7 of the paper. First, focus on Table 3, in particular on the first 7 rows of Table 3. These 7 rules are what are known as "instrument rules": monetary policy is described *explicitly* as a function of macroeconomic variables.
- The 7 rules described in the table are as follows:
  1. The optimal policy (i.e. the best possible result that the policy maker can achieve by reacting to all information).
  2. Optimal Taylor type rule: the best possible Taylor-type rule the policy maker can follow: in this case the rule has reaction coefficients of 2.72 on inflation and 1.57 on output: much higher than in the basic Taylor Rule.
  3. Inflation forecast rule: the possible rule in which the only variable that the policy maker reacts to is an eight quarter ahead forecast of inflation.
  4. Inflation forecast rule with output: same as Rule 3 but allows the policy maker to react to the output gap as well as to forecasted inflation.
  5. Optimal Taylor type rule with smoothing: Similar to Rule 2 but with the addition of an interest rate smoothing term, the coefficient on the lagged interest rate is given by the value h in the table.
  6. Inflation forecast rule with smoothing: similar to Rule 3 but with an interest rate smoothing term.
  7. Inflation forecast rule with output and smoothing: similar to Rule 4 but with a smoothing term.
- Rules 3,4,6 and 7 are what are called "constant interest rate forecasts". In the forecast rules, the policymaker sets interest rates according to the forecast of future inflation that is made assuming interest rates are held constant. More simply, if the policymaker forecasts inflation will be too high if current interest rates are held constant into the future, she will raise interest rates today. Similarly, if the policymaker forecasts inflation will be too low if current interest rates are held constant into the future, she will lower interest rates today. These rules mimic inflation targeting behavior by the policymaker.

- Rule 8 is a more complex forecast of inflation, known as a "rule consistent" forecast. A rule consistent forecast takes into account the fact that, in reality, there is two way causation: the forecast of inflation is needed to figure out the appropriate policy while the choice of the policy affects the forecasted value of inflation! Rule 8 describes a policymaker who reacts to this complex forecast.
- The remaining entries in the table, Rules 9-12 are what are called "targeting rules". Targeting rules are *implicit* rules for monetary policy. The policymaker is assumed to be driven by the objective of achieving some type of target, the resulting policy can be described by a rule known as a "targeting rule".
- These rules are broken down along two dimension, whether they refer to strict inflation targeting (policymaker cares only about inflation targets) or flexible inflation targeting (policymaker cares about minimizing inflation targets but its not the be all and end all of her goals). These are denoted SIFT or FIFT respectively (Rules 9 and 10). Rules 11 and 12 are simply the last 2 with smoothing.
- When comparing the performance of the economy under the 12 rules, there are 2 things you need to look out for: first what happens to reaction coefficients when we switch from one rule to another and second, and more importantly, how the variability of macroeconomic variables, as measured by the standard deviation, is affected by the different rules.
- Some of the interesting findings are
  1. A Taylor type rule performs almost as well as the optimal policy rule.
  2. The reaction coefficients on the optimal Taylor Rule are higher than the 1.5 and 0.5 suggested by Taylor.
  3. The smoothing rule performs better than the rule without smoothing (compare Row 2 to 5, 3 to 6 or 4 to 7). Furthermore, the reaction coefficients on inflation fall when we add interest rate smoothing, basically the policy maker does not react as strongly to inflation once we take the lagged interest rate into account.
  4. When we move from a policy rule with current inflation to a policy rule with an inflation forecast, the reaction coefficient on output falls. Basically, the reason is that much of the information on the output gap is useful for forecasting future inflation. When we use the forecasted value of future inflation, the usefulness of the output gap becomes limited and therefore the policy maker does not need to react as strongly to output.
- These results broadly hold within Tables 4 through 7. These Tables are similar to Table 3 in terms of comparing the performance of different policy rules but where they differ from Table 3 is that they look at the performance of each policy rule under different weights of λ and ν, i.e. under different policy makers.
- For example, consider a comparison of the results in Table 3 and Table 4. The primary difference is that Table 3 describes a policy maker with preferences $\lambda = 1$ and $\eta = 0.5$, basically a policy maker who cares equally about inflation and output fluctuations and only half as much about interest rate fluctuations while Table 4 describes a policy maker with preferences $\lambda = 0.2$ and $\eta = 0.5$, basically who cares relatively less about output fluctuations compared to the one in Table 3.

- The results conform broadly with intuition: the policy maker who cares relatively little about output fluctuations reacts less strongly to output (compare the values of g_y in Table 4 with those in the corresponding row of Table 3) and more strongly to inflation (compare the values of g_π in Table 4 with those in the corresponding row of Table 3).
- Furthermore, the volatility of inflation improves and the volatility of the output gap worsens when we move from the policy maker who cares relatively more about output to the one who cares relatively less.
- The remaining Tables present similar results: Table 5 increases the weight on output (i.e. compares the situation under a policy maker who cares a lot about output fluctuations), Table 6 and 7 holds the weights on output and inflation fluctuations identical to Table 2 but vary the weight on the interest rate smoothing term.
- The basic conclusion you should draw from the model is that it provides an idea of how the U.S. economy would have performed under different policy rules and under different policy makers. The results show that policy makers could have improved on the status quo by following a Taylor-type rule with interest rate smoothing and high reaction coefficients (higher than the Taylor coefficients) on inflation and output.
- Furthermore, since the results provide intuitive conclusions about the behavior of different policy makers and different policy rules, we can also use the model's predictions about the outcome in the economy under different hypothetical situations.
- If one had to make a criticism of the paper, it is that it tackles a lot of issues, without really focusing on any specific one. Therefore, one finds it very useful for thinking about a lot of issues in some detail but does not really provide in depth analysis of any given result. For example, there are many different results presented in Table 2 through 7 but RS don't really provide too much intuition or analysis of any single set of results. Nonetheless, it provides a good example of a certain type of research that is done in the literature: basically estimate a macroeconomic model of an economy and simulate different policy scenarios under the macroeconomic model.