

## Lecture 19: Monetary Policy Rules in an International Setting

### I. OVERVIEW

- For the last time, I will refer you to the three primary areas of applications of monetary policy rules in the literature
  1. Examining how different Taylor type rules perform in a macroeconomic model.
  2. Examining the historical conduct of monetary policy in an economy, using a Taylor Rule to identify the behavior of different policy regimes.
  3. Estimating Taylor-type rules that describe the monetary policy maker's behavior in different countries.
- Today's lecture looks at a paper by Clarida, Gali & Gertler that falls into the third category. The Clarida/Gali/Gertler(CGG) paper analyzes monetary policy making in six major economies: the United States, Germany, Japan, France, Britain and Italy.

### II. BASICS OF THE EXCHANGE RATE MECHANISM

- In order to understand the CGG paper, a little bit of background on the system of fixed exchange rates known as the ERM is needed. The ERM was an exchange rate system where the currencies of participating countries were allowed to fluctuate within pre-specified bands.
- There were 8 original participants in the ERM: France, Germany, Italy, Belgium, Denmark, Ireland, Luxembourg and the Netherlands. Other countries, Spain (1989), Britain (1990) and Portugal (1992) joined at subsequent times. Under the "hard" version of the ERM, each country's exchange rate was effectively allowed to fluctuate band of  $\pm 2.25\%$  against a central rate vis-a-vis the German Mark. Since this is a fairly narrow band, the countries were following an effective fixed exchange rate system.
- Under such a system, the monetary policy maker does not have complete autonomy because she has to follow monetary policy that is consistent with the band. For example, suppose that economic conditions in France were weak, warranting an interest rate cut. Suppose that Germany suddenly raised its own interest rates: this would lead to a switch away from French assets to German assets, causing the Franc to depreciate. If the French Franc was reaching the edge of their currency band then the French Central Bank would in fact have to raise interest rates, when they wanted to lower interest rates.
- In other words, being in a fixed exchange rate system means that the country in question may have to respond more to movements in the other country's interest rate rather than to their domestic macroeconomic conditions. So a monetary policy rule describing the behavior of the policy maker would include foreign variables as well as domestic variables.

### III. INTRODUCTION TO THE CLARIDA/GALI/GERTLER PAPER

- The basic motivation of the paper is that there has been a significant change in the attitudes of monetary policy makers in the major economies from tolerating inflation to fighting inflation in the period following the second oil shock in 1979. As CGG point out, this apparent change in attitude has been seemingly successful given the substantial increase in price stability that has occurred in the 80s and 90s. A secondary motivation comes from the turmoil that accompanied the collapse of the European fixed exchange rate system in 1991 and 1992. CGG want to know what lessons can be drawn from both of these experiences for the future of the European Monetary Union.
- Accordingly, CGG have two research questions. The first is to analyze what types of policy rules have helped the world's major economies achieve greater economic stability in the post-1979 period. The second is to identify the pressures that a fixed exchange rate system puts on the economies that adopt such systems.
- In order to do the study, CGG use data on two sets of countries: the G3 (the U.S., Germany and Japan) and the E3 (France, Britain and Italy) for the period since 1979. The G3 countries have central banks that conduct monetary policy relatively free of international considerations. On the other hand, the E3 countries' monetary policy over this period was extremely constrained by external factors, specifically the ERM system under which their currency was effectively fixed to Germany.
- The paper is extremely useful because we can identify both the negative aspects of a fixed exchange rate system and the positive aspects of a flexible exchange rate system; the results will help us understand why the European nations have chosen to move from a fixed exchange rate system to a single currency with an independent monetary policy maker.
- The findings of CGG confirm that policy makers in the G3 have followed a monetary policy that can be well characterized using a Taylor-type rule, where interest rates are being set in response to movements in forecasted domestic macroeconomic variables like inflation and unemployment. However, the policy of the E3 cannot be explained using a similar rule: interest rates in the E3 are driven significantly by movements in German variables: specifically by the German interest rate and the value of the German Mark.
- The findings confirm that the ERM acted as a significant external constraint on monetary policy in the E3 countries. In particular, CGG show that the interest rates in the E3 countries were higher, given the domestic conditions, than what the Bundesbank would have adopted in the face of similar economic conditions.
- So higher German interest rates, forced policy makers in the E3 countries to keep rates high even when domestic economic conditions were weak. The high interest rates put great pressure on these economies, and eventually forced some of them out of the fixed exchange rate system. The resulting turmoil may also have persuaded some of the countries (e.g. France, Italy) to adopt a different route to a more financially unified Europe under the single currency approach of the EMU. It also may have inspired the reluctance of the U.K. to join the EMU, and instead prefer to stay on the sidelines.

## IV. METHODOLOGY OF THE CLARIDA/GALI/GERTLER PAPER

- CGG estimate forward-looking reaction functions to describe the behavior of monetary policymakers in the G3 and E3. They begin with a reaction function of the form

$$i_t^* = \bar{r} + \bar{\pi} + \beta (E[\pi_{t+n}|\Omega_t] - \bar{\pi}) + \gamma (E[y_t|\Omega_t] - y^*)$$

- Note that I have used notation that is slightly different from CGG in order to better match up with our notation. In the above equation  $\Omega_t$  is the set of information available at time  $t$  and  $y$ ,  $y^*$  are the logs of output and potential output respectively.
- The basic reaction function states that the targeted interest rate is dependent on the inflation target, the equilibrium real interest rate and expectations of the output gap and inflation. So it can basically be characterized as a forward-looking Taylor-type rule.
- By combining various terms, the reaction function can be written as  $i_t^* = \alpha + \beta (E[\pi_{t+n}|\Omega_t]) + \gamma (E[x_t|\Omega_t])$  where  $x_t$  is the output gap and the constant term is a function of the equilibrium real rate and the inflation target  $\alpha = \bar{r} + (1 - \beta)\bar{\pi}$ . The inflation target and the equilibrium rate cannot be independently estimated, we need one to calculate the value of the other.
- The next step is to allow for the possibility that variables other than inflation and output forecasts enter the reaction function. This is done by adding an extra-term,  $Z_t$ , to the policy rule, so that it looks like the following:  $i_t^* = \alpha + \beta (E[\pi_{t+n}|\Omega_t]) + \gamma (E[x_t|\Omega_t]) + \xi (E[Z_t|\Omega_t])$
- Possible variables that could be included here include exchange rates, money supply or foreign interest rates.
- Finally, CGG take into account the possibility that the policy maker smoothes interest rates, so that the actual interest rate ends up being a function of both the desired rate and last period's interest rate. So the actual rate can be expressed as  $i_t = \rho i_{t-1} + (1 - \rho)i_t^*$ . This is the final equation that CGG estimate.
- The details of CGG's analysis are thoroughly presented in their paper. I will only highlight the basic findings here.

### Policy in the G3

- The reaction functions for the G3 are very similar to a Taylor Rule. The reaction coefficients on inflation and output are:

	Bundesbank	Fed	Bank of Japan
Inflation	1.31	1.83	2.04
Output	0.25	0.56	0.08

- Note that the Fed reaction function, reported here, is for post-1982 while the other two are for the post 1979 period. CGG show that money growth seemed to have an important role to play in the early period of Paul Volcker's chairmanship, a feature that has been well documented in the literature.
- So the basic result of this section is that the behavior of G3 policy makers can be well explained by a Taylor-type rule. Furthermore, all 3 policymakers clearly take inflation very seriously: a 1 percentage point increase in inflation leads the Bundesbank to raise interest rates by 131 basis points, the Federal Reserve to raise by 183 basis points and the Bank of Japan to raise by a whopping 204 basis points.

- The reaction to output is different: clearly the Fed reacts more to output fluctuations than either of the other two central banks, which is consistent with its mission which requires it to pay attention to price stability and full employment. The Bundesbank, and in particular, the Bank of Japan do not react very much to output fluctuations.
- In Tables 1, 2 and 3, CGG also show that the addition of other external variables do not change the reaction coefficients very much; indicating that G3 policy makers are primarily concerned with their own economic conditions. In Figure 2, CGG also show that the policy rule does not fit very well in the pre-1979 period, when most of these countries had greater macroeconomic volatility.

### Policy in the E3

- The reaction functions for the E3 are very different from what we found in the previous section. Tables 4-6 in CGG clarify the results for each country separately. Keep in mind that Britain, France and Italy were all part of the Exchange Rate mechanism, a system of fixed exchange rates when the currencies in these countries were de-facto tied to the German Mark. Britain was in the system from 1990-1992, France and Italy were part of it much earlier although they truly were bound to the fixed exchange rate in the period following 1990.
- So in estimating reaction functions for these E3 countries, CGG have to be careful. In the period 1990-1992, there was no effective monetary autonomy in the E3 countries. So they estimate reaction coefficients for the period leading up to the period when they joined the “hard” ERM. They then look at what the interest rates would have been in the period when these three countries were part of the “hard” ERM if they had continued to act with the same degree of monetary autonomy they had before. This is a neat trick that enables CGG to identify exactly how being in the ERM constrained the behavior of the E3 countries.
- The results in Tables 4-6 indicate that the reaction coefficients for the E3 countries were much lower than for the G3 countries. In particular, they are not much higher than 1, which is the bare minimum required to keep real interest rates constant in the face of rising inflation. So the E3 countries did not seem to be doing very much to fight inflation, at least not to the extent that the G3 countries were doing.
- So for example, a basic specification, omitting the Z variables, finds that British interest rates are high, yet react very little to British inflation. This would have to then be attributed to a high value of the constant  $\alpha$ , signifying either that the British were shooting for an unusually low inflation target or had an unusually high equilibrium real interest rate. CGG come up with a third explanation: they add the German interest rate as another explanatory variable, CGG find that a 1 percentage point increase in the German interest rate leads to a 60 basis point increase in the British interest rate. Similar results hold for France and Italy as well: French interest rates rise by 114 basis points, and Italian interest rates by 59 basis points in response to a 1% increase in German inflation [NOTE: these results are mentioned in the text but not shown in Tables 3 to 5]
- So what do these results show? Well, they show relatively weak reaction to domestic economic conditions and a substantial tendency to react to German interest rate movements. In other words, monetary policy in these countries mostly seemed to track German monetary policy, thus by extension, British, French and Italian monetary policy makers were responding more to German economic conditions than they were to their own economic conditions.

- The consequence of reacting to German variables as well as to their own economic conditions are best summarized by Figure 4, which compares the actual interest rate chosen by each country to German interest rates. Through most of the late 80s, and in particular, during the early 90s, the E3 had interest rates that were much higher than Germany.
- CGG carry out an interesting thought experiment in Figure 5. They compare the interest rate path chosen by each of the E3 countries, to what the interest would have been if they had chosen to follow the Bundesbank policy rule, which is considered to be representative of good policy making. The results in Figure 5 show that for most of the late 80s, and in particular, during the early 90s, the E3 had interest rates that were much higher than were consistent with “good” monetary policy given the existing domestic macroeconomic conditions.
- CGG then conclude that the ERM acted as a significant constraint on the monetary policy of the E3 countries: more specifically, it forced the E3 countries to adopt rates that were higher than warranted by domestic macro conditions. The basic reason was German reunification, which led the Bundesbank to significantly tighten interest rates in an attempt to control inflation. Figure 3 shows a tightening of the German interest rate in the period between 1989 and 1991. Since the E3 countries reacted substantially to German interest rates, they ended up raising interest rates as well: the effect being particularly pronounced in the hard ‘ERM’ period.
- The higher interest rates far exceeded what domestic macroeconomic conditions would dictate and the resultant downward pressure on the economy may have helped explain why these countries chose to drop out of the ERM.
- CGG also calculate something called the “stress indicator” to measure how much pressure each country in the ERM was operating under. The measure of stress they use is very simple: it is simply the difference between the actual interest rate they chose ( $i$ ) and the interest rate that they should have chosen if they had been following the Bundesbank’s reaction function ( $i^*$ ), i.e.  $s_t = i_t - i_t^*$
- Given this definition we can decompose stress into three terms:  $(i_t - i_t^g) + (i_t^g - i_t^{g*}) + (i_t^{g*} - i_t^*)$  where  $i_t^g$  is the German interest rate and  $i_t^{g*}$  is what the Germans should have chosen according to their reaction function (Note that the actual rate chosen may differ slightly from the reaction function, which is estimated using a regression).
- The first term is the interest rate differential between the country and Germany, the second is the German stress level (how much Germany was forced to deviate from its ideal policy) and the third term is the difference between the interest rates attributable to differences in macroeconomic conditions.
- The final set of figures 6 through 8, report the stress in each of the E3 countries, and the components of that stress. In all 3 countries, the stress level was very high at the moment they chose to leave the ERM. Furthermore, the stress in Britain was attributable to asynchronized output: Britain was in a recession and did not need such high interest rates, while the stress in France comes from asynchronized inflation: low inflation in France meant that they did not need such high interest rates. In contrast, the stress in Italy comes mostly from the interest rate differential. In other words Italy had to maintain a high interest rate in order to honor their commitment to a fixed exchange rate.

- In summary, CGG show that the G3 countries seemed to follow monetary policy rules with strong reaction to inflation: rules that may explain why inflation was so low in these countries following 1979. In contrast the E3 countries seemed to follow rules that reacted more to German economic conditions than to their own. As a result, the E3 consistently picked interest rates higher than what “good” policy would dictate resulting in high “stress” levels during the ERM crisis of 1992. The high stress levels helped explain why they chose to drop out of the ERM because the system was forcing them to keep interest rates higher than what they would have liked.
- Overall, the results from CGG can also help explain why the search for a financially unified Europe had to take a path that did not involve tying the currency to Germany. That search, led us to the single currency, single European monetary policy maker system that we see today with the European Central Bank and the European Monetary Union.