Lecture 5: Central Bank Mandates, a Streamlined Macro Model and a First Step at Forecasting

In the previous lecture, we learned two essential things about modern day economies. Growth is the goal and the rule. That said, economies exhibit persistent cyclical patterns. Armed with a sense of the long-term sustainable trajectory for an economy, and aware of its recent economic trajectory, we can conjecture about the future pace of economic growth. To do so, however, we need to cast one more player in this drama, the central bank.

The Federal Reserve Board

The U.S. FRB has a dual mandate. They are charged with providing the maximal low inflation and long run sustainable growth rate. They also are responsible for the safety and soundness of the U.S. banking system. Obviously, keeping banks safe is an integral part of keeping growth prospects good. But it is important to remember that the Fed’s original mandate was to protect the banking system — it was created in 1913 in response to an era of banking panics, 1873-1907. As we will learn later in this course, the FRB was created in the image of the Bank of England, itself inspired by the insights of Walter Bagehot. For now, however, we will put lender-of-last-resort issues aside. Aside from bank issues, how does the Fed decide upon monetary policy?

Step 1: They estimate potential real GDP and compare it to the actual level of real GDP. We looked at CBO’s efforts to estimate potential GDP. As a practical matter, we would argue that most forecasters use the unemployment rate and a NAIRU concept, to calculate where real the economy is relative to potential. De facto, therefore, we need to agree upon an estimate for NAIRU, and then we judge the economy to be at, above, or below potential.

Note: CBO has radically altered their sense of potential U.S. growth:

Real Potential Gross Domestic Product

![Graph of Real Potential Gross Domestic Product](image)
Let’s create an expanded definition of labor market slack, \( L \). It will reflect those who identify as unemployed, those who are prime age and out of the labor force and those who hold part-time jobs and wished they had full time jobs. The chart below compares \( L \) with U3, from 1994 through January of 2018. Note that from 1986 through 2009 deviations are quite small. The wedge that appears, post the Great Recession, suggests that labor market slack, early 2018, is considerably higher than the level suggested by the 4.1% level for U-3.

<table>
<thead>
<tr>
<th>Date</th>
<th>U3 Unemployment</th>
<th>Underemployment</th>
<th>Prime-Age Labor Force</th>
<th>Labor Market slack, ( L ), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>January, 2018</td>
<td>4.1%</td>
<td>3.1%</td>
<td>81.8%</td>
<td>5.4%</td>
</tr>
<tr>
<td>April, 2005</td>
<td>5.2%</td>
<td>2.9%</td>
<td>82.7%</td>
<td>5.4%</td>
</tr>
<tr>
<td>February, 2000</td>
<td>4.1%</td>
<td>2.2%</td>
<td>84.4%</td>
<td>3.7%</td>
</tr>
<tr>
<td>April, 1996</td>
<td>5.6%</td>
<td>3.3%</td>
<td>83.6%</td>
<td>5.4%</td>
</tr>
<tr>
<td>December, 1989</td>
<td>5.4%</td>
<td>3.9%</td>
<td>83.7%</td>
<td>5.5%</td>
</tr>
</tbody>
</table>

The table above looks at U-3, other measures of labor slack, and \( L \), our manufactured amalgam of these measures. The table homes in on the months in which \( L \) equaled 5.4%, the level it held in January of 2018. What do we discover? In previous circumstances when \( L \) was at 5.4%, the U3 unemployment rate was a bit above 5%, roughly a full percentage point higher than it is today. It is also important to recognize that at the levels for \( L \) identified above, wage gains accelerated meaningfully.
**Step 2:** The Fed cares about the level of activity relative to potential and the growth rate relative to a measure of long run sustainable growth. We need an estimate for the long term growth rate for the labor force and for labor productivity gains.

- At present we think $\%\Delta\text{labor productivity}=1.5%/\text{yr}$.
- At present we think $\%\Delta\text{labor force }=0.6%/\text{yr}$.
- At present we think $\text{LTSG}=2.1%/\text{yr}$.

**Step 3:** The Fed Sets a Target Zone for Inflation. If inflation is above this zone the FRB tightens, to slow the economy raise unemployment and lower inflation. Conversely, if inflation falls below the zone, the Fed eases in order to stimulate activity. The Fed, at present, identifies 2% as the ideal inflation rate.

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**FRB Policy and the Taylor Rule:**

What constitutes ‘easy’, ‘neutral’ or ‘tight’ monetary policy? In normal times, that is to say, the lion’s share of our experiences from 1950 through 2005, the primary focus was on the FRB determined level of the federal funds rate. In simplest terms Fed monetary policy has amounted to the FRB buying and selling t-bills, in order to peg the level of the fed funds rate—the rate that banks charge one another for short term funds. Over the period 1993-2005, the Taylor rule was embraced as a handy tool for exploring the issues that drove fed funds rate targeting decisions. John Taylor, in 1993, provided us with a simple equation meant to allow for thinking systematically about inflation and unemployment. The Taylor equation:

$$f = \pi + \alpha(\pi-\pi^*) + j(U*-U) + r^*$$

Where:
- $f$ = fed funds rate
- $\pi$ = inflation rate
- $\pi^*$ = the Fed’s inflation target
- $U*-U$ = deviation of unemployment from full employment
- $r^*$ = neutral real short rate.
- $h$ and $j$ are parameters, econometrically determined.

(Note: Inflation appears twice in the equation because the Fed is trying to set real rates. They need to change rates, over and above any changes in the inflation rate.)

The Taylor rule, stated above, attempts to characterize Fed policy a function of two inputs—the unemployment rate and the inflation rate. The logic of the Taylor rule is simple:

- The FRB uses open market operations to set the real fed funds rate.
- If inflation and unemployment are ideal, the Fed puts the real rate in neutral.
If inflation is high and unemployment low the Fed targets a *restrictive* real rate. If unemployment is high with low inflation the FRB sets an *easy* real funds rate.

Let’s posit the following:
The Fed’s target inflation rate is 2%.
The Fed’s target unemployment rate is 5.2%.
The neutral real short rate is 2%
h =0.5 and j=1
The Taylor Rule now reads:
\[ f = \pi + 0.5(\pi - 2) + 1(5.2-U) + 2 \]
If we are in equilibrium, inflation is at 2%, unemployment is at 5.2%. In that case the equation says the fed funds target rate equals the inflation rate plus the neutral real short rate, in this case 2%+2%=4%.
If the economy is overheating, with the unemployment rate at 4.2% and inflation at 3%, the Taylor rule requires the Fed to set a high fed funds rate:
\[ f = 3 + 0.5(3-2) + 1(5.2-4.2) + 2 = 6.5\% \]

**The Taylor Rule: One Modification**

How has the Taylor Rule done as a forecaster of the Fed? As the next charts make clear, the Taylor Rule had a tough ten years from 1997 to 2007, even before we experienced the Great Recession. Part of the problem reflected the wild swing for energy prices. Oil prices fell to below $10 per barrel, in mid-1998, and climbed to more than 15 times that price in mid-2008. That put CPI changes into very volatile territory. Taylor Rule calculations, as chart 1 shows (below), called for volatile swings for fed funds despite relative quiescence for underlying price pressures.

Fed policy makers, in response, elevated the importance of core inflation. We therefore need to revise our calculation of the Taylor rule, using a core measure of inflation. But as chart 2 reveals, a Taylor Rule fed funds trajectory using a core measure (the core CPI) also does a poor job of catching actual swings in the overnight rate. In particular a core CPI generated Taylor Rule fails to anticipate late 1990s tightening. It fails to predict aggressive Fed ease in 2001-2002. And quite spectacularly, both the core CPI Taylor
Rule and a Taylor Rule using headline CPI failed to anticipate the violent Fed ease of 2008. We will address these shortcomings later in the course. (Note: Given problems with owners’ equivalent rent in the CPI, we prefer to use core PCE deflator)

The FRB and the Zero Bound

What does the Taylor rule tell us about Fed policy in a very weak economy? If the economy is in a deep recession, with the unemployment rate at 10% and inflation at 1.5%, the Taylor rule requires the Fed to set an impossibly low fed funds rate:

\[ f = 1.5 + 0.5(1.5 - 2) + 1(5.2 - 10.2) + 2 = -1.25\% \]

More to the point, in the world that followed the onset of the Great Recession a Taylor Rule calculation directed the Fed to target fed funds well BELOW ZERO. That, of course, is impossible to do. And therein lay the justification for various QE2 bond buying efforts by the Fed and for their decision to explicitly specify their intentions concerning when short rates will rise. We will formally explore the dynamic real economy/financial market linkages that justify these actions in the second half of the semester when we introduce the full panoply of financial instruments into our model. For now, we simply need to recognize that ‘the zero bound’ for the nominal fed funds rate is, very much, a real world problem, in the aftermath of the Great Recession. And as a prelude to thinking about these extraordinary measures, read what former FRB Chairman Ben Bernanke had to say about them during Congressional testimony, February 26, 2012.

Chairman Ben S. Bernanke

Semiannual Monetary Policy Report to the Congress

Before the Committee on Banking, Housing, and Urban Affairs, U.S. Senate, Washington, D.C. February 26, 2013

“With unemployment well above normal levels and inflation subdued, progress toward the Federal Reserve's mandated objectives of maximum employment and price stability has required a highly accommodative monetary policy. Under normal circumstances, policy accommodation would be provided through reductions in the FOMC’s target for the federal funds
rate—the interest rate on overnight loans between banks. However, as this rate has been close to zero since December 2008, the Federal Reserve has had to use alternative policy tools.

These alternative tools have fallen into two categories. The first is "forward guidance" regarding the FOMC's anticipated path for the federal funds rate. Since longer-term interest rates reflect market expectations for shorter-term rates over time, our guidance influences longer-term rates and thus supports a stronger recovery. The formulation of this guidance has evolved over time. Between August 2011 and December 2012, the Committee used calendar dates to indicate how long it expected economic conditions to warrant exceptionally low levels for the federal funds rate. At its December 2012 meeting, the FOMC agreed to shift to providing more explicit guidance on how it expects the policy rate to respond to economic developments. Specifically, the December postmeeting statement indicated that the current exceptionally low range for the federal funds rate "will be appropriate at least as long as the unemployment rate remains above 6-1/2 percent, inflation between one and two years ahead is projected to be no more than a half percentage point above the Committee's 2 percent longer-run goal, and longer-term inflation expectations continue to be well anchored." An advantage of the new formulation, relative to the previous date-based guidance, is that it allows market participants and the public to update their monetary policy expectations more accurately in response to new information about the economic outlook. The new guidance also serves to underscore the Committee's intention to maintain accommodation as long as needed to promote a stronger economic recovery with stable prices.

The second type of nontraditional policy tool employed by the FOMC is large-scale purchases of longer-term securities, which, like our forward guidance, are intended to support economic growth by putting downward pressure on longer-term interest rates. The Federal Reserve has engaged in several rounds of such purchases since late 2008. Last September the FOMC announced that it would purchase agency mortgage-backed securities at a pace of $40 billion per month, and in December the Committee stated that, in addition, beginning in January it would purchase longer-term Treasury securities at an initial pace of $45 billion per month. These additional purchases of longer-term Treasury securities replace the purchases we were conducting under our now-completed maturity extension program, which lengthened the maturity of our securities portfolio without increasing its size. The FOMC has indicated that it will continue purchases until it observes a substantial improvement in the outlook for the labor market in a context of price stability.

The Committee also stated that in determining the size, pace, and composition of its asset purchases, it will take appropriate account of their likely efficacy and costs. In other words, as with all of its policy decisions, the Committee continues to assess its program of asset purchases within a cost-benefit framework. In the current economic environment, the benefits of asset purchases, and of policy accommodation more generally, are clear: Monetary policy is providing important support to the recovery while keeping inflation close to the FOMC's 2 percent objective. Notably, keeping longer-term interest rates low has helped spark recovery in the housing market and led to increased sales and production of automobiles and other durable goods. By raising employment and household wealth—for example, through higher home prices—these developments have in turn supported consumer sentiment and spending.

The ECB: A Charter That Dictates a Singular Focus, Inflation

Unlike the FRB, the ECB defines their mandate singularly. They conduct monetary policy solely to ensure price stability, which they target as 1.5% to 2% headline inflation.
Low inflation amid high unemployment, for the ECB, warrants no dramatic response. They argue that price stability is the only purview of the central bank.

In addition, and amazingly, in light of the history that surrounds the development of central banks in modern day economies, the ECB professes to have no lender of last resort responsibilities. As the previous head of the European central bank liked to say, “the ECB has only one needle in its compass, and that is inflation”. Again, this striking difference between the ECB and its sister central banks—the FRB, the BoE, the BoJ—created enormous policy challenges, under the direction of Jean Claude Trichet. Mario Draghi, a much more creative central banker, has end run a good many of these seeming impediments. We will address these in the second half of the semester.

If we, again, ignore bank safety issues, it appears to me that the ‘one needle in the compass’ approach to monetary policy, instead of a dual mandate, has proven to be a painfully sub-optimal approach to conducting policy. We can look upon the Great Recession as a natural experiment, set to test the idea that one focus is all central bank’s need to get policy right. Some academics, champion the ECB mandate asserting that price signals are all a central bank needs to focus upon, in order to deliver optimal monetary policy strategy.

This line of reasoning is labeled the divine coincidence. The argument depends upon the notion that inflationary pressures will recede if excess capacity is available in the system, ultimately causing prices to fall. Thus the central bank that exclusively focuses on prices will be easing aggressively amid high joblessness and excess capacity, just as they should be, notwithstanding the fact that they are solely looking at price statistics. How so? Standard theory asserts that excess capacity will force inflation below the target level, justifying ease on price stability grounds. In other words, whether you focus on inflation and unemployment, or just inflation, you will end up doing the same thing, as weak growth will deliver the faltering price pressures that justify ease.

**The ECB and the Crisis**

Jean Claude Trichet was the ECB President from 2003 to 2011. He steadfastly embraced the singular ECB price stability goal.

This framework was always flawed. As we discuss in the pages that follow, wage and price stickiness, amid BIG Recessions, will lead a one target central bank to remain too tight. Moreover, in a financial crisis such myopia can, indeed did, lead to disastrous results.

In the table below we provide a look at the ECB’S target rate—their key interest rate. They expect that the target rate will greatly influence eonia, the rate that European banks charge one another for funds. How have the two rates fared, since the onset of the crisis, and how has Europe fared relative to the USA? Consider the two tables below:
We discover several things. When the Great Recession took hold, in 2008, the U.S. Fed was easing aggressively. The ECB, slavishly focused upon inflation, actually raised their target rate in July of 2008. We also see that the U.S. FRB much more aggressively eased, hitting the ZERO BOUND in mid-2009. In 2010, and again in 2012-2013, resorted to QE, to supplement their easy money policy.

The Trichet led ECB, in stark contrast, stopped easing in mid-2009, when their overnight rate touched 1%. They tightened in 2011, reacting to a temporary rise for inflation, and ignoring very high joblessness. Obviously there are major differences between the U.S. and Europe. Nonetheless, some of the major gains in the U.S., relative to Europe, in the aftermath of the Great Recession, can be laid at the doorstep of the more aggressive ease delivered by the Fed.

Read the following: http://www.levyinstitute.org/pubs/wp_742.pdf

More Generally: The Central Banker Reaction Function

Central Bankers and the 3-Equation Model

We now have the pieces in place to think about a barebones macroeconomic model.
In this section we will be using the model depicted in the Carlin-Soskice paper (C-S). We assert the following.

**The IS Curve**

The elemental notion that drives central bankers, business planners and speculators is that output is affected by the level of real interest rates. A big jump for real interest rates, other things equal, will reduce investment and in turn the overall level of output and income. C-S puts it this way:

\[ y_t = A - a r_t \]

*(real income is a positive function of autonomous expenditure A and a negative function of the real interest rate r)*

**The Phillips Curve**

We learned about the relationship between price pressures and the level of resource utilization in the last lecture. The most familiar, the Phillips Curve, relates changes in the rate of inflation to deviations from equilibrium levels of output. Changes in inflation are driven by the output gap. Carlin Soskice state:

\[ \pi_1 = \pi_0 + \alpha (y^*_t - y_t) \]

where \( \pi \) is the rate of inflation and \( y^*_t \) is equilibrium output.

We can also think of deviations of unemployment, \( U \), from NAIRU, as a Phillips Curve measure, as we did in the last lecture:

\[ \pi_1 = \pi_0 + \alpha (U - U^*_t) \]

Notice that in both cases we start with a contemporaneous inflation rate, \( \pi_0 \) and the output gap deviation shifts the inflation rate up or down. This is an all important modification of the original notion of an unemployment/inflation tradeoff. We don’t get to have unemployment permanently below NAIRU for a one-time increase for inflation. Instead each year that we operate above output potential, we add to our inflation problem. This *accelerationist* Phillips Curve model makes it clear that we cannot benefit, in the long run, from keeping the economy ‘too hot’.

**The Monetary Policy Rule**

The final equation in our three equation model is the monetary policy rule. A Taylor Rule is a good starting point.
\[ f = \pi + h(\pi - \pi^*) + j(U^* - U) + r \]

Carlin and Soskice point out that a monetary policy rule is a means by which to minimize losses, characterized as below potential output and/or above ideal inflation. The Carlin/Soskice loss function:

\[ L = (y_1 - y_e)^2 + \beta (\pi - \pi^T)^2 \]

For our purposes, we will ignore the derivation of the Carlin/Soskice rule, and simply focus on the graphical representation. We also will shift the parameter, \( \beta \), and have it determine the weight we put on deviation from potential output:

\[ L = \beta (y_1 - y_e)^2 + (\pi - \pi^T)^2 \]

**Manipulating the Barebones Macro Model**

We are now ready to think about forecasting. We have a simple three equation model that relates investment and therefore output to interest rates, inflation as a function of output relative to potential, and interest rates, a function of inflation and output relative to central bank target.

We can add to this model a painful truth about economic forecasting. The starting point, when thinking about the pace of economic growth, is unfortunately, backward looking. It turns out that the best guess, in most cases, about what the next six months real growth, IS WHAT THE LAST SIX MONTHS GROWTH RATE HAS BEEN.

So our forecasting framework now takes shape.

We posit a long term sustainable growth rate, in today’s circumstances in the USA, 2.2%. We posit a NAIRU, in today’s circumstances in the USA, 5%. We identify the Fed’s target for inflation, 2%. We calculate the economy’s real growth trajectory over the recent past. Our preliminary assumption is that, absent policy efforts, exogenous shocks, or cyclical turning point dynamics, the next six months growth rate approximates the last six months pace.

We then ask ourselves 3 questions:

1. If our starting assumption, more of the same, actually transpires, where will that put the unemployment rate, a year or so down the road?
2. What does that level for unemployment imply for the economy’s output gap over the period (the projected jobless rate versus our estimate for NAIRU)?

3. In turn, using a Phillip’s curve calculation, what should we expect from inflation?

We then attempt to modify our preliminary extrapolation, by anticipating the Central bank’s policy response to the extrapolative outlook. In the USA we can use the Taylor Rule to calculate where the Fed will set the fed funds rate, as they attempt to respond to a backdrop that is either too strong or too weak, relative to target. Finally, we then modify our extrapolative forecast, to the extent that we believe Fed policy actions will change the trajectory for economic activity, unemployment, and, in turn, inflation. In the current circumstances, we might make the following statement:

*The economy has been growing at a modest pace for the past six months, with above trend employment gains but poor productivity and output gains. Global growth, however, has been very poor, leading many to worry about downside risks to growth. If we ignore ROW and extrapolate the trend for jobs growth suggests that we will see a 4.5% unemployment rate, sometime over the next 12 to 18 months. Conversely, both headline and core inflation has been climbing at a rate well below the Fed’s 2% target for more than three years. Moreover, plunging oil prices, the rise for the U.S. dollar versus many trading partner currencies, and the sharp fade for prices in China all combine to suggest more weakness for inflation over the next 6 months.*

*One last complication. Unemployment may touch 4.5%, but other measures of labor market slack are still high. We know the FOMC wants interest rates to approach ‘normal’ as the economy approaches full employment and inflation touches its 2% target. That is complex in 2016.*
We now allow for a banking crisis and a violent fall in invested demand, at a given interest rate. In other words we draw a sharp inward shift of the IS curve. We discover that if we leave the Fed Funds rate at 4% we are no longer in neutral. Why? The violence of the fall in output pushes unemployment sharply higher (6% to 10%). The climb for joblessness squeezes out any and all inflation and we face deflation (π falls from 2% to -2%). With deflation of 2% the real rate would leap to 6% from 2%, if the Fed left the nominal rate at 4% lowering the rate to zero, the Fed would keep the real rate at 2%. But as the graph demonstrates, this leaves the economy with high unemployment.
How will the central banks respond? In this simplified world the U.S. Fed confronted deflation and very high unemployment. Note that moving the nominal Fed Funds rate to zero, in the top graph, with the Fed funds rate at zero additional ease by traditional means was not possible. So the Fed embarked on two installments of large bond purchases, commonly called QE1 and QE2.

What about the ECB? They too would have confronted a leap for joblessness and a plunge into deflationary territory. They ignore unemployment, but deflation demands big ease anyway. The divine coincidence triumphs in this simplified framework and we get a big ease from the ECB as well.

**Persistent Large Output Gaps and the Destruction of the Divine Coincidence**

The charts in the previous section lead us to conclude that FRB and ECB monetary policy would be the same during the Great Recession. In fact, the FRB has been much more aggressively easing than has its European counterpart. How do we explain the difference? As it turns out, life is not as simple as the simple model used on the previous page. A key insight into the flaw in our model can be found in the IMF working paper, *Minding the Gap*. The study looks at a host of developed economy experiences with persistent large output gaps (PLOGS). PLOGS are long periods of excess capacity and higher than ideal unemployment. The study investigates what happens to inflation in such circumstances.
The empirical results from the study confirm a prototypical Keynesian concept: **Wages And Prices Are Sticky**. More specifically, it’s easier to get a big fall for inflation, when inflation is high and it’s very hard to convince people to cut wages and prices—generating outright deflation—even amid very high joblessness and ample excess capacity. We draw some stylized Phillips Curves below:

1. Inflation’s Decline is substantial when the starting point is a high inflation rate.

2. Inflation’s decline is moderate when the starting point is a moderate inflation rate.

3. Inflation is unlikely to become deflation due to sticky wages when the starting point is low inflation.

The key point embedded in the graphs above is that a large output gap, starting from a low inflation rate, will generate only moderate disinflation. So far in both the USA and Europe that has been the case. And that is a key result when we think of monetary policy and central banks that are mandated to target only inflation.

Now let’s put these observations into the output inflation space of our 3-equation New Keynesian Model – acknowledging that we now have a non-linear Philips Curve.

A sharp IS decline, the Great Recession, occurring in a low inflation world, elicits Big Ease from dual mandates Central Banks. They respond to the surge in joblessness.

Inflation mandated Central banks ease only moderately given the absence of a move to large price declines. As unemployment endures, cyclical joblessness becomes structural joblessness. In macroeconomics terms, hysteresis occurs. In this circumstance, inflation mandated Central banks conduct sub-optimal monetary policy and are unwitting agents of hysteresis. In effect, by failing to come to their economy’s rescue, they lock many jobless people into long term unemployment. They lose skills and become structurally unemployed.