International Money and Banking: 15. Real Interest Rates and the Taylor Rule

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Part I

Real Interest Rates

Interest Rates and the Economy

- We have described how central banks control short-term interest rates on interbank loans.
- We have also described how longer-term interest rates are affected by expectations about what will happen to short-term rates in the future.
- It is through this mechanism that central banks influence risk-free rates at all maturities.
- Considerations about default risk and collateral then need to be factored in to understand movements in interest rates for risky private sector lending.
- These private sector interest rates have a significant effect on the economy: High interest rates will negatively affect the economy by discouraging spending.
- But what do we mean by a high interest rate?
- Is ten percent a high interest rate? Well, it depends on the level of inflation.

Real Interest Rates and Consumption

- Real interest rates are calculated by subtracting the rate of inflation from the rate of interest (which is also known as the nominal interest rate).
- If the nominal interest rate is 10%, then if inflation is 10%, the real interest rate is zero. If inflation is 5%, then the real interest rate is 5%.
- Consider the decision to save for tomorrow or spend today. The argument for saving is that it can allow you to consume more tomorrow.
- If the real interest rate is negative, then this means that you will be able to purchase less tomorrow with the money that you set aside. For instance, if the interest rate if 5% but inflation is 10%, then you receive 5% in interest but your savings have eroded in value by more than that.
- So low real interest rates discourage savings and high real interest rates encourage it.

Real Interest Rates and Business Investment

- Consider a firm that is thinking about buying capital equipment and suppose the interest rate is 10%.
  - If the firm is borrowing the money, they need to consider whether the investment will generate enough new profit income to justify paying back the amount borrowed (the principal) and the interest.
  - If the firm has spare money available, they need to consider whether they would be better off putting the money in the bank at the prevailing interest rate rather than buying the machine.
- Either way, the higher the interest rate, the less likely the firm is to buy the equipment.
- Again, inflation matters when thinking about whether the interest rate is considered high. If inflation is 10%, then the firm can expect that its profits will be increasing by that much and a 10% interest rate won't seem so high. But if prices are falling, then a 10% interest rate on borrowings will seem very high.
- Low real interest rates encourage business investment and high real interest rates discourage it.

Part II

The Taylor Rule

How Do Central Banks Choose the Right Interest Rate?

- We have covered a lot of material that helps explain roughly how modern central banks should behave: expectations-augmented Phillips curves, commitment and credibility, various central bank constitutions, and so on.
- But this doesn't address the basic operational question: How should a central bank decide what is the right interest rate to set at any point in time?
- Here we discuss a famous "rule" for monetary policy, first discussed in a 1993 paper by Stanford economist John Taylor.
- Much of the discussion of monetary policy today uses the so-called Taylor rule as a benchmark for how policy should be conducted.
- We will describe the rule and how it would be implemented, discuss how well it explains actual policy as well as its relevance to current US monetary policy.

What Is the Taylor Rule?

- Taylor suggested that a good rule for setting monetary policy was to set the policy interest rate (e.g. the federal funds rate in the US) a positive function of both inflation and the output gap, i.e. the gap between output and its long-run potential, non-inflationary, level.
- Algebraically, this can be written as

$$i_t = \alpha + \beta_\pi (\pi_t - \pi^*) + \beta_y (y_t - y_t^*)$$

  where i_t is the short-term interest rate, π_t is the inflation rate and π^* is the target rate of inflation, y_t is GDP and y_t^* is potential non-inflationary level of output.
- Note also that α determines the real interest rate prevailing when output and inflation are at target levels ($r^* = i^* - \pi^* = \alpha - \pi^*$).
- Is the second part of the rule—reacting to output gaps—inconsistent with a commitment to have a primary focus on maintaining low inflation? Not necessarily. A central bank with a focus on inflation may cut rates when output gaps are negative because a recession is expected to reduce inflation.

What Coefficients for the Taylor Rule?

- There is widespread agreement that this type of policy rule should help to stabilize the economy and achieve a low target rate of inflation.
- But there is less agreement about the coefficients. How aggressive should the central bank be in reacting to inflation and reacting to output gaps?
- The answer to this question will reflect the preferences of the central bankers or their legal mandate.
- Central Banks are often described as having preferences of the form of a "loss function" such that they want to minimize

$$L = (\pi - \pi^*)^2 + \lambda (y - y^*)^2$$

  and different central banks may have different values for λ.
- Generally, those with a high λ—a high aversion to output volatility—will react more to output gaps and less to inflation.

The Taylor Principle

- So there is no precise agreement on exactly what specific coefficients the Taylor rule should have.
- However, there is a wide agreement on a principle put forward in Taylor's paper: β_π should be greater than one. This idea is now known as the Taylor Principle.
- $\beta_\pi > 1$ means that when inflation goes up, the policy rate goes up by more. Meeting this condition ensures that increases in inflation lead to higher *real* interest rates. If this is not the case, increases in inflation will stimulate the economy and perhaps further increase inflation.
- Taylor's original rule suggested $\beta_\pi = 1.5$ and $\beta_y = 0.5$.
- Econometric estimates of Taylor rule coefficients showed that his rule described the behavior of the Volcker and Greenspan Fed (i.e. the post-1979 Fed) quite well.
- However, the pre-Volcker Fed does not seem to have obeyed the Taylor principle. Econometric estimates show $\beta_\pi < 1$ for these years.
- This lack of responsiveness of policy to inflation helps to explain why inflation got so high during the 1970s.

Section C Example: The Taylor Principle

A central bank responds to inflation rising from 2 percent to 3 percent by increasing the policy interest rate from 1 percent to 2.5 percent. Does this action conform to the Taylor principle? Explain your answer.

- Inflation rose from 2 percent to 3 percent, so it increased by 1 percent.
- The policy interest rate rose from 1 percent to 2.5 percent, so it increased by 1.5 percent.
- The policy interest rate rose by more than the inflation rate, so this action satisfies the Taylor principle.
- Note that answers like "the Taylor principle states that the policy rate rises when inflation goes up" or "the Taylor principle states that policy interest rates must be higher than the inflation rate" are incorrect and will score very badly.

Operational Issues

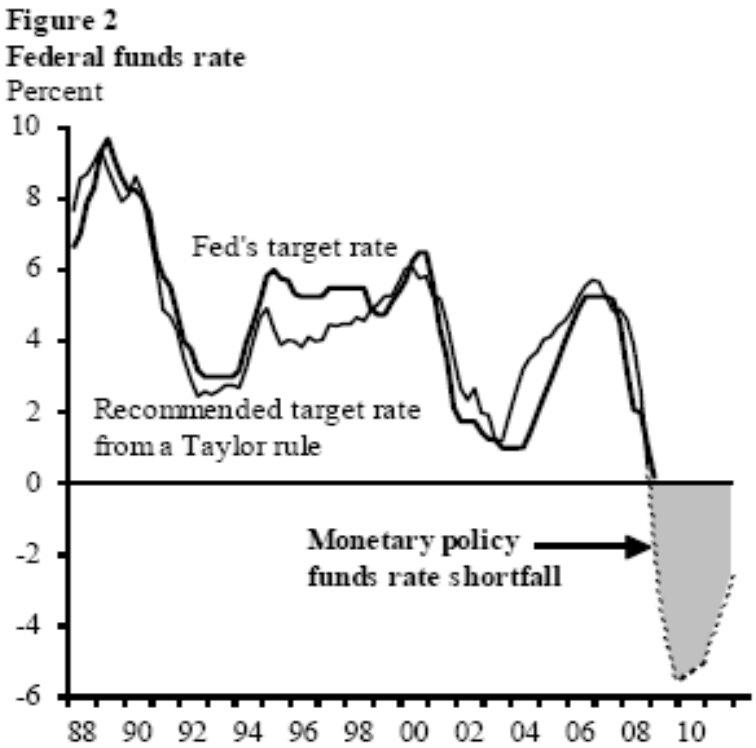
Taylor rules require some subtle decisions before they can be operational:

1. Inflation:
   - What is the relevant price index? All goods and services (GDP deflator) or consumer prices?
   - Total or core inflation? Include volatile components should as food and energy? (Argument for total: People need to purchase food and energy. Argument for core: Why should policy respond to volatile temporary changes?)
   - What is the target inflation rate? 2% is popular, but why? (Some believe official measures overstate inflation by missing quality improvements; also want to avoid deflation.)
2. Output gap:
   - Potential output usually assumed to evolve smoothly.
   - Usually measured as the trend value of output, for instance as fitted value from regressing real GDP on a time trend.
   - Could also be measured using the unemployment rate or an estimated gap between unemployment and the natural rate.

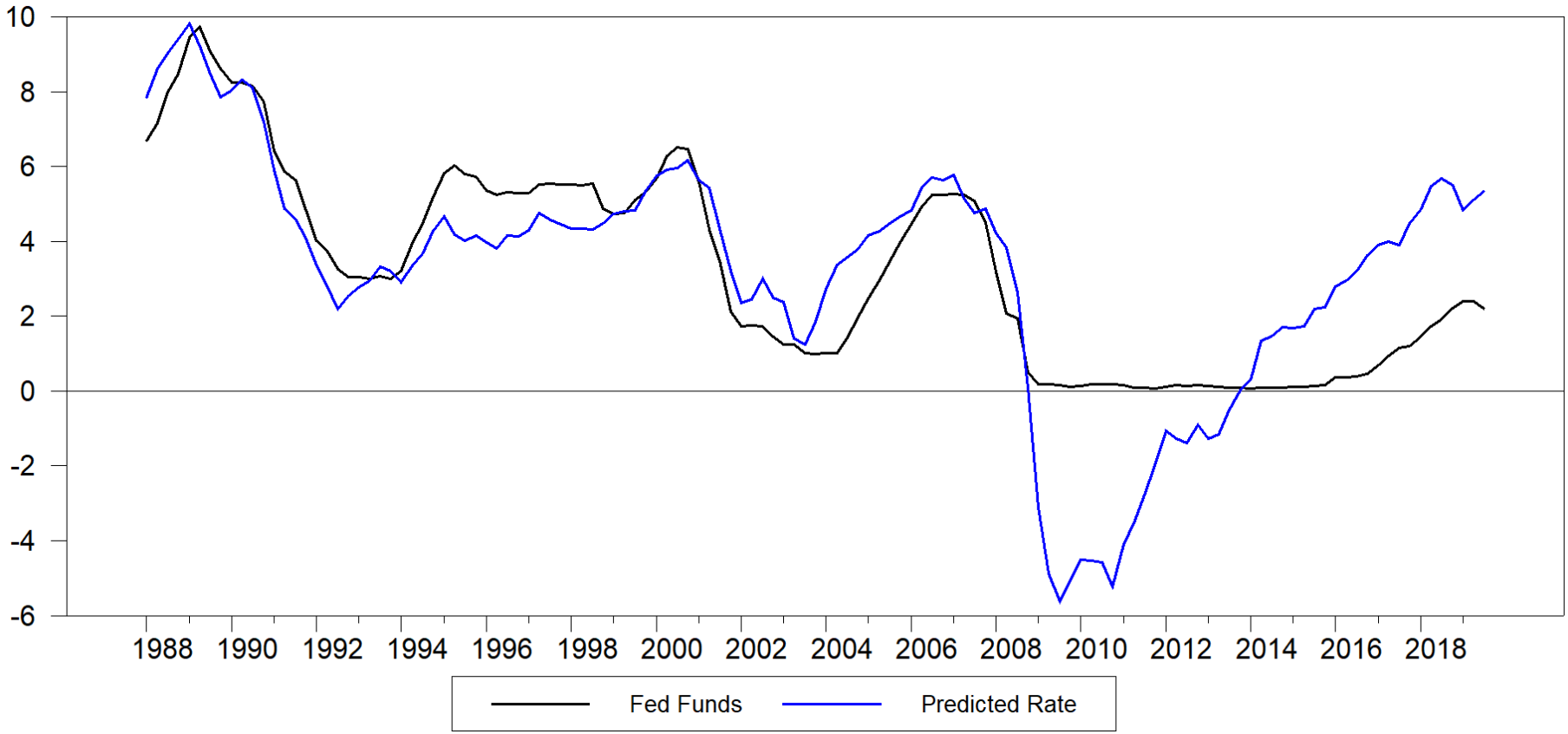
The Taylor Rule and the Lower Bound

- What happens when the Taylor rule tells the central bank that its target interest rate should be negative? As we've discussed before, there are limits to how far central banks can lower interest rates.
- Is this relevant? In May 2009, Glenn Rudebusch of the Federal Reserve Bank of San Francisco published a paper with a version of an estimated Taylor rule—one whose coefficients are estimated from a regression—using core consumer prices to measure inflation and an unemployment gap to proxy for the output gap. It suggested Taylor rules implied negative fed funds rates would be required from summer 2009 on based on the Fed's macro forecasts.
- The next page shows Rudebusch's graph while the page after shows my updating of the graph. The update suggests that the Taylor rule rate remained negative until the end of 2013. This shows that the zero bound was relevant for a number of years.
- These estimates are a bit controversial. Taylor has taken issue with this version of "his" rule, preferring rules that predicted low positive rates. However, the Fed is known to follow the core inflation rate closely and the unemployment gap used here seems reasonable.

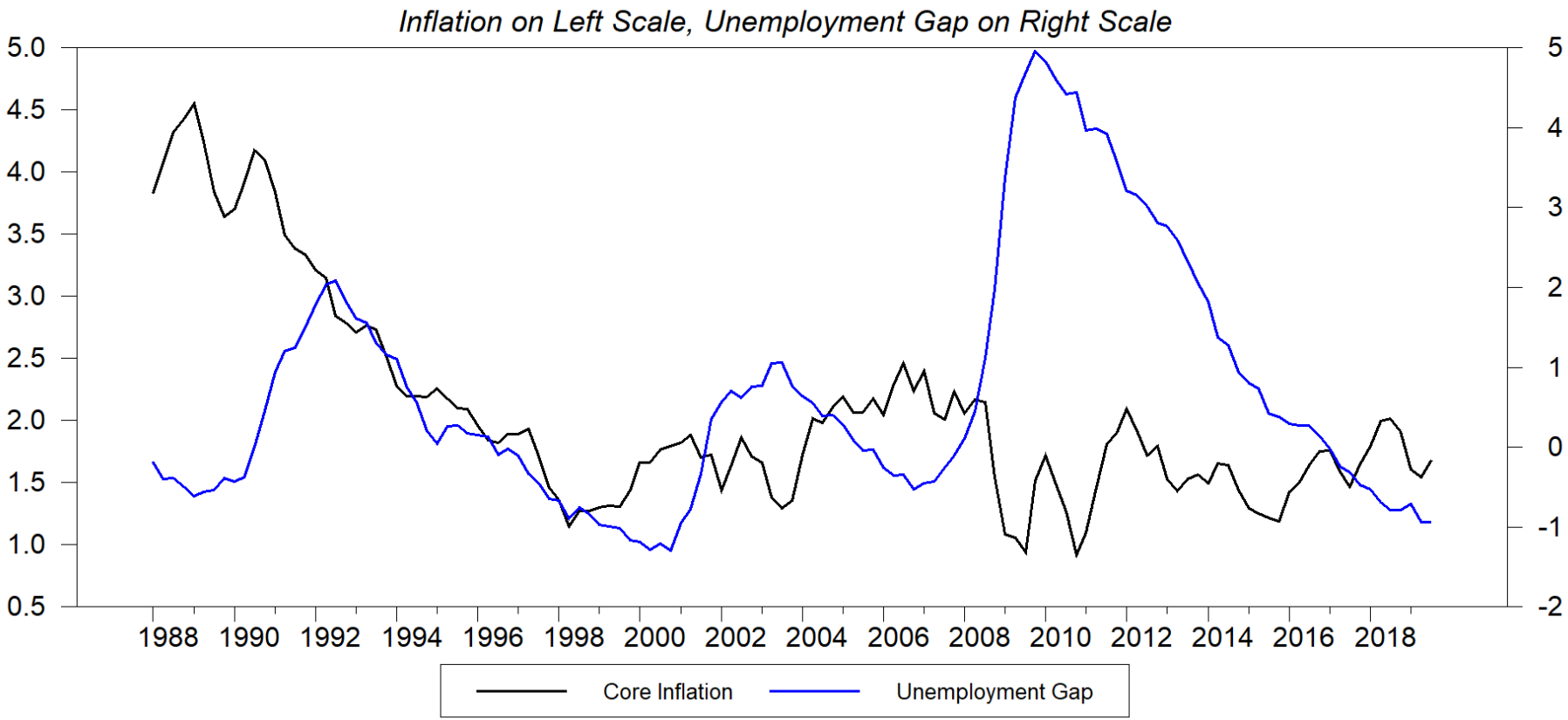
Glenn Rudebusch's Estimated Taylor Rule



An Update of Rudebusch's Graph



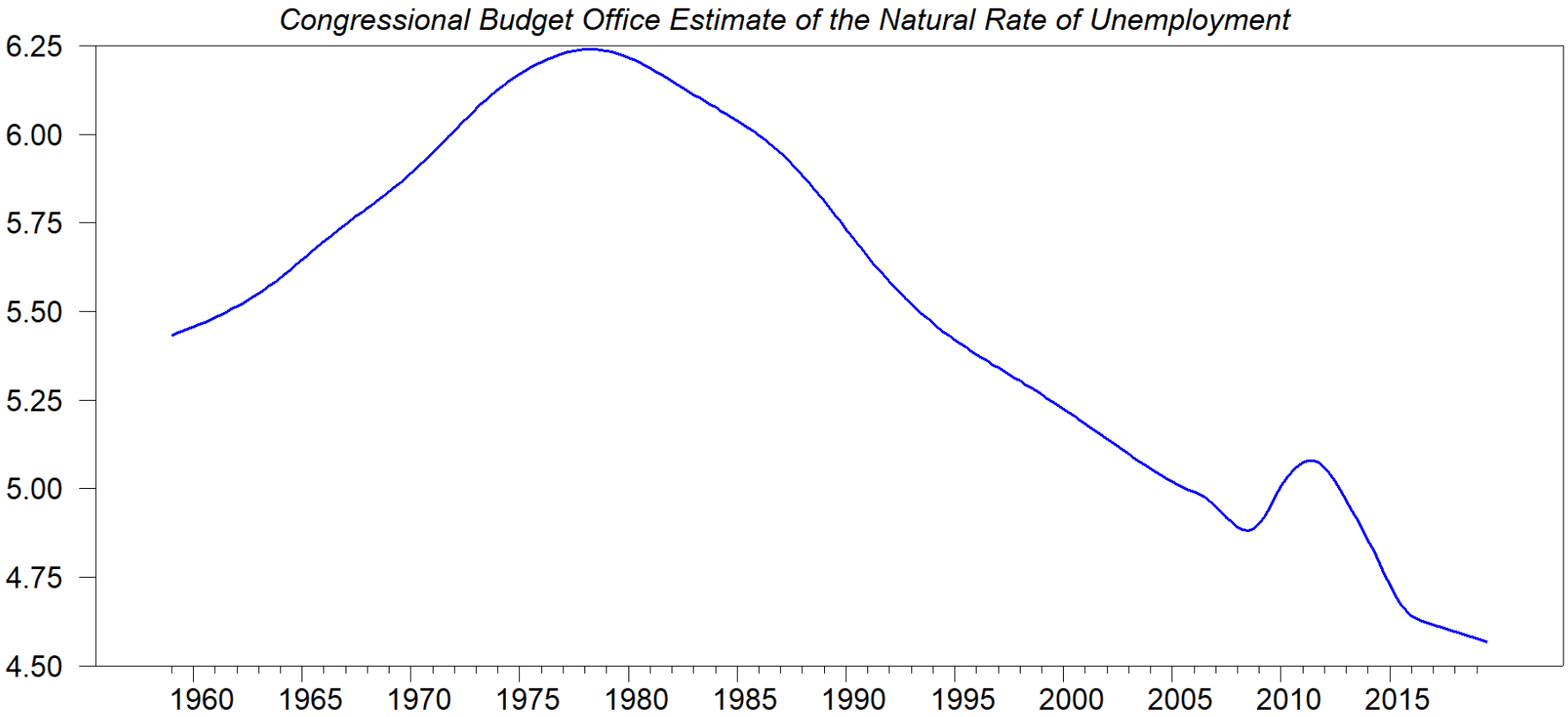
Inputs into the Rudebusch Taylor Rule



Disadvantages of a Taylor Rule? Output Gap Uncertainty

- One important argument against Taylor rules has focused on its reliance on estimates of output gaps: Potential GDP is not actually known, and attempts to estimate it are not very reliable.
- In the Rudebusch version of the rule, there is uncertainty about the natural rate of unemployment. He uses an estimate from the Congressional Budget Office.
- Former Fed economist, Athanasios Orphanides has argued that a reliance on output gap estimates has caused trouble in the past:
  1. During the 1970s, growth rates for major international economies slowed considerably. Policy-makers thought their economies were falling far short of its potential level. In retrospect it is clear that potential output growth rates were falling and true output gaps were small.
  2. Thus, policy was still stimulating the economy when it should have been focused on getting inflation down.
  3. Orphanides also pointed out that the real-time data on GDP that policy makers use are often substantially revised when more data arrive in later. So it is always hard to guess where output is relative to potential.

The CBO's Estimate of Natural Rate



Disadvantages of a Taylor Rule? Equilibrium Real Rates

- Remember that the coefficient α determines the equilibrium real interest rate, i.e. the interest rate that would prevail if $\pi_t = \pi^*$ and $y_t = y_t^*$. In this case, the real interest rate is $r^* = \alpha - \pi^*$.
- Is the equilibrium real interest rate constant over time? Probably not.
- Fast-growing economies in which there are lots of profitable investment opportunities probably require a higher real interest rate on average then slow-growing economies.
- Japan since the early 1990s has often cited as an example of an economy stuck in a slow-growing slump period. With very low returns on capital investment projects, real interest rates had to be very low to make borrowing for capital expenditures worthwhile.
- Economists increasingly think that Europe and the US are also in a similar structural slump with very low real equilibrium interest rates (the not-very-useful phrase "secular stagnation" gets used to describe this idea.)
- So, even after settling on the right inflation target and an estimate of the output gap, central bankers still need to use other information to assess whether they have set the real interest rate at about the right levels.

The Taylor Rule and Current Fed Policy

- The Taylor rule's recommended policy rate turned positive in late 2013 but the Fed did not raise rates above zero until 2016 and then started cutting rates in 2019 when the fed funds rate was well short of the rule's recommendations.
- Recent years have shown how policy-makers seem to be uncertain about various elements of the theoretical framework underlying the Taylor rule.
  1. Inflation has not taken off in recent years despite low levels of unemployment. As we discussed before, this has raised questions about using the Phillips curve relationship as a major influence in setting policy.
  2. The CBO and the Fed have been revising down their estimates of the NAIRU in recent years, now believing the economy can run a lower unemployment rate without triggering inflation.
  3. Various studies also point to the equilibrium real rate in the US as being lower than previously.
- At this point, the Fed seems to be focusing largely on inflation, keeping interest rates relatively low as long as inflation continues to be contained and no longer worrying about the potential inflationary implications of low unemployment.

Recap: Key Points from Part 15

Things you need to understand from these notes.

1. Definition of real interest rate.
2. Why real interest rates matter for consumption.
3. Why real interest rates matter for business capital investment.
4. What is the Taylor rule?
5. How might Taylor rule coefficients reflect policy-maker preferences?
6. The Taylor principle.
7. Decisions required to operationalise the Taylor rule.
8. Implications of the zero bound for implementing the Taylor rule.
9. Implications of uncertainty about the output gap.
10. Implications of uncertainty about the equilibrium real rate.
11. Comparison between the Taylor rule's recommendations and recent actual Fed policy rates.