Monetary Policy Feedback Rules at the Zero Lower Bound

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RUN-UP TO THE PANIC

- The financial crisis began in earnest in August of 2007.
- Commodity price increases led to a slowing in economic activity during the summer of 2008.
  - Peak oil price exceeded the 1980 peak in real dollar terms.
- August 2008 nonfarm payrolls -175, September -321.
- The slowing economy intensified the financial crisis.

AFTERMATH OF THE PANIC

- The FOMC had already lowered interest rates to 2.0 percent during the first half of 2008.
- Intensified financial market turmoil led the FOMC to lower the federal funds target to near zero in December.
- The FOMC added "extended period" language.
- Short-term interest rate policy remains very accommodative today.
- Past two recessions: $2.5 - 3.0$ years after recession end before tightening cycle began.

AVOIDING A LOW NOMINAL INTEREST RATE TRAP

- The potential to become trapped in a low nominal interest rate steady state is very real.
- The trap is characterized by low or zero nominal interest rates and inflation well below target, possibly negative. (See Benhabib, *et al.*, 2001, *JET*).
- Deflation strikes me as undesirable given the extent of nominal contracting in the U.S.
- The trap is created by *dogged commitment* to an interest rate rule.
- Leading central banks have done a good job of trying to switch to quantitative policies.
  - This may help us avoid the trap steady state.
  - The switch to quantitative policies also has a commitment to switch back to interest rate policy. How to model?

KEY ASPECTS OF THE CURRENT SITUATION

- Current U.S. monetary policy has three parts:
  - Liquidity programs associated with the panic, which are running off.
  - An asset purchase program, only partially completed.
  - A near-zero interest rate policy.
- The key issue is how to think about the asset purchase program.
- The economy will experience further shocks while interest rates remain near zero.
- How to run an active monetary policy in this environment?

OUTLINE

- The case for policy rules.
- Some quantitative policy rules from the literature.
  - They do not recommend the rapid base expansion we have seen recently.
- Two natural questions.
- Summary and Q & A.

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WHY WE LIKE TAYLOR

- Taylor (1993) and subsequent literature (including optimal policy) studied state-contingent rules for the adjustment of short-term nominal interest rates.
- The rule was consistent with a steady state with inflation at target and output at potential.
- In short, good policy means ...
  - ... that the Fed needs to communicate to the private sector how it intends to react to shocks in the future.
- Before December 2008, the Fed was able to communicate future monetary policy because the likely path of interest rate adjustment was relatively well understood.
- With nominal interest rates currently at zero, the Fed has lost this ability to communicate future policy.

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EVOLUTION OF SYSTEMATIC POLICY: TAYLOR

Greenspan Years: Federal Funds Rate and Taylor Rule
(CPI $p^* = 2.0$, $r^* = 2.0$) $a = 1.5$, $b = 0.5$
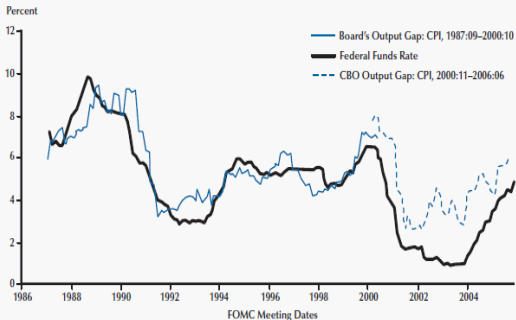
Source: Poole, William. "Understanding the Fed." Federal Reserve Bank of St. Louis Review January/February 2007.

THE ASSET PURCHASE PROGRAM

- The FOMC asset purchase program does not have a state-contingent character.
- The Committee announced an intention to buy up to $1.75 trillion in assets by the first quarter of 2010.
- There has been little indication of how or whether these amounts might be adjusted given incoming information on economic performance.
- It is unclear whether the policy is consistent with a steady state with inflation at target and output at potential.
- Unclear policy creates uncertainty in financial markets.

A POLICY RULE FOR ASSET PURCHASES?

- An optimal asset purchase program would have a state-contingent character.
- A Taylor-type rule for asset purchases could communicate how purchases would be adjusted as information arrives on the economy.
- This would help communicate to markets how it is that the purchase program is consistent with a steady state with inflation at target and output at potential.
- This would reduce uncertainty and make the program more effective.
- It would also help to pin down the optimal size of the program.

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THE IMPACT OF A POLICY RULE

- The asset purchase program as currently implemented is large.
- The monetary base will have more than doubled by the end of 2009.
  - Liquidity programs are running off, but purchases will swamp this effect.
- We know that the inflationary impact of such a policy will depend on future expected policy.
- Sargent ("The Ends of Four Big Inflations") provides a good illustration.
  - In these countries the policy was to increase the monetary base rapidly.
  - But the hyperinflations ended abruptly when new, credible policies were announced.

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WHY QUANTITATIVE RULES?

- We have spent 20 years refining ideas about interest rate rules and optimal monetary policy.
- We should consider quantitative rules because we are at the zero bound and may remain there for some time, depending on how the economy performs.
- Quantitative rules are generally not as satisfactory as interest rate rules.
- But it is still worthwhile to use them because of the need to communicate future monetary policy to markets.

SOME PAPERS

- I will look at this from the monetary base perspective, because that is what the literature does.
- Woodford (2003).
- McCallum and Nelson (1999).
- McCallum's rule in the current situation.
- Christiano, Motto, Rostagno (2003).

"M" AND MONETARY POLICY IN THE NK MODEL

- Many have looked for a role for money in the NK framework.
- In the basic NK model, it is not *necessary* to make reference to money.
  - Many arguments about this.
- But even in the basic NK model, stabilization policy *can be* implemented via movements in the money stock.
- In extraordinary times, one may want to turn to this option.

A CONCEPTUAL QUESTION

- The NK model consists of four equations.
- A fourth equation describes the demand for money as a function of the nominal interest rate.
- It is a decoupled equation: It is not needed to find the equilibrium allocations in the economy.
- A question sometimes asked: is it not possible to invert the money demand equation, expressing the system in terms of a monetary rule instead, without reference to interest rates at all?
- Answer: It is possible, but the monetary rule is not like the ones normally studied in the earlier literature.

PRELIMINARIES

- Assume the inflation target is zero.
- Adopt Woodford's money-in-the-utility function specification.
- Assume that money does not pay interest.
- All variables are expressed as deviations from their steady state equilibrium or target values.
- There is no assumption concerning the zero bound: This is a local analysis for positive nominal interest rates.
- Think of nominal interest rates as being low but positive.

FOUR EQUATIONS

- Consider four equations:

$$x_t = E_t x_{t+1} - \sigma\left[r_t - E_t \pi_{t+1}\right] + \epsilon_{x,t} \qquad (1)$$

$$\pi_t = \kappa x_t + \beta E_t \pi_{t+1} + \epsilon_{\pi,t} \qquad (2)$$

$$r_t = \varphi_\pi \pi_t + \varphi_x x_t \qquad (3)$$

$$m_t = \eta_x x_t - \eta_r r_t \qquad (4)$$

- Equations (1) and (2) are standard.
- Equation (3) is an ad hoc Taylor rule with policy parameters φ_π and φ_x.
- Equation (4) is the MIUF money demand.
- Normally, the money demand equation (4) is viewed as decoupled, and so ignored.
- We can choose optimal values for φ_π and φ_x subject to the determinacy condition.

AN ALTERNATIVE

- Throw out the Taylor-type policy rule, equation (3).
- Invert the money demand relation:

$$r_t = \frac{\eta_x x_t - m_t}{\eta_r} \qquad (5)$$

- Substitute (5) into (1).
- Specify a money supply rule to replace the Taylor rule:

$$m_t = \mu_\pi \pi_t + \mu_x x_t \qquad (6)$$

with new policy parameters μ_π and μ_x.
- Substitute (6) into (1).

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AN EQUIVALENCE

- The new system is two dimensional, with variables x_t and π_t.
- There is no reference to nominal interest rates.
- The new system is identical to the original one if

$$\eta_r \varphi_\pi = -\mu_\pi \tag{7}$$
$$\eta_r \varphi_x = \eta_x - \mu_x. \tag{8}$$

- We can optimize choices of μ_π and μ_x to obtain the optimal allocations given determinacy.
- From this perspective, there is little to choose between interest rate or monetary implementations.
- Higher order approximations also possible.

REMARKS

- Feedback for money supply rules unusual.
- A monetary feedback rule can accomplish everything an interest rate rule can accomplish.
- It is still a rule. All issues about commitment and announcing policy paths are still relevant.
- Setting $\mu_\pi = \mu_x = 0$, "no feedback", "not state-contingent" may yield determinacy but would in general be far from the optimal policy.
- Switching to "quantitative monetary policy" at low nominal interest rates without thinking about issues like this may lead to policy errors.
- Objections to quantitative monetary policy are better couched in terms of practical considerations.

A QUANTITATIVE RULE IN A NK MODEL

- McCallum and Nelson (1999).
- Estimated two-equation New Keynesian model for the U.S.
- Supplement with a money demand equation.
- Simulate with both Taylor and McCallum (monetary base) rules.
- Conclude that performance of the model economy is roughly similar whether the Taylor or McCallum rule is used (pp. 37-42).

THE MCCALLUM RULE IN THE CURRENT SITUATION

- Assume nominal income growth from Macroeconomic Advisers forecast.
- They predict subdued inflation.
- Question: What path of monetary base growth does the McCallum rule suggest is consistent with the forecast?
- Problem: Mechanical application of McCallum rule with the current historical average base growth implies an explosive path for future base growth.
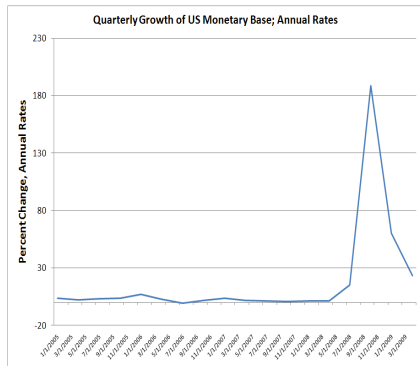
THE MCCALLUM RULE IN THE CURRENT SITUATION
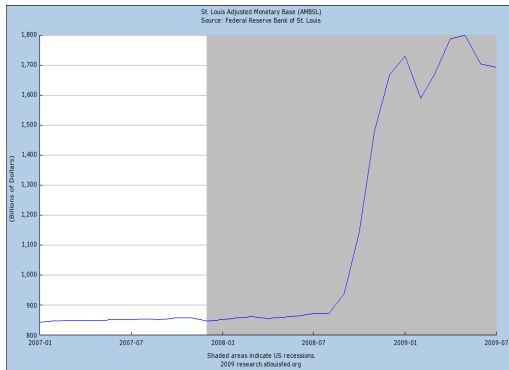
St. Louis Adjusted Monetary Base.

Source: Federal Reserve Bank of St. Louis FRED, research.stlouisfed.org.

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THE MCCALLUM RULE IN THE CURRENT SITUATION

Quarterly Growth of US Monetary Base; Annual Rates

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THE MCCALLUM RULE IN THE CURRENT SITUATION

- Replace historical moving average base growth term in the McCallum rule with a constant 4.5 percent starting in 2008 Q3.

- Represents an expectation of the growth rate of the monetary base over the indefinite future.

- Consistent with an inflation target of 2.0 percent and a real output growth rate of 2.5 percent.

- Assumes constant base velocity over the indefinite future, so that the decline in base velocity started in 2008 is never reversed.

- Questionable.

THE MCCALLUM RULE IN THE CURRENT SITUATION
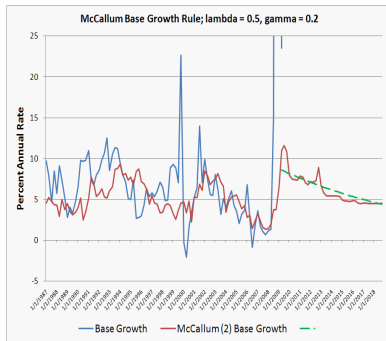
Green line shows a constant rate of decline in base growth

of 1.74 percent per quarter from mid 2009 through 2018.

THE MCCALLUM RULE IN THE CURRENT SITUATION

- The doubling of the monetary base in the past year cannot be justified by an appeal to a quantitative rule like this.
- The doubling of the monetary base could be viewed as destabilizing from the perspective of quantitative rules.
  - The asset purchase program has made the doubling of the monetary base very persistent as well as very large.
- In the example, if inflation were to accelerate, the McCallum rule would begin calling for a shrinking monetary base.
- The fit is perhaps not that different from a Taylor rule.

OTHER QUANTITATIVE RULES

- I have focused on quantitative rules in the literature.
- Rules could be expressed in terms of asset purchases instead.
- In addition to effects on the monetary base, one might want to incorporate effects on interest rate spreads ...
- ... or specific markets, such as housing.
- That would require more elaborate models, but it could be done.

WHAT ABOUT THE GREAT DEPRESSION?

- What about the Great Depression?
  - Slow growth of monetary base from 1929 through 1933.
  - Collapse in base growth in 1936-7 (increase in reserve requirements between August 1936 and May 1937).
  - McCallum (1990) argues that simulations of his rule "clearly indicate the plausibility of the proposition that a monetary base rule could have prevented the Great Depression." (p. 22)

WHAT ABOUT THE GREAT DEPRESSION?

- Christiano, Motto & Rostagno (2003).
  - Construct a DSGE model with shocks to the banking sector & financial frictions.
    - In particular, they incorporate a "liquidity preference shock" when households "accumulate currency at the expense of demand deposits and other liabilities (time deposits) that are used to fund entrepreneurs who own and operate the economy's stock of capital" (p. 1120).
    - This sounds like an element of the Great Panic of 2008.
  - Monetary policy follows a quantitative rule ...
    - "... whatever rule the monetary authority follows, it corresponds to a particular reduced-form feedback function from shocks in the economy to the monetary base." (pp. 1142-3)
  - They conclude the Depression could have been avoided.

WHAT ABOUT JAPAN?

- What about Japan?
  - No sustained path of monetary base expansion
  - A contraction in base growth in 1990-92.
  - Slow (<5% year-over-year) base growth 1992 through late 1995.
  - Year-over-year base growth falls to zero again in 2000.
  - Base growth not sustained after the introduction of "quantitative easing" in 2001.
  - Major contraction in year-over-year base growth in 2006-7.

WHAT ABOUT JAPAN?

Growth Rate of Japanese Monetary Base
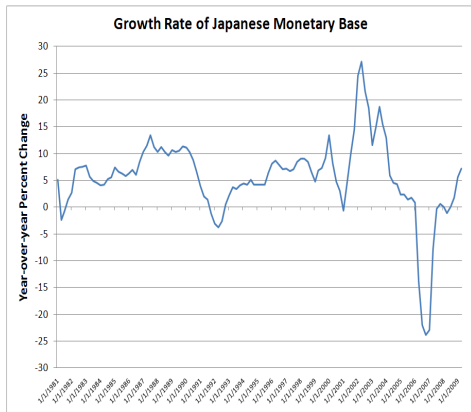
CONCLUSIONS

- We would like to carry out an active stabilization policy during a period of near-zero nominal interest rates.
- Good policy rules describe how the policymaker intends to react to shocks in the future.
- The U.S. asset purchase program does not have a state-contingent character.
- This may be an area where U.S. monetary policy could make improvements.

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Federal Reserve Economic Data (FRED)
research.stlouisfed.org/fred2/

James Bullard

research.stlouisfed.org/econ/bullard/