Public Affairs 974-001 Menzie D. Chinn
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Problem Set 3 Answers

Due in lecture on Wednesday, December 8th.

1. Suppose the bank you own has the following balance sheet, in millions:

Assets		Liabilities	
Reserves	$1600	Deposits	$10000
Loans	$10400	Bank Capital	$2000

If the bank suffers a deposit outflow of $1 billion with a required reserve ratio on deposits of 10%, what actions must you take to keep you bank from failing?

Answer:
Required reserves: 10% of $10000 = $1000
Excess reserve: $1600-$1000 = $600

Deposit outflow of $1 billion.
Balance sheet becomes:

Assets		Liabilities	
Reserves	$600	Deposits	$9000
Loans	$10400	Bank Capital	$2000

Required reserves: 10% of $9000 = $900
Excess reserve: $600-$900= -$300
Insufficient reserves. To eliminate shortfall the bank has 4 basic options to acquire reserves to meet deposit outflow:
1. borrowing them from other banks in the Fed funds market or corporations (cost: interest rates on the loans)
2. sell some of its securities (cost: transaction costs)
3. borrowing from the Fed (cost: 1.interest rate on loan; 2. non-explicit cost of increased scrutiny and Fed's discouragement of too much borrowing)
4. reducing loans by this amount (cost: lose customers, very costly)

Option 1:

Assets		Liabilities	
Reserves	$900	Deposits	$9000
Loans	$10400	Borrowing from other banks or corporations	$300
		Bank Capital	$2000

Option 2: no securities owned

Option 3:

Assets		Liabilities	
Reserves	$900	Deposits	$9000
Loans	$10400	Discount loans from Fed	$300
		Bank Capital	$2000

Option 4:

Assets		Liabilities	
Reserves	$900	Deposits	$9000
Loans	$10100	Bank Capital	$2000

2. Consider these two banks, which are the same size in terms of assets. Suppose further that the return on assets (ROA) is 2%.

High Capital Bank				**Low Capital Bank**			
Assets		Liabilities		Assets		Liabilities	
Reserves	$10	Deposits	$90	Reserves	$10	Deposits	$96
Loans	$90	Bank Capital	$10	Loans	$90	Bank Capital	$4

2.1 Calculate the ROE for each bank.

Answer:

<u>For high capital bank:</u>

ROE = (net profit after taxes)/(equity capital)
= ROA*EM
EM = (assets)/(equity capital)
= $100/$10
= 10
ROE = 2%*10=20%

<u>For low capital bank:</u>

ROE = (net profit after taxes)/(equity capital)
= ROA*EM
EM = (assets)/(equity capital)
= $100/$4
= 25
ROE = 2%*25=50%

2.2 What is the advantage of being a high capital bank?

Answer: The likelihood of having a shock to assets that makes the bank go insolvent is reduced.

2.3 Is either of the banks more susceptible to liquidity problems?

Answer: Not clear.

3. Consider the case of a manager of a bank that is attempting to reduce the risk associated with interest rate changes. The bank has $30 million of fixed-rate assets, $20 million of rate-sensitive assets, $10 million of fixed-rate liabilities, and $40 million of rate-sensitive liabilities. If the bank manager conducts a gap analysis for the bank, show what would happen to bank profits if interest rates rise by 2 percentage points. What actions could the bank manager take to reduce the bank's interest rate risk, if he/she so decided?

Answer: The sensitivity of bank profits to changes in interest rates is given by
(rate-sensitive assets – rate-sensitive liabilities)* (change in interest rates)
($20-$30)*(2%) = -$10*2%=-$10*0.02=-$0.2
If interest rates rise by 2% the bank's profits falls by $0.2 million.

Actions to reduce bank's interest rate risk:
1. shorten the duration of the bank's assets to increase their rate sensitivity
2. lengthen the duration of the bank's liabilities to reduce their rate sensitivity

4. Consider the balance sheet of the Fed.
4.1 If the return on loans and Treasury securities rise, what will happen to the money supply, holding all else constant. Explain the mechanism for this effect.

Answer: Banks will then tend to lend out more of their reserves; this will increase deposits, and hence money supply.

4.2 What could the Fed do in order to control the money supply?

Answer: The Fed could either reduce reserves, or increase the interest rate paid on reserves. The former entails reducing the asset side as well (selling T-bills, bonds, or MBS), while the latter would entail higher payments by the Fed.

5. The Taylor rule. Collect monthly data on the Fed funds rate, inflation, real GDP and potential GDP, and unemployment, over the 1987Q1-2010Q2 period. Potential GDP can be retrieved from here: http://www.cbo.gov/ftpdocs/117xx/doc11705/KeyAssumptionsPotentialGDP.xls .
5.1 Estimate the Taylor rule, using the output gap.

Define interest rate as Fed Funds rate, inflation as annualized quarter-on-quarter core PCE inflation (calculated using logs), output gap is log ratio of real output to CBO potential, Gaps, interest and inflation rates expressed in decimal terms.

$$i_t^{FedFunds} = \pi_t + \beta(y_t - y_t^*) + \delta\,(\pi_t - \pi_t^*) + r_t^*$$

$$i_t^{FedFunds} = (1+\delta)\pi_t + \beta(y_t - y_t^*) + r_t^* - \delta\pi_t^*$$

Dependent Variable: FEDFUNDS1
Method: Least Squares
Date: 12/03/10 Time: 22:02

Sample: 1986Q1 2010Q3
Included observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.016706	0.003670	4.551575	0.0000
GAP	0.531157	0.059948	8.860334	0.0000
INFLPCE_CORE	1.320172	0.136032	9.704896	0.0000

R-squared	0.669425	Mean dependent var	0.045001
Adjusted R-squared	0.662538	S.D. dependent var	0.024207
S.E. of regression	0.014062	Akaike info criterion	-5.660830
Sum squared resid	0.018983	Schwarz criterion	-5.582190
Log likelihood	283.2111	Hannan-Quinn criter.	-5.629012
F-statistic	97.20158	Durbin-Watson stat	0.425421
Prob(F-statistic)	0.000000		

Using the second equation, one can see that δ = 0.32, β = 0.53. The regression estimates imply that $0.017 = r_t^* - \delta\pi_t^*$. With the target inflation rate at 2% (0.02),

$$0.017 = r_t^* - 0.32 \times 0.02$$

Or, the natural rate of interest equals 0.023, or 2.3%.

5.2 Estimate the Taylor rule, using the unemployment gap. Use this equation:

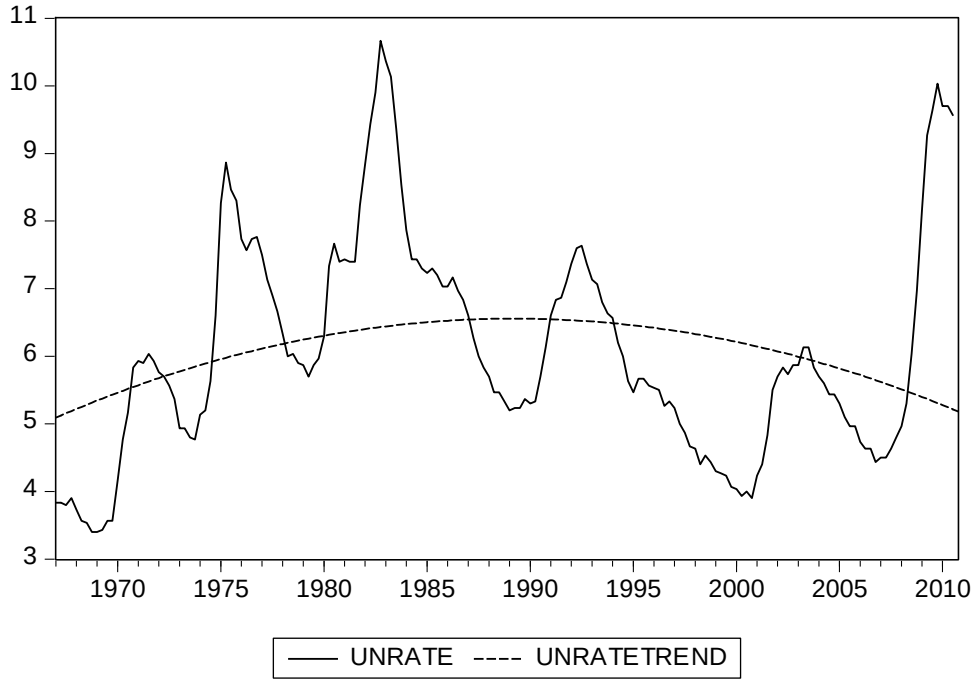
$$i_t^{FedFunds} = (1+\delta)\pi_t + \gamma(u_t - u_t^*) + r_t^* - \delta\pi_t^*$$

Where $\gamma < 0$, *u* is the unemployment rate in decimal form. In order to estimate this, one has to get the unemployment gap. I estimate the natural rate assuming it's a quadratic in time.

Dependent Variable: UNRATE
Method: Least Squares
Date: 12/03/10 Time: 21:57
Sample (adjusted): 1967Q1 2010Q3
Included observations: 175 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.090414	0.349527	14.56370	0.0000
TIME	0.032963	0.009282	3.551474	0.0005
TIMESQ	-0.000185	5.16E-05	-3.591047	0.0004

R-squared	0.070202	Mean dependent var	6.081714
Adjusted R-squared	0.059390	S.D. dependent var	1.607381
S.E. of regression	1.558919	Akaike info criterion	3.742857
Sum squared resid	417.9995	Schwarz criterion	3.797111
Log likelihood	-324.5000	Hannan-Quinn criter.	3.764864
F-statistic	6.493163	Durbin-Watson stat	0.051014
Prob(F-statistic)	0.001912		



Generate the unemployment gap as the residual (divided by 100).

Dependent Variable: FEDFUNDS1
Method: Least Squares
Date: 12/03/10 Time: 22:35
Sample: 1986Q1 2010Q3
Included observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010197	0.003416	2.984761	0.0036
UEGAP	-0.887898	0.090715	-9.787805	0.0000
INFLPCE_CORE	1.307312	0.129819	10.07028	0.0000

R-squared	0.699235	Mean dependent var	0.045001
Adjusted R-squared	0.692969	S.D. dependent var	0.024207
S.E. of regression	0.013413	Akaike info criterion	-5.755332
Sum squared resid	0.017272	Schwarz criterion	-5.676692
Log likelihood	287.8889	Hannan-Quinn criter.	-5.723514
F-statistic	111.5928	Durbin-Watson stat	0.416410
Prob(F-statistic)	0.000000		

Using the second equation, one can see that δ = 0.31, γ = -0.888. The regression estimates imply that

$$0.017 = r_t^* - \delta\pi_t^*$$

Or, with the target inflation rate at 2% (0.02),

$$0.011 = r_t^* - 0.31 \times 0.02$$

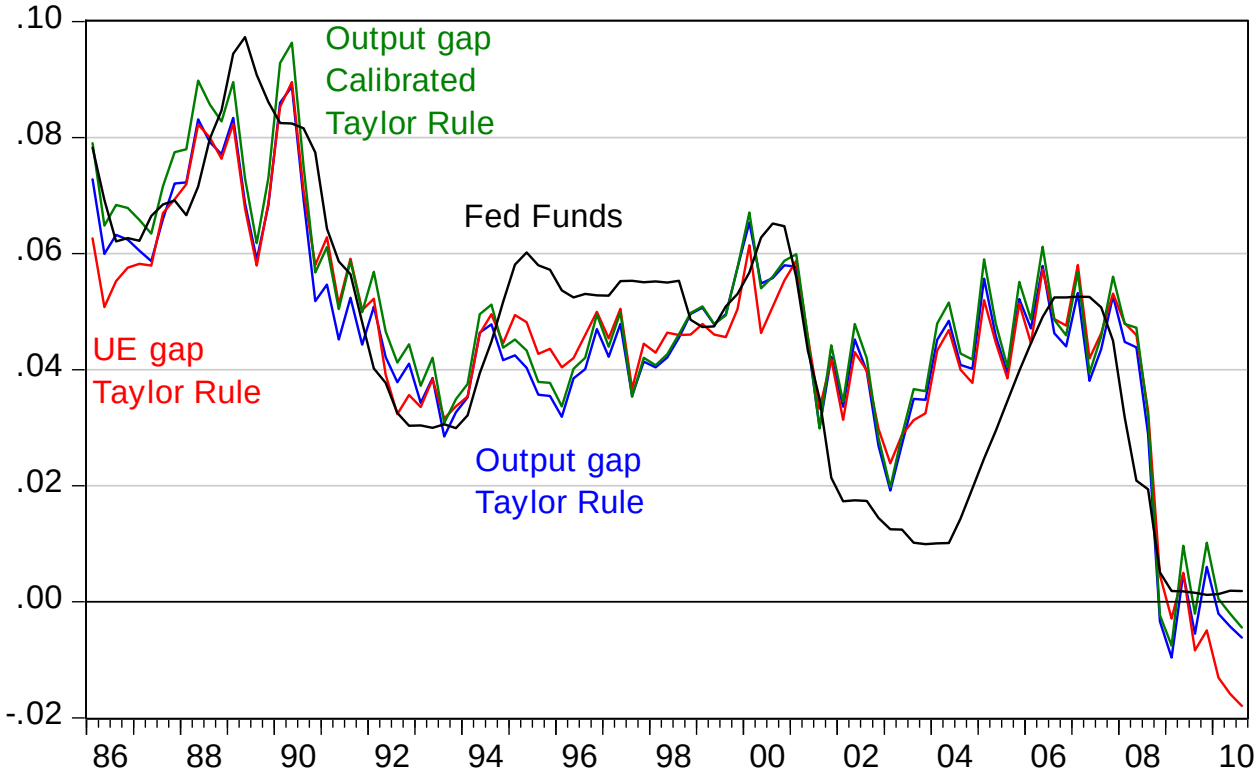
Or, the natural rate of interest equals 0.017, or 1.7%.

5.3 Compare the results assuming the coefficients on the Taylor rule (using the output gap) are 0.5, 0.5

Calibrate the model as:

$$i_t^{FedFunds} = (1.5)\pi_t + 0.5(y_t - y_t^*) + 0.025 - \delta(0.02)$$

Comparing all the implied Fed Funds rates against the actual yields the following figure.



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