

What Determines the Level of Interest Rates

Bjørn Eraker

Wisconsin School of Business

January 4, 2015

Basic Components of the Term Structure

By term structure we mean coupon, zero coupon, or forward rate curve.

Traditional theory of the term structure:

- Level
- Slope
- Curvature

Slope is defined as the difference between long and short rates. Curvature is defined as concavity or convexity of the curve. Instead of *level* and *slope* we can talk about *short vs. long* end of the curve.

What determines the short end?

In short: FED fund policy!

What determines the long end?

- Expected future short rates (mechanically)
- Expected inflation

... so what determines the FED's policy?

The so-called Taylor rule of interest rate policy suggests that the short term interest rate should be determined by

- Strength of Real Economic growth
- Inflation

A mathematical formulation

Let

- π_t denote inflation
- y_t denote **output**, either GDP or other output measure (say industrial production). It can also denote the *growth rate*.
- r_t denote short the term interest rate, typically FED fund rate
- y_t^* and π_t^* denote *target* output and inflation

then

$$r_t = r_t^* + \theta_\pi(\pi_t - \pi_t^*) + \theta_y(y_t - y_t^*) \quad (1)$$

The parameters $\theta_\pi > 0$ and $\theta_y > 0$ determine how responsive the policy is to the target objectives.

- When in a recession (low output), ($y_t < 0 < y_t^*$), interest rates are lower
- Vice versa, when in a boom, interest rates are high
- When inflation is high, rates are high (and vice versa)

Do Taylor rules explain historical rates?

A non-scientific empirical examination:

- Early '80ties: Inflation very high (much above desired level). FED increased rates to almost 20%.
- 2008-now: Strong recession, and low inflation → should predict low rates

Fed Policy: FOMC Meetings

The FOMC meetings take place at pre-announced dates. They will have additional, ad-hoc meetings when the economy calls for it. There are 8 scheduled meetings for 2013. 8 meetings were held in 2012, 8 regular + 2 unscheduled meetings in 2011, etc.

See full schedule and minutes at

<http://www.federalreserve.gov/monetarypolicy/fomccalendars.htm>.

Fed Policy: FOMC Meetings

The Fed now releases detailed information about their economic outlook. In particular, they publish their own expectations of key activity and inflation expectations:

<http://www.federalreserve.gov/monetarypolicy/fomcprojtab120120125.htm>

From the FOMC January 2013 Supporting material :

Figure 1. Central tendencies and ranges of economic projections, 2012-14 and over the longer run

	2008	2009	2010	2011	2012	2013	2014	Long Run
Actual	(3.3)	(0.5)	3.1	1.6	-	-	-	
Upper End of Range	--	-	-	3.0	3.8	4.3	3.0	
Upper End of Cent. Tend	-	-	-	-	2.7	3.2	4.0	2.6
Lower End of Cent. Tend	-	-	-	-	2.2	2.8	3.3	2.3
Lower End of Range	-	-	-	-	2.1	2.4	2.8	2.2

From the FOMC December 2013 Supporting material :

Figure 1. Central tendencies and ranges of economic projections, 2013-16 and over the longer run

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Long Run
Actual	(2.8)	(0.2)	2.8	2.0	2.0	-	-	-	-	-
Upper End of Range	--	-	-	-	-	2.4	3.3	3.6	3.5	2.5
Upper End of Cent. Tend	-	-	-	-	-	2.3	3.2	3.4	3.2	2.4
Lower End of Cent. Tend	-	-	-	-	-	2.2	2.3	3.0	2.5	2.2
Lower End of Range	-	-	-	-	-	2.2	2.2	2.2	2.1	1.8

see

<http://www.federalreserve.gov/monetarypolicy/fomcprojtabl20131218.htm>

The FED uses PCE inflation. This is the inflation of the Personal Consumption Expenditure (PCE) index. This index is computed differently from the CPI. Notably, the two indices use different weighting.

See http://www.bea.gov/national/nipaweb/nipa_underlying/pce-cpi.asp for details.

Since the financial crisis the FED has tried to keep rates low by

- Announcing a multi-year policy
- Members' assessment of appropriate speed of firming (increasing rates)

Figure 2. Overview of FOMC participants' assessments of appropriate monetary policy, January 2012

(Percent)	2012	2013	2014	Longer Run
0.25	14	11	6	
0.50	1	1	2	
0.75		2	1	
1.00	2	1	2	
1.25				
1.50			1	
1.75		1		
2.00		1	1	
2.25				
2.50			3	
2.75			1	
3.00				
3.25				
3.50				
3.75				1
4.00				7
4.25				3
4.50				6

Figure 2. Overview of FOMC participants' assessments of appropriate monetary policy, December 2012

	2012	2013	2014	2015	Longer Run
0.25	19	17	14	1	
0.50		1	1	5	
0.75				3	
1.00		1		3	
1.25				2	
1.50			2		
1.75			1		
2.00				1	
2.25					
2.50				1	
2.75			1		
3.00					1
3.25					
3.50				1	1
3.75				1	3
4.00					5
4.25					6
4.50				1	3

Why it works

Traditionally the FED has had a hard time lowering rates at the long end of the curve. The policy statements work because to the extent the policy is believable, the yield curve will flatten. The reason why it must flatten is the relationship between the zero curve on the forward rate curve and the forward rates are given by

$$f(t, \tau) = E_t^Q(r_{t+\tau}) = E_t(r_{t+\tau}) + \text{risk premium} \quad (2)$$

Let's compare the expected path from the survey to the forward rate curve.

- For 2013 there is 17/2 for the current 0-25 target (average = 30 bp)
- For 2014 there are 14/5 for the 0-25 target (average = 58 bp)
- For 2015 the majority expects 50 or greater (average = 140 bp)

Let's compare to the fitted forward curve to the average of the FED members' survey:

	Piece.w. Lin	NS	FED
2013	15-85		30
2014	45-56		58
2015	137		140
2043	610		404

There is also a market for FED fund futures. We will spend a whole lecture on this so for now, it suffices to mention that we get direct market based interest rate expectations from the FED fund futures market. As of Feb 22, the rate expectations are basically suggesting a flat policy at 25BP until July 2015 (50 BP).

Fed fund futures are very illiquid, especially at longer maturities.

Current interest rate expectations and mean reversion

Remember mean-reversion in Vasicek, $\kappa(\theta - r_t)$

- Mean reversion is stronger when the current rate, r_t , is farther from the long run mean, θ
- Therefore mean reversion suggests that we should have rapidly increasing rates from today's low rates
- However, the policy path suggest slow reversion

This suggests a more complicated model than the Vasicek model is needed to understand the behavior of interest rates.

Quantitative Easing programs were implemented in Japan in 2001 and US and EU following the financial crisis in 2007.

- QE1: Asset purchases by the Fed during 2008 totaling about 1.75 trillion of MBS, bank debt, and treasuries.
- The program resumed in the Fall of 2010 after the economy showed signs of weakening.
- QE2 was announced in Nov 2010. Goal was to purchase 600 BN treasuries by fall of 2011.
- QE3 announced Sept 2012. FED will purchase 40 BN of Asset backed/ mortgage backed securities per month. In addition, they announced zero-25 BP FF rate through 2015.

Do QE programs work?

- Short term: Yes.
- Unclear how large the effect is: Why does one branch of government issue bonds while another branch purchase them?
 - What if the treasury just increase supply?
 - What is the long term consequence of the program?
Inflation?

While the FED does not officially look to equity markets for policy input there are several indications that the level of prices and the stock market volatility impact their decisions

- Toward the end of the 90ties, then FED chairman Alan Greenspan increased rates to combat what he famously referred to as "irrational exuberance" (inflated asset valuations)
- In his Georgetown lectures, current Chairman Bernanke refers to financial stability as a goal. One interpretation is that the FED will lower rates in financial crisis periods (when volatility is high)

Concluding Remarks

- New policy tools since 2008:
 - Commitment to low rates going forward
 - QE programs
- This, in addition to zero FF rate gives maximum stimulus
- Further resources: Bernanke's Georgetown lectures in 2012: <http://www.federalreserve.gov/newsevents/lectures/about.htm>