The term structure

Fixed income

Bootstrapping

- Needed: rates on zeros at all maturities
- What is the present value of 1$, risk free, to be delivered 1, 2, 3.5, 10 years from now?
- This is the information we need to discount "risk-free" strings of payments…
- … and can be inferred from the yield curve
- Only issue is that zero-coupon bonds don't exist for all maturities
- But we can engineer and price zero-coupon portfolios of treasuries
- This gives the *theoretical spot yield curve*

Theories of the term structure

- The *normal shape* of the yield curve is upward sloping and concave
- So much so that we refer to a downward sloping curve as *inverted*…
- …a situation viewed as temporary, a bad omen for the economy, and destabilizing
- Why does the yield curve typically slope up?
- What drives its steepness?

The expectations hypothesis (EH)

- According to this theory, long-term returns are the expected return of short-term roll-over strategies
- Under EH, with t being today:

$$\left(1 + r_{t,2}\right)^2 = \left(1 + r_{t,1}\right)\left(1 + Er_{t+1,1}\right)$$
$$\left(1 + r_{t,3}\right)^3 = \left(1 + r_{t,1}\right)\left(1 + Er_{t+1,1}\right)\left(1 + Er_{t+2,1}\right)$$
$$\dots$$

- So if $r_{t,1} = 2\%$ and $Er_{t+1,1} = 3\%$ then $r_{t,2} = 2.5\%$
- Note that the yield curve slopes up if and only if short-term rates are expected to rise, under this hypothesis

Relations to forward rates

- By definition, forward rates solve:

$$\left(1 + r_{t,2}\right)^2 = \left(1 + r_{t,1}\right)\left(1 + f_{t+1,1}\right)$$

- So under EH and under EH only, $Er_{t+1,1} = f_{t+1,1}$
- We would expect $Er_{t+1,1} < f_{t+1,1} \cdots$
- … because long-term investors are exposed to more risk
- In fact, $f_{t+1,1} - Er_{t+1,1}$ is an excellent measure of that premium

General formula for forward rates

- Notation: $f(t,k)$ forward rate at date today + t for tenor k
- Formula:

$$f(t,k) = \left[\frac{(1+r_{t+k})^{t+k}}{(1+r_t)^t}\right]^{1/k} - 1$$

where r_t is today's spot yield at tenor t

- Plus standard annualization adjustment as needed

A very influential variation

- The *5-year, 5-year forward inflation expectation rate:*

$$\left[\frac{\left(1+r_{10}-r_{10}^{TIPS}\right)^{10}}{\left(1+r_{5}-r_{5}^{TIPS}\right)^{5}}\right]^{1/5}-1$$

is the Fed's favorite gauge of medium-term inflation expectations

- This is what they're currently using to tell us that everything is honkey-dorey

Changing shapes

- *Bear flattening*: short-term rates rise more than long-term rates
- *Bear steepening*: short-term rates rise less than long-term rates
- *Bull flattening*: short-term rates fall less than long-term rates
- *Bull steepening*: short-term rates fall more than long-term rates

Yield-curve strategies

- If stable:
  1. Buy and hold
  2. If upward sloping, ride the YC
  3. Sell convexity
  4. Carry trade (borrow short, invest long)
- For movements in level, slope, or curvature
  1. Duration management
  2. Buy convexity
  3. Bullet, barbells, butterflies, and condors

Riding the yield curve

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FINANCE QUIZ DU JOUR

You invest in a 2 YR Bond yielding 2.42%. What is your total return after one year assuming all rates stay the same?

Treasury Yields

NAME	COUPON	PRICE	YIELD
GB3:GOV **3 Month**	0.00	0.65	0.66%
GB6:GOV **6 Month**	0.00	1.08	1.10%
GB12:GOV **12 Month**	0.00	1.64	1.68%
GT2:GOV **2 Year**	2.25	99.66	2.42%
GT5:GOV **5 Year**	2.50	99.38	2.63%
GT10:GOV **10 Year**	1.88	94.05	2.56%
GT30:GOV **30 Year**	2.25	92.67	2.61%