ASSET MANAGEMENT VIEWPOINT
CONNING
December 2009 – Vol 13, #7

Straight Talk about Curves – why asset-liability managers care about term structure

Richard L. Sega, FSA, MAAA, Chief Investment Officer

Asset-liability management (ALM) is a discipline aimed at controlling and mitigating interest rate risk. This includes not only the exposure of a portfolio to changes in the general level of interest rates, but also to changes in the relative levels of rates along the maturity spectrum. Most portfolio managers will claim that they don't position portfolios on the basis of an interest rate call, but will profess to add value by taking advantage of yield curve reshaping. Why is this so? Is it really any easier to forecast yield curve relationships than outright rate levels?

The term structure of interest is the pattern of yields on US Treasury "on-the run" (generally the most recently issued) notes and bonds. Questions abound regarding the current yield curve (relatively steep by historical standards) such as, "what will the Fed's next move be and when will it occur?" and "will inflation fears continue to rise and steepen the long end further"? Bond traders are constantly reassessing what yields are appropriate compensation for investing over long periods of time. Term structure is, in the language of Capital Asset Pricing Theory, the market's return requirement for cash flows at various points in future time. What then, gives the yield curve its shape? And what can be said of the market's forecast of future interest rates given a particular yield curve?

These questions can be answered only in theory, by asserting something about the behavior of bond buyers and sellers. There are several popular theories, each with some ability to explain the world we observe, but none that does it perfectly. There are three popular ones.

PE term structure theory – forming a baseline

Let's assume that the yield curve's shape is wholly explained by rational, wealth-building market participants' expectations for future interest rates. This leads to the **pure expectations** (PE) theory of the term structure. A simple example will show how an outlook on the direction of interest rates gives rise to an upward, or positive-sloping yield curve.

Suppose in a simple world of nothing but government bonds, the one-year rate is 0.30%. Suppose further that you believe that one-year rates a year from now will be 1.30%; that is, rates will rise 100 bps. If your investment horizon were two years, the two year rate would have to be at least 0.80%, or you wouldn't buy it. You could do better buying the one year at 0.30% and reinvesting next year at 1.30%, as follows:

The first year rate of 0.30%, then reinvest at 1.30% gives 0.80% compounded for two years.

(1.003) x (1.013) = 1.016 ~= (0.80) ^ 2

If you then thought that one-year rates would continue to climb to 2% in the third year and you extended your horizon until then, similar arguments will show that the three-year rate must be 1.20%:

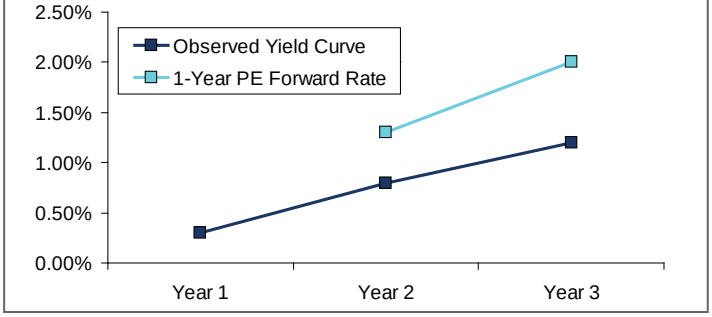
(1.003) x (1.013) x (1.020) = 1.0364 ~= (1.0120) ^ 3

If the market agreed with your outlook and the two or three year rates were anything other than 0.80% and 1.20%, buying and selling pressure from participants acting on their expectations would bring them into line. So if we adhered to the PE theory and we observed the following yield curve, we would immediately deduce a forecast for rates rising to 1.30% next year and 2.00% the year after:

Observed yield curve	One-year PE forward rate
Year 1 – 0.30%	-
Year 2 – 0.80	1.30%
Year 3 – 1.20	2.00%

The expectations for rates in the future that are implied by any particular yield curve shape are called forward rates. The set of forward rates consistent with the PE theory and any particular yield curve is called the PE forward curve for that yield curve.

Exhibit 1 – PE Forward Yield Curve
Source: Conning illustration



By this reckoning, positive yield curves foretell rising rates and inverted curves presage falling rates. Since positively sloped curves are observed some four times as often as any other shape (flat or inverted), but rates don't rise nearly that often, the PE theory has been embellished in an attempt to do better.

LP theory – never underestimate the power of cash

If we assume the same basic bunch of rational investors we had in the PE group, but we assume further that they have a bias for liquidity, we have the makings of the **liquidity preference** (LP) term structure theory and LP forward rates. This preference is often implicitly expressed by insurance companies that hold minimum "liquidity balances" and short, highly marketable bond portfolios as a precaution against unexpected claims. This suggests that some portfolio managers will pay a premium for near-cash alternatives, depressing yields on short paper beyond the level based on expectations alone.

Let's say our liquidity bias is quantified by a yield requirement of an additional 50 basis points per year for maturities beyond one year. In that case, we can compute what our observed yield curve would imply under the LP hypothesis:

Observed yield curve	Liquidity Premium	One-year LP forward rate
Year 1 – 0.30%	-	-
Year 2 – 0.80	0.50%	0.30%
Year 3 – 1.20	1.00%	0.00%

Since you can't earn liquidity premia unless you buy the longer paper, rolling the one-year bond for a two-year horizon suggests that the reinvestment must break even against the two-year rate without the 50 basis points.

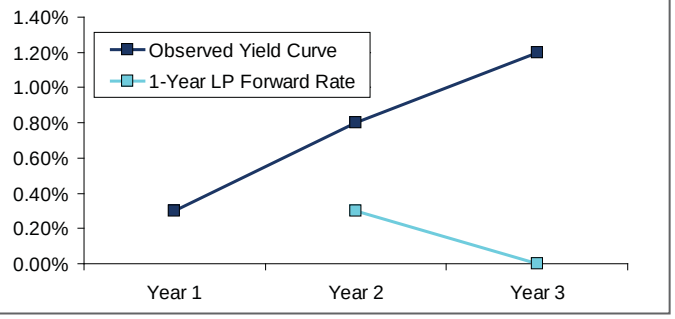
(1.008 - 0.005) ^ 2 ~= (1.003) x (1.003)

and

(1.012 - 0.01) ^ 3 ~= (1.003) x (1.003) x (1.000)

If we do that, the market forecast is seen to be flat, no rise in rates at all. In fact, by the third year, the market is actually calling for rates to go down! The same observed yield curve tells a vastly different story under the LP theory. This adjustment to the PE hypothesis goes a long way toward explaining the preponderance of positively-sloped curves we see in real life.

Exhibit 2 – LP Adjustment to PE Theory
Source: Conning illustration



Market Segmentation – different strokes for different folks

The **market segmentation** (MS) theory generalizes the LP approach to reflect various preferences for maturities, not strictly for liquidity. For example, life insurers might express a preference for a particularly long maturity to support retirement annuity business by requiring somewhat less yield rather than more. That is, some investors are willing to pay up for some maturities some of the time. This could look like a positive or negative liquidity premium in the LP calculation. This allows for many yield curve reshapings depending upon who is in or out of the market and what they like.

The price of tea in China

All of this does have profound impact on ALM and surplus strategy. Using duration as the primary measure of interest rate risk, we can say that if we mismatch assets and liabilities (or equivalently, if our duration of surplus is different from our investment horizon for surplus), the amount of risk taken is proportional to the duration difference between them. That's what mismatching does to risk. What it does to return depends upon your theory about term structure.

PE – one implication of this hypothesis is that all strategies have the same expected return ex ante over a fixed horizon (that's the way we calculated the numbers for it). They won't have the same actual return ex post depending upon what really happens to rates, but taking the additional risk of reinvestment does not add any additional return to your expectation. If all strategies have the same expected return, the dominant strategy is the one with lowest risk: i.e., the duration-matched strategy. Any mismatch adds risk without reward. Clearly, anticipating changes in the yield curve's shape is tantamount to an interest rate forecast under this view.

LP – if a manager believes in the presence of liquidity premia, then, so long as the liquidity is not needed by the liabilities, those premia can be earned. They can contribute to excess returns by mismatching long, regardless of yield curve shape. Surplus duration can be positioned somewhat longer than the investment horizon to take advantage of the preference some investors have for short paper. Trends in overall liquidity and investor demand can give clues as to whether the liquidity premium is expanding or contracting, and thus to the next reshaping of the curve.

MS – it is difficult to generalize if the market segmentation theory is your operating view. One must be able to forecast the flow of funds to and from various sectors which have meaningful effects on the yield curve in order to know where the value is hidden. Such an active approach says that some rate and yield curve changes are more probable than others, and that a portfolio can be positioned to earn excess returns from this knowledge. It is with this view that the "standstill return" and "shape-preserving" shift simulations are most consistent, since this set of forward rates is independent of the market's view of the direction of interest rates. It depends only on the number of natural buyers of bonds at various points on the maturity spectrum relative to their supply.

If you believe a certain supply-demand pattern will persist (and equivalently, that the current yield curve shape will also persist), then "riding the yield curve" (mismatching surplus duration relatively long for positive curves and short for inverted ones) could earn differential returns. Anticipated changes in those supply and leverage trends allow a manager to position a portfolio to take advantage of the inferred reshaping.

Different phases of the business cycle historically have exhibited characteristic reshapings of the yield curve. One critical element is investors' view of inflation. During periods of rising inflation expectations, demand for long-dated assets wanes. This steepens the yield curve until rates increase enough to compensate for reduction in buying power. One must be able to forecast the consensus estimate for inflation and the resulting demand flows in order to know when a curve reshaping might offer an opportunity to benefit performance.

Stanley Kubrick, the film-maker, once said that "...if you can talk brilliantly about a problem, it can create the consoling illusion that it has been mastered." Clients are justly skeptical of managers' claims about market timing prowess and interest rate anticipation. Without a clear articulation of an operating view of the term structure, similar skepticism should be applied to claims about curves . ◆

Richard L. Sega, FSA, MAAA, *is Conning's Chief Investment Officer, responsible for portfolio management and trading. Mr. Sega was President and CEO of Charter Oak Capital Management, Inc. which was acquired by Conning in 2000. He is a graduate of Fordham University with a degree in Mathematics and earned an MA in Statistics from Columbia University. Mr. Sega is a member of the CFA Institute.*

CONNING, One Financial Plaza, Hartford, CT 06103
860-299-2000, www.conning.com