Great expectations

How a view of the future affects the present

Information derived from interest rates, in particular changes in yield curves, is important in explaining market behaviour. JASON TEH describes an analysis of the relationship.

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Understanding the fundamental factors that drive markets is paramount in the investment decision process. The globalisation of financial markets means that understanding the drivers of financial markets may seem more complicated than ever, given the expansion of information and the ease with which it is produced.

However, one economic theory that is as relevant today as when it was first developed is the theory of interest rates developed by Irving Fisher at the turn of the century.[1] This study uses the information derived from interest rates — in particular, relative inflation expectations — in explaining the performance of the Australian dollar and the relative performance between defensive sectors such as listed property and the broader stockmarkets of Australia and the United States.

Fisher popularised the idea that over the term of a debt instrument, interest rates can be decomposed into two components — an expected inflation rate and an expected real rate of return. The Fisher equation, which explains this relationship, is:

$$(1+r) = (1+R)\,(1+I)$$

where r = nominal interest rate
I = expected inflation
R = expected real rate of return

The expected real rate of interest compensates investors for delaying consumption for the term of the debt security. To induce investors to wait, investing in debt securities must offer the prospect of greater consumption in the future. If investors are concerned with expected real returns, then securities will be priced in the marketplace so that interest rates incorporate the expected rate of inflation. The inflation premium compensates investors for the loss in the purchasing power of the dollar that is expected over the life of the security.

Given that interest rates are priced over the term of a debt security, the information derived from different terms to maturity may differ. Therefore, interest rates on bonds with different maturities may diverge on the basis of expectations of the factors affecting bond yields. The yield curve captures the

relationship between maturity and interest rates and is the term structure of interest rates.[2]

Other factors influence interest rates. Investors may require funds earlier than expected and recognise that the longer they invest, the greater the interest rate risk they face.[3] The supply-and-demand conditions in each segment of the market may also influence interest rates.[4] The uncertainty of a bond's payment stream, commonly called default risk, can boost its yield. Changes in tax rates also influence bond yields.

When any of these factors change, the interest rate changes. By examining government securities, default risk and tax changes are eliminated from the analysis. In addition, interest-rate risk and segmented markets affect interest rates but not enough to cause wide fluctuations. Changes in expected real rates may affect interest-rate variations because they may vary from year to year. However, this variation may be relatively small, as in the past decade, and therefore may not substantially drive present interest-rate fluctuations. Figures 1 and 2 display the *ex-post* real rates of interest, as measured by three-month treasury bill rates minus the yearly inflation rates, of Australia and the United States.[5] Before the past decade, both countries had relatively more volatile inflation rates and interest rates, which generated volatile *ex-post* real interest rates. Over the past decade, relatively more stable inflation and interest rates have resulted in more stable *ex-post* real rates from good economic management by the governments and central banks of both countries.[6]

Under conditions of stable expected real rates, the yield curve slope, as measured by taking the difference between the yields of long and short bonds, nullifies the effect of expected real rates from the analysis. Therefore, the past decade provides a good period to single out significant drivers of interest rate fluctuations, since *ex-post* real rates were relatively stable during this period.

If all the factors affecting interest rates are kept relatively stable, expectations about future inflation are the most important determinant. Even though inflation tends to move slowly from year to year, the bond market reacts quickly to expectations of future inflation. This relationship is so tight that the bond market moves on every piece of economic data. Expectations of future inflation are driven by many factors; however, the most important is the expectation of central bank action. A central bank will often change the level of short-term interest rates when inflation data heat up or if it thinks the economy is growing too fast.

In general, when relatively high inflation expectations make short rates abnormally high, the term structure should be downward-sloping. This is because inflation is expected to abate in the future, which would be reflected in lower long rates. Conversely, when relatively low inflation expectations make short-term rates abnormally low, the term structure should be upward-sloping, as inflation would be expected to rise in the future, leading to higher long rates. If the term structure has a flat slope, investors expect inflation to remain unchanged.

Therefore, if the term structure is driven primarily by inflation expectations, the yield curve slope of government securities will provide a relatively "clean" proxy for short-term inflation expectations relative to long-term expectations. If a yield curve slope is

FIGURE 1 **United States ex-post real interest rate (10-year government bond yield – three-month treasury bill rate)**

FIGURE 2 **Australian ex-post real interest rates (10-year government bond yield – 90-day dealers bill rate)**

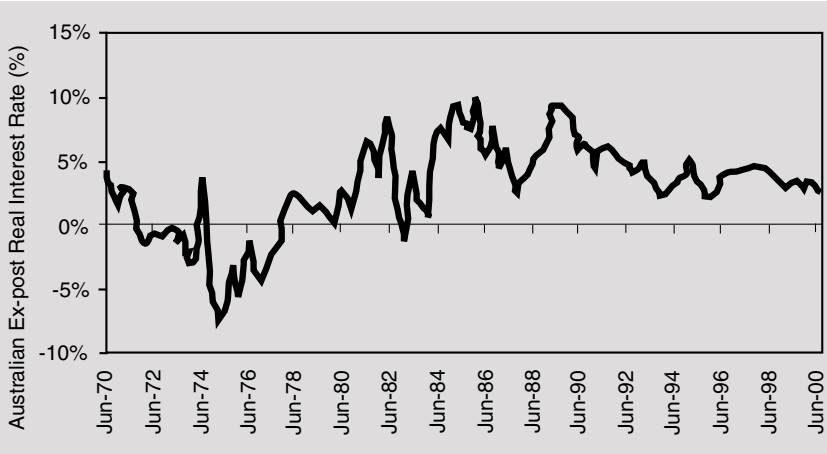
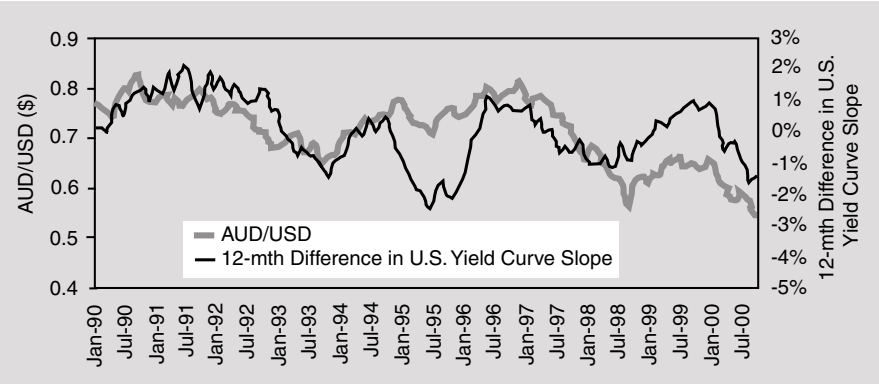


FIGURE 3 **Australian dollar vs 12-month difference in the US yield curve slope**



measured as the difference between the yields of long and short government bond yields, a positive value represents lower short-term inflation expectations relative to long-term, while a negative value represents higher short-term inflation expectations.

The difference between current yield curve slope values and past yield curve slope values represents *changes* in investors' short-term inflation expectations relative to long-term expectations. For the purposes of this study, a 12-month difference in yield curve slope values was used. The points of interest are the peaks and troughs of the resulting series of numbers. That is, the troughs and peaks of the change in yield curve slope values signify extreme differences between the current yield curve slope and the previous yield curve slope.

Specifically, peaks (troughs) of 12-month differences in yield curve slope values coincide with the yield curve being the most positive (flat or negative), suggesting that short-term inflation expectations relative to long-term inflation expectations have deteriorated to a minimum (maximum) for the previous 12 months.[7] In periods of relatively stable real interest rates, these turning points have several implications for financial markets — in particular the Australian dollar movements and the relative performance of defensive sectors such as listed property and the broader stockmarket.[8]

AUSTRALIAN DOLLAR

Inflation expectations affect all classes of assets and the foreign exchange market is no exception. Inflation expectations affect capital flows, which affect the movements of currencies. Since the US financial markets are far bigger than Australia's, any changes in US inflation expectations will tend to have a larger impact on the AUD/USD than changes in inflation expectations in Australia.

Figure 3 shows monthly data of 12-month changes in the US yield curve slope (US 10-year government bond yields minus US three-month treasury bill rates) plotted against the AUD/USD over the period January 1990 to September 2000.

The peaks and troughs of the 12-month change in US yield curve are the most important focus because they indicate when relative short and long-term inflation expectations are at the most extreme. At the troughs of the 12-month change in the US yield curve slope, the yield curve would be at its most flat (or perhaps the most negative), indicating that short-term inflation expectations relative to long-term inflation expectations have deteriorated to their worst over the course of the year. At these times US investments may not seem as attractive, which may encourage a sell-off of the USD, which in turn may appreciate the Australian dollar.

On the other hand, at the peaks of the 12-month change in the US yield curve slope, the slope of the yield curve would be at its steepest, indicating that short-term inflation expectations, relative to long-term, have improved to their best over the course of a year. Therefore, US investments seem more attractive which may put upward pressure on the US dollar, which in turn may depreciate the Australian dollar.

As shown in Figure 3, troughs and peaks in the 12-month difference in the US yield curve slope correspond to turning points of the AUD/USD. Statistically, the relationship between the AUD/USD and the 12-month change in US yield curve slope is expressed in a linear regression equation as follows:

(AUD/USD) = 0.71 - 2.57 (12-month change in US yield curve slope)

Over this period the relationship was significant at the 1% level given a t-statistic of 5.07 for the 12-month change in the US yield curve slope variable. Further, 17% of the variation in the AUD/USD was explained by the variation in the 12-month change in the slope of the US yield curve.[9] Therefore, changes in the US relative short and long-term inflation expectations over the past decade help explain the movements in the Australian dollar.

RELATIVE PERFORMANCE OF LISTED PROPERTY AND THE BROADER STOCKMARKET

Changes in short and long-term inflation expectations reflected in the bond market also have implications for equity markets. Conventional wisdom suggests that returns of defensive stocks should be relatively high when inflation is expected to be relatively high and relatively low when inflation is expected to be relatively low. The rationale is that defensive stocks with higher dividend yields have higher claims on real assets that should increase in value with inflation.

Initially, inflation expectations will be priced in the bond market, which, as explained earlier, moves on every piece of economic information. This is not so true for the stockmarket, which often seems to ignore economic data. The effect on the economy from changes in interest rates as a result of inflation expectations is usually distributed over time. Specifically, central bank actions will initially affect the government bond market. Rising or falling government bond prices subsequently filter into corporate bonds. Changes in interest rates affect many

areas of the economy — for example, the earnings outlook of companies and the discount rates applied to stocks. This transmission process filters into the stockmarket and eventually to the real goods market.

Assuming investors have ideas about the future level of business activity, and assuming they believe the level of interest rates follows the level of business activity, then the yield curve should usually slope upward before economic expansions and downward before contractions.[10] Therefore, inflation expectations derived from the bond market may be used as a leading indicator of subsequent stockmarket performance, given that there is a transmission process from the bond market to the real economy.

The relationship between changes in the yield curve slope and the relative performance of defensive sectors, such as listed property and the All-Ordinaries, is shown in Figure 4. This chart plots monthly data of the 12-month change in the Australian yield curve slope (nine-month lead) against yearly return difference between the listed property trust accumulation index (LPT) and the S&P/ASX 500 accumulation index (All-Ordinaries) over the period May 1993 to September 2000.[11]

Further, to show that this relationship is not confined to Australia, Figure 5 plots monthly data of the 12-month change in US yield curve slope (10-month lead) against yearly return difference between the AMEX Morgan Stanley Real Estate Investment Trust index (REIT) and the S&P 500 index over the period November 1997 to September 2000.[12]

In the Australian market, the period between the peaks and the troughs of the 12-month change in the yield curve slope (with a nine-month lead) approximately corresponds to the time period between the peaks and troughs in the relative performance of the LPTs and the All-Ordinaries. When the 12-month change in the Australian yield curve slope troughs, the yield curve would be at its most flat (or the most negative), indicating that short-term inflation relative to long-term inflation expectations have deteriorated to their worst over the course of a year. Because of the transmission process, it took about nine months (on average) for LPTs to outperform the All-Ordinaries.

FIGURE 4 **Relative performance of the LPT accumulation index and the All-Ordinaries accumulation index vs 12-month difference in the Australian yield curve slope (nine-month lead)**

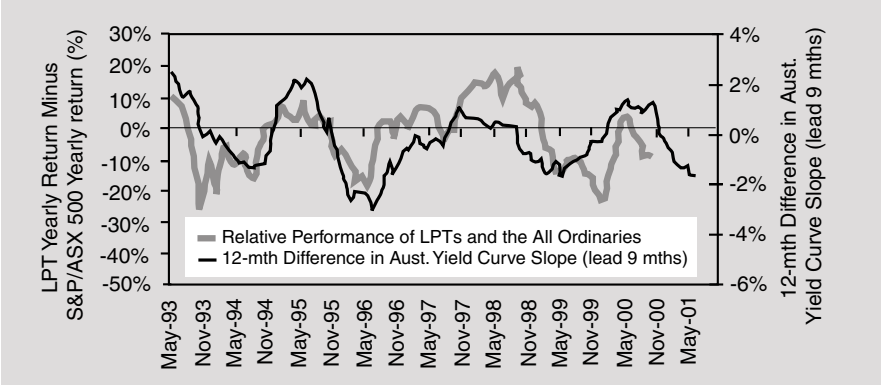
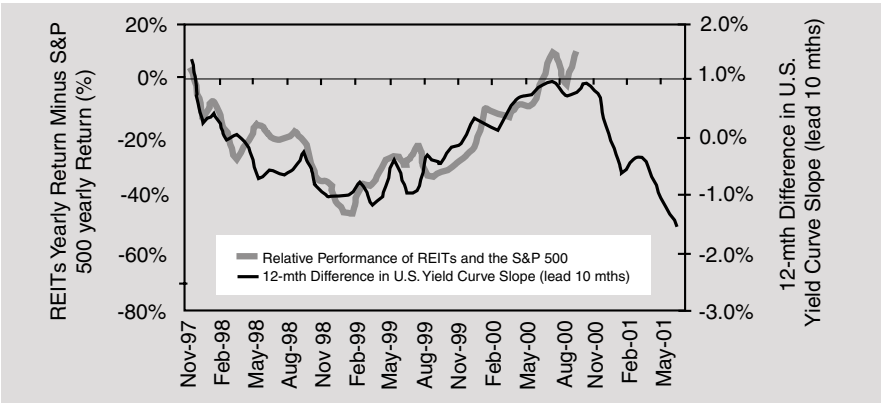


FIGURE 5 **Relative performance of the REITs index and the S&P 500 index vs 12-month difference in the US yield curve slope (10-month lead)**



Conversely, peaks in the 12-month change in the Australian yield curve slope suggest short-term inflation expectations are at their lowest compared with long-term inflation expectations, which is reflected in the steepest yield curve slope over the course of a year. About nine months later the All-Ordinaries begins to outperform LPTs. Similar comparisons can be made about the US stockmarket but with an average of a 10-month lead between changes in the US yield curve slope and the relative performance between REITs and the S&P 500.

Statistically, the relationships are expressed in linear regressions as follows:

- Relative performance of the LPTs and All-Ordinaries) = -0.01 + 3.52 (12-month change in Australian yield curve slope (nine-month lead)
- Relative performance of the REITs and S&P 500) = -0.18 + 17.08 (12-month change in US yield curve slope (10-month lead)

Over the period the relationship was significant for the Australian and the US market at the 1% level given a *t*-statistic of 4.32 and 9.34 for the 12-month change in

the Australian yield curve slope variable and 12-month change in the US yield curve slope variable respectively.

Further, the R-squared values, which explain the amount of variation of the relative performance of listed property and the broader stockmarket by the 12-month change in the yield curve slope, were 18% and 73% for Australia and the United States respectively.[13]

The findings suggest that inflation expectations measured in the bond market eventually affect the performance of the stockmarket.

CONCLUSION AND IMPLICATIONS

Assessing the likely movements of financial markets is complex and difficult. However, one theory that has withstood the test of time is the theory of interest rates developed by Fisher. The Fisher equation forms the basis of extracting information from interest rates in explaining market behaviour. Specifically, in an environment where interest rates are driven mainly by inflation expectations, changes in the yield curve slopes may proxy for changes in short-term market inflation expectations relative to long-term expectations and have several implications for financial market performance. Under different sets of conditions, such as the periods prior to the past decade where real rates were more volatile, the relationships analysed in this article may not be so clear.

Nevertheless, if real rates remain stable, which would result from a continuation of stable inflation and interest rates from good economic management by governments and central banks, changes in the US yield curve slope will have the potential to continue to explain the Australian dollar movements. Further, changes in the yield curve slope may continue to be a leading indicator of the relative performance of defensive sectors such as listed property and the broader stockmarkets in Australia and the United States.

NOTES

1. See Fisher (1930).

2. The term structure of interest rates is explained by the Fisher equation, which forms the basis of Expectations Theory. This theory states that the term structure of interest rates is determined by investors' expectations of short-term rates within the maturity of the competing long-term securities.

3. This forms the basis of the Liquidity Preference Theory. This theory helps explain why upward-sloping yield curves tend to be more frequent, since investors demand a premium associated with investing in longer bonds.

4. This forms the basis of the Market Segmentation Theory. Market segments affect the term structure of interest rates, but only minimally. For instance, the demand from Japanese investors in the late 1980s for just-issued 30-year bonds resulted in a slight kink in the term structure, where 30-year bond rates were slightly lower than 29-year bond rates, even though the rest of the yield curve was upward-sloping.

5. Although expected real rates are difficult to measure, for practical purposes an approximation of it is usually represented as the *ex-post* real rate of interest, which is equal to the interest rate minus the rate of inflation.

6. Further, Wood and Wood (1985) found evidence suggesting that real rates do change over time but stable real rates and a one-to-one relationship between interest rates and inflation will be present in any period or any economy where there is less volatility in interest rates and inflation.

7. The examination of the differences in yield curve slope values does not provide estimates of expected inflation rates. It merely provides information about when short-term inflation expectations relative to long-term expectations are at extremes.

8. The examination of Figures 1 and 2 suggests that the most recent decade would be most appropriate for the analysis, since *ex-post* real rates were relatively stable. Volatile *ex-post* real rates in the previous two decades would have "clouded" the relative inflation expectation information derived from measuring the differences in yield curve slopes. Further, the relationships analysed in this article cannot be explored in other periods of stable real rates due to the lack of long time series of data.

9. The main reasons why the changes in the US yield curve slope do not fully explain all the movements in the AUD/USD are that, first, there are other factors affecting the AUD/USD; second, the change in the US yield curve slope is a rough proxy for changes in relative short-term and long-term inflation expectations since other interest rate factors are not held absolutely constant.

10. There is evidence that the shape of the term structure has strong predictive power for future changes in the real economy. Harvey (1991) examined the G-7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States) and concluded that 54% of world economic growth could be explained by the term structure.

11. The analysis began from May 1993 because yearly returns were calculated from the ASX/S&P 500 accumulation index, which began from May 1992.

12. The analysis began from November 1997 because yearly returns were calculated from the AMEX Morgan Stanley REITs index, which began from November 1996.

13. Similar to the reasons outlined in note 10, there are two main reasons why the changes in the yield curve slope do not fully explain all the movements in the relative performance of listed property and the broader stockmarket. First, there are other factors affecting relative stockmarket performance. Second, the change in the yield curve slope is a rough proxy for relative short-term and long-term inflation expectations since other interest rate factors are not held absolutely constant.

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