

vestment-rate risk since the coupons need to be reinvested at some unknown rate. Immunization is achieved by purchasing a coupon bond whose weighted maturity ("duration") is equal to the investment horizon. This works regardless of interest rate movements. If rates decrease, the investor is forced to reinvest coupons at a lower rate but also makes a capital gain on the sale of the bonds at the end of the investment horizon. If rates increase, the capital loss on the sale at the horizon date is offset by the extra cash flow generated from investing the coupon payments at the new higher rate.

The case of pension funds is noteworthy. If the assets of a pension fund are invested in bonds, the duration (*i.e.* weighted maturity) of the assets can be computed. The duration of the obligations to retirees, analogous to interest payments on debt, can be calculated as well. Managers of pension funds therefore choose pension assets whose duration is matched with the duration of the liabilities. In this way, changing interest rates do not affect the net worth of the pension fund. In a similar fashion, insurance firms invest on bonds where the duration of the bonds is matched to the duration of the future death benefits.

In short, institutional bondholders neutralize the impact of interest rate changes by matching the maturity of a bond portfolio with the investment planning period, or by engaging in hedging transactions in the financial futures and derivatives markets. The merits and mechanics of such immunization strategies are well-documented by academicians and practitioners.<sup>6</sup>

## **Risk-Free Rate: Current vs Forecasts**

While the spot yield on long-term Treasury bonds provides one plausible proxy for the risk-free rate, the CAPM specifically requires the expected risk-free rate. Therefore, forecasts are preferable. One should preferably rely on projected long-term Treasury interest rates in implementing the CAPM or any other type of risk premium model for several reasons.

First, investors price securities on the basis of long-term expectations, including interest rates. Cost of capital models are prospective (*i.e.*, forward-looking) in nature and must take into account current market expectations for the future because investors price securities on the basis of long-term expectations, including interest rates. As a result, in order to produce a meaningful estimate of investors' required rate of return, the CAPM must be applied using data that reflects the expectations of actual investors in the market. While investors examine history as a guide to the future, it is the expectations of future events that influence security values and the cost of capital.

Second, investors' required returns can and do shift over time with changes in capital market conditions, hence the importance of considering interest rate fore-

6. See Reilly & Brown (2012) Chapter 19.

casts. The fact that organizations such as Value Line, IHS (Global Insight), EIA, and CBO, among many others, devote considerable expertise and resources to developing an informed view of the future – and the fact that investors are willing to purchase such expensive services – confirms the importance of economic/financial forecasts in the minds of investors. Moreover, the empirical evidence demonstrates that stock prices do indeed reflect prospective financial input data.

Third, given that the role of a regulatory proceeding is to provide ROE estimates for the future, forecast interest rates are far more relevant. The use of interest rate forecasts is no different than the use of projections of other financial variables, such as growth rates, in DCF analyses.

It is sometimes suggested that little weight should be placed on interest rate forecasts because they are often wrong, and therefore should not be used as proxies for the risk-free rate in implementing the CAPM. The important point is not whether forecasts turn out to be accurate, but rather whether such forecasts are imbedded in investor expectations and stock prices. Investors' required returns can and do shift over time with changes in capital market conditions, hence the importance of considering interest rate forecasts.

The empirical evidence demonstrates that stock prices do indeed reflect prospective financial input data.<sup>7</sup> Moreover, forecasted interest rates are more relevant than current spot rates since in a regulatory setting rates are being set for the future.

In the same way that one relies on forecast growth rates in DCF analyses as we shall see in subsequent chapters, one should rely on interest rate forecasts as proxies for the risk-free rate in the CAPM analysis.

As discussed in Appendix 6-B, market forecasts of rates on Treasury bonds are also available in the form of interest rate futures contract yields, and can be employed as proxies for the expected yields on Treasury securities.

## **Normalized Risk-Free Rate**

During time periods in which Treasury yields are abnormally low due to various "black swan" factors, such as the massive money supply injections in 2020 on account of the Corona virus pandemic, or the accommodating Federal Reserve monetary policy during the 2008-9 credit crisis, periodic flight to quality episodes, normalizing the risk-free rate becomes a reasonable alternative. During these "crises" periods, the government's continuing intervention in the debt markets creates artificially low long-term interest rates, and the resulting sharp decline in interest rates creates ROE estimates that are unreasonable. The same fate awaits MRP estimates which are based on historical data that fail to reflect the increased investor risk aversion during periods of financial crises.

7. This abundant literature is discussed in Chapter 9.