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On Forecasting Long-Term Interest Rates: Is the Success of the No-Change Prediction Surprising?

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I. Introduction

IN A RECENT ARTICLE in this Journal, Elliott and Baier [1] provide empirical evidence that the no-change forecast decidedly outperforms the "unconditional predictions" of long-term interest rates associated with the Modigliani-Sutch, Modigliani-Shiller and other well-known models of interest rate determination. The authors use "unconditional predictions" to refer to forecasts generated by variants of these models in which the current long-term rate is regressed on the relevant sets of exogenous variables lagged one period. These regressions—and the subsequent forecasts—are "unconditional" in the sense that they restrict the information set used to track long-term interest rates to that which is known at the beginning of the period.

The crucial issue that the authors do not address, however, is whether the superior forecasting performance of the no-change prediction is or is not surprising on à priori grounds. This issue is of extreme importance in interpreting their findings. One possible interpretation of the Elliott-Baier results, for example, is that the specific information sets associated with the six models are not valuable in a forecasting context, but other information sets may be. In fact, the empirical results reported by Elliott-Baier are not surprising in view of the accumulating evidence that (1) the bond market is efficient and (2) term premiums, if they exist, are time-invariant. These results imply, in effect, that short-term movements in long-term interest rates will not be "forecastable". This important point is reviewed briefly below.

II. The No-Change Prediction: A "Naive" Forecast?

The fact that long-term interest rates will approximately follow a martingale sequence under the conditions described above, and hence that the no-change prediction will approximate the optimal forecast, has been shown by both Sargent (1976) and Pesando (1978). Let $R_{n,t}$ denote the interest rate (for simplicity) on an n-period, non-coupon, bond in period t, ϕ_t the information available to the market in period t, and ${}_{t+i}f_{1,t}$ the forward rate at time t for the one-period bond rate in period $t + i$. Then, under the joint hypothesis of market efficiency and the pure

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expectations model of the term structure, the ex ante changes in the long-term rate can be approximated as follows:

$$E(\tilde{R}_{n,t} \mid \phi_{t-1}) - R_{n,t-1} = \frac{1}{n} * [E({}_{t+n-1}\tilde{f}_{1,t} \mid \phi_{t-1}) - R_{1,t-1}] \tag{1}$$

The term on the right-hand side of equation (1), which represents the nonoverlapping one-period rates, clearly approaches zero as n gets large. In this case, the optimal forecast of the long-term rate is simply its current value; that is, the optimal forecast is the no-change extrapolation. If $\Psi_{n,t}$ represents the term premium accorded an n-period bond in period t, then (1) may be rewritten as:

$$E(\tilde{R}_{n,t} \mid \phi_{t,1}) - R_{n,t-1} = \frac{1}{n} * [E({}_{t+n-1}\tilde{f}_{1,t} \mid \phi_{t-1}) - R_{1,t-1}] + E(\tilde{\psi}_{n,t} \mid \phi_{t-1}) - \psi_{n,t-1} \tag{2}$$

If this term premium is constant, then (2) simply reduces to (1) and the previous result holds.

Elliott-Baier employ monthly data in their forecasting experiments. Assume, for the sake of argument, that the several long-term rates employed in their study have a representative term to maturity of 10 years. (The synthetic series of U.S. Government bonds employed in the study has an exact maturity of 15 years.) If interest rates are expressed at annual rates, then n equals 120 and thus the ex ante change defined in (1) must be very close to zero, unless the short-term rate is "very" nonstationary. Suppose, for example, that $R_{1,t-1}$ equals five per cent (.05) and that $E({}_{t+n-1}\tilde{f}_{1,t} \mid \phi_{t-1})$ equals 10 per cent, which would be consistent with a sharply rising yield curve. The ex ante change in the long-term rate, in spite of the 500 basis point difference in the respective short-term rates, is only 500 ÷ 120 or approximately 4 basis points. Note, by way of contrast, that if the unit of observation were annual rather than monthly, these same figures would imply—since n would equal 10—an ex ante change of more than 40 basis points in the long-term rate. These figures highlight the fact that it is short-run movements in long-term rates which are not likely to be "forecastable" under the joint hypothesis of market efficiency and a time-invariant term premium.

For non-coupon bonds, as noted by Pesando [5] the expression analogous to (1) is more complicated, but the martingale approximation remains quite close. Intuitively, the martingale approximation—and hence the random walk characteristic of long-term rates—stems from the fact that over short time intervals (one month in the case at hand), the percentage change in bond prices necessary to equate the ex ante returns on short- and long-term securities (up to a time-invariant term premium) is very small. As a result, the implied ex ante changes in long-term rates are very close to zero. In a recent paper (Pesando 1979a), I calculated—for quarterly data—the ex ante changes in long-term Government of Canada and long-term Canadian corporate bonds implied by their yields and the yields on 90-day Treasury Bills and 90-day finance company paper, respectively.[1]

[1] For purposes of these calculations, the (assumed) constant term premiums were set equal to the mean spreads between short- and long-term interest rates in the sample period. The representatives terms to maturity for the two interest rate series were assumed to equal 17 years, although complications posed by call options and sinking funds may cloud the interpretation of this figure in the case of corporate bonds.

The mean absolute values of the ex ante changes in these long-term rates for the sample period 1957:1–1979:1 equalled 2.07 basis points and 2.60 basis points, respectively. If monthly data were employed, the corresponding ex ante changes would be approximately one-third as large. With monthly data, the mean absolute values of the ex ante changes in Government of Canada and Canadian corporate bonds would thus be less than a single basis point. Clearly, if the bond market is efficient and if the term premium accorded long-term interest rate is time-invariant, then agents without access to inside information are not likely to be able to forecast short-term movements in long-term interest rates.

III. Conclusion

Those who work in the capital asset pricing framework of modern finance theory tend to treat the term premium—which is related to the covariance of bond returns and the return to the market portfolio—as constant over time. Many—if not most—of those who have conducted empirical studies of the determinants of term premiums have concluded that they may well be time-invariant. In the absence of convincing evidence of the existence of time-varying term premiums, and in view of the strong à priori belief in market efficiency, the success of the "no-change" prediction in the forecasting experiments conducted by Elliott-Baier is not surprising. Short-run movements in long-term interest rates, quite simply, are not likely to be "forecastable". The failure of recorded forecasts to outperform the no-change prediction of the martingale model, in both the United States (Prell [6], Fraser [2]) and Canada (Pesando [3]), is also noteworthy in this regard.

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