Concurrent Evidence Session: Commentary on Lally's Term Analysis

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Introduction

In the Expert Conclave session Martin Lally suggested that my analysis of his term of equity paper should be demonstrated mathematically. I would argue that my analysis is so obvious and simple it scarcely needs a mathematical presentation. However, in this document I do provide some mathematical notation. The mathematics needs a context and some discussion; thus, this document also contains textual material.

I should also say at the outset that I have a high regard for Martin's work. I have read both academic papers that he has written and various reports relating to regulated rates of return. I have always found his work to be presented with high standards of rigour, clarity, and logic. Furthermore, it seems to me that he has the laudable characteristic of calling it as he sees it, irrespective of the interests of the client. This, of course, does not mean that he is always right.

Martin's Analysis

Below I quote verbatim from Martin's analysis:

"To illustrate this principle, suppose that regulated assets are purchased now for A, with a life of two years, the regulatory cycle is one year, prices are set at the beginning of each year, and the resulting revenues are received at the end of each year. In addition, there is no opex, capex, or taxes. Let the regulatory depreciation of the asset base for the first year be denoted DEP_1, in which case that for the second year is the residue of $A - DEP_1$. Consider first the position at the end of the first year (time 1), at which point a price or revenue cap will be set to yield revenues at time 2 (REV_2). These expected revenues are set equal to depreciation of $(A - DEP_1)$ plus the allowed cost of capital (at some rate k_1 observable at time 1) applied to the undepreciated book value of the assets at time 1 of $(A - DEP_1)$. The value at time 1 (V_1) of this business will be the expectation at time 1 of these future revenues, discounted at the one-year cost of equity prevailing at time 1 (ke_{12}):

$$V_1 = \frac{E(REV_2)}{1 + k_{e12}} = \frac{(A - DEP_1)k_1 + (A - DEP_1)}{1 + k_{e12}} \qquad (1)$$

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$$V_0 = \frac{E(REV_1) + E(V_1)}{1 + k_{e01}} = \frac{[Ak_0 + DEP_1] + E(V_1)}{1 + ke_{01}} \qquad (2)$$

$$V_1 = \frac{(A - DEP_1)k_{e12} + (A - DEP_1)}{1 + k_{e12}} = A - DEP_1 \qquad (3)$$

and equation (2) becomes

$$V_0 = \frac{[Ak_{e01} + DEP_1] + (A - DEP_1)}{1 + ke_{01}} = A \qquad (4)$$

Assumptions about the term structure of equity.

As Martin points out if the discount rates used in the numerator and denominator of his discounting equations are the same, then the value so calculated will equal the initial investment. This will be true for arbitrary values of the discount rate. The key to Martin's conclusions, therefore, is that there are differing market discount rates for each period. That is $k_{e01} \neq k_{e12} \neq k_{e23} \neq \cdots \neq k_{e(n-1)n}$. In other words, there is a term structure of expected equity returns. Furthermore, since the allowed rate of return on equity is to be computed using the CAPM, the implicit assumption is that the term structure of equity follows the term structure of government bonds. However, if $k_{e01} = k_{e12} = k_{e23} = \cdots = k_{e(n-1)n} = k_e$, then there is no term structure, and the regulator's task is to obtain the best estimate of k_e.

I stress that the calculation of V_0 will always give A as long as discount rate is the same in the numerator and denominator of equation 4. A critical assumption, therefore, is that those discount rates are the current market expected returns. If so V_0 will equal the market value of the allowed cash flows and the NPV = 0 criterion will truly be satisfied. Otherwise, it will not be satisfied.

Equity term structure theory and evidence

Is there a term structure for equity expected returns, and if so, what form does the equity term structure take? There is both theoretical and empirical support for equity term structures that are rising, falling, or flat. It is probably fair to say that the empirical evidence is stronger for a rising or falling term structure, than it is for a flat term structure, and "down on average" may be drawing ahead of the field. This latter is inconsistent with a term structure of equity driven by the term structure of government bonds, which is upward sloping on average. However, the evidence in favour of any particular view of term structure is not so great as to drive alternative views from the field. Thus, the issue of equity term structure is very much an open question. It is clear however, that to accept that the equity term structure follows the term structure of government bonds is a strong assumption.

Guidance from the CAPM

If we seek guidance from the CAPM about the term structure of equity, we find that there is no term structure for either equity returns, or interest rates, since the CAPM is a single period model. The duration of the single period is undefined in the CAPM, it is the investment horizon assumed to be homogenous across investors. Unfortunately, investors are not in reality homogenous in their investment horizons. However, since equity is generally used as a long-term source of finance, the return on equity is generally considered a long-term rate of return. Given the nature of the underlying assets of the networks and the nature of their investors, for example pension funds, it is almost certain that the investment is made with very long-term rates of return in mind. Therefore, there are grounds to argue for a long horizon in implementing the CAPM.

The current regulatory debate is whether to use five-year or ten-year government bonds as a proxy for the risk-free rate. Thus, it is worthwhile to note that, when computing the required return on equity, standard practice in Australia is to use long-term bonds. When computing long horizon required returns, the deep and liquid market make the 10-year government bond rate the standard proxy for the risk-free rate. The AER has also followed this practice. The question, therefore, is whether the argument for change justifies a break with standard practice. I suspect not.