The Real Cost of Capital in New Zealand

Is It Too High?

Martin Lally

NEW ZEALAND BUSINESS ROUNDTABLE

The New Zealand Business Roundtable is an organisation of chief executives of major New Zealand businesses. The purpose of the organisation is to contribute to the development of sound public policies that reflect overall New Zealand interests.

First published by the New Zealand Business Roundtable,
PO Box 10–147, The Terrace, Wellington, New Zealand
http://www.nzbr.org.nz

ISBN 1–877148–64–4

Design and production by *Daphne Brasell Associates Ltd*
Typeset by *Chris Judd, Auckland*
Printed by *Astra Print Ltd, Wellington*

CONTENTS

LIST OF TABLES

ABOUT THE AUTHOR

Dr Martin Lally is a senior lecturer in the School of Economics and Finance at Victoria University of Wellington. He has a PhD in Finance from Victoria University of Wellington. His principal areas of teaching and research are portfolio theory, asset pricing and corporate finance. He has acted as a consultant to numerous government departments and private sector organisations.

ACKNOWLEDGEMENTS

The helpful suggestions of David Archer, Peter Hartley, Brian McCulloch, Alastair Marsden, Grant Scobie, Lewis Evans and Bryce Wilkinson are gratefully acknowledged. All remaining errors are the responsibility of the author.

FOREWORD

The cost of capital is an important cost for most New Zealand businesses. If the cost of capital is unnecessarily high, less investment will be undertaken to the detriment of New Zealand at large.

This study was commissioned to shed light on the question of whether the real (that is, inflation-adjusted) cost of capital in New Zealand is high relative to other countries, specifically Australia and the United States. The real cost of debt capital can be estimated by using the interest rates prevailing in financial markets adjusted for inflation. The real cost of equity capital cannot be observed directly and requires the use of analytical techniques.

It should not be the objective of government policy to engineer the lowest possible cost of capital for New Zealand borrowers. Like the price of other resources, the price of capital should be determined in competitive and efficient markets. In the interests of promoting investment and living standards, the government should, however, do everything possible to ensure that the cost of capital is not artificially raised, consistent with achieving other sensible policy objectives.

The New Zealand Business Roundtable (NZBR) has been concerned that a number of factors may have contributed to an unnecessarily high cost of capital in New Zealand. At a time when New Zealand was experiencing high inflation, a premium for inflation uncertainty may have been built into nominal interest rates, raising the expected real cost of borrowing and deterring some investment. With the achievement of a low and relatively stable rate of inflation, this problem may have been largely overcome. Fiscal policy, particularly through trends in levels of government spending, borrowing and debt, has a bearing on New Zealand's sovereign credit rating and hence on its cost of capital. Partly as a result of weak fiscal policy, New Zealand lost its triple A credit rating in the early 1980s and, although its rating was upgraded in the first part of the 1990s, it has subsequently been downgraded again. The international tax regime has, also, an important bearing on the cost of capital in New Zealand insofar as the taxes levied on debt or equity investments by non-resident investors, who are typically the marginal investors, raise the real cost of capital for all New Zealand firms. The exchange rate regime and risks associated with foreign exchange management are further policy-related factors that may affect the real cost of capital.

The key findings of this study by Dr Martin Lally, of Victoria University of Wellington, are twofold, and relate to the two key factors in the cost of capital: the real government borrowing rate and the equity risk premium. First, averaged over the last four years, New Zealand's real government borrowing rate seems comparable with or only modestly higher than Australia's, although considerably higher (by perhaps two percentage points) than that of the United States. Dr Lally estimates that about one-quarter of the differential between New Zealand and the United States may be due to New Zealand's greater default risk and inferior liquidity, and the rest compensation for

New Zealand's exchange rate risk. He suggests that adoption by New Zealand of the US dollar might reduce New Zealand's real interest rate and therefore the overall cost of capital by about one-and-a-half percentage points (but New Zealand would not secure this benefit by entering into a monetary union with Australia). The second key point relates to the risk premium on equity capital. The study suggests that actions that could help lower this in New Zealand include continued sale of state assets, demutualisation of producer boards, liberalising foreign investment restrictions, further reforms to the international tax regime, entry into a currency union and combining the New Zealand and Australian stock exchanges.

The study also forms part of a programme of research by the NZBR into the possible benefits for New Zealand of joining another country or countries in some form of currency union.

RL Kerr
Executive Director
New Zealand Business Roundtable

INTRODUCTION

There seems to be a widely held view or suspicion in New Zealand that this country's real cost of capital is high, and that this obstructs investment and/or places New Zealand firms at a disadvantage to foreign competitors. Motivated by these concerns this paper examines the following questions:

(i) is the real cost of capital high in New Zealand by comparison with other countries?

(ii) if it is high, what are the most plausible explanations for this? and

(iii) what might be done to lower it?

The first two questions are concerned with 'high' in a relative sense, whereas the last question is consistent with 'high' in either a relative or absolute sense. To deal with the relative concerns, some foreign countries must be selected. Both Australia and the United States are selected for examination on the basis of being the most significant sources to New Zealand of foreign direct investment. This paper commences by estimating the cost of capital in each country, invoking widely used models and parameter estimates. The paper then considers whether the actual cost of capital may diverge from these calculations. In doing the latter, we consider two polar cases – one involving complete segmentation and the other complete integration of world equity markets. Explanations for these results are offered, followed by an inquiry into their policy implications.

1

THE PERCEIVED REAL COST OF CAPITAL

1.1 Formulas

The nominal cost of capital for a company is a value weighted average of the costs attaching to each of that company's types of capital. The two principal forms of capital are debt and equity (comprising equity issues and retained earnings), and we shall henceforth assume these are the only two. In addition, the cost of debt is tax deductible and therefore the effective cost is net of the corporate tax deduction. For a typical firm in New Zealand the weights on debt and equity are the market aggregate weights, denoted L and $(1-L)$. Additionally, denoting the pre-tax cost of debt by k_d, the cost of equity by k_e and the corporate tax rate by T_c, the nominal cost of capital is then:[1]

$$k_n = (1-L)k_e + Lk_d(1-T_c)$$

Conversion to the real cost of capital involves extracting the effect of the expected inflation rate i, to yield the real cost of capital k_r:

$$k_r = \frac{1+k_n}{1+i} - 1 \approx k_n - i$$

So the real cost of capital is:

$$k_r = (1-L)k_e + Lk_d(1-T_c) - i$$

The nominal cost of debt is the promised interest rate on it, and is observable. It comprises the riskfree rate R_f plus some premium p that allows for expected default losses, risk and inferior liquidity relative to government bonds. Substituting this into the last equation yields a real cost of capital of:

$$k_r = (1-L)k_e + L(R_f + p)(1-T_c) - i \tag{1}$$

By contrast with debt, equity brings no promise of payouts, and hence the cost of equity is not observable. The nominal cost is defined as the expected rate of return which just compensates for risk. This must be estimated and there is some difficulty in doing so. The principal method for estimating this expected rate of return is to invoke some version of a model called the Capital Asset Pricing Model (CAPM). Two versions of this model are in widespread use in New Zealand. The first is the standard version, attributable to Sharpe (1964), Lintner (1965) and Mossin (1966). The second is a version that allows for the difference in the personal taxation of various forms of income, most particularly

[1] The costs of debt and equity are each functions of leverage, and they are also before deduction of any personal taxation. An increase in the level of personal taxation should increase both of these costs.

interest, dividends and capital gains. A variety of the latter models exist, including Cliffe and Marsden (1992), Lally (1992), Monkhouse (1993) and Officer (1994).

However all these models can be viewed as special cases of Lally (1992). The second class of CAPMs appears to be dominant, and the trend also seems to favour them. Accordingly, a model of this form will be invoked for New Zealand.

A further issue concerns whether world equity markets are integrated or not. Standard practice reflects a belief in segregation, by virtue of using versions of the CAPM that assume segregation. Lally (1992) reflects this scenario as well as reflecting differential personal taxation. Under this model, the expected rate of return on the equity of firm j, before personal tax, is then as follows:

$$k_{ej} = R_f(1-T) + D_j T_j + \lfloor E(R_m) - D_m T_m - R_f(1-T) \rfloor \beta_j \tag{2}$$

where R_f = riskfree rate, proxied by the promised return on government bonds

D_j = dividend yield of company j

$E(R_m)$ = expected rate of return on the market portfolio, with the latter portfolio proxied by a diversified share index[2]

D_m = dividend yield of the market portfolio

T = weighted average over investors of $(t_i - t_{gi})/(1 - t_{gi})$ where t_i is investor i's interest tax rate and t_{gi} is their capital gains tax rate

T_j = weighted average over investors of $(t_{di}^j - t_{gi})/(1 - t_{gi})$ where t_{di}^j is investor i's tax rate on cash dividends from company j, that is, tax paid directly by the investor as a proportion of the cash dividend

T_m = weighted average over assets of the firm's T_j

β_j = systematic risk of company j's equity

For a typical company within a country the value of β_j would be equal to 1. In addition, its dividend yield D_j and tax parameter T_j will correspond to D_m and T_m respectively. Substituting this information into equation (2), and the latter into equation (1), yields a real cost of capital of:

$$k_r = (1-L)\{R_f(1-T) + D_m T_m + \lfloor E(R_m) - D_m T_m - R_f(1-T) \rfloor\} + L(R_f + p)(1 - T_c) - i \tag{3}$$

Lally (2000) shows that T_m can be expressed as:

$$T_m = T - U(1-T)\frac{IC_m}{DIV_m} \tag{4}$$

2 By virtue of this model assuming segregation of capital markets, the 'market' portfolio is domestic rather than world.

where U is the weighted average of investors' utilisation rates for imputation credits (0 for no ability to use, 1 for full utilisation), DIV_m is the annual cash dividends on the market portfolio and IC_m is the imputation credits attached to these dividends.

Comparison of this model with the situation for typical corporates in Australia and the United States is complicated by the dominance of alternative versions of the CAPM used in both of these countries. In Australia, the dominant version appears to be that of Officer (1994). By contrast with Lally (1992), the process known in both Australia and New Zealand as dividend imputation is treated as a phenomenon that lowers corporate rather than personal taxes. Consequently, it raises the cash flows that are discounted rather than lowers the tax parameter T_m. Lally (1999a, pp 10–11) shows that this is purely a matter of form with no distinction in substance. Thus we will act as if the Officer model allows for imputation via the cost of equity. In that case the model differs from that used widely in New Zealand only in that capital gains are assumed to be taxed equally with interest. This implies that $T = 0$ and therefore, following equation (4):

$$T_m = -U\frac{IC_m}{DIV_m}$$

Equation (3) then becomes:

$$k_r = (1-L)\left\{R_f - U\frac{IC_m}{DIV_m}D_m + \left[E(R_m) + U\frac{IC_m}{DIV_m}D_m - R_f\right]\right\} + L(R_f + p)(1-T_c) - i \tag{5}$$

Turning now to the United States: the dominant form of the CAPM in use there appears to be the standard version. This can be viewed as a special case of Lally (1992) in which capital gains, interest and dividends are equally taxed for any investor. Accordingly both T and T_m are zero. Equation (3) then becomes:

$$k_r = (1-L)\{R_f + \lfloor E(R_m) - R_f \rfloor\} + L(R_f + p)(1-T_c) - i \tag{6}$$

Two further points warrant mention here. First, equations (3), (5) and (6) have an apparently perverse effect in that reductions in the corporate tax rate will increase the cost of capital, by virtue of the latter being defined as incorporating the tax saving on interest payments. However, for the three markets examined (Australia, the United States and New Zealand), the corporate tax rates are very similar and hence this characteristic of the cost of capital will not affect the cross-country comparison.

Secondly, some observers (generally in tax or economics rather than finance) argue that the cost of retained earnings may differ from that of share issues due to personal taxation considerations (see, for example, Sinn, 1991). For example, under a classical tax system such as that of the United States, the payment of a dividend by a firm generates increased personal tax obligations for shareholders and this implies that firms will retain funds and invest them into projects that would not be financed with external capital. One view of this policy is that the cost of retained earnings is thereby lower than external equity. Another view is that the two costs are the same but the net present value (NPV) cut-off mark for project acceptance differs according to whether the equity used is external or not. In general, the finance literature favours the latter view. The advantage of doing so is that an undesirable property of a tax system (project acceptance by a firm is dependent upon the size of its retained earnings) is made explicit, rather than being buried in an adjustment to the discount rate. I favour the 'finance' view and, accordingly, no distinction is drawn in this paper between the costs of internal and external equity.

We now proceed to estimate the real cost of capital under equations (3), (5) and (6). In each of these models, the riskfree rate R_f, market leverage L, company tax rate T_c and the debt premium p can be observed. The remaining parameters must be estimated, and we invoke widely used estimates of these.

1.2 Parameter estimates

We start with equation (3) for New Zealand. Typical applications of this model in New Zealand assume *T* is 0.33 (this arises from the assumption that interest income is taxed at 0.33 and capital gains are tax free). In addition, the most frequently used estimate of the market risk premium [ ] is 0.09. This is based on simple averaging of the annual *ex post* counterpart outcomes over the period since 1958 (the estimates are proprietory). The market dividend yield D_m is about 0.04 (data courtesy of Ord Minnett). The parameter U is typically assumed to be 0.50–0.70, based on Australian studies of price behaviour around the time that shares go ex-dividend.[3] We use the midpoint of 0.60. In respect of the ratio $(IC_m)/(DIV_m)$, the maximum value permitted by law is 0.49 (arising from a company tax rate of 0.33). The range of values is substantial across firms. However, the average value is about 80 percent of the maximum value, implying a value of 0.40 (data courtesy of Ord Minnett). Regarding the debt premium p, typical values are 0.01–0.02 (data courtesy of Ord Minnett), and we adopt the midpoint of 0.015.

All of these parameters are reasonably stable over time. By contrast, the remaining three parameters (R_f, i and L) are less so. Such instability over time leads to results becoming rapidly outdated. In addition, all three phenomena should exhibit mean reversion. Consequently, we average each of them over the last few years. In addition to this instability problem, expected inflation *i* is not even observable. We proxy it by averaging *ex post* outcomes over the same period for which the riskfree rate is averaged (1996–99 inclusive).[4] Following standard practice, we proxy the riskless rate by the yield on 10-year government bonds.[5] The results are 0.07 for the riskfree rate and 0.012 for consumer price inflation (International Monetary Fund (IMF), 1999). In respect of market leverage Lally (1998) gives estimates for 1995–97 inclusive, and these average 0.28. Finally, the corporate tax rate is 0.33. Inserting these parameters into equations (3) and (4) yields a real cost of capital of 0.107.

3 Bruckner *et al* (1994) obtain 0.68 using 1990–93 data, Hathaway and Officer (1995) obtain 0.44 using 1986–95 data, and Brown and Clarke (1993) obtain 0.80 using 1989–91 data.

4 At least in New Zealand's case, the use of forecasts yields much the same result. For example, the New Zealand Institute of Economic Research (NZIER) forecasts over the same four years, made in the preceding December, average 0.012 compared with the actual of 0.012.

5 The use of a 10-year rate is consistent with use of the cost of capital for the discounting of long-term cash flows.

Turning now to Australia: the most extensively used estimates in Australia of the market risk premium [ ] and U in equation (5) seem to be 0.06 and 0.50 respectively.[6] In respect of the ratio $(IC_m)/(DIV_m)$ the maximum value permitted by law is 0.56 (arising from a corporate tax rate of 0.36). The average value is about 60 percent of this, implying a value of 0.34 (data courtesy of Ord Minnett). In addition, the market dividend yield for Australian stocks is about 0.03 (data courtesy of Ord Minnett). Casual empiricism suggests that a typical debt premium in Australia is comparable with the 0.015 for New Zealand. Averages in Australia for R_f and i, obtained in the same manner as those for New Zealand, are 0.067 and 0.012 respectively (IMF, 1999). Regarding the Australian company tax rate, this is 0.36 (although it is scheduled to fall to 0.30 over the next two years). Finally, in respect of market leverage in Australia, the value for 1999 is 0.15 (data courtesy of Ord Minnett). Inserting all this into equation (5) yields a real cost of capital of 0.10.

Finally, in the United States, there seems to be much more diversity in estimates of the market risk premium. This is reflected in both the academic literature and regulatory activities in which 'fair' rates of return are prescribed for monopolists in industries such as power and telecommunications. A very commonly used source is the Ibbotson data, which provides US stock market, Treasury Bill and Treasury Bond data for all years since 1926 (Ibbotson Associates, 1999). The data can be manipulated in a number of ways. The most common method (which is recommended by Ibbotson) is to compute, for each year, the excess of the stock market return over the long-term Treasury Bond yield prevailing at the beginning of that year, and then arithmetically average over the years (for example, see Brealey and Myers, 1991, p 194). The result is an estimate of 0.080 (Ibbotson Associates, 1999, Table 8–1). Consistency then requires that the first use of R_f in equation (6) is the long-term Treasury Bond yield. In respect of market leverage, Damodaran (1997, p 137) gives a figure of 0.27 for 1995. Furthermore this is very close to the long-run average of 0.25 (based on data from Holland and Myers, 1979, over the period 1929–76). Again, the debt risk premium p seems comparable with that for New Zealand, of 0.015.[7] Averages for R_f and i are obtained in the United States in the same manner as for New Zealand, and are 0.061 and 0.023 respectively (IMF, 1999). Finally, the US company tax rate is 0.34. Inserting all of these parameters into equation (6) yields a real cost of capital of 0.093.

A widely used alternative to the market risk premium estimate just described is to arithmetically average stock-market returns over the Treasury Bill return, and therefore to use the Treasury Bill yield for the first instance of R_f in equation (6) (see, for example, Ross *et al*, 1996, p 279). The result, a lower riskfree rate and a higher market risk premium, largely offsets for a typical company. Other widely used processes for estimating the market risk premium produce lower estimates. Some authors (for example, Damodaran,

[6] Two recent examples are the Victoria Gas Decision (Office of the Regulator General, 1998) and the Adelaide Airport Decision (Australian Competition and Consumer Commission, 1999). Both are cases in which a regulatory body has specified a cost of capital for a monopolist.

[7] This is larger than the average excess return on corporate bonds over government bonds (Ibbotson Associates, 1999), because the 0.015 is a differential in promised rather than expected returns.

1997, pp 126–127) recommend use of the geometric, rather than the arithmetic, mean of the Ibbotson data. If used in conjunction with Treasury Bond data, the geometric mean reduces the estimated market risk premium by about 0.02. Furthermore, estimation methods that do not invoke the Ibbotson data have been suggested. Siegel (1992) extends the Ibbotson data back to the year 1802. Over the period 1802–1925 Siegel finds the arithmetic average of stock market returns over Treasury Bonds to be only 0.027, compared with the 0.080 since. Pooling the two data sets yields an estimate for the market risk premium of 0.044. Siegel (1999) attributes the higher Ibbotson result to unexpected inflation in the post World War II period that produced unduly low real returns on bonds but did not affect the real returns on equities.

All of these estimates invoke historical data. A commonly used alternative is to generate forward-looking estimates as follows. In respect of each company j, dividends per share are expected to grow at some constant rate g_j forever. This implies that the company's cost of equity is:[8]

$$k_{ej} = D_j + g_j \tag{7}$$

Constant growth in expected dividends implies constant growth in expected earnings per share. Harris and Marston (1992) estimate the latter from analysts' five-year-ahead forecasts for earnings per share. Insertion of this latter estimate into equation (7), along with the current dividend yield D_j gives a current estimate for k_{ej}. Value weighting over the results for each company then yields the estimate for $E(R_m)$. Subtraction of the current value for R_f (proxied by the Treasury Bond yield) then provides a current estimate of the market risk premium. Applying this methodology, Harris and Marston generate estimates for the market risk premium for each of the years 1982–91, ranging from 0.048 to 0.074 and averaging 0.065. The latter number is about one percentage point less than the Ibbotson arithmetic average with Treasury Bond data, for the period up till the midpoint of the Harris and Marston study.

The above approach extrapolates the five-year forecast to all future years. Some analysts (see Cornell, 1999, Ch 4) argue that the long-run expected growth in dividends must equal long-run economic growth g_l (of around 0.025 real), and that the five-year forecasts for companies typically exceed this. The latter must then converge to the former. If, for example, convergence is achieved in 20 years then the growth rate g_j applies to each of the first five years $(g_1 \ldots g_5)$, rate g_l to year 20 and beyond, and rates $g_6 \ldots g_{19}$ linking them. In respect of company j, with current dividend per share DIV_{0j}, the current stock price P_j can be expressed as the sum of the expected dividends discounted back to the present:

$$P_j = \frac{DIV_{0j}(1+g_1)}{1+k_{ej}} + \frac{DIV_{0j}(1+g_1)(1+g_2)}{[1+k_{ej}]^2} + \ldots \tag{8}$$

By substituting in the observed share price, the current dividend per share and the set of growth rates, this equation is then solved for the cost of equity k_{ej}. Averaging the return

8 It might seem that this model cannot accommodate personal taxation. This is not in fact the case. Personal taxes affect the share price, which is the denominator of the dividend yield. Thus, as personal taxes on equity rise, share prices fall and the dividend yield thereby rises. In accordance with equation (7), the cost of equity then rises.

over companies then yields $E(R_m)$, and subtraction of the current value for R_f then yields the estimate for the market risk premium. The result is around 0.045 over Treasury Bonds, that is, 0.035 less than the most recent Ibbotson arithmetic average of 0.080. The figures quoted here are Cornell's (1999, Ch 4). However, Cornell observes (1999, pp 109–113) that these results closely match those of Goldman Sachs and Merrill Lynch, who in turn can be expected to influence market practice.

Even more radical is to dismiss the analysts' forecasts over earnings per share and to use only the long-run estimate for g_l. Thus:

$$E(R_m) - R_f = D_m + g_l - R_f \approx D_m + \text{real } g_l - \text{real } R_f \qquad (9)$$

Cornell (1999, p 181) suggests a long-run value for real g_l of 0.025. A long-run estimate for D_m is the post World War II average of 0.04 (Cornell, 1999, p 160), and our earlier estimate for real R_f is 0.04. The result is an estimate for the market risk premium of only 0.025.

In addition to these views, there are a number of other academic studies that have contributed to a widespread belief in the United States that the Ibbotson estimate is too large. Goetzmann and Jorion (1996) survey a large set of markets, and find that results from the US and other Anglo-Saxon markets are abnormally large, by around three percentage points. The authors attribute this to the fact that the US markets have never experienced any major breaks over the estimation period. Consistent with this is the work of Brown *et al* (1995) who suggest that survivorship biases the observed risk premium by 0.04. Merton (1980) observes that the market risk premium is a reward for bearing equity risk and therefore must be related to the level of market volatility. Furthermore Friend and Blume (1975) show that aggregate relative risk aversion seems to be constant, and this implies that the market risk premium is proportional to market variance. Merton (1980) estimates the coefficient of proportionality at 1.9. Applying this to an estimate of US market variance, over the period 1980–2000, of 0.15^2 (data courtesy of Ord Minnett), the result is an estimated market risk premium of:

$$E(R_m) - R_f = 1.9(0.15)^2 = 0.043$$

The value is lower than Ibbotson's 0.080 simply because the variance figure used is below the US average over the Ibbotson data period, of about 0.20^2 (Merton, 1980, Table 4.8).

Mehra and Prescott (1985) produce even more startling results. Starting with the consumption CAPM, they derive an equation for the market risk premium, the parameters of which are open to empirical estimation. Inserting what would seem to be reasonable estimates of these parameters results in an estimate of the market risk premium of less than 0.01! Of course it is an open question which version of the CAPM is valid. If the consumption CAPM is valid then the Ibbotson data would seem to generate a wildly excessive estimate of the market risk premium. A number of responses have been offered to this puzzle. Cornell (1999, p 154) concludes that a variety of explanations might explain it. Nevertheless it has contributed to the belief amongst many US academics and those involved in valuation that the Ibbotson estimate is too large.

The above evidence constitutes a set of approaches, along with examples of support, within the academic and financial community. Broader survey evidence comes from Welch (1998), who surveys 112 professors of Financial Economics, and yields an average estimate for the market risk premium of 0.06 over Treasury Bonds, compared with Ibbotson's 0.08. That the lower value reflects the alternative approaches discussed here is illustrated by Reilly and Brown (2000, p 795):

> … there is substantial controversy on the appropriate estimate for the equity market risk premium – estimates range from a high of about 8% (the arithmetic mean of the actual risk premium since 1926) to a low of about 3%, which is the risk premium suggested in several recent academic studies. The authors reject both of these extreme values and suggest using a 5% risk premium.

Finally, further evidence on the variety of market practice comes from the evidence presented to regulatory bodies concerned with setting 'fair' rates of return. Thompson (1991), in a survey of rate setting for regulated firms in the United States, observes that a wide variety of approaches are used, including both the standard version of the CAPM and the dividend growth model (7). In those cases in which the standard version of the CAPM is used, the Ibbotson data are typically used to estimate the market risk premium. However, Thompson (1991, Ch 9) also observes that this data generates a variety of outcomes (as we have illustrated earlier) depending on the time span, use of a geometric or arithmetic mean and the choice of Treasury Bill or Bond rates.

In summary, there is a considerable range of opinion about the market risk premium in the United States, with widely used estimates ranging from about 0.04 to Ibbotson's 0.080. In conjunction with the other parameters this leads to a real cost of capital ranging from 0.064 to 0.093. By contrast there is considerable uniformity in Australian and also in New Zealand practice in this area, leading to real costs of capital for typical firms in Australia and New Zealand of about 0.10 and 0.107 respectively.

1.3 Sources of difference

Having provided estimates of market risk premiums for each of the three countries, we now seek to identify the sources of difference. We start by comparing New Zealand with Australia. Our estimates here were 0.107 and 0.10, a difference of 0.007. The difference lies largely within the cost of equity, for which different versions of the CAPM are used. Notwithstanding this, because we examine a typical firm, both CAPMs can be reduced to the standard version, the components of which are the riskfree rate R_f and the traditional market risk premium $E(R_m) - R_f$. Having commented on the former, we now need only consider the latter. The value of the market risk premium can be deduced for each of the two countries as follows. For New Zealand, the market risk premium in its CAPM is estimated at 0.09, that is:

$$E(R_m) - D_m T_m - R_f(1 - T) = 0.09$$

The estimated values for D_m, T_m, R_f and T have been indicated earlier as 0.04, 0.17, 0.07 and 0.33 respectively. Inserting these into the last equation yields an implied value for $E(R_m) - R_f$ of 0.074.

For Australia the market risk premium in its CAPM is estimated at 0.06, that is:

$$E(R_m) + U\frac{IC_m}{DIV_m}D_m - R_f = 0.06$$

The estimated values for U, $(IC_m)/(DIV_m)$, D_m and R_f were 0.50, 0.34, 0.03 and 0.067. Inserting these into the last equation yields an implied value for $E(R_m) - R_f$ of 0.055, compared with 0.074 for New Zealand. The difference between these two traditional market risk premium values for Australia and New Zealand is then 0.019. However, there is also a leverage difference between the two markets, which affects the market risk premium and can largely be dealt with by converting the market risk premiums (MRP) to their unlevered counterparts MRP_u. Lally (1999b, p 8) shows that, approximately:

$$MRP = MRP_u\left[1 + \frac{L}{1-L}\right]$$

In the above equation the substituting in of the Australian MRP of 0.055 and leverage of 0.15 yields an MRP_u of 0.047. Repeating this for New Zealand yields MRP_u of 0.054. This difference of 0.007 corresponds to the difference in the real costs of capital.

We now compare New Zealand with the United States, for which market leverage is almost identical. However, again, different versions of the CAPM are used, therefore we compare the traditional market risk premiums. For New Zealand the implied estimate for $E(R_m) - R_f$ is 0.074. For the United States, the traditional market risk premium has been estimated at various values. We start with the largest value, of 0.080, implying a real cost of capital of 0.093 compared with New Zealand's 0.107. The difference of 0.014 is attributable largely to the difference in the real riskfree rates: 0.038 for the United States and 0.058 for New Zealand. If the lowest estimate of the US market risk premium (0.04) is used, then the result is:

New Zealand real cost of capital	0.107
United States real cost of capital	0.064
Difference	0.043
Effect of the real riskfree rate difference	0.02
Effect of the $E(R_m) - R_f$ difference	0.025

The real riskfree rate differential that we have identified against the United States is sensitive to our use of average *ex post* inflation to proxy for expectations. Some observers are sceptical about whether such a differential exists (for example, Hargreaves and McDermott, 1999, p 24). The problem is a history of much higher inflation in New Zealand, possibly inducing a 'peso effect' in the probability distribution over future inflation, that is, a small probability of a high inflation rate, which is not reflected in the very recent history (see, for example, Eckhold, 1998, p 20). Surveys of expected inflation do not necessarily address this concern because respondents will usually give the most likely values rather than expectations (which are weighted averages over the possible outcomes).[9] Another possibility is to deduce expected inflation from the difference in

9 Unsurprisingly, forecasts yield much the same result as actual when averaged over the period considered, as noted earlier in footnote 4.

yields between nominal and inflation index bonds. However the latter may embody some premium for inferior liquidity relative to nominal bonds, and the former may embody some reward for bearing inflation risk as well as for expected inflation (see Eckhold, 1998, p 33). Thus the difference in the two yields may reflect not only expected inflation but also a reward for bearing inflation risk, and an allowance for differential liquidity on the two types of bonds.[10]

In summary, invoking widely used parameter estimates, reveals that the real cost of capital in New Zealand is higher than that of Australia by less than 0.01 and higher than that of the United States by 0.015–0.045. The principal sources of difference are in the traditional market risk premium and in the real riskfree rate. In comparing the New Zealand and Australian real costs of capital, we estimate that virtually all of the difference arises from the traditional market risk premium. In comparing New Zealand with the United States, we estimate that there is a difference of 0.02 in the real riskfree rate, and there is also a difference of up to 0.025 attributable to a lower US market risk premium, depending upon how the market risk premium is estimated. The apparently higher real riskfree rate in New Zealand relative to the United States comes with a substantial caveat.

---

10 For New Zealand, the average difference in the two yields over the period 1996–99 was 0.019 compared with average inflation of 0.012. The corresponding figures for Australia are 0.026 and 0.012.

2

THE REAL COST OF CAPITAL UNDER SEGMENTED MARKETS

2.1 The model

Having offered estimates of the real cost of capital based on models and parameter values used extensively in New Zealand, Australia and the United States, we now ask whether these estimates are in fact 'correct'. Since the cost of debt is essentially observed, the issue is largely limited to the cost of equity. Consequently we require a model that specifies the 'true' cost of equity. Such a model must embody the fundamental factors that underlie the cost of equity. These are the riskfree rate, risk, personal taxation, and the extent to which equity markets are internationally integrated.

We will address the last of these points by considering the polar cases of complete segregation and complete integration, starting with the former. A model that addresses complete segregation and reflects the riskfree rate, personal taxation and risk, is a domestic version of the CAPM embodying personal taxation. Lally (1992, p 33) offers a model of this form, shown earlier in equation (2), that admits a wide range of personal tax situations. For a typical stock within any market, the beta is 1, and the stock's D_j and T_j correspond to that of the market. The cost of equity is then:

$$\begin{aligned} k_e &= R_f(1-T) + D_m T_m + \lfloor E(R_m) - D_m T_m - R_f(1-T) \rfloor \\ &= R_f + \{D_m T_m - R_f T\} + \lfloor E(R_m) - D_m T_m - R_f(1-T) \rfloor \end{aligned} \tag{10}$$

The cost of equity is then the sum of the riskfree rate R_f, an allowance for the differential taxation of equities and bonds { }, and an allowance for risk [ ]. The parameters requiring determination are the riskfree rate R_f, the market dividend yield D_m, the tax parameters T and T_m, and the market risk premium [ ]. We deal with these in turn.

2.2 Riskless rate

The riskless rate is the rate of return that can be earned with certainty, over the period to which the CAPM relates. In practice no such asset exists. Even government bonds carry some risk of default, arising from economic collapse, natural disaster, war or revolution. However, for the three countries under examination, at least, these risks appear trivial. Thus government bonds should offer a good proxy for the riskfree rate.

The question of existence aside, riskfree rates (like all interest rates) come in three forms:

(i) forward rates, which are rates set now for each future year;

(ii) spot rates, which are rates set now for time spans running from now until some specific future point. Thus, the five-year spot rate will be a weighted average over the forward rates for each of the next five years; and

(iii) yields to maturity, which are the internal rates of return on bonds maturing at various future points in time. Thus the yield to maturity on five-year bonds will reflect the coupon rate on the bond along with the spot rates for years one to five.

Because our concern here is with specifying the cost of equity capital over some interval commencing now, a focus on spot rates is appropriate. These rates vary generally with the term in question, that is, the term structure of spot rates is not flat. Thus there is a spot rate, and hence a cost of capital, for the interval from now until each future point in time. Consequently, if our concern is with applying the cost of capital to future cash flows, so as to produce a discounted cash flow, then we have a set of costs of capital. A simplification is to use one riskfree rate, and hence one cost of capital, for all future periods. This rate should average over the various spot rates, with weights determined by the contributions of each future period's cash flow to the overall valuation of the cost of equity capital. A simple rule is to use the riskfree rate, the term of which corresponds to the median in the succession of present values that arise as we accumulate over the future cash flows. For example, a project for which half of the present value is captured by the first 10 years of cash flows would warrant use of the 10-year spot rate. Further simplification is often invoked by using the 10-year yield to maturity, rather than the 10-year spot rate, because they are in general very similar. All of this leads us to select 10-year yields to maturity.

The final issue here concerns the volatility in these yields over time. Consequently, use of today's rate would rapidly consign the results to history. Accordingly an average is taken over the last four years. Consistency demands the same approach to inflation. As discussed earlier in Chapter 1, these averaged yields to maturity for New Zealand, Australia and the United States are 0.07, 0.067 and 0.061 respectively.

2.3 Market dividend yields

Market dividend yields at a given point in time are observable, and this suggests the use of their current values. However, our concern is with a cost of capital that is suitable for discounting long-run future cash flows. This points to long-run estimates of these parameters. In the case of New Zealand and Australia, the current values of around 0.04 and 0.03 respectively have been reasonably stable over time, and therefore are invoked for our purposes (data courtesy of Ord Minnett). By contrast, the current US value of 0.015 is significantly below the post World War II (and even the 1980s) average of 0.04 (Cornell, 1999, Figure 5.1). Accordingly, we use the longer-run average of 0.04 for the United States.

In summary, our estimates of the market dividend yield for each of New Zealand, Australia and the United States are 0.04, 0.03 and 0.04 respectively.

2.4 Tax parameter *T*

The tax parameter T reflects the difference between personal taxation on interest and on capital gains, and is defined in section 1.1. A good approximation is:

$$T = \frac{t_I - t_g}{1 - t_g}$$

where t_I is the average investor tax rate on interest and t_g is the average investor tax rate on capital gains. Standard practice in both Australia and the United States is to suppose that t_I and t_g are equal, implying a value for T of zero. By contrast, standard practice in New Zealand is to suppose that t_g is zero (capital gains are tax free to all investors) and $t_I = 0.33$ (all investors are taxed on interest at 0.33). Both approaches are simplifications of the true situation. Capital gains tax applies to some investors in all three markets, but generally at a lower rate than for interest; this implies a value for T that is positive, but below the tax rate on interest, in all three markets.

The less onerous taxation of capital gains arises in general for four reasons. First, in some tax jurisdictions, some investors are exempt from capital gains tax but not from interest tax; individuals in New Zealand for example, fall into this category. Second, even when an investor is subject to capital gains tax, only part of the capital gain may be taxable (in Australia's case this is 50 percent for individuals and 33 percent for some superannuation funds). Third, and again, even when an investor is subject to capital gains tax, the tax is generally payable on realisation, and the deferral opportunity resulting from this effectively reduces the rate of tax.[11] Protopapadakis (1983) estimates that this option reduces the effective tax rate by one half. Finally, some tax systems (including Australia's until recently) levy capital gains tax only on the real return, thereby further reducing the effective rate of tax. To illustrate the latter, suppose an asset's expected return is 0.15, its dividend yield is 0.05 and inflation is 0.02. The expected capital gain will then be 0.10, of which only 80 percent will be taxed. Thus the exemption of the inflation element is equivalent to reducing the tax rate by one-fifth.

In light of these facts, our estimates are as follows. Most interest income in the United States should be taxed at around 0.30 (the top two marginal tax rates are 0.28 and 0.31, and apply from a modest level of income). This suggests $t_I = 0.30$. In addition, capital gains are taxed at around the same level for all investors, but, further, enjoy the deferral option. Invoking Protopapadakis' 50 percent discount to reflect this, t_g would then be 0.15, implying that:

$$T = \frac{0.30 - 0.15}{1 - 0.15} = 0.18$$

For Australia, personal tax rates on interest are higher than in the United States (the top tax rate is 0.47) but superannuation funds are taxed at only 0.15. An average tax rate on interest t_I of 0.30, similar to that of the United States, is then suggested. It also seems

[11] Deferral lowers the effective rate not merely because of the time value of money but, as Hamson and Ziegler (1990, p 49) note, because of the opportunity to realise when the investor's marginal tax rate is lower, such as in retirement.

reasonable to apply the same 50 percent deferral discount for capital gains. In addition, the Australian capital gains exemptions described above should lower the effective capital gains tax rate by approximately a further 50 percent, yielding a rate equal to one-quarter that for interest. This implies a value for T of 0.24.

In New Zealand, an average tax rate on interest t_I of 0.30, similar to that of Australia and the United States, also seems appropriate; this is consistent with the top three marginal tax rates of 0.21, 0.33 and 0.39, and, with opportunities for avoidance of the top tax rate, suggests that little interest income will be taxed at that rate. The capital gains deferral discount of 50 percent also seems appropriate for New Zealand. In addition, in New Zealand, individuals have roughly comparable market weight to that of institutions, and the former are effectively exempt from capital gains tax. This suggests an effective average tax rate on capital gains equal to one-quarter of that for interest, implying a value for T of 0.24. This is not substantially different from the estimate for the United States, despite the exemption of individuals from capital gains tax.

In summary, our estimates for T are 0.24 for New Zealand and Australia, and 0.18 for the United States.

2.5 Tax parameter T_m

The tax parameter T_m reflects the difference between personal taxation on dividends and capital gains, and is defined in section 1.1. In the United States, dividends are taxed in the same way as interest, and therefore T_m is equal to T, that is, 0.18. In both New Zealand and Australia, dividend imputation applies, leading to T_m being given by equation (4), that is:

$$T_m = T - U(1-T)\frac{IC_m}{DIV_m} \tag{11}$$

For Australia, T has been estimated above at 0.24. The parameter $(IC_m)/(DIV_m)$ is capable of being observed, and the value suggested earlier in Chapter 1 was 0.34. This leaves the utilisation coefficient U. This is approximately a value weighted average of the imputation utilisation coefficients that are applicable to investors. Because we are assuming complete segregation of capital markets, all investors, except those who are tax exempt, are able to utilise the imputation credits fully. Wood (1997, footnote 10) estimates that the percentage of shares held by Australian investors who are tax exempt is 3–4 percent. This implies a value for the utilisation coefficient U close to 1. Inserting this value, and the other tax parameter estimates, into equation (11) yields an estimate for T_m of –0.02.

Our estimate here for U of 1 conflicts with the utilisation coefficient value used widely in Australia of 0.60, which is based on an examination of price behaviour around the time that shares go ex-dividend. There are a number of difficulties with this latter estimate. First, the confidence intervals on these latter estimates are very wide. For example, the 95 percent confidence interval for the estimate of Bruckner *et al* ranges from 0.44 to 0.92. Second, ex-dividend day returns are known to exhibit perverse behaviour, which contaminates the estimate (see Frank and Jagannathan, 1998, in respect of Hong Kong, and Brown and Walter, 1986, in respect of Australia). Finally, the estimate for U of 0.60 reflects the presence of foreign investors in the Australian market, who can only partially utilise the credits at most and this exerts a downward influence on the estimate.[12] However, since complete segregation of markets is assumed, it would be inconsistent to use an estimate affected in this way.[13] Thus we estimate U as 1.

For New Zealand, the tax parameter T has been estimated above as 0.24. In addition, the parameter $(IC_m)/(DIV_m)$ is capable of being observed, and the value suggested earlier in Chapter 1 was 0.40. Finally, the estimate for U follows the same reasoning as for the estimate U in Australia, and leads to the same result of 1. Inserting these estimates into equation (11) yields an estimate for T_m of –0.06.

In summary, our estimates of T_m are –0.06 for New Zealand, –0.02 for Australia and 0.18 for the United States. The lower values in Australia and New Zealand compared with the United States reflect the presence of dividend imputation in the former markets.

2.6 Market risk premium

This parameter is particularly difficult to estimate. However, our concern is in large part with a cross-country comparison, and therefore with the differences across the three countries. The earlier sections of this paper have described a number of methodologies for estimating market risk premium, and we now review these.

The standard methodology for estimating is to form an arithmetic average of the *ex post* annual counterparts over a long series of years, in which the market portfolio is proxied by listed equity. There are a number of difficulties with this methodology. First, the true market portfolio is a value weighting of all risky capital assets (those held for investment purposes). The proxy represents only a small proportion of it, and the rest is not obviously similar in its risk characteristics.[14] The resulting potential for bias is well recognised in empirical tests of the CAPM – see Roll (1977), Kandel and Stambaugh (1987), Shanken (1987), and Roll and Ross (1994). In respect of the cost of equity capital, Lally (1995) indicates the potential for serious bias, through the use of non-compensating biases in estimating both beta and the market risk premium.

The second concern is that the 95 percent confidence intervals on these estimates are large enough to admit substantial estimation error, even if the true value has not changed over the estimation period. To illustrate this we consider the longest series, involving almost 200 years of US data back to 1802 (Siegel, 1992). With a standard deviation of 0.20 per year (see Merton, 1980), the resulting 95 percent confidence interval is ± 0.03. Since the point estimate arising from the Siegel data is 0.044, the 95 percent confidence interval

12 JB Were (1996) estimate that 30 percent of Australian equities are foreign owned. This fact alone would point to an estimate for U of 0.70.

13 Using such an estimate for U would raise the cost of capital. However, the overall effect of market integration would be to lower the cost of capital. Consequently, the partial recognition of integration that is implicit in using the lower estimate of U has the effect of pushing the cost of capital in the opposite direction to that implied by integration. This is perverse and should therefore be avoided.

14 Stambaugh (1982) estimates that equities represent only about 25 percent of the US market portfolio.

ranges from 0.014 to 0.074. For the Ibbotson data, the interval is almost ±0.05. Thus Ibbotson's point estimate of 0.080 has a 95 percent confidence interval running from 0.03 to 0.13. Relative to the debate over the correct value, these intervals are huge. This uncertainty is reflected in the sensitivity of the results to the time span selected: Siegel obtains an estimate for the United States which is 0.036 less than Ibbotson's by extending the data back from 1926 to 1802. Clearly there is a trade-off here between the precision offered by more data and the risk of the additional data being outdated. However, there is no means of knowing the optimal time period.

The third concern, alluded to previously, is that the estimates are biased in a number of ways. One of these is survivorship bias, arising from the fact that the three markets examined here survived, and this has the potential to significantly bias the results upwards. Brown *et al* (1995) suggest a bias of 0.04 arising from this. In addition, Goetzmann and Jorion (1996) survey a large set of markets, many of which have failed at some point, and find that the results from Anglo-Saxon markets are unusually high by about 0.03. Another source of bias, suggested by Siegel (1999), is that unexpected inflation over the post World War II period has lead to the real returns on bonds (but not stocks) being significantly less than expected, and this has led to market risk premium estimates being biased upwards.

The fourth concern is that such estimates assume that the true value is unchanged over time. Siegel (1999) suggests that the costs of acquiring a well-diversified portfolio (via a mutual fund) have fallen considerably in the past 20 years, and offers an estimate for the resulting reduction in the market risk premium of 0.015. However, no quantitative analysis supports this conjecture. Other factors affecting the market risk premium, and which may have changed, are risk aversion and market risk.[15] Changes over time in risk aversion are difficult to estimate. However, changes in market risk can be estimated, and have been substantial. Merton (1980, Table 4) presents US estimates over successive four-year periods from 1926 to 1978, and finds that the annualised standard deviation ranges from 0.45 during the Great Depression to 0.11 during the 1960s.

It might then seem that an appropriate estimate of the market risk premium will arise from recognising its relationship with market risk. Scruggs (1998) clarifies the earlier controversy (French *et al*, 1987, and Glosten *et al*, 1993, reach opposite conclusions) and concludes that the relationship is positive. However, the functional form of the relationship is unclear. Friend and Blume (1975) conclude that aggregate relative risk aversion is constant, and this implies that the market risk premium is proportional to variance (see Chan *et al*, 1992). However, French *et al* (1987) could not statistically distinguish between the market risk premium being proportional to market standard deviation and to market variance, and Merton's (1980) estimates of the coefficients for these two functional forms lead to markedly different estimates of the market risk premium. For example, the US market's standard deviation is estimated at 0.15 over 1980–2000 (data courtesy of Ord Minnett). Coupling this with Merton's coefficients leads us to an estimate for the market risk premium of 0.043 if one believes the market risk

15 In addition, changes in personal tax rates will affect estimates of the traditional market risk premium.

premium is proportional to variance, and 0.097 if one believes it is proportional to standard deviation! This is an enormous discrepancy.

In addition to this concern, all efforts to recognise time-series variation in the market risk premium, leading to a current estimate of the market risk premium, presume that the estimate can be extrapolated forwards indefinitely for the purpose of valuing future cash flows. However, the mere fact that the market risk premium has changed in the past implies that it will do so in the future. If it follows a random walk without drift, this will not be a concern because today's value will then be the best estimate for all future years. However, as one might expect, the market risk premium appears to exhibit mean reversion over time (see Bookstaber and Pomerantz, 1989). Consequently, one would have to estimate market risk over a sufficiently long period in the past in order to act as a good estimate for the long-run future. If this past period is equal to that used in Ibbotson type analysis, the resulting market risk premium estimate will be much like that from the Ibbotson approach. Examination of time-series data on US market volatility (Cornell, 1999, Figure 5.3) suggests a regime shift to lower volatility at the end of World War II, and a further decline in the 1990s. Should one then use the post World War II average or the 1990s average? Time-series data for New Zealand and Australia (data courtesy of Ord Minnett) also suggest declines in their market volatilities in the 1990s.

All of these concerns with the use of historical data can be addressed by invoking the forward-looking estimates of the dividend discount model, which are reflected in equations (7), (8) and (9). However, the old concerns are replaced by new ones, as follows. First, the three variants reflected in these three equations differ according to when current forecasts of earnings growth are assumed to converge on the long-run forecast. Respectively, these are: never, in 20 years and immediately. It is not apparent which of these convergence intervals is appropriate and yet the difference in market risk premium estimates across them (for the United States) is 0.015, 0.035 and 0.055 respectively below the Ibbotson number of 0.080. So, even if one accepts the short- and long-run forecasts, one has to choose a convergence period, to which the resulting market risk premium estimate is very sensitive.

Secondly, these short- and long-run forecasts are not self-evidently valid. Thirdly, if any reliance is placed on the current dividend yield (as opposed to a longer-run average), one has to believe that the current market price is correct (because it constitutes the denominator in the current dividend yield). Finally, these forward-looking estimates reflect the actual pricing model invoked by the market. Because we do not know what this is, we are in danger of inserting a parameter estimate into a domestic version of the CAPM that is incompatible with it. To illustrate this concern, suppose that equity markets are internationally integrated. In this event, a forward-looking estimate of the market risk premium will reflect that fact, and will accordingly be different from an estimate appropriate to a CAPM reflecting market segmentation. However, the beta estimate that will be inserted will be that applicable to segmented rather than integrated markets (we will elaborate on the distinctions shortly). Thus we will have inserted incompatible parameter estimates into the model. Estimates of the market risk premium that are derived from historical data are less subject to this concern because most of the data used will pre-date the earliest point at which one could argue for significant integration of markets (mid-1970s).

In view of all these concerns it is not apparent what the appropriate estimation method is, and therefore what the correct estimate should be. Credible estimates for the traditional market risk premium in the United States range from 0.04 to 0.080, and a wide range will also apply to the tax-adjusted version (in the United States and elsewhere). What we can say is as follows. Our principal concern is to obtain estimates for the three markets that are consistent with the differences between them. Furthermore, since a tax-adjusted version of the CAPM is being invoked, the market risk premium in equation (10) is purely a reward for bearing risk.[16] Thus, differences in the estimate across the three markets of concern must reflect only differences in market risk and investor risk aversion. The latter is difficult to estimate. By contrast, market risk can be estimated with reasonable precision around a point in time, and estimates for the United States are consistently below those for Australia and New Zealand. Thus we are driven towards Merton's (1980) methodology for estimating the market risk premiums in the three countries. In doing so we assume that the market risk premium is proportional to market variance, and adopt Merton's coefficient of 1.9.

Estimates for the long-run future variance in each market are then required. Time-series returns data (courtesy of Ord Minnett) imply standard deviations for the United States, Australia and New Zealand, over the period 1980–2000, of 0.15, 0.18 and 0.20 respectively. However, it is not clear which prior period provides the best long-run estimate of future variance, for purposes of setting the market risk premium (standard deviations for the 1990s are 0.13, 0.13 and 0.16 respectively). Furthermore, this optimal period may differ across the three countries. Mindful of these concerns, we use the period 1980–2000, implying long-run market standard deviations of 0.15, 0.18 and 0.20 for the United States, Australia and New Zealand respectively. It then follows that the market risk premiums are 0.043, 0.062 and 0.076 in the United States, Australia and New Zealand respectively.

A final issue here relates to the nature of the cross-country comparison. The comparison of interest is of the average cost of capital for New Zealand firms (reflecting a particular set of projects engaged in by them) with the average faced by Australian and US firms across the *same* set of projects. Thus the set of projects is held constant, and the variation is exclusively over the country, and hence the capital market, in which the projects are undertaken. However, the market variances that we have estimated, so as to calculate the market risk premiums in the three countries, will reflect any differences across the three markets in their project sets. The extent to which any change in project sets affects the market variances is unclear. It is not apparent that any change in project sets would materially affect the market variances. By contrast, it is conceivable that the differences in market variances (the United States has the lowest, followed by Australia) could be explained by the differing degrees of diversification within the three markets (the United States is the most diversified, followed by that of Australia, ahead of New Zealand). To

16 Differences in personal taxation across equities and bonds are reflected in the term { } in equation (10).

illustrate this, suppose that all firms in these markets have a standard deviation of 0.30 and a correlation coefficient against any other firm in their market of 0.30. A market with five equally weighted such firms will then have a standard deviation of 0.20, a market with ten equally weighted firms will have a standard deviation of 0.18, and a market with 100 equally weighted firms will have a standard deviation of 0.16. These three standard deviations are approximately those of New Zealand, Australia and the United States. Thus the difference in the standard deviations of these three markets could be explained entirely by the differing degrees of diversification in the three markets. We will assume that this is in fact the case.

2.7 Real costs of capital

Once the market risk premiums have been estimated, the cost of equity for each of the three markets then arises by substituting these values along with values for R_f, T, D_m, and T_m into equation (10). These cost of equity results are then substituted into equation (1), to obtain the real cost of capital. The last step requires estimates for the parameters T_c, p, i and L. For the first two parameters (T_c and p) we use the current values given earlier in Chapter 1. In respect of expected inflation, we use the values for i and L, given earlier in Chapter 1, that are averaged over the last few years. Finally, in respect of market leverage, this is a factor that affects market variance. Having estimated the market variance over the period 1980–2000, our estimate for market leverage should be arrived at using the same period. However, data access difficulties, most particularly for New Zealand and Australia, precluded this. Consequently, the estimates given earlier in Chapter 1 are invoked. By inserting all of these parameter estimates into equation (1), we get the results shown in Table 2.1.

The results for New Zealand and Australia are very similar. The result for the United States, however, is lower than that for New Zealand by 0.031 due to a combination of factors. The first factor is a real riskfree rate that is 0.02 lower in the United States. The second factor is a market risk premium that is lower in the United States, and the feed-through effect into the real cost of capital is 0.024. These two effects are partly mitigated by a less favourable tax element in the United States, of which the feed-through effect into the real cost of capital is 0.011.

Table 2.1: Real costs of capital – segmented markets

Country	R_f	*Tax*	*Risk*	k_e	k_r
New Zealand	0.07	–0.019	0.076	0.127	0.095
Australia	0.067	–0.015	0.062	0.112	0.091
United States	0.061	–0.004	0.043	0.100	0.064

3

THE REAL COST OF CAPITAL UNDER INTEGRATED MARKETS

3.1 The model

The preceding calculations assume that equity markets are completely segregated. We now consider the opposite case, that of complete integration. Our model for the cost of equity must now reflect complete integration, along with the riskfree rate, personal taxation and market risk. Lally (1996) presents a version of the CAPM that embodies all of these requirements and that is consistent with a wide range of personal tax regimes. Under Lally's version the cost of equity for a typical firm within country j is:

$$k_{ej} = R_{fj}(1-T) + D_{mj}T_{mj} + \lfloor E(R_w) - D_wT_w - R_{fw}(1-T)\rfloor\beta_{mj} \tag{12}$$

where R_{fj} = riskfree rate of country j

D_{mj} = dividend yield of country j's market portfolio

$E(R_w)$ = expected rate of return on the world market portfolio

D_w = dividend yield of the world market portfolio

T = weighted average over investors, world-wide, of $(t_i - t_{gi})/(1-t_{gi})$ where t_i is investor i's interest tax rate and t_{gi} is investor i's capital gains tax rate

T_{mj} = weighted average over investors of $(t^j_{di} - t_{gi})/(1-t_{gi})$ where t^j_{di} is investor i's tax rate on cash dividends from country j's market portfolio

T_w = weighted average over countries of their T_{mj}

β_{mj} = systematic risk of country j's market portfolio against the world market portfolio

R_{fw} = weighted average over countries of their R_{fj}

Of these parameters, the riskfree rates R_{fj} and dividend yields D_{mj} have already been discussed earlier. The remaining parameters that require determination are tax parameters T and T_{mj}, the market risk premium [ ] and the betas β_{mj}.

3.2 Tax parameters

With integration of markets, the diversification benefits would lead to most investors holding bonds and equities in foreign countries rather than in their own country. Most of these assets would then be held by foreigners. The resulting difficulties for taxation authorities then point to average capital gains taxes shrinking towards zero, and taxes on interest and dividends shrinking towards the withholding tax rates (which are generally much less than normal statutory tax rates).[17] Dividend imputation or variants of it is common, but benefits are in general limited to domestic investors, who, in an integrated market, will be in a distinct minority. Thus, even with dividend imputation, the negative tax rates induced by it shrink towards zero. All of this suggests that the best estimates of T and T_{mj} are close to zero in the context of fully integrated markets. The CAPM then simplifies to:

$$k_{ej} = R_{fj} + \lfloor E(R_w) - R_{fw} \rfloor \beta_{mj} \tag{13}$$

which is Solnik's (1974) version. This leaves two parameters to estimate – the market risk premium [ ] and β_{mj}.

3.3 The world market risk premium

Prima facie, the estimation process for the world market risk premium should be much like that of its domestic counterparts. However, if an international CAPM is valid, implying complete market integration, it cannot have been so for much more than the last 25 years. The regime shift would create a new market portfolio with a lower variance than its domestic counterparts, due to the diversification effect. This would induce a reduction in expected returns. In turn this would rule out Ibbotson-type estimation processes for calculating the market risk premium, because these processes assume that expected returns are unchanged over very long periods. In addition, forward-looking estimates of the market risk premium would also be ruled out, because they would require that market prices reflect complete market integration, and this has clearly not yet been accomplished.

A possible solution to this problem is suggested by Stulz (1995a). This is to estimate the market risk premium over a period likely to pre-date significant world market integration, and then reduce this estimate to reflect the regime shift. This requires a judgment about the functional relationship between market risk and the market risk premium. Stulz (1995a) assumes that aggregate relative risk aversion is constant, and therefore that the market risk premium is proportional to market variance. He also assumes that the ratio of market risk premium to market variance is equal across countries. Consequently the world ratio post-integration is equal to the US ratio prior to integration. Thus, letting subscript m denote the US pre-integration and w the world post-integration:

$$\frac{MRP_m}{\sigma_m^2} = \frac{MRP_w}{\sigma_w^2}$$

It follows that the world market risk premium post-integration is:

$$MRP_w = MRP_m \frac{\sigma_w^2}{\sigma_m^2} \tag{14}$$

---

17 For example, the New Zealand government charges a mere 2 percent withholding tax on interest income to foreign entities, in recognition of the difficulties of collecting taxes levied at higher rates, and of the fact that competition from other tax authorities implies that higher tax rates in one country simply force up the interest rate its borrowers must pay.

Because the market risk premium is assumed to be proportional to market variance, the estimate for MRP_m must be derived in accordance with that variance, and also with the estimate for σ_m used in equation (14). Merton (1980) concludes that:

$$MRP_m = 1.9\sigma_m^2$$

We have earlier used an estimate of 0.15 for the standard deviation of the US market, and this implies that $MRP_m = 0.043$. Using Morgan Stanley (1996) data for the period 1985–95, Lally (1999c) estimates the world standard deviation to be 10 percent less than that of the United States over that period. Consistent with $\sigma_m = 0.15$, σ_w is then estimated at 0.135. Following equation (14), the world market risk premium is then estimated at 0.035, and we will use this estimate for the world market risk premium.

3.4 Betas

We turn finally to beta estimates. Unlike the domestic CAPM, the beta for a typical stock within a market is no longer 1, because betas are now defined against the world market portfolio rather than against domestic market portfolios. Bryant and Eleswarapu (1997, Table 5) estimate betas for various portfolios of New Zealand stocks against both a New Zealand and a world index of equities, and find an average reduction of 30 percent when shifting to world betas. Since the beta of a typical New Zealand stock against the New Zealand market is 1, we assign it a beta of 0.70 against the world market portfolio. Ragunathan *et al* (1999, Table 1) find a similar average reduction in beta for Australian stocks. So, again, we assign a beta for typical Australian stocks against the world market portfolio of 0.70. Lally (1999c) investigates a number of estimates for the beta of the US market against the world index, and finds values close to 1 (this is unsurprising in view of the huge weight of the US market in world equity markets). Accordingly, an estimate of 1 will be used for the US beta against the world market portfolio.

Having asked earlier, in the case of segmented markets, whether differences in market variances were due at least in part to differences in the activities undertaken by firms in Australian, New Zealand and United States markets, we now ask a parallel question here: is the difference in the average betas against the world market portfolio for New Zealand and US firms due to differences in the activities that these firms undertake in the market place. Equivalently, we could ask whether the difference in average betas is consistent with the firms in each country being engaged in similar activities within their own market. *Prima facie*, the answer is yes. For example, a US telecommunications company, with US projects, could have a higher beta against the world market portfolio than a New Zealand telecommunications company with New Zealand projects. This is because the US company's cash flows are more sensitive to world gross national product (GNP) by virtue of the US company's domestic market representing a larger fraction of that world GNP.

A final caveat should be offered as follows. Although the average betas for New Zealand and Australian stocks are now less than under a domestic CAPM, some firms in these countries may experience an increase in their betas. Furthermore, the increase in betas might even be so large as to offset the reduction in the market risk premium, and thereby increase a firm's cost of capital.

3.5 Real costs of capital

Our substitution of the beta estimates in the previous section, the world market risk premium estimate of 0.035, and the riskfree rates used earlier in the paper, into equation (13) yields the cost of equity for each country. Substitution of the cost of equity into equation (1) then yields the real cost of capital for each country. As discussed in section 2.7, the earlier estimates for T_c, p, i and L are equally applicable here. The resulting real costs of capital appear in Table 3.1 below.

Table 3.1: Real costs of capital – integrated markets

Country	R_f	β_{mj}	k_e	k_r
New Zealand	0.07	0.70	0.095	0.072
Australia	0.067	0.70	0.092	0.074
United States	0.061	1.0	0.096	0.061

The real costs of capital are then similar for New Zealand and Australia, while that for the United States is about 0.01 lower. The latter is due to a real riskfree rate that is 0.02 lower, partly mitigated by a higher beta against the world market portfolio. It is interesting to compare the New Zealand result of 0.072 with its counterpart under complete segmentation, of 0.095. The reduction of 0.023 arises exclusively from a lower cost of equity. The contributory factors are threefold: lower market risk premium (0.03), lower beta (0.007) and loss of the tax advantage (–0.014). In short, a large reduction in risk is partly offset by loss of a tax advantage. The earlier tax advantage arose from lower taxation on equities (both on capital gains and dividends) than on bonds. Internationalisation of markets pushes all tax rates on financial assets towards zero, and therefore tends to eliminate any tax advantage.

4

SUMMARY OF RESULTS

We have estimated the real costs of capital for typical firms in Australia, New Zealand and the United States in three distinct ways: estimates based on models and parameters used widely in each country, estimates that assume complete segmentation of equity markets, and estimates that assume complete integration of equity markets. The results appear in Table 4.1 below and can be summarised as follows:

(i) If the perceived cost of capital is considered, then Australia is modestly better than New Zealand, and the United States is even better still, with the degree of difference depending upon which market risk premium estimate is used in the United States.

(ii) If the cost of capital is assessed under complete segmentation of markets, then New Zealand and Australia are comparable while the United States is substantially lower. The US advantage comes from both an apparently lower real riskfree rate and a lower market risk premium (the latter being due to lower market volatility).

(iii) If the cost of capital is assessed under complete integration of markets, then New Zealand and Australia are again comparable while the United States is modestly lower. By comparison with Table 3.1, the US result is largely unchanged due to various offsets. By contrast, both New Zealand and Australia experience substantial declines for two reasons: the market risk premium is now lower, and their betas against it are also lower.

Table 4.1: Real costs of capital – three approaches

Country	*Perceived*	*Segmentation*	*Integration*
New Zealand	0.107	0.095	0.072
Australia	0.100	0.091	0.074
United States	0.064 – 0.093	0.064	0.061

In assessing the costs of capital listed in Table 4.1 we have used versions of the CAPM, and these allow for the time value of money, personal taxation and market risk. However, a number of other factors have been suggested as contributing to the cost of capital, including firm size, book-to-market value, liquidity and the extent to which insider trading laws are enforced. We now discuss these in turn.

In respect of firm size and book-to-market value, Fama and French (1993, 1997) incorporate these factors into a CAPM and estimate the resulting parameters.[18] The size

[18] The size effect was first documented by Banz (1981) and the book-to-market effect by Rosenberg *et al* (1985).

factor is particularly interesting in the context of this study because New Zealand, Australian and US stocks are clearly differentiated in size. However there is considerable controversy about the firm size and book-to-market value factors. At least three grounds for concern arise, as follows. The first is the possibility of data mining, that is, the inevitability of finding additional 'explanatory' variables if enough possibilities are examined (Black, 1993). The second is the possibility that the results are an artifact of the market proxy that is selected (Roll and Ross, 1994). The third concern is the sensitivity of the results to various changes in data and methodology, including new data sets (Kothari *et al*, 1995), the use of time-varying betas (Jagannathan and Wang, 1996) and the deletion of extreme observations (Knez and Ready, 1997). In light of these concerns, no allowance is made for firm size or book-to-market effects in this study.

We now turn to the issue of liquidity. As with firm size, it seems likely that New Zealand, Australian and US stocks are also differentiated by this factor. Amihud and Mendelson (1986) define liquidity as the spread between the bid and ask quotes of a 'specialist'. So defined, the authors show that expected returns are increasing in this spread. However Eleswarapu and Reinganum (1993) demonstrate that this effect is seasonal, and this casts doubt upon the liquidity explanation. Brennan and Subrahmanyam (1996) consider more sophisticated definitions of liquidity. Using these definitions they show that expected returns are inversely related to liquidity and that the relationship is not seasonal. Despite the difference in definitions, the authors' measures of liquidity still require the existence of bid-ask spreads under a 'specialist' system. However 'specialists' are not a feature of the stock markets in either New Zealand or Australia. Consequently, the Brennan and Subrahmanyam results do not allow for costs of capital in the three markets to be differentiated according to liquidity.

Finally, we consider the question of enforcing insider trading prohibitions. Bhattacharya and Daouk (1999) find that the cost of equity is reduced by about 0.05 if insider trading prohibitions are enforced. However the 95 percent confidence interval just embraces zero, and therefore one cannot reject the hypothesis of no effect at the conventional significance level. Furthermore, enforcement is deemed to exist if even one prosecution is undertaken. On this basis, each of the three countries examined in this study would be deemed to enforce their prohibitions, and hence would not differ in their cost of capital in this respect.

In view of these reservations about the additional cost of capital factors, and the lack of differentiation across the three markets examined, our cost of capital estimates are restricted to considerations of the time value of money, market risk and personal taxation. The estimates arising from these considerations are as shown in Table 4.1 above.

5

POLICY IMPLICATIONS

The policy implications for New Zealand of the results in Chapter 4 can now be considered. In doing so we focus on the assessed costs of capital, under both segmentation and integration of equity markets, rather than on the perceived cost of capital. Three issues present themselves:

(i) Because the US real interest rate seems to be about two percentage points less than that of New Zealand, we investigate the causes for this and whether New Zealand's rate could be lowered towards that of the United States.

(ii) In so far as markets are segmented, the United States enjoys a lower cost of capital than does New Zealand due to lower market volatility. We therefore investigate the causes for this and whether New Zealand's market volatility could be lowered.

(iii) In so far as the New Zealand market is segmented from the rest of the world, the effect of integration would be to reduce New Zealand's real cost of capital by about 0.025. Assuming reasonably that full integration has not yet been attained, we then inquire how New Zealand can be more integrated into the world market.

We start with the issue of the apparently higher real riskfree rate in New Zealand compared with the United States. As indicated earlier, its existence is not uncontroversial. Leaving this controversy aside, we now ask where any difference that exists in the real riskfree rate might arise. In doing so we presume that interest rates are determined internationally rather than domestically.[19] Possible explanations for the interest rate differential then include greater default probability, inferior liquidity, higher personal taxes, and currency risk. In respect of taxes, the withholding tax rate levied by New Zealand on foreign holders of local bonds is a mere 0.02, so this rules out tax as an explanation for the interest rate differential. In respect of default risk and inferior liquidity, these two effects can be estimated collectively by comparing the yields on New Zealand government bonds denominated in US dollars with the yields of the US government bonds. Over the last four years the yields on New Zealand government bonds denominated in US dollars have exceeded the US government bond yields by around half of one percentage point (see Hawkesby *et al*, 2000, Figure 4).[20] In judging the real interest rate differential to be about two percentage points over the same period, we conclude that the remaining one-and-a-half percentage point differential is an allowance for currency risk.[21]

---

19 This is consistent with consensus opinion and the dominance of foreigners in the market for New Zealand government bonds (Eckhold, 1998 p 25, gives a figure of 65 percent).

20 Over the same period, the margin seems to have grown. The growth seems to reflect increased concerns by lenders about both liquidity and default, and seems to derive from the Asian crisis, the Russian default and the Long Term Capital Management (LTCM) problems (discussion with Reserve Bank personnel).

21 The reader may wonder why we describe New Zealand government bonds as riskfree if they are subject to currency risk. The explanation is that 'riskfree' means free of risk to a New Zealander.

We now enquire whether this one-and-a-half percent differential between the yields on New Zealand and US government bonds that has been attributed to currency risk can be reconciled with asset pricing theory. Having assumed that bonds are priced internationally rather than domestically, we then assume that assets in general are so priced, that is, that an international rather than domestic CAPM prevails.[22] In general, international versions of the CAPM offer risk-based explanations for real interest rate differentials. Most of these models ignore personal taxes, which is consistent with our earlier comments about very low personal taxes under international CAPMs. In addition, most versions of the CAPM also assume the existence of bonds that are free of default risk (which are identified with government bonds) and they ignore liquidity issues. These assumptions are consistent with our present concern being limited to explaining the pricing of currency risk. Finally, most of these models assume that investors are concerned with real, rather than nominal, returns. Beyond this, such CAPMs differ in their assumptions about the following questions:

(i) is inflation stochastic?

(ii) is the investment opportunity set constant?

(iii) does purchasing power parity operate? and

(iv) are investors' consumption bundles the same across countries?

Different answers to these questions can lead to significantly different risk-based explanations for real interest rate differentials. To illustrate the range in possible explanations we will consider two models: that of Solnik (1974), which we employed earlier to determine the cost of equity in a world of integrated capital markets, and that of Stulz (1995b).

Solnik (1974) assumes a constant investment opportunity set, which implies that the only risk of concern to investors is that surrounding assets' rates of return over the period until investors reassess their portfolios.[23] In addition, Solnik assumes that each country's investors consume a unique set of consumption goods, in which there is no inflation. Despite this, exchange rates are stochastic, and therefore purchasing power parity fails. Thus there is real exchange rate risk but no inflation risk. Furthermore this exchange rate risk is assumed to be uncorrelated with asset returns measured in their domestic currency. This motivates foreign investors to borrow in each foreign currency in which they hold assets, so as to nullify the exchange rate risk.[24] Thus, if a country is a net importer of capital, foreign investors seeking to hedge in this way will force up the local interest rate. Because governments are assumed not to borrow, they do not contribute to

[22] Of course it is possible that bonds are internationally priced and equities are not. However, the lack of asset pricing models consistent with this scenario precludes the pursuit of it.

[23] If investment opportunities can also change, then this introduces a second level of risk, and assets will be priced additionally to reflect that risk.

[24] This implication is consistent with the widespread recommendation in the financial management literature for firms with foreign assets to borrow in the foreign currency (or, equivalently, to undertake a forward contract) so as to hedge the exchange rate risk.

this situation. Accordingly, differences across countries in their real interest rates arise because some are net importers of capital and others are net exporters. For example, this is consistent with Japan which is both the largest net exporter of capital in the world and a country with the lowest real interest rates.

Stulz (1995b, pp 202–204) presents a model that also assumes a constant investment opportunity set but that is otherwise quite different, that is, all investors consume the same consumption bundle for which prices are stochastic, and purchasing power parity holds at all times. Thus there is inflation risk but no real exchange rate risk, that is, exchange rate movements are simply a reflection of differential inflation in the New Zealand and US economies. Due to this relationship between inflation and exhange rate movements, all investors world-wide can agree *ex post* on an asset's real rate of return. The simple CAPM then applies globally to the real returns on assets. Thus the expected real returns on assets differ only in so far as their real returns are more or less sensitive to the real return on the world market portfolio. The expected real returns on the default-free bonds of New Zealand and the United States will then differ according to the sensitivities of their national inflation rates to the real return on the world market portfolio. Under purchasing power parity, this differential sensitivity of national inflation rates to the real return on the world market portfolio is equivalent to the sensitivity of the exchange rate between the two countries to the real return on the world market portfolio. The expected real riskfree rates in New Zealand and the United States would then differ as follows:

$$E(\text{Real } R_f^{NZ}) - E(\text{Real } R_f^{US}) = \beta_{US,NZ} MRP_w \tag{15}$$

where $\beta_{US,NZ}$ is the sensitivity of the rate of change of the exchange rate (US dollars per New Zealand dollars) to the real return on the world market portfolio, and MRP_w is the market risk premium on the world market portfolio. Thus, if the expected real riskfree rate in New Zealand exceeded that of the United States, the reason would be because of a positive correlation between the US dollar−New Zealand dollar exchange rate and the real return on the world market portfolio, that is, negative shocks to the real value of the world market portfolio are associated with a depreciation in the exchange rate, which would impose losses on foreign investors in New Zealand bonds and therefore aggravate the investors' total portfolio risk, for which they must be compensated via a higher expected real rate of return on these bonds. Although data for assessing such a correlation is lacking, a positive sign is not implausible. Furthermore, a non-trivial correlation could explain an interest rate differential of 0.015, and the reasoning is as follows. The sensitivity coefficient $\beta_{US,NZ}$ can be expressed as:

$$\beta_{US,NZ} = \frac{\rho\sigma_x}{\sigma_w} \tag{16}$$

where ρ is the correlation between the rate of change of the exchange rate and the real return on the world market portfolio, σ_x is the standard deviation of the rate of change of the exchange rate, and σ_w is the standard deviation of the real rate of return on the world market portfolio. If the standard deviation σ_w is equated with the standard deviation of the nominal return on the world market portfolio, ignoring exchange rate effects, an estimate is reached of 0.135 over the period 1985–1995 Lally (1999c). Over the same period σ_x is estimated as 0.10.[25] Accordingly, if the correlation coefficient is 0.60, then substitution of these parameters into equation (16) yields an estimate for $\beta_{US,NZ}$ of 0.44. Substituting this into equation (15), along with our earlier estimate for MRP_w of 0.035, yields an expected real interest rate for New Zealand that is 0.015 larger than that of the United States. Thus Stulz's version of the international CAPM could explain the one-and-a-half percent real interest rate differential that we have attributed to currency risk.

The Solnik and Stulz models can be viewed as the extreme explanations for pricing of currency risk in the following sense. Exchange rate movements can be decomposed into real shocks to the exchange rate and movements attributable to differential inflation. Solnik's model ascribes the movements entirely to real shocks whereas Stulz's model ascribes them entirely to differential inflation (that is, purchasing power parity holds over all periods). The reality appears to lie between these two positions – Froot and Rogoff (1995) report a consensus view amongst researchers that purchasing power parity holds in the long but not in the short run, with a four-year half life on deviations from it.

Theoretical explanations aside, there is considerable empirical evidence about whether currency risk is in fact 'priced' through interest rates. De Santis and Gerard (1998) find evidence of premiums for currency risk in a number of assets, including both equities and bonds. Hawkesby *et al* (2000) compare nominal government bond rates in New Zealand and the US over the period 1990–2000, and conclude that long-term New Zealand rates embody a 1–2 percentage point premium attributable to currency risk (*ibid*, p 40). This result is consistent with that obtained in this paper. In addition to this research on currency risk premiums, there is a considerable amount of research on the closely related question of whether the forward premium on the US–New Zealand dollar exchange rate (the difference between the current spot and forward rates) is an unbiased predictor of the subsequent change in the exchange rate ΔX, and conclusions on this question sometimes appear to be extrapolated to the former question of whether currency risk is priced through interest rates. However, if investors are concerned with real rather than nominal returns, the two questions are different, as explained by Stulz (1995, pp 205–206), that is, a difference between the forward premium and the $E(\Delta X)$ is not equal to an allowance for currency risk. Rae (1997) concludes, by empirical examination of this forward premium relative to ΔX, that a difference exists and he describes it as a risk premium. He attributes empirically the difference to volatility in exchange rates and to the level of New Zealand's foreign debt. Rae's (1997) explanation for the latter is that increasing foreign debt raises the probability that the New Zealand government will inflate away the value of its New Zealand dollar denominated debt. This is equivalent to suggesting that expected inflation in New Zealand may be higher than indicated by the recent historical data, and therefore the real interest rate is lower than indicated by the recent historical data (and this possibility has been raised earlier in section 1.3). In respect of exchange rate volatility, its mere existence does not imply that currency risk will be priced.

[25] Based on exchange rate data from the Reserve Bank of New Zealand.

By contrast, Razzak (1999) concludes, again through an empirical examination of the US–NZ forward premium relative to ΔX, that there is no difference between the forward premium and $E(\Delta X)$, although the opposite situation does seem to exist for other country pairs. Razzak (1999) also recognises that any such difference is not equivalent to an allowance for currency risk, and he suggests that any currency risk allowance would be very small. However the latter judgment is in the context of a 'consumption' version of the CAPM, in which $\beta_{US,NZ}$ is replaced in equation (15) by a measure of the sensitivity of exchange rate changes to changes in real consumption rather than to the real return on the world market portfolio.[26] Changes in real consumption are much less volatile than real returns on the world market portfolio, implying a much lower allowance for currency risk. Of these models, it is unclear which one is the better description of asset pricing. All empirical testing of CAPMs suffers from a number of problems, including estimation error in expected returns and betas, and the use of proxies for the true market portfolio.

In short, a real interest rate differential against the United States of about 0.02 appears to exist for New Zealand, partly due to default and liquidity considerations (0.005) and partly to allowance for currency risk (0.015). One policy implication of this is for New Zealand to adopt the US dollar, thereby eliminating the currency risk and with it the associated real interest rate differential of 0.015. With New Zealand's foreign debt at about $100 billion, this alone implies a saving of about $1.5 billion per year.[27] Coleman (1999, p 11) suggests this course of action, but observes that there are a host of other implications that would need to be considered, some of which are negative. A closely related alternative to adoption of the US dollar, with potentially similar benefits, would be some form of monetary union with the United States (as suggested by Hargreaves and McDermott, 1999, pp 23–24). Grimes *et al* (2000) consider both possibilities, along with adoption of the Australian dollar, and favour one of these possibilities, although principally because of the resulting reduction in exchange rate shocks to the real economy. However, since New Zealand's interest rate differential against the Australian dollar is much less than for the US dollar, the cost of capital benefits from New Zealand adopting the Australian dollar, or adopting a joint currency, would be much less than for New Zealand adopting the US dollar.

We now turn to the second question: that concerning lower market risk in the United States. *Prima facie*, the lower US market risk would seem to reflect greater diversification within that market. This might seem to lie outside the bounds of policy. However, the state asset privatisation programme that has been effective in New Zealand since 1984 has released a number of assets into the 'market', including forests, banks, airports,

[26] This characteristic of the consumption CAPM arises from the assumption that the investment opportunity set is not constant over time. Consequently, investors are concerned not merely with uncertainty about asset returns over some period but also with uncertainty about the opportunities that will confront them at the end of that period.

[27] The $100 billion figure is drawn from the Reserve Bank of New Zealand's website, and includes private as well as public debt. Some of this debt is not denominated in New Zealand dollars. However, if it is hedged against exchange rate risk, then the interest rate parity theorem assures us that this is equivalent to borrowing in New Zealand dollars.

telecommunications, railways, commercial property, ports, power generators and power distributors. The diversification effect of all this should have been to reduce the degree of market risk in the New Zealand market.[28] The demutualisation process affecting insurance companies has also contributed to market diversification. The policy implication here is for New Zealand to continue the process, for which an additional justification is now offered. Obvious candidates are the remaining state assets and demutualisation of the primary producer boards. Of course there are other effects to consider in this area; this paper is concerned solely with cost of capital issues. Furthermore, the benefits in terms of a lower cost of capital arise only to the extent that there is some degree of market segmentation, and this fact seems indisputable.[29] The changes in the composition of the market referred to here should not only lower the market risk premium but also change the betas of most firms.[30] Of course the average firm will still exhibit a beta of 1. However, some firms will experience an increase in their beta, possibly to the point that their cost of equity is raised.

We now consider the third question: how can the New Zealand market be more integrated with other markets? The first policy issue relevant to this is that of government restrictions on the sale of locally owned assets to foreigners. Prominent examples are the Air New Zealand 'A' shares (which can only be held by New Zealanders) and the recent restriction on the sale of the Brierley Investments Limited Sealord shareholding to foreigner investors. The consequence of such restrictions is to reduce significantly the market value of the affected assets. The Air New Zealand situation neatly quantifies this, since two types of shares are traded that are otherwise identical: those restricted to New Zealanders ('A' shares) and those that are unrestricted ('B' shares). The observable price discount on the 'A' shares relative to the 'B' shares has ranged from 10 percent to 20 percent during 1999 (data from Datex). Since the cash flows to both sets of shareholders are identical, the reduction in market value is equivalent to a rise in the cost of capital. This can be quantified using equation (7), as follows. With an initial cost of capital of 0.12 and an expected growth rate of 0.06, a 15 percent reduction in value induced by this restriction implies a rise in the cost of capital of 0.01. This is roughly equivalent to raising the government stock rate by one and a half percentage points (the tax effect reduces this to one percentage point). This is a substantial penalty. Clearly some non-economic arguments can be raised to support such restrictions. However, optimal policy requires an appreciation of the costs flowing from a given action, and these costs are demonstrably large. A closely related phenomenon to that of sale restrictions is the allocation, in the course of selling state assets, of some shares to local investors. In so far as these investors retain the shares for non-financial reasons, we have the same outcome: inadequate diversification by local investors at the behest of government, leading to an increase in the cost of capital for New Zealand firms.

---

28 An empirical estimate is difficult because the counterfactual is not known.

29 This is consistent with the overwhelmingly home country bias exhibited by investors (Cooper and Kaplanis, 1994, and Tesar and Werner, 1995). In addition Korajczyk and Viallet (1989) reject the hypothesis of world integration using individual assets, and Bekaert and Harvey (1995) find evidence of partial segmentation across a range of countries.

30 Lally (1999d, Table 3) shows that changes in the industry weights within a market, corresponding to the variations across several european countries, will induce changes in industry betas of up to 40 percent.

A second policy issue relating to equity market integration arises from the extension of only partial dividend imputation benefits to foreigners. Because a majority of New Zealand equities are owned by foreign investors, the market prices of these equities must be significantly affected by foreign investors.[31] The effect of this is that the market value of these equities will not fully reflect the imputation benefits to New Zealanders. Consequently, the after-tax returns to New Zealanders on New Zealand equities are enlarged relative to foreign equities. This propels New Zealanders toward the ownership of local, rather than foreign, equities.[32] The objective of the government in this area was to improve the after-tax returns to New Zealand investors. This objective should not be achieved through mechanisms that require local investors to hold New Zealand assets in order to receive this advantage, because this requirement discourages international diversification by New Zealanders. As a consequence, it raises the cost of capital to New Zealand firms.

A further factor relevant to market integration is that of exchange rate risk. This has already been discussed as an explanation for the apparently higher real interest rate in New Zealand relative to the United States. It may also contribute to the home-country bias exhibited by New Zealanders, notwithstanding the opportunities for hedging the exchange rate risk. If such a risk is a factor in home-country bias, then the adoption by New Zealand of the US dollar, or entry into a monetary union with the United States, should reduce that bias.[33] This would improve financial integration and should therefore lower the cost of equity for the average New Zealand firm. Lesser but still substantial effects of this kind would arise from the adoption by New Zealand of the Australian dollar.

A final policy issue bearing on market integration, but one that is outside the direct control of government, is that of stock exchange listings. One manifestation of this issue is the listing of New Zealand stocks on foreign exchanges, most particularly in Australia and the United States. This should increase foreign ownership of these assets, and therefore improve market integration. However, the effects of listing on foreign exchanges are limited to the small number of such dual listed stocks, and the costs of this exercise may discourage most New Zealand firms from undertaking it. A second manifestation of the listing issue, but with more general effects, is the recent proposal to combine the Australian and New Zealand stock exchanges. If achieved, this merger should also improve market integration, because (leaving aside exchange rate risk) investors focusing upon 'local' assets may now redefine 'local' assets as Australasian rather than merely New Zealand.

---

31 BT Alex Brown (1998) estimates foreign ownership at 60 percent.

32 Optimal portfolios are very sensitive to expected returns in the Markowitz framework that underlies all CAPMs. Thus, a small improvement induced by dividend imputation to the after-tax expected returns of New Zealanders from New Zealand assets can increase substantially the optimal weighting on New Zealand assets by New Zealanders.

33 Further discussion of this point appears in Hargreaves and McDermott (1999, p 26).

6

CONCLUSION

This paper has addressed three questions, starting with that of whether the real cost of capital is high in New Zealand. Comparisons were offered with Australia and the United States on three bases: widely used estimates, estimates contingent on complete segregation, and estimates contingent on complete integration. In respect of widely used estimates, New Zealand's real cost of capital seems only modestly higher than Australia's but considerably higher than that of the United States. In respect of estimates contingent on market segregation and estimates contingent on market integration, New Zealand seems comparable with Australia, and both seem higher than that of the United States.

The second question concerns plausible explanations for the result. Regardless of which of the three approaches is adopted, both New Zealand and Australia appear to face a higher real riskfree rate than the United States. If New Zealand's real riskfree rate is higher than that of the United States, and this is not uncontroversial, then it would appear to be partly due to greater default risk/inferior liquidity, and partly to compensation for exchange rate risk. Other factors vary across the three approaches to estimating the cost of capital. In respect of widely used estimates, New Zealand also experiences a modestly higher perceived market risk premium than Australia and possibly a significantly higher premium relative to the United States. In respect of the estimated cost of capital under complete segmentation, both New Zealand and Australia seem to experience higher market risk premia than the United States. Finally, in respect of the estimated cost of capital under complete integration, both New Zealand and Australian stocks experience lower betas on average than their US counterparts.

The final question is whether actions can be taken to lower New Zealand's real cost of capital. The following observations were offered. First, New Zealand's adoption of the US dollar, or entry into a monetary union with the United States, will eliminate exchange rate risk against the United States and may therefore reduce New Zealand's real interest rate by about one-and-a-half percentage points. Secondly, continued sale of state assets, and demutualisation of producer boards, should help to diversify the New Zealand market further, and therefore lower its market risk premium. This only matters in so far as the New Zealand equity market is at least partly segmented from world equity markets, and this seems clear. Thirdly, a number of actions should increase New Zealand's integration with world equity markets, and thereby reduce the cost of capital for New Zealand firms. These actions include desisting from restrictions on the sale of locally owned assets to foreign investors; desisting from allocations of shares to local investors in the course of selling state assets; modifying the dividend imputation process, so that New Zealanders are not pushed towards ownership of local rather than foreign equities; entry into a currency union, or adoption of the US or Australian dollars, thereby reducing the home-country bias exhibited by New Zealanders; finally, although outside government control, the further listing of New Zealand stocks on foreign exchanges and the proposed combining of the New Zealand and Australian stock exchanges.

REFERENCES

Amihud, Y and Mendelson, H 1986, 'Asset Pricing and the Bid-Ask Spread', *Journal of Financial Economics*, vol 17, pp 223–249.

Australian Competition and Consumer Commission, May 1999, Application to Pass Through the Price Cap the Costs of a Multi-User Integrated Terminal at Adelaide Airport.

Banz, R 1981, 'The Relationship Between Return and the Market Value of Common Stock', *Journal of Financial and Quantitative Analysis*, vol 14, pp 421–441.

Bekaert, G and Harvey, C 1995, 'Time Varying World Market Integration', *Journal of Finance*, vol 50, pp 403–444.

Bhattacharya, U and Daouk, H 1999, 'The World Price of Insider Trading', working paper, Kelley School of Business, Indiana University, Bloomington, Indiana.

Black, F 1993, 'Beta and Return', *Journal of Portfolio Management*, vol 20, pp 8–18.

Bookstaber, R and Pomerantz, S 1991, 'An Information-Based Model of Market Volatility', *Financial Analysts Journal*, Nov–Dec, pp 37–46.

Brealey, R and Myers, S 1991, *Principles of Corporate Finance*, 4th edition, McGraw-Hill, New York.

Brennan, M and Subrahmanyam, A 1996, 'Market Microstructure and Asset Pricing: On the Compensation for Illiquidity in Stock Returns', *Journal of Financial Economics*, vol 41, pp 441–464.

Brown, P and Walter, T 1986, 'Ex-Dividend Day Behaviour of Australian Share Prices', *Australian Journal of Management*, vol 11, pp 139–152.

— and Clarke, A 1993, 'The Ex-Dividend Day Behaviour of Australian Share Prices Before and After Dividend Imputation', *Australian Journal of Management*, vol 18, pp 1–40.

Brown, S, Goetzmann, W and Ross, S 1995, 'Survival', *Journal of Finance*, vol 50, pp 853–873.

Bruckner, K, Dews, N and White, D 1994, 'Capturing Value from Dividend Imputation', *McKinsey and Company*, Sydney.

Bryant, P and Eleswarapu, V 1997, 'Cross-Sectional Determinants of New Zealand Share Market Returns', *Accounting and Finance*, vol 37, pp 181–205.

BT Alex Brown, 1998, *Ownership Structure*, BT Alex Brown New Zealand Ltd.

Chan, K, Karolyi, A and Stulz, R 1992, 'Global Financial Markets and the Risk Premium on US Equity', *Journal of Financial Economics*, vol 32, pp 137–167.

Cliffe, C and Marsden, A 1992, 'The Effect of Dividend Imputation on Company Financing Decisions and the Cost of Capital in New Zealand', *Pacific Accounting Review*, vol 4, pp 1–30.

Coleman, A 1999, 'Economic Integration and Monetary Union', *Treasury Working Paper 99/6*, New Zealand Treasury.

Cooper, I and Kaplanis, E 1994, 'Home Bias in Equity Portfolios, Inflation Hedging and International Capital Market Equilibrium', *Review of Financial Studies*, vol 7, pp 45–60.

Cornell, B 1999, *The Equity Risk Premium*, John Wiley & Sons, New York.

Damodaran, A 1997, *Corporate Finance: Theory and Practice*, John Wiley & Sons, New York.

De Santis, G and Gerard, B 1998, 'How Big is the Premium For Currency Risk', *Journal of Financial Economics*, vol 47, pp 375–412.

Dumas, B and Solnik, B 1995, 'The World Price of Foreign Exchange Risk', *Journal of Finance*, vol 50, pp 445–479.

Eckhold, K 1998, 'Determinants of New Zealand Bond Yields', *Reserve Bank Working Paper G98/1*, Reserve Bank of New Zealand, Wellington.

Eleswarapu, V and Reinganum, M 1993, 'The Seasonal Behaviour of the Liquidity Premium in Asset Pricing', *Journal of Financial Economics*, vol 34, pp 281–305.

Fama, E and French, K 1993, 'Common Risk Factors in the Returns on Stocks and Bonds', *Journal of Financial Economics*, vol 33, pp 3–56.

— 1997, 'Industry Costs of Equity', *Journal of Financial Economics*, vol 43, pp 153–193.

Frank, M and Jagannathan, R 1998, 'Why do Stocks Prices Drop by less than the Value of the Dividend? Evidence from a Country without Taxes', *Journal of Financial Economics*, vol 47, pp 161–188.

French, K, Schwert, W and Stambaugh, R 1987, 'Expected Stock Returns and Volatility', *Journal of Financial Economics*, vol 19, pp 13–29.

Friend, I and Blume, M 1975, 'The Demand for Risky Assets', *American Economic Review*, vol 65, pp 900–922.

Froot, K and Rogoff, K 1995, 'Perspectives on PPP and Long-Run Real Exchange Rates', in *Handbook of International Economics*, vol 3, Grossman, E and Rogoff, A eds, North-Holland, Amsterdam.

Glosten, L, Jagannathan, R and Runkle, D 1993, 'On the Relation Between the Expected Value and the Volatility of the Nominal Excess Return on Stocks', *Journal of Finance*, vol 40, pp 1779–1801.

Goetzmann, W and Jorion, P 1996, 'A Century of Global Stock Markets', working paper, Yale School of Management, New Haven, Connecticut.

Grimes, A, Holmes, F and Bowden, R 2000, *An Anzac Dollar? Currency Union and Business Development*, Institute of Policy Studies, Victoria University of Wellington.

Hamson, D and Ziegler, P 1990, 'The Impact of Dividend Imputation on Firms' Financial Decisions', *Accounting and Finance*, vol 30, pp 29–53.

Hargreaves, D and McDermott, J 1999, 'Issues Relating to Optimal Currency Areas: Theory and Implications for New Zealand', *Reserve Bank of New Zealand Bulletin*, vol 62, No 3, pp 16–29.

Harris, R and Marston, F 1992, 'Estimating Shareholder Risk Premia Using Analysts' Growth Forecasts', *Financial Management*, vol 21(2), pp 63–70.

Hathaway, N and Officer, R 1995, 'The Value of Imputation Tax Credits', working paper, University of Melbourne.

Hawkesby, C, Smith, C and Tether, C 2000 'New Zealand's Currency Risk Premium', *Reserve Bank of New Zealand Bulletin*, vol 63, No 3, pp 30–44.

Holland, D and Myers, S 1979, 'Trends in Corporate Profitability and Capital Costs', in Lindsay, R ed, *The Nation's Capital Needs: Three Studies*, Committee For Economic Development, Washington, DC.

Ibbotson Associates, 1999, *Stocks, Bonds, Bills, and Inflation: 1998 Yearbook,* Ibbotson Associates, Chicago.

International Monetary Fund, 1999, *International Financial Statistics*, December, Washington, DC.

Jagannathan, R and Wang, Z 1996, 'The Conditional CAPM and the Cross-section of Expected Returns', *Journal of Finance*, vol 51, pp 3–53.

JB Were, 1996, *Australian Equity Market Profile*, March, Auckland.

Kandel, S and Stambaugh, R 1987, 'On Correlation and Inferences about Mean-Variance Efficiency', *Journal of Financial Economics*, vol 18, pp 61–90.

Knez, P and Ready, M 1997, 'On the Robustness of Size and Book-to-Market in Cross-Sectional Regressions', *Journal of Finance*, vol 52, pp 1355–1382.

Kothari, S, Shanken, J and Sloan, R 1995, 'Another Look at the Cross-section of Expected Stock Returns', *Journal of Finance*, vol 50, pp 185–224.

Korajczyk, R and Viallet, C 1989, 'An Empirical Investigation of International Asset Pricing', *Review of Financial Studies*, vol 2, pp 553–585.

Lally, M 1992, 'The CAPM Under Dividend Imputation', *Pacific Accounting Review*, vol 4, pp 31–44.

— 1995, 'The Accuracy of CAPM Proxies for Estimating a Firm's Cost of Equity', *Accounting and Finance*, vol 35, pp 63–72.

— 1996, 'The CAPM under Dividend Imputation and International Portfolio Selection', *Pacific Accounting Review*, vol 8, pp 48–65.

— 1998, 'Correcting Betas for Changes in Firm and Market Leverage', *Pacific Accounting Review*, vol 10, pp 98–115.

— 1999a, *The Cost of Equity Capital and its Estimation*, McGraw-Hill Series in Advanced Finance, Volume 3, McGraw-Hill, Australia.

— 1999b, 'Time Varying Market Leverage, the Market Risk Premium and the Cost of Capital', working paper, Victoria University of Wellington.

— 1999c, 'Internationalisation and the Cost of Equity', working paper, Victoria University of Wellington.

— 1999d, 'Betas and Industry Weights', working paper, Victoria University of Wellington.

— 2000, Valuation of Companies and Projects Under Differential Personal Taxation, *Pacific-Basin Finance Journal*, vol 8, pp 115–133.

Lintner, J 1965, 'The Valuation of Risky Assets and the Selection of Investments in Stock Portfolios and Capital Budgets', *Review of Economics and Statistics*, vol 47, pp 13–37.

Mehra, R and Prescott, E 1985, 'The Equity Premium: A Puzzle', *Journal of Monetary Economics*, vol 15, pp 145–161.

Merton, R 1980, 'On Estimating the Expected Return on the Market', *Journal of Financial Economics*, vol 8, pp 323–361.

Monkhouse, P 1993, 'The Cost of Equity under the Australian Dividend Imputation Tax System', *Accounting and Finance*, vol 33, pp 1–18.

Morgan Stanley, 1996, Morgan Stanley Capital International Perspectives, New York.

Mossin, J 1966, 'Equilibrium in a Capital Asset Market', *Econometrica*, vol 24, pp 768–783.

New Zealand Institute of Economic Research, *Quarterly Predictions*, 1995–1999, Wellington.

Office of the Regulator General, Victoria, 1998, Access Arrangements for Multinet, Westar and Stratus, Melbourne.

Officer, R 1989, 'Rates of Return to Equities, Bond Yields and Inflation Rates: An Historical Perspective', in Ball, R, Finn, F, Brown, P and Officer, R eds, *Share Markets and Portfolio Theory*, 2nd edn, University of Queensland Press, Brisbane.

— 1994, 'The Cost of Capital of a Company under an Imputation Tax System', *Accounting and Finance*, vol 34, pp 1–17.

Protopapadakis, A 1983, 'Some Indirect Evidence on Effective Capital Gains Taxes', *Journal of Business*, vol 56, pp 127–138.

Rae, D 1997, 'New Zealand's Forward Exchange Market', National Bank of New Zealand Financial Research Paper No 8, Wellington.

Ragunathan, V, Faff, R and Brooks, R 1999, 'Australian Industry Beta Risk, the Choice of Market Index and Business Cycles', *Applied Financial Economics*, forthcoming.

Razzak, W 1999, 'The Forward Rate Unbiasedness Hypothesis in Inflation-Targeting Regimes', *Reserve Bank of New Zealand Discussion Paper G99/3*, Wellington.

Reilly, F and Brown, K 2000, *Investment Analysis and Portfolio Management*, 6th edn, Dryden Press, Fort Worth.

Reserve Bank of Australia 2000, *Interest Rates and Yields*, February, Sydney.

Reserve Bank of New Zealand 2000, *Financial Statistics*, February, Wellington.

Roll, R 1977, 'A Critique of the Asset Pricing Theory's Tests; Part I: On Past and Potential Testability of the Theory', *Journal of Financial Economics*, vol 4, pp 129–176.

— and Ross, S 1994, 'On the Cross-Sectional Relation Between Expected Returns and Betas', *Journal of Finance*, vol 49, pp 101–121.

Rosenberg, B, Reid, K and Lanstein, R 1985, 'Persuasive Evidence of Market Inefficiency', *Journal of Portfolio Management*, vol 11, pp 9–17.

Ross, S, Westerfield, R and Jaffe, J 1996, *Corporate Finance,* 4th edn, McGraw-Hill, Boston.

Scruggs, J 1998, 'Resolving the Puzzling Intertemporal Relation Between the Market Risk Premium and Conditional Market Variance: A Two-Factor Approach', *Journal of Finance*, vol 53, pp 575–603.

Shanken, J 1987, 'Multivariate Proxies and Asset Pricing Relations: Living with the Roll Critique', *Journal of Financial Economics*, vol 18, pp 91–110.

Sharpe, W 1964, 'Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk', *Journal of Finance*, vol 19, pp 425–442.

Siegel, J 1992, 'The Equity Premium: Stock and Bond Returns since 1802', *Financial Analysts Journal*, Jan–Feb, pp 28–38.

— 1999, 'The Shrinking Equity Premium', *Journal of Portfolio Management*, Fall, pp 10–17.

Sinn, H 1991, 'Taxation and the Cost of Capital: The Old View, the New View, and Another View', in *Tax Policy and the Economy,* NBER vol 5, pp 25–54.

Solnik, B 1974, 'An Equilibrium Model of the International Capital Market', *Journal of Economic Theory,* vol 8, pp 500–524.

Stambaugh, R 1982, 'On the Exclusion of Assets from Tests of the Two-Parameter Model: A Sensitivity Analysis', *Journal of Financial Economics*, vol 10, pp 237–268.

Stulz, R 1995a, 'The Cost of Capital in Internationally Integrated Markets: The Case of Nestlé', *European Financial Management*, vol 1, pp 11–22.

— 1995b, 'International Portfolio Choice and Asset Pricing: An Integrative Survey', in R Jarrow *et al*, eds, *Handbooks in OR & MS Vol 9*, Elsevier Science BV.

Tesar, L and Werner, I 1995, 'Home Bias and High Turnover', *Journal of International Money and Finance*, vol 14, pp 467–492.

Thompson, H 1991, Regulatory Finance: Financial Foundations of Rate of Return Regulation, Kluwer Academic Publishers, Boston.

Welch, I 1998, 'Views of Financial Economists on the Equity Premium and Other Issues', working paper, University of California, Los Angeles.

Wood, J 1997, 'A Simple Model for Pricing Imputation Tax Credits under Australia's Dividend Imputation Tax System', *Pacific-Basin Finance Journal*, vol 5, pp 465–480.

LIST OF ACRONYMS

CAPM	Capital Asset Pricing Model
GNP	Gross national product
IMF	International Monetary Fund
MRP	Market risk premium
NPV	Net present value
NZIER	New Zealand Institute of Economic Research