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Tax-adjusted market risk premiums in New Zealand: 1931–2002

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Abstract

This paper documents historical returns to equities and long-term government bonds, bond yields and inflation rates in New Zealand over the period 1931–2002. Personal tax rates on various types of investment income are also estimated. This data is used to estimate the market risk premiums in two forms of the capital asset pricing model (CAPM). In particular, the market risk premium in the standard CAPM is estimated using the Ibbotson [Ibbotson Associates, 2000. Stocks, bonds, bills and inflation: 2000 year book] methodology, yielding an estimate of 0.058 relative to long-term government bond returns and 0.055 relative to bond yields. In addition, in respect of the tax-adjusted version of the CAPM [Cliffe and Marsden, Pac. Account. Rev. 4 (1992) 1; Lally, Pac. Account. Rev. 4 (1992) 31] that is now widely used in New Zealand, the market risk premium is estimated using parallel methodology, yielding estimates of 0.074 relative to bond returns and 0.072 relative to bond yields.

JEL classification: G12
Keywords: Equity returns; Bond returns; Market risk premium; Equity risk premium

1. Introduction

The market risk premium is a parameter appearing in all versions of the capital asset pricing model (CAPM) and is equal to the excess of the expected return on the market portfolio of risky assets over the return on the risk-free asset (subject to tax adjustments in some versions). The parameter is of considerable practical importance to investors in

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their portfolio allocation decisions, and for estimation of a company's cost of equity capital under the widely used CAPM. The latter is significant in the valuation of companies, valuation of real investment projects and setting of fair rates of return for regulated firms.

The parameter has been estimated in a variety of ways, in a variety of markets and for various versions of the CAPM. The seminal work is that of Ibbotson and Sinquefield (1976), who estimate it for the standard version of the CAPM (Sharpe, 1964; Lintner, 1965; Mossin, 1966) in the US. They assume that the parameter is constant over time and therefore estimate it by averaging the ex-post outcomes over a long time period, i.e., by determining the excess of the actual market return for a year over the risk-free rate at the beginning of the year, and then averaging this margin over the period of study. Recent such estimates for the US, using data from 1926 to 1999, are between 0.080 and 0.095 (Ibbotson Associates, 2000). In respect of other markets, Dimson et al. (2002, Table 4) have estimated the premiums in the standard CAPM for 16 developed countries over the period 1900–2001, yielding results from 0.039 (Switzerland) to 0.100 (Japan) with an average of 0.054. This set does not include New Zealand. The only published estimates for New Zealand of the Ibbotson type are those of Chay et al. (1993, 1995), covering the period 1931–1994 and yielding an estimate of 0.065.[1]

The objectives of this study are as follows. First, we seek to update the work of Chay et al., to cover the period 1931–2002. Second, we seek an Ibbotson type estimate of the market risk premium in the tax-adjusted version of the CAPM that is widely used in New Zealand (Cliffe and Marsden, 1992; Lally, 1992). Unlike the standard version of the CAPM, this version acknowledges differential personal taxation of interest, dividends and capital gains.[2] The latter is favoured by the preferential tax treatment of dividends arising from the dividend imputation system in New Zealand, and also by the preferential tax treatment of capital gains arising from various exemptions and deferral of payment until realization. Furthermore, Lally and van Zijl (2003) show that, in the presence of differential taxation of sources of personal income, the use of the standard version of the CAPM can significantly mis-estimate the cost of equity capital. As far as we are aware, there is no published study in New Zealand that estimates the tax-adjusted market risk premium by the Ibbotson methodology.[3] Our results should therefore be of considerable interest to academics, investors, corporates and regulators.

The rest of this paper is structured as follows. Section 2 describes the process for estimating the market risk premium in the standard form of the CAPM, using data from the period 1931 to 2002. Section 3 then extends this to the tax-adjusted version of the CAPM.

[1] These three studies referred to here utilize varying periods, and therefore the results are not comparable. We mention them to illustrate the extent of other work in this area.

[2] This form of the CAPM extends Brennan (1970) to allow for dividend imputation. The model is widely used by NZ companies (such as Transpower and Telecom), practitioners, The Treasury (1997), The Ministry of Economic Development, and has recently been adopted by the Commerce Commission (2002).

[3] PricewaterhouseCoopers (2002) in an unpublished study estimated the tax-adjusted market risk premium to be 0.075 in New Zealand over the period 1925–2002. However, they do not fully disclose details of their methodology, and also simply assume that shareholders are always taxed on interest at the top marginal ordinary rate.

Section 4 presents the results, comprising historical average nominal returns to equities and bonds, bond yields, inflation rates and estimates of the standard and tax-adjusted versions of the market risk premium. We conclude in Section 5.

2. The standard market risk premium

The market risk premium in the standard form of the CAPM (Sharpe, 1964; Lintner, 1965; Mossin, 1966) is defined as

$$E(R_{\mathrm{m}}) - R_{\mathrm{f}}$$

where R_{m} is the actual rate of return on the market portfolio (comprising the capital gains yield and the cash dividend yield) and R_{f} is the risk-free rate of return. The ex-post counterpart in year t is

$$R_{\mathrm{mt}} - R_{\mathrm{ft}}.$$

Following standard practice (Ibbotson Associates, 2000; Dimson et al., 2002), this difference is measured for each year, and then averaged over the period of study (1931–2002). Again, following standard practice, the market portfolio is proxied by an index of listed equities. In respect of the risk-free rate, practice is more varied. Ibbotson Associates (2000) uses yields to maturity on both Treasury Bills and longer-term government bonds. This reflects uncertainty about the investor horizon implicit in the CAPM. However, if bonds with maturity greater than one year are used, there is a mismatch between the annual term over which market returns are measured and the life of the bond. In fact, over this period, the returns on the longer-term bonds are not risk-free and, arguably, the relevant proxy for the risk-free rate is the actual return on the long-term bonds over that year. Dimson et al. (2002) use returns rather than yields for the longer-term bonds. We utilize long-term bonds and present results using both yields and returns.

The data for determining returns, yields and inflation rates is primarily sourced from Chay et al. (1993, 1995), but updated to the end of December 2002. A more detailed description of the data series and index construction is contained in that paper. The one exception to use of the Chay et al. data is as follows. From January 1987, they obtain their R_{m} from the New Zealand Stock Exchange ("NZSE") gross share price index. However, with the introduction of dividend imputation in New Zealand in April 1988, that index also includes the imputation credits attached to the cash dividends and no index corresponding to R_{m} was maintained.[4] Accordingly, to facilitate estimation of the standard market risk premium, we constructed our own series for R_{m} by stripping out the imputation credits from the NZSE gross index. Details of this adjustment appear in Appendix A.

[4] For a discussion of the dividend imputation system in New Zealand, see Cliffe and Marsden (1992) and Lally (1992).

3. The tax-adjusted market risk premium

3.1. Introduction

The market risk premium in the tax-adjusted version of the CAPM (Cliffe and Marsden, 1992; Lally, 1992) is as follows:

$$E(R_{\mathrm{m}}) - D_{\mathrm{m}}T_{\mathrm{m}} - R_{\mathrm{f}}(1 - T_{\mathrm{I}}) \tag{1}$$

where R_{m} = return on the market portfolio (cash dividends and capital gain), D_{m} = cash dividend yield on the market portfolio m, R_{f} = risk-free rate of return, T_{I} = weighted average (weights x_i) over investors of $(t_i - t_{gi})/(1 - t_{gi})$, T_{m} = weighted average (weights x_i) over investors of $(t_{di} - t_{gi})/(1 - t_{gi})$, t_i = investor i's tax rate on interest, t_{gi} = investor i's tax rate on capital gains, t_{di} = investor i's tax rate on cash dividends from the market portfolio, $x_i = \frac{w_i}{\theta_i(1-t_{gi})} \div \sum \frac{w_i}{\theta_i(1-t_{gi})}$, w_i = market value weight of investor i's equity holdings in m, θ_i = measure of the risk aversion of investor i.

The ex-post outcome in year t is

$$R_{\mathrm{m}t} - D_{\mathrm{m}t}T_{\mathrm{m}t} - R_{\mathrm{f}t}(1 - T_{\mathrm{I}t}). \tag{2}$$

Thus, we require annual values for R_{m}, R_{f}, D_{m}, T_{m} and T_{I}. The first three arise in the course of estimating the standard risk premium. The last two require an examination of the personal tax regime in New Zealand over the period 1931–2002. However, before doing so, two background issues must first be discussed.

The first background issue relates to the definition of an "investor". There are a number of issues here. Firstly, the investors referred to in Eq. (1) are the holders of the market portfolio. Since the latter is proxied by an equity portfolio, then investors are those who hold equities (of course, they may also have holdings of the risk-free asset). A second issue arises from the fact that this CAPM assumes that investors choose portfolios (equities and the risk-free asset) in the Markowitz fashion. However, a large proportion of the owners of equities and bonds are not individuals, and include other companies, superannuation funds and unit trusts.[5] These additional owners do not make portfolio decisions in the Markowitz fashion. They simply offer portfolios to individuals, who may choose to add them to their portfolios. Thus the investors in a CAPM world are individuals, and other owners of equities and bonds are simply conduits through which interest, dividends and capital gains flow to individuals. If these conduits do not give rise to additional (or reduced) taxes, they can be ignored. This is the case with companies, due to dividend imputation operating from 1988, to dividends and capital gains received by companies being exempt from tax prior to 1988, and to corporate holdings of government bonds being very small. However, in some cases, these conduits add or subtract from the tax layer, and such additional layers should be added or subtracted from the personal taxes ultimately faced by individuals. There are two significant instances of this. The first is that of superannuation funds prior to 1988. In general, this conduit generated a tax saving for

[5] Life insurance companies are included within the term "superannuation funds" because of the similarity in taxation treatment.

individuals relative to direct ownership of shares or bonds. The second is that of superannuation funds and unit trusts in the period from 1988, most of which are taxed on capital gains. By contrast, individuals are not taxed on capital gains when they own shares directly. Accordingly, individuals were taxed on capital gains after 1987, to the extent that they own equities via superannuation funds and unit trusts.

A third issue in defining investors arises from cross border ownership of assets. The CAPM of interest here assumes that capital markets are segregated. Accordingly the investor set must exclude foreigners, notwithstanding their substantial ownership of New Zealand equities and bonds.

In summary then, investors are defined to be New Zealand individuals who hold equities. Ownership of equities via another company has no tax implications. Ownership of assets via superannuation funds in the pre-1988 period reduces personal taxation. Ownership of assets via superannuation funds and unit trusts in the period from 1988 adds a layer of tax (in respect of capital gains). In respect of the first conduit, it can be ignored because it has no tax implications and ownership devolves to both individuals and funds. The other two cannot be so ignored. To deal with them, we decompose individual investors into two groups: those who own assets directly (type A) and those who own them via funds and unit trusts (type B).

The second background issue relates to the introduction of dividend imputation in 1988. Prior to its introduction, one simply calculates T_{m} as defined above and then inserts this into Eq. (2). After its introduction, calculation of the tax parameter T_{m} is complicated in that knowledge of the ratio of imputation credits to cash dividends is required. However, we can circumvent the need to determine this ratio by rearranging Eq. (2). Lally (2000a) shows that if imputation operates, and dividends are taxed identically with interest when no imputation credits are attached to the dividend, then

$$T_{\mathrm{m}} = T_{\mathrm{I}} - U(1 - T_{\mathrm{I}})Q_{\mathrm{m}} \tag{3}$$

where U is the average utilization rate on imputation credits and Q_{m} is the ratio of imputation credits attached to the market portfolio's dividends to those cash dividends. Since all investors are assumed to be local and they can fully use the credits, then the average utilization rate is 1. Substituting this into Eq. (3), and then Eq. (3) into Eq. (2), yields an ex-post value for the market risk premium in year t of

$$R_{\mathrm{m}t} - D_{\mathrm{m}t}[T_{\mathrm{I}t} - (1 - T_{\mathrm{I}t})Q_{\mathrm{m}t}] - R_{\mathrm{f}t}(1 - T_{\mathrm{I}t}).$$

Recognizing that $D_{\mathrm{m}t}Q_{\mathrm{m}t}$ is the imputation credits as a proportion of the equity value at the beginning of the year, denoted $ICY_{\mathrm{m}t}$, then the ex-post value for the market risk premium in year t becomes

$$[R_{\mathrm{m}t} + ICY_{\mathrm{m}t}] - [D_{\mathrm{m}t} + ICY_{\mathrm{m}t}]T_{\mathrm{I}t} - R_{\mathrm{f}t}(1 - T_{\mathrm{I}t}). \tag{4}$$

The first term [ ] here is the market return inclusive of the imputation credits (the "gross" return), and this is provided by the NZSE. The second term [.] is the dividend yield inclusive of the imputation credits (the "gross" dividend yield), and this too is provided by the NZSE in that it is the difference between the return on their "gross" and capital indexes. Consequently, the only tax parameter required in Eq. (4) is T_I for each year.

In summary, prior to 1988, the ex-post value for the market risk premium is calculated directly from Eq. (2), and the tax parameters required here are T_I and T_m for each year. These tax parameters are defined following Eq. (1) and they weight over types A and B investors. Thus, for each year prior to 1988, we ascertain tax rates on dividends, interest and capital gains and also the weights for each of the two-investor types. From 1988 on, the ex-post value of the market risk premium is calculated from Eq. (4), and the only tax parameter required is T_I for each year. Again, this weights over types A and B investors. Thus, for each year from 1988 onwards, we ascertain tax rates on interest and capital gains, and also the weights for each of types A and B investors.

3.2. Taxation of types A and B investors

We now investigate the tax circumstances of these two investor types, for each of the periods before and from 1988. We start with type A investors in the period before 1988, i.e., individuals who owned assets directly. In respect of capital gains, they were exempt from taxation in this period (and also subsequently). In respect of interest, they faced taxation on this at their marginal ordinary tax rate, subject to a level based exemption.[6] Depending upon the year this was up to \$200. The effect of the exemption cannot be computed but our conjecture is that it is small. Accordingly, we ignore it. Finally, in respect of dividends, type A investors were exempt from taxation on these until 1958 (see Census and Statistics Department, 1958). Thus, this tax rate was zero for the 1931–1957 period. From 1958, dividends were taxed at the ordinary rate, subject to two possible exemptions. The first was a level based exemption (depending upon the year, up to \$200 was exempt). As with interest, the effect of the first of these exemptions cannot be computed, but is judged to be small; accordingly, it is ignored. In addition, up until 1985, dividends paid from "tax-free" sources were exempt from tax.[7] We accommodate this by estimating the proportion of dividends paid from tax-free sources for each of the years 1958–1985 and reduce the effective tax rate on dividends accordingly.

We now turn to type A investors in the period from 1988, for which tax rates on only interest and capital gains need to be considered. The situation is identical to that prevailing before 1988, i.e., capital gains were exempt from tax and interest was taxed at the investor's marginal ordinary tax rate.

We now turn to type B investors in the period before 1988, i.e., investors who received asset returns via superannuation funds rather than directly. The result is lower effective tax rates on these returns due to the aggregate effect of two principal incentives. The first is a tax deduction on the contributions made up to some level. The second is, in respect of some funds, the deferral of tax on the returns until the investor's retirement (Minister of

[6] The ordinary tax rate is that applicable to all income subject to the application of any exemptions.

[7] The opportunity to pay dividends from tax-free sources was terminated in August 1985 (Minister of Finance, 1985).

Finance, 1988, Ch. 4).[8] Both features reduce the effective tax rate quite significantly. In respect of deferral, to illustrate this, suppose that deferral operated on average for 10 years; the effective tax rate would then be reduced by the present value of the tax obligation for 10 years at the risk-free rate. If the latter were 0.06, then the reduction in the effective tax rate would be from the statutory rate T to

$$\frac{T}{(1.06)^{10}} = 0.56T,$$

i.e., a reduction of almost 50%.

In respect of the tax saving on the amount invested, suppose each dollar invested generated an immediate tax saving at the investor's marginal ordinary rate T. Also, let the expected pre-tax return per \$1 invested be denoted k and this is taxed at rate T at that time. The expected rate of return after personal tax is then

$$\frac{k(1-T)}{\$1 - \$1T} = k.$$

Thus, the effect of the immediate tax saving is to reduce the effective tax rate to zero. To this can be added the benefit of deferring tax until retirement, which is equivalent to a further reduction in the effective tax rate. This suggests that the effective tax rate was negative.

However, there were some countervailing factors. First, there were limits on the tax deductibility of the premiums paid. Second, some superannuation schemes paid tax immediately on their investment income (rather than the tax being deferred until the retirement of the beneficiary, at which point the latter paid it on the pension payments from the fund). We judge it impossible to properly allow for all of these factors. Instead, we assume that returns (interest, dividends and capital gains) received via superannuation funds in the period prior to 1988 incurred an effective tax rate of zero.

Finally, we consider type B investors in the period from 1988. In respect of taxation of dividends, receipt of them via funds and unit trusts in this period is essentially identical to that of receiving them directly, and therefore Eq. (4) is still valid in the presence of type B investors. The explanation for the largely identical tax treatment is as follows. First, in respect of unit trusts, they are taxed on dividends at the corporate tax rate but can fully utilize the associated imputation credits to reduce the tax payable, and any additional tax paid gives rise to imputation credits, which can be passed on to the individual claimants. The end result (in after-personal tax terms) for a New Zealand individual is identical to receipt of the dividend directly from the company. Secondly, in respect of superannuation funds, they are taxed like unit trusts except that imputation credits cannot be passed on and the beneficiaries face no tax on payouts upon retirement. For beneficiaries with a marginal ordinary tax rate below the company tax rate faced by the fund, this is disadvantageous relative to direct ownership of shares; for those with a higher tax rate, it is advantageous. We judge any net effect to be small and therefore disregard it. In addition, some funds

[8] These favourable features of the tax regime were progressively eroded over the period from 1982 to 1988. In the interests of simplicity, we act as if the regime shift took place solely in 1988 (Minister of Finance, 1988, Ch. 4).

faced a lower tax rate than the corporate rate for a transitional period; again, the effect is considered small and therefore disregarded.

Since Eq. (4) is still valid from 1988 even in the presence of type B investors, only their tax rates on interest and capital gains are required. In respect of interest, for the reasons just given in respect of dividends, taxation is essentially identical to that when the interest is received directly rather than via a fund or unit trust. In respect of capital gains, and unlike that of direct receipt, taxation is incurred by the fund or unit trust. The taxation rate is the corporate tax rate, but taxation only occurs upon realization of the capital gain by the intermediary. Protopapadakis (1983) estimates that this opportunity to defer payment of the tax until realization of the asset reduces the effective tax rate by 50%, and we invoke this figure. Thus, the effective tax rate faced by type B investors on capital gains in the period from 1988 is 50% of the corporate tax rate.

In summary then, we can decompose the estimation process for the tax parameters in Eqs. (2) and (4) into three subperiods.

(a) 1931–1957: Eq. (2) is employed, and this requires values for the tax parameters T_{m} and T_{I}. Neither type A nor type B investors are taxed on dividends or capital gains, and therefore T_{m} is zero. In addition, capital gains are tax-free for both investor classes, and type B investors are exempt from tax on interest. So, following the definition in Eq. (1), T_{I} is the market value weight of type A investors (w_{A}), multiplied by the weighted average (using market value weights) of the marginal ordinary tax rates faced by individuals. The latter weighted average is denoted T_0. In short,

$$T_{\mathrm{m}} = 0, \quad T_{\mathrm{I}} = w_{\mathrm{A}} T_0. \tag{5}$$

(b) 1958–1987: Eq. (2) is employed, and this requires values for the tax parameters T_{m} and T_{I}. Both types A and B investors are free of tax on capital gains. Type B investors are exempt from tax on both dividends and interest. So, following the definition in Eq. (1), T_{m} is the market value weight of type A investors (w_{A}), multiplied by the weighted average of the marginal ordinary tax rates faced by individuals (T_0), multiplied by the proportion of dividends that were not from tax-free sources (p). In addition, T_{I} is the same as in Eq. (5). In short,

$$T_{\mathrm{m}} = w_{\mathrm{A}} T_0 p, \quad T_{\mathrm{I}} = w_{\mathrm{A}} T_0. \tag{6}$$

(c) 1988–2002: Eq. (4) rather than Eq. (2) is used, requiring values for only the tax parameter T_{I}. Type A investors are taxed on interest at the marginal ordinary tax rate for individuals and exempt from tax on capital gains. Type B investors are also taxed on interest at the marginal ordinary tax rate for individuals, and taxed on capital gains at 50% of the corporate tax rate T_{c}. So, following the definition in Eq. (1), T_{I} becomes

$$T_{\mathrm{I}} = x_{\mathrm{A}} T_0 + x_{\mathrm{B}} \left[\frac{T_0 - 0.50 T_{\mathrm{c}}}{1 - 0.50 T_{\mathrm{c}}} \right]. \tag{7}$$

So, we perform the calculations in Eqs. (5) and (6) for the pre-imputation period, which are then used in Eq. (2). In addition, we perform the calculations in Eq. (7) for the imputation period, which are then used in Eq. (4). To do so, we require estimates for various years of T_0, T_c, w_A, x_A, x_B and p.[9] We now address these in turn.

3.3. Estimation of T_0

The process of calculating this tax parameter is affected by the available data and four subperiods arise from this: 1931–1958, 1959–1983, 1984–1998 and 1999–2002.

We start with the period 1959–1983, because the available data is best in that period. For each of these years, the Census and Statistics Department (1959–1983) provides a classification of the aggregate assessable income of individuals into income brackets, along with the dividend component and applicable marginal ordinary tax rates. This permits calculation of the weighted average of the marginal ordinary tax rates for the individuals who held equities. To illustrate this, suppose that in a particular year, the first \$20,000 of assessable income (AY) is taxed at 20% (subject to exemptions), the next \$10,000 at 40% and so on as shown below. In addition, the aggregate assessable incomes earned by individuals whose assessable income lay in these three brackets, along with the dividend component, are as follows:

AY	Tax rate	Total AY	Total div.
\$0–20,000	0.20	\$20m	\$1m
\$20,000–30,000	0.40	\$15m	\$3m
\$30,000–40,000	0.50	\$10m	\$5m
>\$40,000	0.60	\$5m	\$3m

In this scenario, if exemptions are ignored, then \$1m of dividend income will be taxed at 20%, \$3m at 40%, \$5m at 50% and \$3m at 60%. To form the market value weighted average of these tax rates, we require the market values of the assets generating these dividends. The latter is not known but should be approximately proportional to the levels of the dividends. The weighted average marginal ordinary tax rate would then be

$$T_0 = 0.20\left[\frac{\$1\text{m}}{\$12\text{m}}\right] + 0.40\left[\frac{\$3\text{m}}{\$12\text{m}}\right] + 0.50\left[\frac{\$5\text{m}}{\$12\text{m}}\right] + 0.60\left[\frac{\$3\text{m}}{\$12\text{m}}\right] = 0.48.$$

However, the existence of exemptions implies that this will be an overstatement, and exemptions were significant for much of this period. For example, in respect of the assessable income in the second tax bracket, exemptions imply that the taxable incomes of some of these taxpayers will be less than \$20,000, implying that their dividends will be taxed at a marginal rate of only 20%. To address this problem, we firstly employ an

[9] Since returns are measured over calendar years, we seek estimates of these parameters over calendar years. However, in respect of the tax parameters T_0 and T_c, the times spans to which they relate generally differ from calendar years. In particular, the tax year for individuals is April 1 to 31 March. However, the tax rates do not generally differ greatly from year to year and our analysis in Section 5 shows that the estimate of the tax-adjusted market risk premium is not very sensitive to modest changes in tax rates. So, we treat the tax rates as if they were for calendar years.

approximation to the above calculation, by simply using the tax rate applicable to the median of the dividend income distribution. In this example, with total dividend income of \$12m, the median point is \$6m and this corresponds to an assessable income of \$34,000 and a marginal ordinary tax rate of 0.50.[10] Having done this, we then reduce this assessable income of \$34,000 by the typical level of exemptions and then invoke the marginal ordinary tax rate at that level of taxable income. For example, suppose the typical level of exemptions for an individual was \$7000.[11] This would reduce the assessable income of \$34,000 to a taxable income of \$27,000 with an associated marginal ordinary tax rate of 0.40 rather than 0.50. Thus, our estimate of T_0 would be 0.40.

We now turn to the period 1931–1958. For these years, dividend income data of the kind described above was not presented by the Census and Statistics Department (1931–1958) (primarily because dividends were not taxed in all but the last of these years). Thus, we cannot directly calculate the weighted average of the marginal ordinary tax rates faced by individuals holding equities. We cannot simply take the median total assessable income, determine the income level associated with that (Z), reduce it for exemptions, and then use the tax rate applicable at that income level, because this clearly produces lower tax rates than obtained by the process above (this is because equityholders tend to be of above average incomes). So we proceed as follows. For each of the years 1959, 1960 and 1961, we calculate Z as just described. We also compute the median total dividends and then determine the assessable income corresponding to that (W) for each year. We then take the ratio W/Z for each year and average it over these 3 years. The result is 2.34. We then use this ratio for each of the years 1931–1958 as follows. First, we calculate the value of Z for each year. Second, we multiply it by 2.34, to obtain an estimate of the assessable income corresponding to the median of the total dividend income. Third, we reduce this by the level of exemptions for a typical taxpayer (again, they were significant in this period). Finally, we note the marginal ordinary tax rate corresponding to this income level. This tax rate is the estimate of T_0 for that year. There is one exception to this, for the year 1957. In this year, the ordinary rates were zero, due to the transition from a system of paying tax at the end of a year to a system in which tax was deducted at source.

The third subperiod to consider is 1984–1998. For these years, the tax information described above was not produced by the Census and Statistics Department. However, Inland Revenue Department (1999) has recently complied information relating to the first three columns of the illustrative table above, for the years 1984–1998.[12] Since dividend data is absent, we proceed in a fashion matching that for the years 1931–1958. First, we estimate the ratio W/Z for each of the years 1981, 1982 and 1983. Second, we average these to yield a figure of 1.27. Third, for each of the years 1984–1998, we calculate Z. Fourth, we multiply this by 1.27, to obtain an estimate of the assessable income corresponding to the median of the total dividend income. Fifth, we reduce this by the level of exemptions for a

[10] Having checked for a sample of years, this yields a very good approximation in most cases.

[11] The principal exemptions to consider are the personal exemption and those for dependent spouses and children. We assume that each taxpayer enjoyed the personal exemption and that for a dependent spouse. Exemptions contingent upon investing in superannuation funds are not considered here; they have been recognized earlier in estimating the effective tax rate on such investments for type B investors.

[12] The Income Distribution information appears in Inland Revenue Department (1999) and the information on tax rates was kindly supplied by Sandra Smith (Forecasting and Analysis Unit, Inland Revenue Department).

typical taxpayer. Finally, we note the marginal ordinary tax rate corresponding to this income level. This tax rate is the estimate of T_0 for that year.

The final set of years to consider is 1999–2002. For these years, the income distribution information has not been compiled. Consequently, we extrapolate the distribution for 1998 to the remaining years and couple it with the actual tax rates for those years, to estimate T_0 in the same fashion as for the years 1984–1998. These estimates of T_0 are shown in column 2 of Table 1.

3.4. The corporate tax rate

The values for the corporate tax rate are required only for the period 1988–2002. The values were obtained from the Inland Revenue Department and are shown in column 3 of Table 1.

3.5. The market weight of type A investors

The market value weight of type A investors (individuals who own assets directly as opposed to via superannuation funds and unit trusts) is required for all years. For a particular year, this is the ratio of the market value of shares held by New Zealand individuals to the sum of the market value of shares held by New Zealand individuals, funds and unit trusts. Deutsche Bank (2000) provides an ownership analysis for the New Zealand sharemarket for 1991–2000, from which the value weights on type A investors can be computed. For example, for 2000, the proportion of New Zealand shares held by New Zealand individuals was 24% and that of New Zealand funds and unit trusts was 14%.[13] Accordingly, the year 2000 market value weight on type A investors is 0.63. These value weights are shown in column 4 of Table 1, for the years 1991–2000. In respect of the years 2001–2002, we invoke the value for 2000. In respect of the years 1988–1990, we invoke the 1991 figure (of 0.77).

Turning now to the period before 1988, Young (1987) provides an analysis of New Zealand's equity market ownership in 1987. Local superannuation funds (which includes life insurance companies) held 10% of the market and local individuals 43%, with the remainder being largely New Zealand companies and foreigners.[14] This implies a value weight on type A investors of 0.81. Courtis (1975) provides an analysis for 1975, at which point local individuals owned 62%, and companies and institutions owned the remaining 38%. However, Courtis does not separately identify local superannuation funds. Nevertheless, part of the 38% will be foreigners, which we exclude, and part will be local companies, which we also exclude. Neither of the groups excluded would have been trivial at this time (1975). This points to a similar value weight in 1975, on individuals relative to superannuation funds, to that prevailing in 1987. In the absence of further data on this subject, we assign a value weight for individuals of 0.81 for the entire period 1931–1987.

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[13] The figure for individuals includes that for ESOPs, because their beneficiaries are solely individuals and this conduit has no personal tax implications.

[14] The figure for individuals includes that of nominee companies, because their owners are largely individuals (rather than individuals and funds), and this conduit has no personal tax implications.

Table 1
Estimation of tax parameters

Year	T_0	T_c	w_A	x_A	p	T_I	T_m
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
1931	0.127		0.810			0.103	0.000
1932	0.122		0.810			0.099	0.000
1933	0.122		0.810			0.099	0.000
1934	0.117		0.810			0.095	0.000
1935	0.115		0.810			0.093	0.000
1936	0.144		0.810			0.117	0.000
1937	0.146		0.810			0.118	0.000
1938	0.144		0.810			0.117	0.000
1939	0.190		0.810			0.154	0.000
1940	0.307		0.810			0.249	0.000
1941	0.307		0.810			0.249	0.000
1942	0.325		0.810			0.263	0.000
1943	0.325		0.810			0.263	0.000
1944	0.325		0.810			0.263	0.000
1945	0.325		0.810			0.263	0.000
1946	0.344		0.810			0.279	0.000
1947	0.344		0.810			0.279	0.000
1948	0.364		0.810			0.295	0.000
1949	0.364		0.810			0.295	0.000
1950	0.316		0.810			0.256	0.000
1951	0.315		0.810			0.255	0.000
1952	0.320		0.810			0.259	0.000
1953	0.325		0.810			0.263	0.000
1954	0.312		0.810			0.253	0.000
1955	0.350		0.810			0.284	0.000
1956	0.362		0.810			0.293	0.000
1957	0.000		0.810			0.000	0.000
1958	0.325		0.810		0.42	0.263	0.111
1959	0.400		0.810		0.42	0.324	0.136
1960	0.387		0.810		0.42	0.313	0.132
1961	0.387		0.810		0.42	0.313	0.132
1962	0.387		0.810		0.42	0.313	0.132
1963	0.400		0.810		0.42	0.324	0.136
1964	0.412		0.810		0.42	0.334	0.140
1965	0.412		0.810		0.42	0.334	0.140
1966	0.412		0.810		0.42	0.334	0.140
1967	0.425		0.810		0.42	0.344	0.145
1968	0.437		0.810		0.42	0.354	0.149
1969	0.490		0.810		0.42	0.397	0.167
1970	0.620		0.810		0.42	0.502	0.211
1971	0.475		0.810		0.42	0.385	0.162
1972	0.435		0.810		0.42	0.352	0.148
1973	0.423		0.810		0.42	0.343	0.144
1974	0.450		0.810		0.42	0.365	0.153
1975	0.480		0.810		0.42	0.389	0.163
1976	0.483		0.810		0.42	0.391	0.164
1977	0.486		0.810		0.40	0.394	0.157
1978	0.473		0.810		0.44	0.383	0.169

Table 1 (*continued*)

Year	T_0	T_c	w_A	x_A	p	T_I	T_m
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
1979	0.480		0.810		0.43	0.389	0.167
1980	0.480		0.810		0.30	0.389	0.117
1981	0.550		0.810		0.36	0.446	0.160
1982	0.310		0.810		0.24	0.251	0.060
1983	0.312		0.810		0.31	0.253	0.078
1984	0.320		0.810		0.21	0.259	0.054
1985	0.451		0.810		0.66	0.365	0.241
1986	0.520		0.810		1.00	0.421	0.421
1987	0.480		0.810		1.00	0.389	0.389
1988	0.400	0.280	0.770	0.742		0.375	
1989	0.330	0.330	0.770	0.737		0.295	
1990	0.330	0.330	0.770	0.737		0.295	
1991	0.330	0.330	0.770	0.737		0.295	
1992	0.330	0.330	0.700	0.661		0.285	
1993	0.330	0.330	0.650	0.608		0.278	
1994	0.330	0.330	0.650	0.608		0.278	
1995	0.330	0.330	0.690	0.650		0.284	
1996	0.330	0.330	0.690	0.650		0.284	
1997	0.330	0.330	0.650	0.608		0.278	
1998	0.330	0.330	0.570	0.525		0.267	
1999	0.330	0.330	0.600	0.556		0.271	
2000	0.330	0.330	0.630	0.587		0.275	
2001	0.330	0.330	0.630	0.587		0.275	
2002	0.330	0.330	0.630	0.587		0.275	

The tax parameter T_0 is the market value weighted average of the marginal ordinary tax rates faced by individual investors in shares; T_c is the company tax rate; w_A is the market value weight of investors who hold shares directly as opposed to via superannuation funds and unit trusts; x_A is defined in accordance with Eq. (9); p is the proportion of dividends that were not generally tax-free; T_I is defined in accordance with Eq. (1) and reflects the differential between the marginal tax rates on ordinary income and on capital gains, in respect of investors who hold equities; T_m is defined in accordance with Eq. (1) and reflects the differential between the marginal tax rates on dividends and on capital gains, in respect of investors who hold equities.

This is similar to the figure of 0.77 for the 1991 year that was derived from the Deutsche Bank (2000) data. Thus, the removal in 1988 of the tax advantages from investing via superanuation funds does not appear to have reduced the desire for such investment mediums. This may seem paradoxical; however, there is likely to have been an adverse effect resulting from the tax change, masked by a long-term trend away from individual holdings in favour of institutional ownership (this trend is apparent in the figures after 1990 in Table 1, and parallels such trends in other Anglo-Saxon markets).

3.6. Weights x_A and x_B for types A and B investors

These weights, x_A and x_B, arise in the definition of T_I and are required only for the years 1988–2002. Following the definition of T_I in Eq. (1), the weight x_i for investor i is

$$x_i = \frac{w_i}{\theta_i(1 - t_{gi})} \div \sum \frac{w_i}{\theta_i(1 - t_{gi})}$$

where w_i is the market value weight of investor i and θ_i is a measure of the risk aversion of investor i. In light of the absence of any information about variation in risk aversion across investors, we assume that they are equal. Accordingly,

$$x_i = \frac{w_i}{(1-t_{gi})} \div \sum \frac{w_i}{(1-t_{gi})}. \tag{8}$$

This formula will also apply to any aggregate group of investors with a homogeneous capital gains tax rate. So, the formula will apply to both types A and B investors. The former are exempt from capital gains and the latter are taxed on capital gains at a rate equal to 50% of the corporate tax rate T_c. So, Eq. (8) implies that

$$x_A = w_A \div \left[w_A + \frac{1-w_A}{1-0.50T_c} \right] \tag{9}$$

and x_B is simply $1 - x_A$. The values for x_A are shown in column 5 of Table 1, with values for T_c and w_A being obtained from columns 3 and 4, respectively.

To illustrate the application of Eq. (9), consider the year 2002. The market value weight for type A investors is $w_A = 0.63$, and the applicable corporate tax rate is $T_c = 0.33$. Following Eq. (9), the value for x_A is then

$$x_A = 0.63 \div \left[0.63 + \frac{0.37}{1-0.50(0.33)} \right] = 0.587$$

and this is shown in column 5 of Table 1. The value for x_B is then $1 - 0.587 = 0.413$.

3.7. Estimation of the proportion of taxable dividends

The last parameter to estimate is the proportion of dividends that were not tax-free, and denoted p. This is required only for the years 1958–1987, and the results are shown in column 6 of Table 1. For the years 1986–1987, the figure is 1 because the ability to pay dividends from tax-free sources was annulled in 1985. In respect of the years 1976–1985, the estimates are based on examination of the top 20 companies in each year, drawing upon the Annual Reports of the New Zealand Stock Exchange. There were difficulties in obtaining data prior to 1976. So, the estimate for 1976 was extrapolated back to the years 1957–1975. In respect of doing so, Prebble (1986, pp. 6–7) notes that the opportunities for creating tax-free dividends increased as one moves back through time.[15] However, awareness of these opportunities is likely to have been less in the earlier years, and we assume that the two effects offset.

3.8. Summary

We now summarize the sequence of operations leading to an estimate the market risk premium in Eq. (1). First, we estimate the parameters T_0, T_c, w_A, x_A and p for relevant

[15] To illustrate the point concerning opportunities, Prebble (1986) notes that, up until 1965, merely revaluing assets could create tax-free dividends and, until 1982, the same opportunity could be generated by the sale of company assets to a subsidiary at a “profit”.

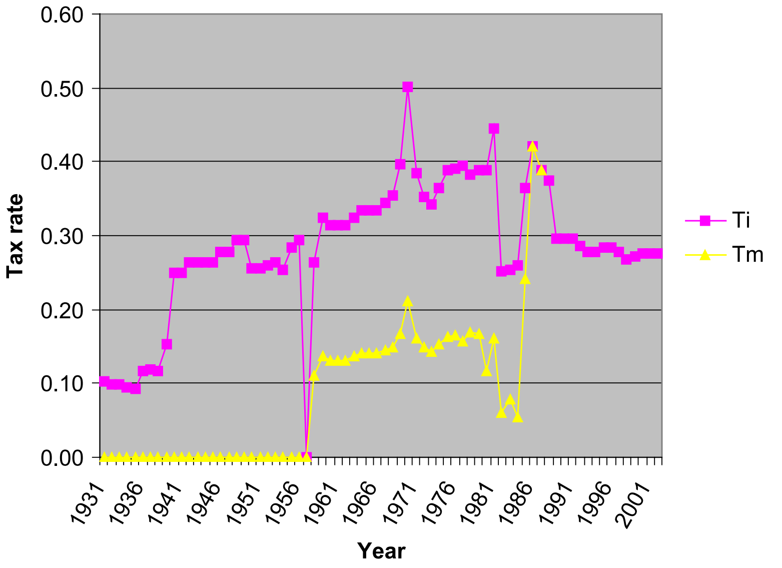

Fig. 1. Estimates for T_I and T_m: 1931–2002.

years in the period 1931–2002. These are shown in columns 2 to 6 of Table 1. Using these estimates, and Eqs. (5), (6) and (7), the estimates for the tax parameters T_I and T_m are then calculated; these are shown in columns 7 and 8 of Table 1, and also in Fig. 1. To illustrate these latter calculations, consider the year 2002, which requires calculation of only T_I in accordance with Eq. (7). The subsidiary parameter values for this year are

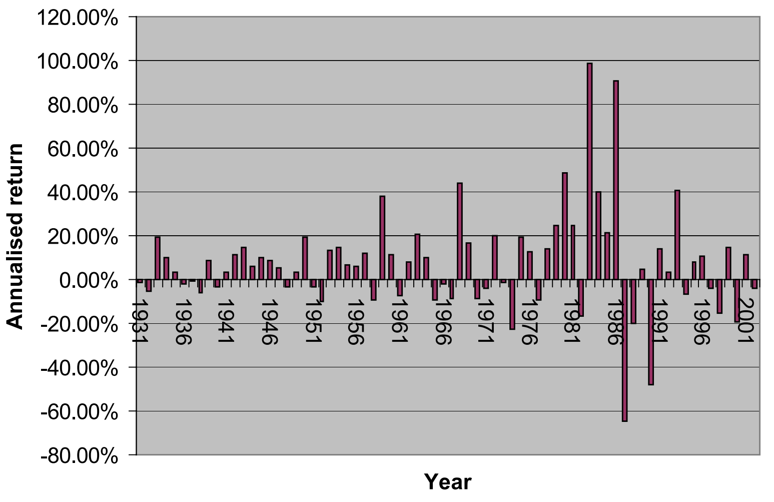

Fig. 2. Annual estimates of the NZ tax-adjusted MRP relative to bond returns: 1931–2002.

$T_0 = 0.330$, $T_c = 0.330$, $x_A = 0.587$ and $x_B = 1 - 0.587 = 0.413$. Following Eq. (7), T_I is then as follows:

$$T_I = 0.587(0.330) + 0.413\left[\frac{0.330 - 0.50(0.330)}{1 - 0.50(0.330)}\right] = 0.275.$$

These estimates for T_I and T_m are combined with returns data in Eq. (2) to generate estimates of the tax-adjusted market risk premium for the years 1931–1987. In addition, the estimates of T_I, along with returns data and Eq. (4), are used to generate estimates of the tax-adjusted market risk premium for the remaining years 1988–2002. These results are shown in Fig. 2. Averaging over these yearly outcomes then yields the estimate for the tax-adjusted market risk premium. The results are discussed in Section 4.

4. Results

Table 2 summarizes nominal and real returns to equities and bonds, bond yields, inflation rates and Ibbotson type estimates of both the standard and tax-adjusted market risk premiums over the period between 1931 and 2002.

The arithmetic mean annual return to equities was 0.122.[16] This exceeded both the arithmetic mean return on long-term government bonds of 0.064 and the arithmetic mean yield on long-term government bonds of 0.067. However, the estimated standard deviation of annual equity returns (0.243) was higher than those for bond returns (0.071) and bond yields (0.036).

Using nominal returns for the full 1931–2002 period, the Ibbotson type estimate of the standard market risk premium using arithmetic averaging and bond returns is 0.058.[17] If bond yields are used instead, the figure is slightly lower at 0.055. The corresponding estimates for the tax-adjusted market risk premium are 0.074 and 0.072, respectively. In using the tax-adjusted version of the CAPM, many analysts assume that capital gains tax is zero for all investors and imputation credits are attached at the maximum possible rate of 0.4925. If these simplifying assumptions are made, then it is necessary to invoke the same assumptions in estimating the market risk premium in this model. Doing so, we find that our estimates for the tax-adjusted market risk premium rise only slightly, by 0.0005.[18]

We test the sensitivity of our estimate of the tax-adjusted market risk premium to different personal tax parameter estimates. The estimates of the tax parameters T_0, and also the capital gains tax rates for type B investors post-1987 (of $0.50T_c$), may be in error. One possible source, which implies overestimation, is that of tax avoidance and/or evasion.[19]

[16] This comprises capital gains and the cash dividend yield, and therefore excludes any imputation credits attached to dividends from 1988 onwards. If imputation credits were included, the arithmetic mean annual return to equities over the period 1931–2002 would be 0.126.

[17] By way of comparison, the arithmetic average for the markets examined by Dimson et al. (2002) for the period 1900–2001 is 0.054. However, the periods studied are different.

[18] To estimate the tax-adjusted market risk premium for this simplified version of the CAPM, we used Eqs. (2) and (3) over the entire period 1931–2002, where D_{mt} is the cash dividend yield. Details of our approach to estimating D_{mt} for 1988 onwards are set out in Appendix A, Eq. (A3).

[19] In recognition of the evasion problem, resident withholding tax on dividends and interest was introduced in 1986.

Table 2
Historical highlights

Series	Arithmetic mean annual return	Geometric mean return	Standard deviation of annual returns	Number of years returns are positive	Number of years returns are negative	Highest annual return	Lowest annual return
Equity returns	0.122	0.099	0.243	52	20	1.194	− 0.486
Long-term government bond returns	0.064	0.061	0.071	66	6	0.271	− 0.192
Long-term government bond yields	0.067	0.066	0.036	72	0	0.177	0.030
Inflation rate	0.053	0.052	0.056	70	2	0.182	− 0.114
Nominal market risk premium (bond returns)	0.058	0.030	0.233	43	29	0.923	− 0.725
Nominal market risk premium (bond yields)	0.055	0.029	0.237	45	27	1.072	− 0.643
Nominal tax-adjusted market risk premium (bond returns)	0.074	0.048	0.233	44	28	0.985	− 0.645
Nominal tax-adjusted market risk premium (bond yields)	0.072	0.047	0.238	46	26	1.096	− 0.594

For example, tax minimization schemes were prevalent in the 1970s and 1980s when personal tax rates were as high as 66%. Examples of "tax-driven" schemes include special purpose partnerships in forestry investment, primary industry investment and films. Many of these special purpose partnerships were targeted at high tax rate investors and provided large up-front tax deductions and write-offs. In recognition of all this, the tax-adjusted market risk premium is re-estimated under the assumption that T_0 and $0.50T_c$ are either lower or higher by 10 percentage points than the rates set out in Table 1. The new values for these parameters are then used to recalculate the values for T_I and T_m in Table 1. These variations in tax rates are subject to the restrictions that they cannot be negative and that T_0 cannot exceed the top marginal personal tax rate for that particular income year. Under the assumption that T_0 and $0.50T_c$ are at a maximum of 10 percentage points lower (higher) than provided in Table 1, the arithmetic mean based estimate of the tax-adjusted market risk premium falls by only 0.004 (rises by only 0.002). This is not a substantial change, and the reason is thus. Increasing tax rates increases the term $R_{ft}T_{It}$ in Eq. (2) and hence increases the estimate of the tax-adjusted market risk premium. However, this increase is partly offset by an increase in the term $D_{mt}T_{mt}$ in Eq. (2). Consequently, the estimate of the tax-adjusted market risk premium is not particularly sensitive to variations in investors' personal tax rates as set out in Table 1.

We also undertook sensitivity analysis on the market value weights for type A investors. Under the assumption that the weights for type A investors were 0.10 lower (higher) than our estimates in Table 1, the arithmetic mean estimate of the tax-adjusted market risk premium falls (rises) by only 0.001. Again, this is not a substantial change.

5. Conclusion

We document historical returns to equities and long-term government bonds, bond yields and inflation rates in New Zealand over the period 1931–2002. Over this period, the arithmetic average of the annual returns to equities was 0.122 compared to that on long-term government bonds of 0.064. The arithmetic average of the yields on these bonds was 0.067. However, equities also had higher risk than bonds, with standard deviations for annual returns of 0.243 and 0.071, respectively.

Our study also estimates the standard and tax-adjusted market risk premiums over the 1931–2002 period. Applying the Ibbotson methodology, the former is estimated at 0.058 relative to bond returns and 0.055 relative to bond yields. In respect of the tax-adjusted market risk premium, the corresponding estimates are 0.074 and 0.072, respectively. The estimates of the tax-adjusted market risk premium are of particular significance in view of the widespread use of the tax-adjusted version of the capital asset pricing model in New Zealand by investors, corporates and regulators. In using the latter model, many analysts assume that capital gains tax is zero for all investors and imputation credits are attached at the maximum possible rate. If these assumptions are made, then it is necessary to invoke the same assumptions in estimating the market risk premium in this model. Doing so, we find that our estimate for the tax-adjusted market risk premium rises by only 0.0005.

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Appendix A

This appendix explains the calculation of the market returns R_{mt} exclusive of imputation credits for the period since 1988. Over this time span, the NZSE gross index provides a market return GR_{mt} inclusive of imputation credits as follows:

$$GR_{mt} = R_{mt} + > ICY_{mt} \tag{A1}$$

where ICY_{mt} is the imputation credits attached to the cash dividends, as a proportion of the value of the market portfolio at the beginning of the year t. Define

$$Q_{mt} = \frac{ICY_{mt}}{D_{mt}} \tag{A2}$$

where D_{mt} is the cash dividend yield on the market portfolio for year t. It follows that the sum of D_{mt} and ICY_{mt}, called the "gross" dividend yield GD_{mt}, can be expressed as

$$GD_{mt} = D_{mt} + ICY_{mt} = D_{mt}[1 + Q_{mt}].$$

The cash dividend yield can then be expressed as

$$D_{mt} = \frac{GD_{mt}}{(1 + Q_{mt})}. \tag{A3}$$

The "gross" dividend yield can be calculated as the difference in returns between the NZSE Gross capital index (which includes capital gains, cash dividends and the attached imputation credits) and the NZSE Capital index (which comprises only capital gains). In addition, over the period 1988–2002, the imputation credit ratio Q_{mt} was assumed to be 0.40 (Lally, 2000b, p. 6 gives this figure for 1999). Substitution of these results into Eq. (A3) yields D_{mt} for each year. Substitution of this, along with Q_{mt}, into Eq. (A2) then yields values for ICY_{mt}. Substitution of this, along with the gross returns GR_{mt}, into Eq. (A1) then yields the returns R_{mt}.

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