Beta and Return: Implications of Australia's Dividend Imputation Tax System

by
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Abstract:
US studies have consistently reported that the relationship between beta and return is less steeply sloped than that implied by the simple CAPM. The introduction of a dividend imputation tax system in Australia and other tax law differences suggest the relationship between beta and return may be more steeply sloped in this country. Empirical evidence subsequent to the introduction of the dividend imputation tax system in July 1987 supports this hypothesis. Further, it is found that no such change occurs in the US market over this time period, which strengthens the conclusion that the finding is tax-driven.

Keywords:
RISK AND RETURN; IMPUTATION EFFECTS; ASSET PRICING.

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We would like to thank John Bowers, Frank Finn, Garry Twite, two anonymous referees and seminar participants at the University of Tasmania, Monash University and University of Queensland and the 1996 AGSM Research Camp for helpful discussions and feedback on this topic. Also special thanks to Brad Thilges and David Simmonds at the Centre for Research in Finance in the AGSM for access to data and considerable computing assistance. Part of this research was conducted while the first author was visiting the Department of Accounting and Finance at the University of Strathclyde. All remaining errors are solely attributable to us.

1. Introduction

The potential effect that taxes may have on financial decision-making has long been recognised by financial economists. Traditional work dealing with taxation issues has assumed a classical taxation framework, reflecting the fact that the dominant world markets, particularly the US, have long been operating such a taxation system. However, with the advent of dividend imputation systems in several major countries (such as Australia, Canada, New Zealand, Spain and the United Kingdom), combined with the fact that markets have become increasingly globalised during the 1980s and 1990s, researchers have become more concerned about whether and to what extent long-accepted finance principles are robust to non-classical tax environments. The aim of the current paper is to add to this broad literature in the area of asset pricing.

While the issue of taxation has a longer history in the capital structure debate, it has also received considerable attention in the area of asset pricing. The seminal work is represented by Brennan (1970) in which the ‘no-taxes’ capital asset pricing model (CAPM) was adjusted to allow for the taxation disadvantage of dividends relative to capital gains, under a classical taxation system. The purpose of the current paper is to provide evidence on the relationship between beta and return in the Australian market both before and after the introduction of a dividend imputation tax system in July 1987. The research is motivated by US studies that have reported a less steeply sloped line relating average return and risk than the slope of the line between expected return and risk implied by the simple CAPM.

An Australian setting is interesting because Australian tax rules differ from US tax rules in a way that suggests a more steeply sloped relationship between beta and return in this country. Since July 1987 Australia has employed a dividend imputation tax system which provides for tax credits that vary cross-sectionally with the size of dividend payments. The tax credits are only available to Australian taxable investors holding Australian equities. If, as expected, dividend yield is negatively correlated with risk, low-beta stocks are predicted to offer a lower return than that expected under the simple CAPM.

Accordingly, in the current paper this taxation hypothesis is investigated. In conducting this analysis, we allow for prior research that has reported a link between beta and industry classification (Ball & Brown 1980; Ball 1986), beta and size (Fama & French 1992) and beta and dividend yield (Keim 1986) and Booth (1987). Conducting the same essential experiment on US data over the same time period performs a final control. The US provides a useful benchmark for comparison, since this market remained within a classical tax environment.

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1. A recent example of this concern is Harris, Hubbard and Kemsley (1998) in which they examine data from the US, Australia, France, Germany, Japan and the UK, to assess whether and to what extent dividend taxes and tax imputation credits are capitalised in equity values. With regard to Australia, they find that tax imputation credits are capitalised into share prices and that this is consistent with evidence of Bellamy (1994) regarding ex-dividend price falls of ‘franked’ versus ‘unfranked’ dividends. Further, the findings of Harris, Hubbard and Kemsley (1998) are consistent with the evidence of Chan, McColough and Skully (1993) who find positive announcement-day abnormal returns for Australian companies announcing dividend reinvestment plans.

2. See Black (1993) for a review of this evidence. Studies extend from Friend and Blume (1970) and Black, Jensen and Scholes (1972) to more recent studies by Fama and French (1992) and Black (1993).

3. See Wood (1997) for asset pricing models that incorporate this feature of the Australian dividend imputation tax system. Returns are measured exclusive of any dividend tax credits.
throughout. Further, it provides an opportunity to investigate whether the close proximity of the October 1987 stock market crash to the tax change is a confounding event.

The remainder of the paper is set out as follows. In section 2 we briefly describe the workings of the Australian dividend imputation tax system. In section 3 we outline a pricing model with imputation taxes and explore the pricing implications of the model. The empirical analysis is described and reported in section 4. Finally, in section 5, a summary and conclusions are provided.

2. The Australian Dividend Imputation Tax System—A Brief Overview

On 1 July 1987 Australia changed from a ‘classical’ to a full ‘dividend imputation’ tax system. The imputation system applies to dividends paid by resident companies from 1 July 1987. Dividends carrying tax credits are termed franked dividends. Franked dividends must be paid out of profits from 1986/87 or later tax years, which have attracted Australian corporate tax. Dividends are grossed up by the applicable general company tax rate on the date the dividend is paid. The applicable general corporate tax rate was 49% for dividends paid 1 July 1987 to 30 June 1989, 39% for dividends paid 1 July 1989 to 30 June 1994 and 36% for dividends paid after 1 July 1996. For 1994/95 the franked amount must be separately identified as class A (39%) or class B (33%), depending upon the tax rate that has been applied to the profits from which the dividends are paid.

Shareholders who are resident natural persons or resident superannuation funds include in taxable income the grossed-up dividend. These shareholders are then entitled to a tax rebate equal to the imputation credit included in assessable income. For example, consider a situation in which the corporate tax rate is 39% and the investor’s personal tax rate is 46%. Suppose a corporation earns $100 of income per share. It pays $39 in corporate tax, leaving $61 of income per share to distribute after tax. The company can pay a (fully franked) dividend of $61 per share, with an associated imputed dividend of $100 against which the personal tax liability is calculated. Accordingly, the personal tax liability is $46, against which the $39 corporate tax is treated as a tax credit, leaving an additional tax burden of $6.

A variety of tax rules determine the level of franking on dividends. Generally, a dividend should be franked to the full extent possible and where it is not possible to fully frank the current dividend it should be partially franked. Franking credits are wasted if dividends are franked less than is possible. Dividends that are over

4. For a brief discussion of the basic features of the alternative imputation taxation systems of France, Germany and the UK see Harris, Hubbard and Kemsley (1998, pp. 30)

5. The requirement to gross-up assessable income by the tax credit also applies to shareholders who are approved deposit funds, pooled superannuation trusts, registered organisations or life assurance companies. When franked dividends are received by a resident company the imputation credits are preserved and may be used to frank dividends paid by the recipient company. The dividend itself will generally not be taxed in the hands of the recipient company because of a full dividend rebate provision in the Act which applies to companies.

6. Excess credits can be set against tax on other income. Where the rebate exceeds other tax it cannot be carried forward or back, it is wasted. Franked dividends paid to non-residents are exempt from Australian withholding taxes.
franked can result in the requirement to pay franking deficit tax, which can be set against future tax liabilities. If the deficit tax required, exceeds certain prescribed limits, a penalty tax that cannot be offset against future corporate tax is required. Finally, it should be noted that different levels of franking cannot easily be channeled selectively to different shareholders because of a requirement that the same level of franking must apply to all shares of the same class.

3. Pricing Implications of Dividend Imputation

3.1 A Pricing Model with Dividend Imputation Tax Credits

The pricing implications of dividend imputation tax credits can most simply be illustrated with a model which assumes only one class of investor. The tax credit yield on security \( i \) (\( \tau_i \)), is modeled in the form of a non-stochastic tax rebate that can be claimed by shareholders on the payment of a dividend, divided by the start of period security price. The fundamental pricing equation referred to as an ‘imputation-adjusted CAPM’, is

\[
E(R_i) = R - \tau_i + \beta_i [E(R_m) + \bar{\tau}_m - R]
\]

where:

- \( \hat{R}_i \) is the return on asset \( i \);
- \( R_m \) is the return on the market portfolio, ignoring imputation tax credits; and
- \( \bar{\tau}_m \) may be regarded as the tax credits distributed from the market portfolio.

3.2 Basic Predictions

The simple CAPM predicts a relationship between beta and expected return with a slope given by \( [E(R_m) - R] \). In contrast, the model derived above with imputation tax credits predicts a relationship between beta and expected return, measured exclusive of any imputation tax credits, with a slope given by \( [E(R_m) + \bar{\tau}_m - R] \). If all securities were to offer an identical level of imputation tax credit, the slope of the relationship between beta and expected return would be more steeply sloped than that predicted by the simple CAPM. Security market lines (SMLs) for securities with \( \tau_i < 0 \) (low tax credit yield stocks), \( \tau_i = \bar{\tau}_m \) (average tax-credit-yield stocks), and \( \tau_i > \bar{\tau}_m \) (high tax-credit-yield stocks), are shown in figure 1, where beta is measured using the Australian market portfolio.

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7. See Wood (1997) for a model of dividend imputation with two classes of investors.
8. It should be noted that this formulation, with the exception of the sign on the taxation-related parameters, is identical to Brennan’s (1970) classical tax-based model.
9. A derivation of the general form of this pricing equation is outlined in Wood (1997).
10. In practice in Australia, most commentators have argued that the market ‘risk’ premium has been unchanged when estimating a required rate of return, incorporating imputation tax credits. This would be consistent with a fall in \( E(R_m) \) by an amount equal to \( \bar{\tau}_m \), leaving the magnitude of the market risk premium unchanged.
If, as anticipated, low-beta assets are typically those with high tax-credit yields \((\tau_i > \tau_m)\), and high-beta assets are those typically with low tax-credit yields \((\tau_i < \tau_m)\), the measured relationship between returns and beta will be even more steeply sloped than the relationship between beta and returns for securities with similar levels of tax credits.\(^{11}\) This is illustrated in figure 2.

A useful way of clarifying what we expect to find in the empirical analysis is to rearrange the simple imputation-adjusted CAPM of equation 1:\(^{12}\)

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11. Booth (1987) using Canadian data 1968–83 reports a negative correlation, significant at the 5% level, between a sector’s dividend yield rank and its ranking according to standard deviation. The prediction that low beta assets will have negative alphas in countries with dividend imputation tax systems is consistent with results using Canadian data 1968–80 reported in Schwartz and Brennan (1985). These authors report \(\gamma_0 = -0.0049\) (0.0036) for the period, where \(\alpha_i = \gamma(1 - \beta)\). Canada adopted a dividend imputation tax system in 1973.

12. We would like to thank an anonymous referee for suggesting this explanation.
\[ E(\tilde{r}_i) = (\beta_i \tau_m - \tau_i) + \beta_i E(\tilde{r}_m) \]  

(2)

where: \( \tilde{r}_i \) (\( \tilde{r}_m \))= the excess return on asset \( i \) (the market portfolio).

If as we expect, stocks which have above average tax credit yields (that is \( \tau_i > \tau_m \)), also have relatively low-betas (that is, \( \beta_i < 1 \)), then the term in parentheses on the RHS of equation 2 should be negative. Conversely, if stocks which have below average tax credit yields (that is \( \tau_i < \tau_m \)), also have relatively high-betas (that is, \( \beta_i > 1 \)), then the term in parentheses on the RHS of equation 2 should be positive. Hence, if we run time-series regressions of the excess returns market model

\[ r_{it} = \alpha_i + \beta_i r_{mt} + error_{it} \]  

(3)

then we expect, in the absence of any other effects, a pattern of increasing (in beta) alphas post-imputation. That is, we expect a positive correlation between alpha and beta, across portfolios.\(^{13}\) This is in contrast to an expected zero ‘alpha’ in the pre-imputation period, in the context of the simple CAPM. Indeed, we know that the empirical SML in a classical tax environment does not hold true, in that it is typically flatter than that predicted by the simple CAPM. In other words, in a classical tax environment we expect to empirically observe a negative relationship between alpha and beta. Thus it turns out that we can expect an even greater contrast between the post-imputation and pre-imputation periods. These predicted features are explored in the empirical analysis to follow.

3.3 Multivariate Asset Pricing Tests

The adequacy of the model can be directly tested in the tradition of multivariate asset pricing tests. Taking expectations through the market model of equation 3 and comparing to equation 2 can identify a test of the simple (Sharpe-Lintner) version of the model. This provides the multivariate null hypothesis:

\[ H_0: \alpha_i = \beta_i \tau_m - \tau_i \quad i = 1, 2, \ldots N. \]  

(4)

Unfortunately, this hypothesis cannot be directly tested since it would require \( 2N+1 \) parameters to be estimated from \( 2N \) pieces of information. However, it can be operationalised by restricting the test to a subset of portfolios which have a common value for the tax credit yield, \( \tau_i \). The only case in which a ‘good’ control can be placed on this variable, while at the same time furnishing a good spread for the risk variable, is that of zero dividend (\( \tau_i = 0 \)) firms. The null hypothesis becomes:

\[ H_0: \alpha_i = \beta_i \tau_m \quad i = 1, 2, \ldots N. \]  

(5)

\(^{13}\) Note also that equation 2 makes it easy to see that the average (market) alpha equals zero, since in this case beta equals unity and \( \tau_i = \tau_m \).
This non-linear cross equation restriction can be tested using the likelihood ratio test (LRT) of Gibbons (1982) and it is applied to beta decile portfolios formed from all zero dividend companies.

The imputation-adjusted CAPM can further be directly tested in its zero-beta form. Firstly, by replacing $R$ with $R_z$ (the expected return on the zero-beta portfolio) we can re-arrange the model as:

$$E(\tilde{R}_i) = (R_z(1 - \beta_i) + \beta_i \tau_m - \tau_i) + \beta_i E(\tilde{R}_m)$$

and the null hypothesis becomes:

$$H_0: \alpha_i = R_z(1 - \beta_i) + \beta_i \tau_m - \tau_i \quad i = 1, 2, \ldots N.$$ (7)

As was the case above, this hypothesis cannot be tested directly. We therefore again focus on zero–dividend paying companies for which $\tau_i = 0$, and the null hypothesis then becomes:

$$H_0: \alpha_i = R_z(1 - \beta_i) + \beta_i \tau_m \quad i = 1, 2, \ldots N.$$ (8)

As discussed above, we conduct LRT cross-equation restriction test, applied to beta decile portfolios formed from all zero dividend companies.

One way of further assessing how well the imputation-adjusted CAPM works is to run similar pricing tests for the counterpart standard ('no-tax') versions of the models. In the case of the standard CAPM, the null hypothesis is simply that the alphas in the excess returns market models are jointly equal to zero. Alternatively, for the 'no-tax' version of zero-beta CAPM we have the counterpart null hypothesis:

$$H_0: \alpha_i = R_z(1 - \beta_i) \quad i = 1, 2, \ldots N.$$ (9)

In all cases the LRT statistics are adjusted for small sample bias following Gibbons, Ross and Shanken (1989) and MacKinlay and Richardson (1991).

4. Empirical Analysis

4.1 Data

We use monthly data from the Centre for Research in Finance (CRIF) over the period 1974–95. Beta estimates for all stocks are computed using Ordinary Least Squares (OLS) regression of monthly excess returns over a four year sample period. Starting in June 1978, we rank all stocks according to their OLS beta estimates and use deciles to form 10 equally weighted portfolios (portfolio 1 = high-beta stocks; portfolio 10 = low-beta stocks). The portfolio return is then calculated for the subsequent 12 months July to June. Beta estimates are recomputed over the four years to June 1979 and the procedure is repeated until we have portfolio returns for each decile over the period July 1978 to June 1995. Stocks must have at least 20 valid rates of return over each four-year sample period to be included in the beta
ranked portfolios. Stocks that fail this criterion are grouped into an ‘excluded stocks’ portfolio (portfolio 11) that will allow us to test for survivorship bias with this selection criterion.

Thin trading in Australian stocks is extensive and even with monthly data, this bias can be important, particularly in small stocks. To correct for this bias, the weight given to each asset must be contemporaneously negatively correlated with computed returns. We form portfolios weighted by last month’s price relative (one plus last month’s rate of return) and refer to these as Blume Stambaugh (BS) corrected equally weighted portfolios. It should be noted that these portfolios are essentially buy-and-hold indices. Initially beta estimates for individual stocks have been calculated using continuously compounded rates of return in excess of the Treasury Bill rate and a BS corrected equally weighted market portfolio comprising all stocks on the CRIF database.

4.2 Beta Ranked Portfolios Using All Stocks

The results for beta ranked portfolios for the period July 1978 to June 1987 (not reported), are consistent with the US results reported by Black (1993), namely, that high-beta portfolios tend to have negative alpha values while low-beta portfolios tend to have positive alpha values. Over this period a classical tax system operated in Australia and hence the pricing implications of dividend imputation would not have had an effect on Australian returns. The excess monthly return for the BS corrected equally weighted market portfolio is 0.021, indicating a high positive realised market excess return over this period. The correlation between beta estimates and the alpha values for the 10 beta ranked portfolios is –0.99. The relationship between mean excess returns and beta over this period is positive, but not of the strength predicted by the simple CAPM. All these results are consistent with those reported using US data.

Now consider the excess return to the ‘beta factor’ over the pre-imputation tax period, calculated in the same way as in Black, Jensen And Scholes (1972). Specifically, the ‘beta factor’ represents the excess return on a ‘zero-beta’ portfolio constructed to be long in low-beta portfolios and short in high-beta portfolios. The results suggest a statistically significant ($t$-statistic of 5.85) positive excess return for the beta factor of 1.7% (per month) prior to dividend imputation using all

14. Foreign stocks listed on the Australian Stock Exchange (ASX) that are not included in official ASX Indices have also been excluded.

15. Blume and Stambaugh (1983) observe that the measured return on an equally weighted portfolio, rebalanced daily, will have an upward bias due to measurement errors in closing prices. Their evidence indicates that the bid-ask effect in closing prices can be non-trivial for daily returns of small US firms. They also note that aside from the bid-ask effect, the closing price can deviate from the true price if the last transaction occurs before the end of the period.

16. We have also grouped stocks on the basis of their beta estimates relative to a value weighted market portfolio of all stocks on the CRIF database. The average beta values are lower when the value weighted market portfolio is used, but the groupings are similar. The average cross-sectional correlation between the two measures of beta is 0.86 over all years. The analysis reported in this paper is qualitatively robust to the choice of market index on this and all later issues examined. Hence, to conserve space, detailed results using the value-weighted market are not reported but are available from the authors on request.

17. The analysis reported in this section and similar analysis reported in sections 4.3 to 4.5, are robust to the use of one period lead/lag Dimson (1979) betas. Details are available from the authors upon request.

18 For the purpose of brevity, we do not report the results in addition to those discussed in sections 4.3 and 4.4. Details are available from the authors upon request.
stocks. These results indicate that, over this period, investors would have been able to earn excess returns similar to those available from the market portfolio at substantially lower portfolio risk.

The results for the period July 1988 to June 1995 do not reflect the same pattern. Specifically, in this imputation tax environment the negative correlation between beta estimates and alpha values no longer exists. The correlation between beta estimates and the alpha values for the 10 beta ranked portfolios is +0.63. Low-beta assets on average offer lower returns than those predicted by the simple CAPM. Further, estimates of the excess return for the zero-beta portfolio after the introduction of dividend imputation provide a point estimate, −0.6% per month, but not statistically significant. The excess return on the market portfolio is +0.6% per month. After the introduction of dividend imputation, investors appear not to have been able to achieve market portfolio excess returns by constructing a zero-beta portfolio.

There are a number of potential explanations for the changed relationship between returns and beta after June 1988. One noticeable fact is that the excess return for the market portfolio is lower in the post imputation period, 0.6% per month versus 2.1% per month in the pre-imputation period. The difference in these estimates is marginally significant at conventional statistical levels (absolute value of the \(t\)-statistic is 1.94). Accordingly, a critical question is how much the changed relationship between the alpha and beta estimates is due to a lower market risk premium and how much is due to the changed tax system. Further investigation reveals that the lower market risk premium does not explain the changed relationship.\(^{19}\)

### 4.3 Beta Ranked Portfolios Controlling for Industry Classification

A second potential non-tax explanation is that the relationship between return and beta is driven by changed returns to Australia’s two main industry sectors. The resource sector (Australian Stock Exchange (ASX) industries 1–5) comprises approximately one third of the Australian market with the industrial sector (ASX industries 6–24) comprising the other two thirds. To control for the sector effect, we have recomputed the analysis discussed above for each sector separately. Briefly, the results indicate that most industrial stocks earned significant positive alpha and most resource stocks earned significant negative alpha during the pre-imputation sample period. The correlation between the alpha and beta estimates were −0.95 and −0.87 for the industrial and resource stocks respectively, using 10 beta ranked portfolios. After the introduction of dividend imputation stocks from both sectors appear to earn returns with insignificant alphas. The correlation between the alpha and beta estimates were +0.71 and +0.48 for the industrial and resource stocks respectively. Thus the changed relationship between return and beta after the introduction of dividend imputation occurs within both sectors of the Australian market. This conclusion is re-inforced when the estimates of the excess return on the zero-beta factor are recomputed separately for the Industrials and for

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\(^{19}\) Specifically, over a pre-imputation tax period when the value weighted market excess return was close to zero (October 1978 to July 1982), the correlation between beta estimates and the alpha values for the 10 beta ranked portfolios is still strongly negative (−0.96). The excess return on the BS equally weighted market portfolio is 0.012, indicating a small firm premium, and the excess return on the zero beta portfolio is 0.014.
the Resources based portfolios. Specifically, the estimates for both sectors, for both sub-periods, mimic the results obtained for the all stocks portfolios (as discussed in section 4.2).

4.4 Beta Ranked Portfolios Controlling for Size

A third possible non-tax confounding effect concerns the relationship between returns and size. We have split the sample stocks into three size groupings based upon market capitalisation each June 1978–1994. Large stocks comprise the top 100 stocks by market capitalisation each June, medium stocks comprise the next 200 stocks by market capitalisation and small stocks are the remaining stocks. As before, all stocks with less than 20 return observations over the beta estimation period are grouped into a residual portfolio, portfolio 11. Within each size grouping we have split the sample into quintiles based upon their beta ranking each June. The results indicate the negative relationship between alpha and beta prior to imputation seems to hold across each of the size classifications. While the evidence regarding this relationship over the post imputation period is less clear, there is some support for a changed relationship consistent with a tax explanation.\footnote{20}

4.5 Dividend Yield Ranked Portfolios

As discussed in section 3, theory predicts that the measured relationship between returns and beta will be even more steeply sloped than the relationship between beta and returns for securities with similar levels of tax credits. To more directly test this prediction, we re-analysed the sample by forming portfolios based on dividend yields. Specifically, all stocks which meet the minimum of 20 valid observations requirement, were re-allocated into portfolios ranked on dividend yield (portfolios 1 to 10) for non–zero dividend paying stocks; while the remaining zero dividend stocks were all allocated to a single portfolio (portfolio 12). Portfolio 11 reports the results for the excluded stocks portfolio.

The results for the dividend yield ranked portfolios are presented in table 1 for the pre-imputation period (panel A) and for the post-imputation period (panel B). The first thing to observe in this table is that, as expected, the highest risk portfolio in either subperiod is the zero–dividend portfolio (number 12). It should be noted however, that while the presumed monotone relationship between dividend yield and beta risk is moderately in evidence in the pre-imputation period, it is not at all detectable in the post-imputation period. Nevertheless, table 1 shows that during the pre-imputation period, most dividend paying stocks had significantly positive alphas, whereas the aggregated zero–dividend portfolio (portfolio 12) produced a significantly negative alpha. Given that all betas for these portfolios are less than unity, this result is again strongly consistent with the relationship expected in a

\footnote{20. For example, in the case of the large stock portfolios over the post-imputation period, betas are less than unity whilst alphas are negative—in two instances significantly so. In contrast, for the smallest stock portfolio the beta, which clearly exceeds unity, is associated with a significantly negative alpha in the pre-imputation period versus a significantly positive alpha in the post-imputation period. The belief that a tax induced change has occurred, is supported by the excess return on the zero beta portfolio, constructed from large, medium and small stocks. It changes from being significantly positive prior to imputation to being significantly negative after imputation. Large and medium stock beta values are typically below unity and if, as expected these stocks offer positive dividend yields and franking credits, the negative alpha would be consistent with the predictions of the imputation tax model.}
classical taxation environment. The results obtained for the post-imputation period are in direct contrast to those found for the pre-imputation period and, hence, confirm the changed relationship already established in the earlier analysis. That is, in the latter period all dividend-paying portfolios display negative alphas, with the majority being significantly so. Moreover, the aggregate zero–dividend portfolio now offers a significantly positive alpha. Arguably, the changed relationship between return and beta after the introduction of dividend imputation is more clearly detectable when using these dividend yield ranked portfolios.

### Table 1

**Monthly Regression Results: All Stocks/Div Yield Portfolios: Australian Evidence**

<table>
<thead>
<tr>
<th>Portfolio Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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<tr>
<td>Panel A: Period July 1978 to June 1987</td>
<td>β</td>
<td>0.72</td>
<td>0.60</td>
<td>0.40</td>
<td>0.40</td>
<td>0.34</td>
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<tr>
<td></td>
<td>α</td>
<td>–0.001</td>
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<td>0.007</td>
<td>0.003</td>
<td>0.012</td>
<td>0.009</td>
<td>0.006</td>
<td>0.008</td>
<td>0.009</td>
<td>0.010</td>
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<tr>
<td></td>
<td>t(α)</td>
<td>–0.47</td>
<td>0.79</td>
<td>2.96</td>
<td>1.12</td>
<td>4.45</td>
<td>3.23</td>
<td>2.79</td>
<td>3.02</td>
<td>4.26</td>
<td>4.13</td>
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</tr>
<tr>
<td>Panel B: Period July 1988 to June 1995</td>
<td>β</td>
<td>0.55</td>
<td>0.42</td>
<td>0.55</td>
<td>0.49</td>
<td>0.55</td>
<td>0.44</td>
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<td>0.49</td>
<td>0.49</td>
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<tr>
<td></td>
<td>α</td>
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<td>–0.007</td>
<td>–0.005</td>
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<td>–0.007</td>
<td>–0.006</td>
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<td>t(α)</td>
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<td>–1.52</td>
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</table>

**Note:** For each panel, rows 1 and 2 provide estimates of the slope and intercept of a regression of portfolio excess returns against a BS corrected equally weighted market excess returns. Row 3 is a statistical measure of significance of the intercept (compared with zero). Everything is expressed in monthly terms.

Finally, as before we recalculated the excess return on the beta factor using the dividend yield ranked portfolios. The results reveal a statistically significant positive (negative) excess return for the beta factor of 1.2% per month with a $t$–statistic of 4.26 (–1.3% per month with a $t$–statistic of –3.51) in the pre-imputation (post-imputation) period. Yet again, the analysis suggests a changed relationship consistent with the altered taxation environment.

### 4.6 US Market Evidence for Dividend Yield Ranked Portfolios

A final possible non-tax confounding effect that is worthy of analysis is that the observed change is due to the stock market Crash of October 1987. Given the close proximity of the crash and tax change events, devising a direct control for the crash is extremely problematic. The approach we take here is to replicate the main

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21. A further piece of analysis combines the concern about dividend yields, while ranking stocks into portfolios based on betas. Specifically, the dividend paying stocks were re-allocated into decile portfolios ranked according to beta and, likewise, the zero–dividend stocks were re-allocated into decile portfolios ranked according to beta. These results largely confirm the finding of a changed relationship between returns and beta produced repeatedly throughout this paper.

22. We thank an anonymous referee for making this suggestion.
part of our experiment with US market data. Given that the US remains a classical tax environment throughout our sample period, we predict that no major change should take place between our two periods of analysis. That is, a finding of change for the US market would provide indirect evidence against the tax explanation and in favour of an October 1987 stock market crash explanation of our results.

We choose to perform this analysis on the most directly relevant set of portfolios, namely, dividend yield ranked portfolios—hence, providing a point of comparison with the Australian results contained in table 1. Very briefly, the details of how these portfolios are created as follows: monthly dividend yield and return index data (adjusted for dividends) was collected from Datastream\textsuperscript{23} for every company traded on the NYSE and AMEX between July 1978 and June 1995. In July of each year, all firms are sorted into ten portfolios based on their dividend yield value for that month. Equally weighted monthly portfolio returns are then calculated for the next twelve months, July to June. The monthly portfolio returns are subsequently combined to construct a continuous time series of monthly dividend yield portfolio returns for July 1978 to July 1995. The market return proxy for the US was the S&P 500 Composite index and the risk free rate was taken to be the 90–day US treasury bill rate.

The results for the US dividend yield ranked portfolios are presented in table 2 for the pre-imputation period (panel A) and for the post-imputation period (panel B). Table 2 shows that, similar to the case of the counterpart Australian portfolios (panel A, table 1), during the pre-imputation period dividend paying stocks had significantly positive alphas. In contrast, the US aggregated zero–dividend portfolio also produced a significantly positive alpha, as compared to a significantly negative alpha for the counterpart Australian portfolio. In the case of the US dividend yield ranked portfolios, the results obtained for the post-imputation period still provide positive alphas, although with the exception of the zero dividend portfolio, they are statistically insignificant. Hence, this analysis is a little ambiguous except in the case of the zero dividend portfolio which supports the no change hypothesis (significantly positive alpha in both periods).

Calculation of the excess return on the beta factor using the US dividend yield ranked portfolios provides a clearer result. Specifically, in both periods a statistically insignificant negative excess return for the beta factor is produced. Indeed, there is a very close similarity between the economic magnitude of the estimated excess return on the US beta factor across the two periods (–1.1% vs –1.3% per month). This is in strong contrast with the results discussed previously for the Australian data. Finally then, we are comfortable to report that the Australian analysis suggests a changed relationship consistent with the altered taxation environment.

\textsuperscript{23} Datastream is a commercial data provider.
Table 2
Monthly Regression Results for the All Stocks/Div Yield Portfolios:
US Evidence

<table>
<thead>
<tr>
<th>Portfolio Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Zero-Div</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \beta )</td>
<td>1.39</td>
<td>1.32</td>
<td>1.14</td>
<td>1.08</td>
<td>1.04</td>
<td>0.97</td>
<td>1.00</td>
<td>0.87</td>
<td>0.63</td>
<td>1.23</td>
<td></td>
</tr>
<tr>
<td>( \alpha )</td>
<td>0.017</td>
<td>0.009</td>
<td>0.008</td>
<td>0.010</td>
<td>0.007</td>
<td>0.009</td>
<td>0.008</td>
<td>0.009</td>
<td>0.006</td>
<td>0.014</td>
<td>0.015</td>
</tr>
<tr>
<td>( t(\alpha) )</td>
<td>2.98</td>
<td>3.34</td>
<td>3.29</td>
<td>4.50</td>
<td>3.19</td>
<td>3.90</td>
<td>3.53</td>
<td>4.86</td>
<td>3.13</td>
<td>2.47</td>
<td>3.61</td>
</tr>
</tbody>
</table>

Panel A: Period July 1978 to June 1987

| \( \beta \)       | 0.98 | 0.99 | 0.99 | 0.96 | 1.02 | 0.90 | 0.89 | 0.70 | 0.44 | 0.45 | 1.39 |
| \( \alpha \)       | -0.002 | 0.000 | 0.001 | 0.003 | 0.003 | 0.002 | 0.001 | 0.002 | 0.001 | 0.001 | 0.034 |
| \( t(\alpha) \)    | -0.76 | 0.28 | 0.47 | 1.50 | 1.36 | 0.85 | 0.60 | 0.98 | 0.55 | 0.50 | 2.38 |

Panel B: Period July 1988 to June 1995

Note: Row 3 is a statistical measure of significance of the intercept (compared with zero). Everything is expressed in monthly terms

4.7 Multivariate Asset Pricing Tests

While all of the foregoing analysis is highly suggestive that the tax hypothesis is the preferred explanation of the observed changed relationship between beta and return, it logically leads to the question of whether more direct tests of the model support this conclusion. Accordingly, as outlined earlier in section 3, we confront the pricing issue directly by conducting a series of multivariate tests. Further, recall from the previous discussion that the tests are conducted using the Australian beta-ranked zero dividend portfolios. The outcome of these asset-pricing tests are reported in table 3. In this table we report four sets of tests applied to both the pre- and to the post-imputation period. Specifically, we consider the validity of the restrictions imposed by both a simple and zero-beta version of the traditional ‘no-tax’ CAPM and of the imputation-adjusted CAPM.

Initially, consider the outcome of these tests for the pre-imputation subperiod, reported in panel A. First, we observe that the restrictions imposed by the simple traditional no-tax CAPM are rejected at the 5% level of significance. However, the restrictions imposed by its imputation-adjusted counterpart come in with a \( p \)-value of 0.052, suggesting a marginal rejection. Interestingly, the estimate provided for the average market tax yield parameter is \(-0.42\%\) per month and is highly significant. The fact that this estimate is negative (while opposite in sign to that predicted by the imputation model), is consistent with the prediction of Brennan’s model as expected in the classical taxation environment of this first subperiod. Next, consider the results with respect to the zero-beta CAPMs in the post-

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24. All the tests reported in this section were re-worked using a one-lead/one-lag version of Dimson’s (1979) beta in response to the potential thin trading problem. As the results are robust to this variation, they are not reported to conserve space. They are available from the authors upon request.
imputation subperiod. Here we see that the restrictions imposed by the imputation adjusted CAPM are not rejected.

### Table 3

**Multivariate Likelihood Ratio Tests of “No-tax” and Imputation Versions of the CAPM using Zero-Dividend Portfolios**

This table reports the results of multivariate likelihood ratio (LRT) tests. The LRT are adjusted for small sample bias following Gibbons, Ross and Shanken (1989) and MacKinlay and Richardson (1991). The calculated LRT values, which have a chi-squared distribution with \( df \) degrees of freedom, are reported together with the associated \( p \)-values in parentheses. In the case of the simple imputation adjusted version of the CAPM, estimates are provided for the market portfolio tax credit yield, \( \tau_m \), with the associated \( t \)-statistic in parentheses. In the case of the zero-beta imputation adjusted version of the CAPM, estimates are provided for the market portfolio tax credit yield, \( \tau_m \), and the expected return on the zero-beta portfolio, \( R_z \), with the associated \( t \)-statistics in parentheses.

<table>
<thead>
<tr>
<th>Model</th>
<th>Simple CAPM</th>
<th>Zero-beta CAPM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( H_0 ) ( \alpha_i = 0 )</td>
<td>( H_0 ) ( \alpha_i = R_c(1-\beta_i) )</td>
</tr>
<tr>
<td></td>
<td>( \tau_m ) ( \tau_m ) LRT</td>
<td>( \tau_m ) ( \tau_m ) LRT</td>
</tr>
<tr>
<td>\textbf{Panel A: Pre-Imputation Subperiod, July 1978 to June 1987}</td>
<td>( \alpha_i = 0 ) ( 10 - 20.47 ) ( (0.025) )</td>
<td>( \alpha_i = R_c(1-\beta_i) ) ( 9 - 0.0258 ) ( (8.60) ) ( (0.542) )</td>
</tr>
<tr>
<td>“No-tax” CAPM</td>
<td>( \beta_i \tau_m ) ( 9 - 0.0442 ) ( (-3.34) ) ( (0.052) )</td>
<td>( \beta_i \tau_m ) ( 8 - 0.0057 ) ( (2.56) ) ( (0.0380) ) ( (6.76) ) ( (0.864) )</td>
</tr>
<tr>
<td>Imputation-adjusted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAPM</td>
<td>( \alpha_i = 0 ) ( 10 - 28.29 ) ( (0.002) )</td>
<td>( \alpha_i = R_c(1-\beta_i) ) ( 9 - (-0.0098) ) ( (-2.28) ) ( (0.103) )</td>
</tr>
<tr>
<td></td>
<td>( \beta_i \tau_m ) ( 9 - 0.0058 ) ( (5.54) ) ( (0.664) )</td>
<td>( \beta_i \tau_m ) ( 8 - 0.0067 ) ( (3.67) ) ( (1.75) ) ( (0.582) )</td>
</tr>
</tbody>
</table>

| \textbf{Panel B: Post-Imputation Subperiod, July 1988 to June 1995} | \( \alpha_i = 0 \) \( 10 - 28.29 \) \( (0.002) \) | \( \alpha_i = R_c(1-\beta_i) \) \( 9 - (-0.0098) \) \( (-2.28) \) \( (0.103) \) |
| “No-tax” CAPM             | \( \beta_i \tau_m \) \( 9 - 0.0058 \) \( (5.54) \) \( (0.664) \) | \( \beta_i \tau_m \) \( 8 - 0.0067 \) \( (3.67) \) \( (1.75) \) \( (0.582) \) |

Now consider the outcome of these tests for the post-imputation subperiod, reported in panel B of table 3. It can be seen that the restrictions imposed by the simple traditional no-tax CAPM are rejected at the 5\% level of significance. In contrast, the restrictions imposed by its imputation-adjusted counterpart cannot be rejected at any conventional level of statistical significance. Further, the estimate provided for the average market tax credit yield is 0.39\% per month and is highly significant. While this value is perhaps a little on the high side, as empirical estimates go it is not unreasonably so. In sum, a comparison of the results for the two versions of the simple CAPM clearly favours the imputation-adjusted version.

Finally, we turn our attention to the results for the zero-beta CAPMs, displayed on the right hand side of panel B. In the case of the traditional no-tax CAPM, the restrictions cannot be rejected—although the extent of non-rejection is not overwhelming. Interestingly, the estimate of the expected return on the zero-beta portfolio produced by this model is negative (approximately –1\% per month) and statistically significant. This is consistent with the estimates discussed earlier, although it may be a little high given that those numbers relate to excess returns. In
comparison, the restrictions implied by the zero-beta version of imputation-adjusted CAPM also cannot be rejected—although in this case the extent of the non-rejection is far more convincing. The estimate provided for the average market tax credit yield is higher this time at 0.67% per month and again is highly significant. The model also provides an estimate of the expected return on the zero-beta portfolio which is positive but insignificant from zero. While a comparison of the results for the two versions of the zero-beta CAPM are less clear (than the comparison of the results for their simple CAPM counterparts), they provide some preference for the imputation-adjusted version.

5. Summary and Conclusions
The purpose of this paper was to provide evidence on the relationship between beta and return in the Australian market both before and after the introduction of a dividend imputation tax system in July 1987. The research is motivated by US studies, accumulated over a quarter of a century, that have reported a less steeply sloped line relating average return and risk than the slope of the line between expected return and risk implied by the simple CAPM.

Since July 1987, Australia has employed a dividend imputation tax system which provides for tax credits that vary cross-sectionally with the size of dividend payments. The tax credits are only available to Australian taxable investors holding Australian equities. If, as expected, dividend yield is negatively correlated with risk, low-beta stocks are predicted to offer a lower return than that expected under the simple CAPM. Hence, there are taxation reasons to suggest that the relationship between beta and return will be more steeply sloped in the Australia market than in the US market.

Initially, to test this taxation-related hypothesis, we examined the relationship between beta and return using Australian market data, incorporating controls for industry classification, size, dividend yield and the stock market crash of October 1987. Importantly, the basic outcome of our investigation is robust to all of these methodological variations. Specifically, we found consistent evidence in favour of the prediction that the relationship between beta and returns is more steeply sloped in the post-imputation tax environment. In particular, a negative relationship between market model alphas and betas was observed in the pre-imputation period, in contrast to a positive relationship observed in the post-imputation period. Moreover, this evidence in favour of a changed risk/return relationship was re-inforced by the consistent finding of a significantly positive excess return on the zero-beta factor in the pre-imputation period, compared to a zero or significantly negative excess return on the zero-beta factor in the post-imputation period. Finally, we conducted a series of multivariate asset pricing tests. We interpret these results, particularly, in the case of the simple CAPM as re-inforcing our earlier conclusions in favour of the imputation-adjusted CAPM.

Hence, based on the totality of our analysis, we conclude: (a) that there has been a changed relationship between beta and return between the pre- and post-imputation subperiods; and (b) that the tax hypothesis is the preferred explanation of the observed changed relationship.
References


Harris, T., Hubbard, R. & Kemsley, D. 1998, ‘Are dividend taxes and tax imputation credits capitalised in share values?’, Columbia University, unpublished manuscript.

