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**An Empirical Analysis
of the Market Value of
Imputation Tax Credits in the
New Zealand Share Market**

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Abstract

This study argues that the value of imputation tax credits should be taken into account when firms are making decisions on investment, capital structure and dividend policy. The research examines ex-dividend day share price behaviour to determine empirically the estimated value of imputation tax credits in the New Zealand sharemarket, and tests the 'tax-effect hypothesis' that share price behaviour on ex-dividend day reflects marginal investors' after-tax value valuation of income received as dividends as opposed to capital gains. Hence a dividend drop-off ratio model is used to determine whether or not investors have recognised and are receiving the value of imputation tax credits. It was estimated that shareholders do, on average, value tax credits at just under 60% of their face value.

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1. Introduction

A major topic of concern in corporate finance theory is the identification and analysis of the affects that taxes have on the value of the firm and on the firm's decisions regarding its capital structure, investment and dividend policies. Mainstream corporate finance theory prescribes 'text-book' models and techniques to assist firms with these three decisions. However these are within the context of a 'classical' tax system whereby equity investors' income is taxed twice; firstly at the corporate level when a company's profits are taxed, and secondly at the personal level, when dividends are paid to the shareholders from this after-tax income, and are taxed at the relevant marginal tax rate. On the other hand, under an imputation tax system (such as the one operating in New Zealand since 1988), equity investors receive a tax credit for the amount of tax paid at the corporate level, and so the effective tax paid is at the investors' marginal tax rate.¹

Some prior research² has identified, in a general way, how an imputation tax system affects the models and techniques utilised in the investment, capital structure and dividend policy decisions of a firm and has sought to modify the 'textbook' models and techniques accordingly. The adjusted formulae contain parameters representing the value of imputation credits attached to the dividends distributed. Although it is often assumed that the value of the imputation credits equals their face value if they can be utilised or zero if not [Officer (1994) p.4], empirical studies conducted in Australia have indicated that the market value of any imputation credits lies somewhere between zero and the face value.³

The aim of this paper is to report on the results of the empirical investigation carried out to estimate the average market value of imputation credits in the New Zealand sharemarket. This investigation uses empirical models based on Elton and Gruber's (1970) dividend drop-off ratio model.

This model is based on the premise that the change in share price on ex-dividend day⁴ is due to tax liability differences between dividend income and capital gain income.⁵ This is referred to

¹ An explanation of how the New Zealand dividend imputation system operates can be found in Cliffe and Marsden (1992).

² As reviewed in the Section 3.

³ Hathaway and Officer (1992), Brown and Clarke (1993), McKinsey and Co (1994).

⁴ Ex-dividend day is the first day of trading ex the right to receive the dividend.

⁵ This is covered in Section 4.

as the tax-effect hypothesis. Although some earlier studies⁶ carried out on the ex-dividend day behaviour of shares in New Zealand find evidence to support the tax-effect hypothesis, the empirical results of our investigation indicate this is not strictly the case. Investors are still discounting dividends relative to capital gains even when the tax law changes are aimed at eliminating this bias. Hence, this suggests taxation is not the sole explanation for share price behaviour around ex-dividend day. We find evidence of a positive and significant relationship between imputation credits and the drop-off ratio, and that the average market value of imputation credits in the New Zealand sharemarket is estimated to be about 57 percent of the face value.

The remainder of this paper is organised as follows. Section 2 contains a brief literature review. Section 3 identifies specific hypotheses to be tested, specifies several theoretical and empirical models and describes the sample data. Section 4 reports the main empirical results while Section 5 summarises and concludes the study.

2. Brief Literature Review

Much of the literature on the topic of dividend imputation is of a theoretical nature and has concentrated on establishing the impact an imputation tax system has on the value of the firm and then adjusting the models and techniques used in assisting firms with decisions on dividend policy, capital structure and investment. Another strand of literature consists of empirical studies conducted using the dividend drop-off ratio model, some of which have been to establish an estimate of imputation tax credits. This section will collect the main ideas arising from both strands of the relevant literature.

2.1 Dividend Policy

Finance theory, under a classical tax system, suggests that dividend policy is relevant to firm value due to the inequality between tax rates on dividend income and capital gains. Proponents do argue however that the clientele effect⁷ sharply reduces the impact of a firm's dividend policy on its market price. Dividend imputation introduces a stronger argument for

⁶ Bowman, Cliffe and Navissi (1990), Bartholdy and Brown (1995).

⁷ This effect is brought about by investors preferring firms with dividend payout policies suited to their own marginal tax rate.

dividend irrelevancy. However, under certain circumstances, dividends are relevant to firm value in an imputation tax system.

Howard and Brown (1992) use a model of shareholders' total after-tax income to demonstrate that for investors with a marginal tax rate lower than the company tax rate, the optimum dividend policy is a fully imputed 100% payout.⁸ Hamson and Ziegler (1990) develop a numerical example which also demonstrates the preference of shareholders with marginal tax rates less than the corporate tax rate for fully imputed dividends. Their example also shows that investors unable to utilise tax credits will be indifferent to dividend policy. The combination of different investor groups will lead to variation in the valuation of dividends with credits attached. The analysis of Cliffe and Marsden (1992) demonstrates that dividend policy is irrelevant when an investor's personal tax rate equates to the company tax rate and no capital gains tax is applicable. However, when a capital gains tax exists or if an investor's personal tax rate is less than the company tax rate, the investors will prefer imputed dividends.

Therefore, the effect of imputation on dividend policy depends on the ability of the investor to utilise tax credits and on the marginal tax rate of the investor. When investors can utilise tax credits, they will prefer a full payout ratio if their tax rate is lower than the corporate tax rate or if a capital gains tax exists. Dividend policy is irrelevant when company and personal tax rates are equal and investors are not subject to capital gains tax. When investors are unable to utilise tax credits, it is likely they will prefer earnings retention. From these results, one would expect dividend clientele groups to form.

2.2 Capital Structure

A well-supported proposition in finance theory is that the capital structure of a firm can affect the value of the firm when taxes are introduced. One of the objectives of the imputation tax system was to eliminate the bias toward favouring corporate debt over equity resulting from the presence of a gain to leverage under a classical tax system [Arthur Young (1989)]. As with dividend policy, the impact an imputation tax system has on capital structure is dependent on the dividend payout policy and the marginal tax rates of the investors.⁹

⁸ Assuming all shareholders can fully utilise tax credits.

⁹ Although the introduction of corporate and personal taxes is the strongest rationale for the possible existence of an optimal capital structure, there are also other factors that have been proposed as explanations. These include bankruptcy costs, signalling theory and agency costs. Empirical evidence on each of these factors is mixed and therefore inconclusive. Hence, taxes remain the prevailing explanation for the existence of an optimal capital structure [Copeland and Weston (1988)].

Howard and Brown (1992) examine the capital structure issue by comparing after-tax income to investors in a levered company to that in an unlevered company under an imputation tax system. Their analysis shows that when a firm pays imputed dividends, there is a reduction in tax savings from maintaining debt in the corporate structure. When a firm has a 100% dividend payout ratio, the gain from leverage is zero if the marginal tax rate on dividend income is equal to that on debt income. If the marginal tax rate on dividend income is greater than that on debt income, the gain from leverage is positive and vice versa.

Cliffe and Marsden (1992) derive a model representing the value of a levered firm which shows that the value of the debt shield under an imputation tax system is a function of dividend policy, the corporate tax rate, the imputation credits attached to dividends, and the investors' average weighted marginal tax rates on interest, dividends and capital gains. Cliffe and Marsden (1992) show that with a fully imputed 100% dividend payout ratio, corporate debt is an advantage only if the marginal tax rate on dividend income is greater than that on debt income. There should be no preference between debt and equity when investors' marginal tax rates on dividends and interest are equal.

Where a firm retains all earnings, Cliffe and Marsden (1992) state capital structure is irrelevant for those investors whose marginal tax rate on debt income is equal to the company tax rate and are not subject to capital gains tax. However for those investors on a low personal tax rate and/or subject to capital gains tax (for example, superannuation funds and life insurance companies), preference will be for companies that have debt in their capital structure. For investors unable to fully utilise tax credits, Hamson and Ziegler (1990) conclude that an incentive to minimise tax for the company by using debt is likely.

Therefore, the effect on capital structure is dependent on the firm's dividend payout ratio and the tax status of investors. With a full dividend payout policy, leverage increases firm value when the tax rate on dividends is greater than that on interest. When these tax rates are the same, imputation neutralises the advantage of debt over equity. With a less than full dividend payout policy, capital structure is relevant to investors who have a personal tax rate lower than the corporate tax rate or those subject to capital gains tax.

2.3 Investment

One common technique used to evaluate an investment opportunity is discounted cash flow (DCF) analysis. When operating under an imputation tax system, if tax credits are valued by investors, the before-personal-tax return on equity is lowered, and hence a firm's WACC is consequently lowered. The effective reduction in corporate tax when fully imputed dividends are paid should be incorporated in either the cash flows or the cost of capital when conducting investment appraisal.

Officer (1990) and Monkhouse (1993) both stress the importance of ensuring consistency in the definitions of net cash flows and discount rates used in the DCF model. If carrying out investment analysis on a before-tax basis, the cash flows are unchanged but the cost of capital is reduced due to the effective reduction in the company tax rate. Conversely, on an after-tax basis, the cost of capital is unchanged but an adjustment to the cash flows is necessary for the effective reduction in the company tax paid.

The literature regarding the investment decision under dividend imputation covers authors' re-definitions of the cash flows and discount rates used in the DCF model. Officer (1994) gives four alternative definitions of after-tax net cash flows and the appropriate weighted average cost of capital (WACC) under an imputation tax system associated with each cash flow. The capital asset pricing model (CAPM) has been modified by Officer (1994), Lally (1992), Cliffe and Marsden (1992) and Monkhouse (1993) to reflect the value to shareholders of receiving imputation tax credits. These adjusted models are on an after-corporate-tax but before-personal-tax basis. All of these either implicitly or explicitly incorporate the value of the tax credits to the investor. Lally (1992) states that the expected return on a risky asset before personal tax could rise or fall by 3.3% but the most likely effect is a fall of less than 1% and the majority of theoretical cases involve falls in the range of 0-2%.

2.4 Ex-dividend Behaviour of Shares

Many studies have attempted to explain why share prices do not drop by the full amount of the dividend on ex-dividend day. The tax effect of the marginal investor has been the most extensively examined proposition. An alternative explanation is the short-term trading hypothesis which postulates 'professional' traders are attracted to the market by the prospect

of making arbitrage profits from the tax premium as shares go ex-dividend. The dividend drop-off ratio model has been one of the models used to attempt to find evidence to support these hypotheses.

Elton and Gruber (1970) developed the drop-off ratio model to determine the implied marginal shareholder's tax bracket. They conclude that the ex-dividend day share price behaviour could be explained by the tax differential between dividends and capital gains. Other studies finding support for the tax-effect hypothesis include Litzenberger and Ramaswamy (1979, 1980), Booth and Johnston (1984), Eades, Hess and Kim (1984) and more recently, Robin (1991).

Kalay (1982) suggested the alternative hypothesis of short-term trading. Recent studies conducted by Michaely (1991), Heath and Rimbey (1993) and Han (1994) find results that suggest evidence of short-term trading impacting share prices around ex-dividend day.

Introduction of the dividend imputation tax systems in the United Kingdom, Australia and New Zealand has given researchers an ideal scenario to examine share price behaviour around ex-dividend day. Clarke (1992) examined the introduction of imputation in Australia and states that there should be an associated fall in the tax premium on ex-dividend date and an increase in the payout ratios of dividend paying firms. The results were contrary to those expected. He found that after imputation, the drop-off ratios actually decreased, implying investors were demanding a higher tax premium. He then investigated whether investors differentiate between imputed and non-imputed dividend equity prices and he found investors demanded a higher premium for non-imputed dividend paying shares which is consistent with the tax-effect hypothesis. However, the difference in premiums required for imputed and non-imputed dividends was not statistically significant.

Brown and Clarke (1993) also examined the Australian sharemarket ending up with conflicting results. The behaviour observed after introducing capital gains tax was contrary to the tax-effect hypothesis. Their results were consistent with the hypothesis after imputation was introduced, but statistically insignificant.

This form of empirical analysis has also been used in Australia to determine the market value of imputation tax credits. The results of Hathaway and Officer (1992) show a positive value of the tax credits ranging between 58 cents and 82 cents in each dollar of tax credit. Along

similar lines to Hathaway and Officer (1992), McKinsey and Co. (1994) analysed 88 of Australia's largest companies over six years. Their research shows the tax credits carry an average market value of 68 percent of face value.

3. Hypotheses, Models and Data

The current value of a share is theoretically determined as the present value of expected future dividends. As a corporation pays dividends, the share price should immediately decline by the amount paid. However many studies¹⁰ have shown that share prices do not in fact decrease by the full amount of the dividend. The difference in the tax treatment of dividend income and capital gains has commonly been suggested as the reason for these observations. When the effective tax on dividend income is higher than that on capital gains, a premium is required on dividends paid to compensate for the extra tax burden. This premium will ensure that marginal investors are indifferent between trading cum or ex-dividend shares¹¹, and is represented in the market by a share price decline of less than the amount of the dividend paid. The ratio of the change in price when a share is first quoted ex-dividend to the dividend amount is known as the "drop-off ratio" [Brown and Clarke (1993)]. Therefore, when the marginal investor believes that he/she is taxed more on dividends than on capital gains, the drop-off ratio should be less than one [Brown and Clarke (1993)].

Under a dividend imputation tax system, the decline in share price on ex-dividend day should represent the market valuation of the current dividend and attached imputation credit. The economic model used in this study was a dividend drop-off ratio model similar to previous studies conducted in Australia¹² and follows Elton and Gruber (1970). The basis of Elton and Gruber's model is that in equilibrium, the shares must be priced such that the marginal investor is indifferent to buying or selling cum or ex-dividend day [Kalay (1982)]. That is,¹³

¹⁰ Including Elton and Gruber (1970), Poterba and Summers (1984), Eades, Hess and Kim (1984).

¹¹ A share is "cum-dividend" prior to the "ex-dividend day". On the "ex-dividend day", the owner of the share becomes legally entitled to the previously announced dividend. The share is then known as "ex-dividend". Therefore, if the share is sold "ex-dividend", it is the seller who is entitled to receive the dividend and not the buyer when the dividend is finally paid out.

¹² Hathaway and Officer (1992), Brown and Clarke (1993), McKinsey and Co (1994).

¹³ Notation of original models has been modified for consistency within this paper.

$$P_c - t_g(P_c - P_o) = P_x - t_g(P_x - P_o) + Div(1 - t_{div}) \quad (1)$$

where: P_c = the cum-dividend price immediately before the share is quoted ex-dividend;
 P_x = the price immediately after the share is quoted ex-dividend;
 P_o = the price at which the share was originally purchased;
 Div = the cash dividend to be paid on the share;
 t_{div} = the investor's marginal tax rate on dividend income; and
 t_g = the investor's marginal tax rate on realised capital gains.

The left hand side of equation (1) represents the profit from selling the share immediately prior to the dividend payment, and the right hand side is the profit from selling the share immediately after the dividend payment. The two must be equal in order to prevent arbitrage.

Rearranging equation (1) yields

$$\frac{P_c - P_x}{Div} = \frac{1 - t_{div}}{1 - t_g} \quad (2)$$

where the left hand side of equation (2) is defined as the drop-off ratio. Incorporating dividend imputation and transaction costs, the drop-off ratio for buyers may be given as:

$$\frac{P_c - P_x}{Div} = \frac{1 - t_{div}}{(1 - t_g)(1 + \lambda)} \left(1 + \frac{\phi t_c}{1 - t_c} \right) \quad (3)$$

where: λ = the transaction cost per dollar of shares bought;
 ϕ = the proportion of company tax paid and attached as imputation credits;
and
 t_c = the statutory company tax rate;

and for sellers:

$$\frac{P_c - P_x}{Div} = \frac{1 - t_{div}}{(1 - t_g)(1 - \lambda)} \left(1 + \frac{\phi t_c}{1 - t_c} \right). \quad (4)$$

Assuming insignificant transactions costs, the models given in (3) and (4) are equivalent. Either of these models can be used to predict the expected price change per dollar of dividend for the specific investor groups below:

- (a) Resident individual investors who are able to utilise imputation credits, are on the same tax rate as the company tax rate and not subject to capital gains tax:

$$\frac{P_c - P_x}{Div} = 1 - t_{div} \left(1 + \frac{\phi t_c}{1 - t_c} \right) = 1.$$

- (b) Resident individual investors who are able to utilise imputation credits, are on a lower tax rate than the company tax rate, and who are not subject to capital gains tax:

$$\frac{P_c - P_x}{Div} = 1 - t_{div} \left(1 + \frac{\phi t_c}{1 - t_c} \right) > 1.$$

- (c) Resident investors who are able to utilise imputation credits and are subject to tax on dividends and capital gains at the same rate:

$$\frac{P_c - P_x}{Div} = \frac{1 - t_{div}}{1 - t_g} \left(1 + \frac{\phi t_c}{1 - t_c} \right) > 1.$$

- (d) Resident investors exempt from tax on dividend income and capital gains tax:

$$\frac{P_c - P_x}{Div} = 1.$$

- (e) Non-resident investors who are unable to utilise imputation tax credits, and are subject to tax in their country of residence and subject to non-resident withholding tax of 15% (30% if no Double Tax Agreement exists between New Zealand and their country of residence) and not subject to capital gains tax in New Zealand:¹⁴

¹⁴ Not all non-residents are unable to utilise imputation tax credits. If there is 10% or less of foreign ownership in the dividend paying company, the company may pay a "supplementary dividend" in which the tax credits for the New Zealand tax paid can be attached to the dividend.

$$\frac{P_c - P_x}{Div} = 1 - t_{div} < 1.$$

The above demonstrates the range of possible share price drop-offs. The difficulty of obtaining the tax status of every investor in a company leads to the inability to determine the price drop-off from these theoretical predictions. These drop-off ratios must be determined empirically with econometric models.

Prior to the introduction of the dividend imputation tax system, with no capital gains tax, investors would require a premium when receiving dividend income. Therefore the drop-off ratio would be less than one. After the introduction of the imputation tax system, the drop-off ratio is expected to change, with the direction and magnitude of the change dependent on the characteristics of the marginal investor. Therefore, the first hypothesis to be tested involves establishing the mean drop-off ratio attributed to the payment of dividends in New Zealand on an annual basis between 1987 and 1995. The theoretical null hypothesis is:

H1: There was no change in the drop-off ratio from year to year.

Rejection of this null hypothesis indicates investors were recognising some value of the tax credits. The expected change in the drop-off ratio was an increase toward one after the introduction of the imputation tax system.

Equations (3) and (4) predict a difference in the observed drop-off ratios as the proportion of imputation differs. Where dividends are not imputed (i.e., $\phi=0$), the drop-off ratio should be less than that if the dividend were imputed. To establish more closely whether imputation has had an effect on the dividend drop-off ratios, analysis was carried out on the sample classifying the dividends as either imputed or non-imputed. Hence the second theoretical null hypothesis is:

H2: There is no difference between the drop-off ratios for shares with imputed dividends and shares with non-imputed dividends.

Rejection of this null hypothesis supports the proposition that investors do recognise some value of the tax credits. The drop-off ratio for shares with imputed dividends was expected to be greater than that of shares with non-imputed dividends.

Under an imputation tax system, changes in the company and personal tax rates affect the value to the investor of receiving imputation tax credits. Such changes during the estimation period were separated into four tax regimes as listed below:

- (i) *Prior to April 1988 - Pre-imputation tax regime (TR1);*
- (ii) *1 April 1988 to 31 March 1989: Post imputation with a drop in the company tax rate from 48% to 28% and individual tax rates range from 19.5% to 40.5% (TR2);*
- (iii) *1 April 1989 to 31 August 1993: Post imputation with company tax rate at 33% and individual tax rates at 24% or 33% (TR3); and*
- (iv) *1 September 1993 to 31 October 1995: Introduction of supplementary dividends (TR4).*

From these four tax regimes a difference in the drop-off ratios was predicted if investors were recognising the impact taxes have on the value of dividends and imputation credits versus capital gains. Hence the third theoretical null hypothesis is:

H3: There is no change in the drop-off ratio between the pre-imputation period and the subsequent tax regimes.

Rejection of this null hypothesis indicates investors have recognised not only the initial value of introducing imputation, but the subsequent value as changes in the taxing of income arose. It was expected the drop-off ratio would get nearer to one in each of the subsequent tax regimes.

Because some investors are unable to utilise tax credits, it was expected that the market value of the imputation credits would in fact be less than the face value. Therefore, the fourth theoretical null hypothesis is:

H4: For investors in New Zealand companies, the average market value of the imputation credit is equal to its face value.

Rejection of this hypothesis indicates the average market value does not equate with the face value of credits.

From the theoretical models presented above, several empirically estimable models were derived. There were two models (namely, *unconditional* and *conditional*) used to test hypotheses H1 and H2. Firstly, the *unconditional* model is given by equation (5):

$$\frac{P_{c,i} \left(\frac{I_x}{I_c} \right) - P_{x,i}}{Div_i^*} = \alpha + w_i \quad (5)$$

where: $P_{c,i}$ = the cum-dividend price of share i immediately before the share price is quoted ex-dividend;
 $P_{x,i}$ = the price immediately after the share is quoted ex-dividend;
 I_x = market index on ex-dividend day;
 I_c = market index on cum-dividend day;
 Div_i^* = $Div \left(1 + \frac{\phi t_c}{1 - t_c} \right)$;
 Div_i = cash dividend on share i ;
 α = a parameter which measures the value of a dollar of dividends relative to a dollar of capital gains; and
 w_i = is a random error term with $E(w_i)=0$ and $Var(w_i)=P_i^2 \sigma^2$,

Secondly, the *conditional* model is represented by equation (6):

$$\frac{P_{c,i} \left(\frac{I_x}{I_c} \right) - P_{x,i}}{P_{c,i}} = \beta \frac{Div_i^*}{P_{c,i}} + e_i. \quad (6)$$

where β = a parameter which measures the value of a dollar of dividends relative to a dollar of capital gains; and
 e_i = is a random error term assumed to be normally, identically and independently distributed.

These two models are based on the model presented by Lakonishok and Vermaelen (1983), i.e.,

$$P_{c,i} - P_{x,i} = \alpha Div_i + u_i$$

where: u_i = random price change with $E(u_i)=0$ and $Var(u_i)=P_i^2\sigma^2$ (i.e., non-constant variance).

This represents the price ‘drop-off’ attributable to a share i going ex-dividend under a classical tax system. The non-constant variance in the error term comes from a standard assumption in finance literature that the standard deviation of the price change is proportional to the share price. Accordingly, several authors¹⁵ have scaled the model by the dividend which gives:

$$\frac{P_{c,i} - P_{x,i}}{Div_i} = \alpha + \frac{u_i}{Div_i}$$

This is the basis of the *unconditional* model. Wood (1991) and Davidson and Mallin (1989) rearrange this *unconditional* model to stabilise the error term which gives:

$$\frac{P_{c,i} - P_{x,i}}{P_{c,i}} = \beta \frac{Div_i}{P_{c,i}} + e_i,$$

where e_i is a random error term assumed to be normally, identically and independently distributed. This is the basis of the *conditional* model.

Incorporating dividend imputation required utilising the grossed-up dividend variable

$$Div_i^* = Div_i \left(1 + \frac{\phi t_c}{1 - t_c} \right)$$

instead of Div_i in both of the equations. A further enhancement to these models was the adjustment made to account for market movements on ex-dividend day. Eades et al (1984) and Kalay (1982) highlight the point that opening ex-day prices should be used as opposed to

¹⁵ Elton and Gruber (1970), Kalay (1982), Booth and Johnston (1984), Michaely (1991).

closing prices. One way to correct for this is to adjust the cum-dividend price by the ratio of the market index on ex-dividend day to the index on the cum-dividend day.

To test the remaining two hypotheses, an unrestricted specification of the *conditional* model was used. The *conditional* model assumes the imputation credits attached to the dividends are fully valued by investors. Therefore the coefficient of the imputed amount is restricted to equal the coefficient of the non-imputed amount multiplied by $t_c/(1-t_c)$. The unrestricted specification is:

$$\frac{P_{c,i} \left(\frac{I_x}{I_c} \right) - P_{x,i}}{P_{c,i}} = \gamma + \delta \frac{Div_i}{P_{c,i}} + \lambda \frac{IC_i}{P_{c,i}} + \omega_i \quad (7)$$

where: γ = the intercept representing a component of the drop-off unrelated to the dividend and imputation;
 δ = represents the drop-off for dividends as a proportion of the dividend;
 λ = represents the incremental drop-off for imputation credits as a proportion of the face value of the credits;
 IC = dollar amount of imputation credits;
 Div = dollar amount of the dividend; and
 ω_i = error term with $E(\omega_i) = 0$ and $Var(\omega_i) = \sigma^2$.

The statistical models¹⁶ included a dummy variable (*Crash*) to control for noise due to the “1987 crash” which was equal to one if the ex-dividend day fell within the defined crash period (19 October 1987 to 12 November 1987) and zero otherwise and a dummy variable (*DY*) to account for one-off events¹⁷ associated with particular observations and equal to one if the event occurred within the ex-dividend period and zero otherwise.

The data were collected from the New Zealand Stock Exchange and consisted of observations of all listed companies paying dividends (final, interim and special) from January 1987 to October 1995. The data file contained the company name and stock exchange code, the type of dividend paid, the ex-dividend date, amount of the dividend, amount of imputation tax attached and amount of any withholding tax paid. The total number of observations was 1,845. The data file was then reduced to include only those firms in the Top 40 as at the last

¹⁶ Listed in Appendix 1 along with summary diagnostic results.

¹⁷ Examples of such events include the company under a takeover offer, the company buying or selling subsidiaries, announcement of financial results.

trading day of the month they paid their dividend. This reduction was mainly due to thin trading issues and the inability to collect all the information required for many of the stocks. Preference share dividends were excluded due to the different tax status of these shares.¹⁸

To avoid non-related share price movement, these observations were screened for companies who may have changed their basis of quotation within the 6 day period prior to and including ex-dividend day (for example, bonus issue, rights issue, share entitlement, share split or new issue). Observations were also eliminated if they had not traded on the cum-dividend or ex-dividend day or if the dividend was non-cash (i.e. bonus shares were allotted in lieu of dividend). Closing share prices were then collected from the National Business Review (NBR) and The Press for the following periods:

- ex-dividend day (t);
- the trading day before ex-dividend day (t-1); and
- five trading days before ex-dividend day (t-5).

The final number of observations is 373. The table below details the make-up of these observations.

Table 1
Data Details

Year	Number (N)	N imputed dividends	N non-imputed dividends
1987	43	0	43
1988	42	5	37
1989	31	12	19
1990	31	15	16
1991	41	22	19
1992	42	27	15
1993	46	36	10
1994	57	47	10
1995	40	35	5
Total	373	199	174

¹⁸ Prior to 1 April 1992, dividends received by corporate shareholders were exempt income and hence not liable to taxation except for preference share dividends.

The Barclays Industrial Index (1 January 1987 to October 1991) and the NZSE 40 Gross Index (October 1991 to October 1995) were used for the market index to adjust closing prices. These index figures were obtained from the NBR and The Press.

4. Empirical Results

To enable comparison with previous studies, two observation intervals were used to test H1 and H2. The “one-day interval” is the period from the close of trading on cum-dividend day to the close of trading on ex-dividend day (adjusted for market movement). The “one-week interval” is the period from the close of trading five trading days prior to ex-dividend day to the close of trading on ex-dividend day (adjusted for market movement). The rationale of the “one-week interval” period is that this period serves as a control sample for the testing of share price behaviour around ex-dividend day. Support for the tax-effect hypothesis would be the ex-dividend day being distinguishable. Only the “one-day interval” period was used to test H3 and H4. The use of this period only was mainly because the results of the estimation over the two periods indicated more noise in the weekly data (as would be expected). Previous studies that have investigated periods of up to eleven days surrounding the ex-dividend day all conclude that the main impact on the change in price, relative to the dividend, occurs over the one-day interval.¹⁹ For the purpose of brevity, the following discussion will concentrate on the results from the estimation of the conditional model for the one-day interval except where otherwise noted.

Results of testing H1 suggested statistically significant drop-off ratios of less than one were present over the sample period.²⁰ These results support the prediction of the tax-effect hypothesis that investors prefer capital gains to dividends due to the difference in taxation. If there were no changes to the taxation laws over this period, a constant mean drop-off ratio would be expected. However there were tax law changes during the estimation period, and although the results of the one-day interval *conditional* model rejected the null hypothesis of a constant mean, the remaining estimated models did not. Therefore, a constant mean drop-off ratio could not be dismissed and is contrary to what is predicted under the tax-effect hypothesis. With the changes that occurred, if taxes are the main explanation for ex-dividend

¹⁹ Brown and Walter (1986), Eades et al (1984), Brown and Clarke (1993).

²⁰ Result tables may be obtained from authors.

day share price behaviour, a drop-off ratio nearing one over the estimation period would have been expected. This did not appear to be the case.

With the introduction of dividend imputation, theoretically, the post-imputation drop-off ratio should be nearer to one than that of the pre-imputation period. If all investors could utilise tax credits and were taxed at the same tax rate as companies (with no capital gains tax) the tax-effect hypothesis would predict a drop-off ratio of one. However, not all investors can utilise the tax credits and therefore a drop-off ratio of less than one would be predicted. There are also the investors paying tax at a rate lower than that of companies and hence would prefer to receive dividends. This leads to a drop-off ratio greater than one. Overall, a drop-off ratio close to one but probably less than one would be expected. The results from this study are opposite to what theory predicts.

The mean drop-off ratio decreased from 0.871 in the pre-imputation period to 0.645 in the post-imputation period. Both means are statistically significantly different from zero at the 1% significance level. The null hypothesis of no statistically significant difference between the pre-imputation and post-imputation mean drop-off ratios was rejected, however, the direction of the change in the drop-off ratio is opposite to that predicted. This change is inconsistent with the tax-effect hypothesis. Pre-imputation evidence indicates investors preferred receiving capital gains over dividends.²¹ Post-imputation evidence indicates this is still the case. There has been a significant change in magnitude and direction in the drop-off ratio since the introduction of imputation. However this change is contrary to expected changes under the tax-effect hypothesis.

These results are consistent with results from Clarke (1992) and Brown and Clarke (1993), who also found the post-imputation drop-off ratios decreasing from the pre-imputation drop-off ratios.

The testing of H2 was to establish further whether investors are recognising the impact imputation has on the after-tax value of dividends compared to capital gains. The results of testing this hypothesis indicate they are not. If, in New Zealand, the tax-effect hypothesis holds, then the mean drop-off ratios of imputed dividends would be greater than those of non-imputed dividends. This is due to the expectation that investors require a lower premium on

²¹ Although sample data from prior years to 1987 would be useful to support this further.

imputed dividends because they have less tax to pay on this dividend income. The results from testing H2 show that in the year in which imputation was introduced, the imputed mean drop-off ratio was greater than the non-imputed drop-off ratio. This is consistent with what theory predicts. However, in the following years, the opposite occurred. Over the entire estimation period, the mean drop-off ratio of non-imputed dividends is 0.784 and of imputed dividends is 0.597 (both significant at the 1% level). For the entire estimation period, the null hypothesis of no difference between imputed and non-imputed mean drop-off ratios was rejected at the 1% significance level.

However, rejection of the null in this case does not lead to “acceptance” of the alternative. The alternative hypothesis is that the mean drop-off ratio of imputed dividends is greater than that of non-imputed dividends. The results suggest this is not the case. The results are inconsistent with the tax-effect hypothesis but the difference between the two types of mean drop-off ratios is statistically significant. This tends to lend itself to the possibility of some factor other than taxes underlying the share price behaviour on ex-dividend day in the New Zealand sharemarket.

A plausible explanation of these results have been alluded to by Brown and Clarke (1993) and Hathaway and Officer (1992). If the marginal shareholders on ex-dividend day are those who cannot utilise imputation credits, (e.g. foreign investors and other non-tax paying investors) then the drop-off ratio for imputed dividends would be an average of that of non-imputed dividends.

The results from the test of H3 are again inconsistent with the predictions of the tax-effect hypothesis. Each of the changes to the tax laws in New Zealand since 1987 should have resulted in investors preferring to receive dividends as opposed to capital gains. This would have been reflected in a movement of the dividend drop-off ratio closer to one in each of the tax regime periods. There was no statistically significant evidence found to support this movement toward one. This suggests therefore, that when investors receive dividends, the premium being required is not changing in line with the changes in the tax laws that are making dividends theoretically more appealing. Brown and Clarke (1993) and Hathaway and Officer (1992) report similar findings.

The final hypothesis to test was whether the market value of the imputation credit was equal to its face value. The results of this study indicate that the coefficient on the imputation credit variable does have a positive and significant relationship with the observed drop-off ratio. This supports the tax-effect hypothesis. Estimation of model (7) indicates the value of the imputation tax credit is approximately 57 percent of face value with a company tax rate of 33 percent. The implication of this finding is that when the modified models and techniques are applied, this value can be incorporated to give a more realistic impact of imputation on corporate policy. In comparison to studies carried out in Australia, Hathaway and Officer (1992) value the tax credit at between 77 and 82 cents per dollar of tax credit and McKinsey and Co (1994) suggest a value of 68 percent of face value of the imputation credit.

The value established in this study should represent an average of: investors who can fully utilise tax credits and hence would be expected to value the credits at face value; and those investors who cannot utilise the credits and would therefore carry a value of zero. The results from the previous hypothesis tests however put doubts on the above representation. It could be that other factors are influencing share price behaviour and hence it is not solely the tax credit utilisation ability of investors that is underlying this value.

5. Summary and Conclusion

An empirical model based on the dividend drop-off ratio model was used to estimate the average market value of imputation credits in the New Zealand sharemarket. This value is estimated at about 57 percent of the face value of the tax credit.

The other interesting findings of this study questions the previously held belief of tax induced pricing behaviour in the New Zealand sharemarket. Most of the results point to evidence suggesting taxation is not the sole explanation for share price behaviour around ex-dividend day in New Zealand.

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Appendix

The empirical models used to statistically analyse equations (5) and (6) are shown below.

For the *unconditional* mean drop-off ratio (*i.e.* equation (5)) the empirical model is:

$$DOR_{t,i} = \alpha_{t,y} D_{t,i,y} + \psi_t Crash + \chi_t DY_{t,i} + e_{t,i}$$

where
$$DOR_{t,i} = \left(\frac{P_{c,i} \left(\frac{I_x}{I_c} \right) - P_{x,i}}{Div_i^*} \right) \quad \text{for } t = 1 \text{ (one-day interval);}$$

for $t = 2$ (one-week interval);

- $D_{t,i,y}$ = Dummy variable representing the annual observations and equal to 1 if the ex-dividend day fell in that year and zero otherwise where $y = 1 \dots 9$;
- $Crash$ = Dummy variable to control for noise due to the “1987 crash” equal to one if the ex-dividend day fell within the defined crash period (19 October 1987 to 12 November 1987) and zero otherwise;
- $DY_{t,i}$ = Dummy variable to account for one-off events associated with particular observations and equal to one if the event occurred within the ex-dividend period and zero otherwise; and
- $e_{t,i}$ = error term with $E(e_{t,i}) = 0$ and $Var(e_{t,i}) = P_i^2 \sigma^2$.

For the *conditional* mean drop-off ratio (*i.e.* equation (6)) the empirical model is:

$$DOR_{t,i}^* = \beta_{t,y} DD_{t,i,y} + \psi_t Crash + \chi_t DY_{t,i} + u_{t,i}$$

where
$$DOR_{t,i}^* = \left(\frac{P_{c,i} \left(\frac{I_x}{I_c} \right) - P_{x,i}}{P_{c,i}} \right) \quad \text{for } t = 1 \text{ (one-day interval);}$$

for $t = 2$ (one-week interval);

$$\begin{aligned}
DD_{t,i,y} &= D_{t,i,y} \text{ multiplied by } \frac{Div_i^*}{P_{c,i}}; \\
Crash &= \text{Dummy variable to control for noise due to the "1987 crash" equal to one if the ex-dividend day fell within the defined crash period (19 October 1987 to 12 November 1987) and zero otherwise;} \\
DY_{t,i} &= \text{Dummy variable to account for one-off events associated with particular observations and equal to one if the event occurred within the ex-dividend period and zero otherwise; and} \\
u_{t,i} &= \text{error term with } E(u_{t,i}) = 0 \text{ and } \text{Var}(u_{t,i}) = \sigma^2.
\end{aligned}$$

The estimable form used to examine the *unconditional* mean drop-off ratios for imputed dividends and non-imputed dividends is:

$$DOR_{t,i} = \rho_{t,y} D_{t,i,y} + \zeta_{t,y} DI_{t,i,y} + \psi_t Crash + \chi_t DY_{t,i} + e_{t,i}$$

where $DI_{t,i,y}$ = Dummy variable representing the annual observations of dividends carrying imputation credits and equal to 1 if the ex-dividend day fell in that year and zero otherwise where $y = 1 \dots 9$; and

other variables as previously defined.

The estimable form used to examine the *conditional* mean drop-off ratios for imputed dividends and non-imputed dividends is:

$$DOR_{t,i}^* = \eta_{t,y} DD_{t,i,y} + \phi_{t,y} DDI_{t,i,y} + \psi_t Crash + \chi_t DY_{t,i} + u_{t,i}$$

where $DDI_{t,i,y}$ = $DI_{t,i,y}$ multiplied by $\frac{Div_i^*}{P_{c,i}}$.

The statistical model representing (7) was:

$$DOR_i^* = \gamma + \delta DIV_i + \lambda IC_i + \omega_T TR_T + \psi Crash + \chi DY_i + \varepsilon_i$$

where:
$$DOR_i^* = \left(\frac{P_{c,i} \left(\frac{I_x}{I_c} \right) - P_{x,i}}{P_{c,i}} \right)$$

$$DIV_i = \frac{Div_i}{P_{c,i}};$$

$$IC_i = \frac{IC_i}{P_{c,i}};$$

TR_T = Dummy variable representing the three post-imputation tax regimes where $T=2,3,4$ and equal to one if the ex-dividend day fell within the tax regime, zero otherwise;

$Crash$ = Dummy variable to control for noise due to the “1987 crash” equal to one if the ex-dividend day fell within the defined crash period (19 October 1987 to 12 November 1987) and zero otherwise;

DY_i = Dummy variable to account for one-off events associated with particular observations and equal to one if the event occurred within the ex-dividend period and zero otherwise; and

ε_i = error term with $E(\varepsilon_i) = 0$ and $Var(\varepsilon_i) = \sigma^2$.

Summary of Diagnostic Tests

The JB test results of the initial estimation of the models used in this research revealed non-normality in the estimated residuals. Examination of the standardised residuals identified particular observations having large residual values.²² This outcome resulted in the inclusion of dummy variables to account for these one-off events. Some of the re-estimated models continued to indicate non-normality of the residuals. However, due to the large sample size employed in this research (373 observations), it was decided that the re-estimated models including the dummy variables for the one-off events were sufficiently statistically adequate for testing the proposed substantive hypotheses.²³

Estimation results indicate that the distribution of residuals is not symmetric due to negative skewness. There is also evidence of excess kurtosis, meaning the distribution has ‘thicker’ tails than a normally distributed sample set. The results from the one-day interval estimation

²² Observations with standardised residuals of greater than absolute values of 2.5 were noted.

²³ Due to the inclusion of these dummy variables, the *unconditional* model is no longer strictly unconditional. However the conditioning on the dummy variables for the one-off events is for statistical purposes only, not theoretical and hence reference is still made to the unconditional model.

indicate a negative skewness which is greater using the *unconditional* model compared with the *conditional* model. The one-week interval estimation results indicate a negative skewness for the *unconditional* model but a positive skewness for the *conditional* model. The measure of excess kurtosis is closer to zero (i.e. normal distribution measure) when estimating the *conditional* model as opposed to the *unconditional* model for both observation periods. Previous studies²⁴ on ex-dividend day share price behaviour have also found skewness and excess kurtosis, often being greater in the weekly data than the daily data. However, the skewness has been positive as opposed to the negative skewness found in this study.

Results from the B-P-G test for heteroscedasticity on each of the models indicated the presence of heteroscedasticity in the residuals. This was dealt with by using White's (1980) Heteroskedastic-Consistent Covariance matrix estimation in SHAZAM. Examining the R² values from each of the estimations, the *conditional* model has greater R² values than the *unconditional* model and the one-day interval period has higher R² values than the one-week interval period. These measures of explanatory power between models and intervals are consistent with previous studies. On the whole, the results of the diagnostic statistics do not indicate that the empirical models are seriously misspecified.

²⁴ Davidson and Mallin (1989), Brown and Walter (1986), Brown and Clarke (1993).