Motivations for Derivatives Usage among New Zealand Firms

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Abstract

Theoretical research argues that using derivative instruments for risk management can add value to a firm if there are capital market imperfections such as costs associated with financial distress, progressivity in tax rates, and conflicts of interest between the fixed claimholders and the shareholders.

For comparison this study repeats Berkman and Bradbury's (1996) research to provide non-survey evidence on the use of derivative financial instruments from the 1999 audited financial reports of 117 New Zealand firms.

Three models are used to analyse derivative use. The first two models use a Tobit regression model with the fair and contract values scaled by the market value of the firm to measure the extent of derivative use. Due to possible misclassification of derivative and non-derivative users, the third model uses a binary dependent variable to represent if a firm is a user or non-user of derivatives.

Support is found for some of the theoretical models of derivative use for risk management. However, these results are sensitive to the way in which the derivative user is classified.

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Introduction

The past few decades have seen strong growth in firms' use of derivative instruments as global markets have become more integrated. Along with the use of derivative instruments there has also been strong growth in the research studies addressing what firms are using derivatives for, why firms are using derivatives and whether or not these firms are better off using derivatives.

According to Modigliani and Miller (1958), no financial contract can alter firm value. Portfolio theory implies that as long as financial instruments are fairly priced, using derivatives does not benefit investors. However, theoretical studies argue that financial derivatives can increase firm value if there are certain market imperfections. These market imperfections are financial distress costs, convexity in the tax function and agency costs (see Smith and Stulz, 1985; DeMarzo and Duffie, 1991; Froot, Scharfstein and Stein, 1993).

While the majority of empirical studies concentrate on American firms, the object of this research is to explore which theories of derivative use best describe the motivations for New Zealand firms. New Zealand is an ideal country in which to evaluate derivative use, as it has a small open economy that relies heavily on imports (raw materials) and exports (predominantly primary products). Therefore, a high number of New Zealand firms are exposed to volatile changes in exchange rates, interest rates and commodity prices. Consequently, financial derivative instruments – forwards, futures, swaps and options - are commonly used to manage these changes.

Previous research by Berkman and Bradbury (1996), using 1994 data for New Zealand non-financial firms, evaluated various proposed motivations for using derivatives. Their results are largely insensitive to the measure of derivative usage and generally in line with theoretical models of corporate risk management.[1] In surveying New Zealand firms, Prevost, Rose and Miller (2000) find that the extent of derivatives usage by New Zealand firms has increased substantially in recent years. This calls into question the results of Berkman and Bradbury (1996) based on data from an earlier era.

This research uses the same variables and re-examines what influences the demand for derivative instruments proposed in Berkman and Bradbury (1996) i.e. they reduce the expected costs of financial distress, reduce taxes, and reduce agency costs. This is

[1] Berkman and Bradbury use the fair value and contract (notional) value of derivative contracts, both scaled by the market value of the firm to represent the level of derivative usage.

achieved by examining the assumption that firms use derivatives for hedging purposes by comparing various operational and performance measures of derivatives-using firms with these measures for firms that do not use derivatives. This research examines hedging with derivatives for risk management not derivative use for enhancing risk, i.e. speculating.

This research contributes to the existing literature on derivative use in the following ways. First, it follows Berkman and Bradbury's (1996) study using the same classifications for dependent variables and independent variables to analysis the motives for derivative use using a sample of 1999 non-financial firms. The analysis is achieved with the use of a Tobit model. Two models using different dependent models are examined. The first model (Model A) uses the fair value of derivative contracts outstanding at balance date scaled by firm value as the dependent variable, and the second model (Model B) uses the contract amount at balance date scaled by firm value as the dependent variable. The independent variables are the same as Berkman and Bradbury and are used to proxy for the various motives for derivative use. The results are compared with those of Berkman and Bradbury. Secondly, this research extends the Berkman and Bradbury study by changing some of their independent variables and re-testing the 1999 sample. Thirdly, as there may be errors caused by misclassification of derivative and non-derivative users, the independent variables are re-examined using a binary dependent variable to re-classify derivative and non-derivative users.

In line with theoretical models of derivative use for risk management, support is found for the economies of scale (size) hypothesis as large firms use more derivatives and as derivative use increases with leverage. This is similar to the findings of Berkman and Bradbury. However, there is no support for the theory that New Zealand firms use derivatives to lower agency costs or to lower expected taxes (the tax hypothesis appears to be less important for firms in 1999 than for the firms sampled by Berkman and Bradbury). Furthermore, contrary to Berkman and Bradbury the results do not support the suggestion that firms use substitutes instead of derivatives to lower the agency cost. However, support is found for the theory that firms using derivatives have a better ability to pay their dividend from their earnings.

Similar to Berkman and Bradbury, the results provide no support for the proportion of overseas assets to total assets and the investment hypotheseses. As the asset growth to cash flow coefficient has the opposite sign to that hypothesized in Model B, the earnings-price ratio has the opposite sign to that hypothesized in Model A. The coefficients for Tobin's *q* and market-to-book have the wrong signs, although they are not significant.

The results are sensitive to the way in which derivative users are classified. To be classified as a derivative user in the Tobit models the firm must have a derivative contract amount recorded in their financial statement. This will misclassify firms that use derivatives during the year but do not have a contract outstanding at balance date. Therefore, firms are reclassified as a user or non-user of derivatives by additional information in their annual reports. A Logit model is used with a binary dependent variable that takes the value one if a firm is a derivative user and 0 otherwise.

Like the fair value and contract amount classification used in the Tobit model, the results for derivative and non-derivative users' classification under the Logit model provide support for the economies of scale hypothesis, and that derivative use increases with leverage. The difference is that, with the new classification of derivative users, support is found for the investment hypothesis, with both the asset growth, market-to-book and earnings-price ratio coefficients having the correct directional sign (the earnings-price coefficient is significant at a 5% level). There is an ambiguous result for the derivative substitute variables. The coefficients for the dividend variable have the same relationships as the Tobit regression. However, the alternative capital instruments coefficient is in the direction hypothesized and significant, while the liquidity coefficient is contrary to expectations and is significant in the opposite direction. The relationships for Tobin's q and both new dividend variables remain the same as the original Tobit regressions. There is once again no support provided for the managerial ownership hypothesis.

Section 1 provides a review of the theoretical literature and presents the results of previous research on the motivations for firms to use derivative instruments to hedge. Section 2 presents the variable measurements, hypothesis to be tested and contains details of the sample to be tested. Section 3 contains the results of the empirical analysis and a comparison with Berkman and Bradbury's results. Section 4 presents information on the reasons for the new variable measures, the new hypothesis to be tested and results. Conclusions are presented in Section 5.

1 Motivations for firms to hedge with derivative

1.1 Reduction in expected taxes

The structure of the tax code sometimes means it is advantageous for firms to hedge with derivatives. If a firm faces an effective tax function that is convex, the

effective tax rate for the firm will be low in years when taxable income is low and high in years when taxable income is high. This will affect the variability of a firm's income.

Progressivity in a firm's marginal tax schedule means that its effective marginal tax function will be convex. Tax preference items, such as investment tax credits and tax-loss carry backs and carry forwards, enlarge the convexity of the tax function. This is because these tax preferences offset part of a firm's tax liability. Investment tax credits offset a stated maximum fraction of a firm's tax liability. This results in a downward shift in the effective tax schedule to reflect the value of the tax credit. The convexity of tax-loss carry forwards is created because firms with tax losses do not receive the immediate payment from the government equal to the product of the corporate tax rate and the dollar amount of the loss. Instead of receiving such payments, firms can carry losses forward to offset taxable income, whereas positive taxes are due when earned. Therefore, it is the limitation on the ability to immediately receive the tax-loss payment that leads to a convex tax function and the incentive to hedge.[2]

If a firm faces a convex effective marginal tax function, it can use derivatives to reduce the variability of its taxable income and minimize the present value of its tax loss, therefore increasing firm value (see Mayers and Smith, 1982; Smith and Stulz, 1985; Rawls and Smithson, 1990; Stulz, 1996; and Oosterhof, 2000). The logic behind the effects on taxes of hedging with derivatives is that if the effective tax function is convex, the effective tax rate will be low in years when taxable income is low but, in years when taxable income is high, the tax rate will be high. If a firm uses derivatives to hedge its taxable income, the tax increase in high income years would be less than the tax reduction in low income years, which would lead to a firm's expected tax liability falling and a smoothing in the variability of its income. If using derivatives reduces the variability of a firm's pre-tax value, then by Jensen's Inequality, the expected tax liability is reduced and the value is increased. Thus, the more convex the effective tax schedule the greater the possible benefits of using derivatives.

This suggests that the economic incentives for firms to use derivatives should be higher if the expected amount of a firm's pre-tax income is in the progressive region of the tax schedule and if the firm has a greater number of tax preference items.

Another tax incentive to hedge is related to debt capacity. Stulz (1996) argues that hedging is used to lower the probability of "left-tail" outcomes, which will lead to increased debt capacity and interest expense write-offs, and to lowering the costs of financial distress. Ross (1997) and Leland (1998) show that by hedging, firms can increase

[2] It should be noted that the tax-loss carry forward variable may also proxy for financial distress.

their debt capacity. If firms add leverage in response to greater debt capacity, the associated increase in interest deductions will reduce the tax liability and increase firm value (see DeAngelo and Masulis, 1980). The increased debt capacity could be driven by other non-tax factors. For example, a firm may increase debt to generate external funding to invest in profitable projects, even though it might not benefit from the interest tax deductions. This may lead to financial distress.

In contrast to Smith and Stulz's convexity hypothesis, it is implied in Froot, Scharfstein and Stein (1993) that, due to the negative relationship between expected taxes and the expected availability of internally generated cash flows, decreasing expected taxes will indirectly increase the availability of internally generated funds. This effect leads to more internally generated funds becoming available for investment. Therefore the increase in firm value is attributed to the increase in investment of positive net present value projects.

1.1.1 Evidence from New Zealand studies

Berkman and Bradbury (1996) investigated 116 non-financial firms listed on the New Zealand Stock Exchange to compare firms that do use derivatives with firms that do not use derivatives. They find that firms in New Zealand that use derivatives are more likely to have tax-loss carry forwards. This is the result of univariate and multivariate tests and adds strong support to the theory that firms in New Zealand use derivatives to minimize the present value of tax losses.

Berkman and Bradbury (1998) evaluate derivative use by New Zealand government-owned enterprises and compare this with the use of derivatives by New Zealand listed firms.[3] Such a comparison is possible, as New Zealand government departments and state-owned enterprises (SOEs) have adopted a commercial accounting culture with full accounting compliance to the accounting standards issued by the New Zealand Society of Accountants.[4] Berkman and Bradbury state that, at a national level, there is no reason for an SOE to minimize the present value of taxes as the gain is completely offset by the loss of another government department. However, SOEs operate as decentralized units and strive to maximise the value of assets under their direct control. Hence the tax-loss hypothesis is equally as valid for an SOE as it is for private firms, as the

[3] Unlike other countries the term "state-owned enterprises" in New Zealand relates to a specific statutory form of government organization. The term "government-owned organization" is used as a general description and "state-owned enterprise" is used for the specific New Zealand descriptions.
[4] The New Zealand Society of Accountants has developed a single conceptual framework and reporting standards that apply to privately owned, publicly owned and government organizations.

goal of both SOEs and private firms is to maximise shareholders' value. In evaluating the tax-loss carry forward hypothesis, Berkman and Bradbury (1998) find that 38 percent of the listed firms and 33 percent of the SOEs have tax-loss carry forwards. Their results indicate that derivative use increases with the existence of tax losses.

Berkman, Bradbury and Magan (1997) surveyed 79 New Zealand non-financial firms asking if they used derivatives to minimize expected taxes. None of the surveyed firms indicated that they used derivatives to minimize expected taxes. In a survey of 175 New Zealand public and private firms, Prevost, Rose and Miller (2000) find that the single most important objective of derivative use for risk management is to manage real cash flows. This is consistent with the standard motivations of derivative use in risk management, such as reducing expected taxes. However, managers did not explicitly state that they used derivatives to reduce the expected tax payments by actively managing pre-tax income.[5]

1.1.2 Evidence from other research

Empirical evidence from other countries is mixed as it relates to Smith and Stulz's tax proposition. Evidence supports the idea that firms are more likely to use derivatives if there is a greater likelihood that a firm's pre-tax income falls in the progressive region of the tax schedule (see Mian, 1996; Nance, Smith and Smithson, 1993). However, Geczy, Minton and Schrand (1997), Goldberg, Godwin, Kim and Tritschler (1998), and Graham and Rodgers (2001) find no support for hedging as an important determinant of derivative use to reduce the expected tax liability if a firm's tax function is convex. In a survey of 75 UK multinationals, Joseph and Hewins (1997) find a weak result for the tax motive and conclude that this motive is not important.

Mian (1996), in a sample of 3,022 US corporations, finds an increasing use of derivatives by corporations with more foreign tax credits. Nance et al. (1993), evaluating 169 US firms, find that the more investment tax credits they have, the more likely firms are to use derivatives. Both researchers report inconsistent evidence on the impact of tax-loss carry forwards. Geczy et al. (1997), examining currency derivative use for 372 US non-financial firms from the Fortune 500 in 1990, do not find supporting evidence for the tax-loss hypothesis.

Graham and Smith (1999) using Compustat data and a Monte Carlo approach, simulate tax savings for a large number of US firms to derive the possible benefits from

[5] This finding is similar to other surveys (Bodnar, Hayt and Marston, 1996, and 1998).

hedging. They point out that the tax savings from hedging can be extensive in some extreme cases and could lead to tax savings worth millions of dollars. Consequently, hedging pre-tax income can lead to significant increases in firm value.

In investigating the advantages of hedging and debt capacity relating to taxes, Graham and Rogers (2001), in a sample of US corporations, find that leverage exerts a positive influence on the use of derivatives. They find that the incentive to hedge to increase debt capacity is positively related to a firm's tax rate. Thus hedging leads to greater debt capacity. Hedging increased the debt ratio of their sample by 3%, with the capitalized value of the incremental tax shield resulting from this increased debt equalling 1.1% of firm value.

In summary, mixed support has been found in New Zealand based research for the tax hypothesis. The empirical research finds strong support, while survey research finds no support. Empirical studies from other countries are also inconclusive with research finding weak or no support for the tax motive.

1.2 Reduction in the expected cost of financial distress

The expected costs of financial distress give rise to situations where a firm might hedge. Mayers and Smith (1982) and Smith and Stulz (1985) suggest that hedging will increase the value of a levered firm when the costs of financial distress are decreasing in firm value. Rawls and Smithson (1990) show that the expected costs of financial distress are a positive function of two factors. The first is the probability of encountering financial distress if the firm does not hedge and the second is the cost imposed on a firm by possible bankruptcy. These costs, which can be substantial, are the direct costs (legal cost, re-organisation costs) and indirect costs (loss of customers, higher compensation required by contracting parties).

Hedging can decrease the variance of firm value by reducing the volatility of cash flows, therefore reducing the likelihood of financial distress. This happens by limiting the states in which a firm will default on its payments to its fixed claimholders. Smith and Stulz (1985) also state that bond covenants can reduce the cost of financial distress. Bond covenants may force shareholders to take action that they may otherwise avoid. As binding bond covenants can force a firm to alter its investment policy, hedging can reduce the likelihood that such covenants become binding.[6] Bond covenants use accounting

[6] See sub-section on under-investments in the agency cost section for a more detailed example of the investment relationship.

numbers to define states where a firm's activities are restricted, so a firm that wants to decrease the probability of financial distress must manage its accounting numbers so that bond covenants do not become binding. Hedging the balance sheet and income statement may become the goal of managers.

The amount of debt (leverage) in a firm's capital structure can influence the need for hedging. Nance et al. (1993) claim that the argument of reducing the cost for financial distress implies that the benefits of hedging should be greater the larger the fraction of fixed claims in a firm's capital structure. The higher the fixed claims in the capital structure the higher the probability that a firm may encounter financial distress, especially as the volatility of a firm's earnings increases. Hedging, therefore, will lower the risk of default and improve debt terms or capacity.[7] Leland, (1998) examined optimal ex-post risk strategies and showed that the extent of hedging and hedging benefits increases with default costs. Using an $\alpha = 0.5$ (α is default cost), hedging permitted the firm to raise its leverage from 28 to 38 percent. It is important to emphasize that theory indicates that the hedging/leverage relationship can have two effects: hedging can increase debt capacity (and tax deductions), but higher leverage can increase incentives to hedge (due to the increased probability of financial distress).

Mello and Parsons (2000) show that financial constraints vary with time and so should a firm's need for derivatives. This creates a time-varying pattern of hedging intensity that seems consistent with findings that firms do not hedge systematically and that hedging is done on a short-term basis. Their predictions that severely constrained firms may not be able to hedge (firms do not have the access to the extra cash flow they need to purchase derivative instruments for a hedging program as their cash flow is constrained) offers a new explanation to the reported weakness of the relationship between hedging and leverage. It also offers an explanation why empirical research has frequently found an apparently stronger relationship between larger firms and hedging. This may be influenced by specific characteristics typical of small and financially weak firms. More analysis is need for the relationship of derivative use and financial constraints.

1.2.1 Evidence from New Zealand studies

Berkman and Bradbury (1996) provide evidence that firms in their sample use derivatives to reduce the expected cost of financial distress. Using the debt ratio as a

[7] Note that there are also the indirect costs of financial distress due to the possibility of bankruptcy. If hedging avoids bankruptcy the increase in firm value may be larger since the indirect cost of financial distress will be avoided.

measure of expected cost of financial distress they find that hedging increases with the debt ratio. This assumes that firms with high debt face a higher probability of encountering financial distress. This result is interpreted as evidence that greater expected financial distress costs cause firms to use more derivatives. Berkman, Bradbury and Magan (1997) find that all of the New Zealand firms surveyed in their study use derivatives to reduce the volatility of earnings, cash flows and firm value.[8] This is similar to the findings of Prevost, Rose and Miller (2000) who discover that the most important reason firms give for hedging is to minimize fluctuations in real cash flow. None of these studies explicitly state that managers hedge in order to avoid certain costs of financial distress (i.e., the question was not asked).

Berkman and Bradbury (1998) provide evidence that New Zealand listed firms use derivatives to reduce the expected cost of financial distress, while SOEs make less use of derivatives as they have lower expected financial distress costs. The probability of financial distress is low for SOEs due to implicit government guarantees and they often operate in less than fully competitive markets and are able to pass on losses to customers.

1.2.2 Evidence from other research

The empirical evidence does not present strong support for the hypothesis that a firm's managers try to increase firm value by hedging in order to manage the expected cost of financial distress. There was no supporting evidence found by Mian (1996) and Nance et al. (1993). Nance et al. (1993) remark that the lack of significance found for the expected cost of financial distress might be explained by possible interactions between the leverage and growth opportunity variables used (firms with high growth opportunities have less leverage and hedge more). Geczy et al. (1997) find mixed evidence. However, Goldberg et al. (1998) replicate Nance et al.'s (1993) study using their own data, but use Nance et al.'s (1993) variable definitions, models and estimation methods. Their findings are consistent with Nance et al. (1993). They find a positive coefficient for the leverage variable and the ratio of long-term debt to size. They find a negative coefficient for earnings before interest and taxes. In their own model specification, Goldberg et al. (1998) find that users of interest rate derivatives have higher leverage.

[8] Dolde (1995) and Haushalter (2000) find the same relationship for hedging and debt ratio in their studies from the US.

Joseph and Hewins (1997) find evidence that a firm that minimizes any loss to operational cash flow exhibits less variability on its market value of secured debt.[9] A survey by Bodnar, Hayt, and Marston (1998) finds that US non-financial firms use derivatives to manage their cash flows. They conclude that this is consistent with minimizing financial distress costs.

1.3 Reduce Agency Costs

Hedging can increase shareholder wealth if it relieves the sub-optimal investment policies of managers, thereby reducing the agency costs. This sub-optimality results from unfavourable situations, which are influenced by specific risk-sharing relationships between financing participants. These sub-optimal relationships are risk shifting, under-investment, information asymmetry and managerial risk aversion.

1.4 Risk shifting

The first unfavourable situation is referred to as the risk-shifting problem, introduced by Jensen and Meckling (1976). In risk shifting, a firm may participate in risky investment projects with a negative NPV, as the potential gains accrue to shareholders whereas the potential losses are borne by the bondholder. Bondholders who anticipate this behaviour will protect themselves by increasing the required rate of return or by imposing bond covenants that constrain the shareholder. For instance, binding bond covenants can force the firm to alter its investment policy, as covenants will restrict the behaviour of managers by stipulating a desired debt-equity ratio. Hedging can reduce the likelihood that covenants will become binding, and may reduce costs associated with debt financing if debt holders can alleviate the expected opportunity of being expropriated, which will increase firm value. The question arises: do firms use derivatives to lower risk (hedge) or to enhance risk (speculate)?

1.4.1 Empirical evidence

Chan (2000) in her study of publicly listed New Zealand firms over the period 1994-1998, finds evidence that, on average, New Zealand firms use derivatives to reduce their risks not to increase them. This supports Prevost, Rose and Miller's (2000) survey

[9] They find that multinationals use derivatives more often, and mostly to protect against interest rate and exchange rate risks.

findings that New Zealand firms use derivatives to hedge rather than to speculate. Chan (2000) finds that derivative users have lower total risk and idiosyncratic risk but not significantly different systematic risk, exchange rate and interest rate exposure. Derivative users also have smaller variations in risk measures when compared to non-derivative users. Guay (1999) finds that the riskiness of a firm decreases after the initiation of a derivative program. Allayannis and Ofek (2000) find evidence that the firms in their study, on average, reduce their exchange rate exposure with the use of currency derivatives, thus hedging and not speculating. Hentschel and Kothari (2001) examine what effects derivatives have on a firm's risk characteristics for 425 large U.S. corporations. They find that the firms in their sample that disclose large derivative positions have similar risk characteristics to firms that use few or no derivatives. All of these studies indicate that managers are using derivatives for hedging purposes rather than speculating and increasing risk.

1.5 Under-investment

The second unfavourable situation is Myers (1977) under-investment problem, in which management may prefer to pass up positive investment projects if the gains from the projects accrue to bondholders.[10] Forgoing these investment opportunities is a rational decision if too little of the value of the potential new investment goes to shareholders. This is because investment in a project with an overall positive NPV has a negative NPV from the shareholders' viewpoint. Therefore, shareholders acting in their own best interest will forgo these investment opportunities, which would reduce the overall firm value.

Bessembinder (1991) shows that a firm can reduce the incentives of equity holders to under-invest by hedging with derivatives. This is because as hedging transforms some of the individual future default states to non-default states, the number of states in which equity holders are the residual claimholders is increased. This will reduce the number of states in which debt holders will not be paid and debt becomes less sensitive to investment. Shareholders will be more willing to provide funds for positive NPV projects as they gain from further investment. In this situation, shareholders have more to lose if they engage in risky projects and the risk-shifting problem will be reduced. The net effect of hedging is that fixed claim holders will require a lower rate of return, which adds additional value to a firm.

[10] The more financially constrained a firm is the higher the probability it will pass up the positive investment project.

Froot et al. (1993) and Mello and Parsons (2000) show that firms hedge in order to mitigate the under-investment problem of Myers and Majluf (1984), by ensuring that a company has enough internally-generated cash available to make value-enhancing investments. According to this view, firms that hedge should have a higher level of investment than non-hedging firms. Thus, if firms use derivatives for hedging purposes, then derivative-using firms should have a higher level of investment than firms that do not use derivatives. However, the implication of Froot et al. (1993) is that it is not the existence of growth options that is a determinant of a firm's hedging policy, but the risk of not being able to convert a growth option into assets in place.

Two common proxy measures have been used to capture a firm's investment opportunities. The first of these is a firm's market-to-book ratio value.[11] The rationale for this proxy is that it measures the likelihood that a firm will have positive growth opportunities. This ratio provides a relative measure of growth opportunities. This is because the market value of the firm is considered to reflect the value of the firm's assets in place plus its future growth opportunities, while the book value represents the value of assets in place.

The second measure is normalized research and development expenditure.[12] Research and development cost is used as a proxy on the basis that these expenses are predictors of the development of future projects. Therefore, firms with a higher ratio of research and development expense to firm value should hedge the volatility of firm value.

1.5.1 Evidence from New Zealand studies

Berkman and Bradbury (1996) use an earnings-price ratio (see variable section for an explanation for the earnings-price ratio) to proxy for the long-term growth prospects of a firm. To incorporate Froot et al's (1993) argument, they use an asset growth/cash flow variable as a proxy for a firm's ability to generate enough cash to finance its investment program.[13] They find little support for the under-investment hypothesis using the earnings-price ratio and no support for the hypothesis using the asset growth/cash flow variable. Berkman and Bradbury (1998), using only an asset growth/cash flow variable to proxy for the ability to generate enough cash to finance a firm's investment program, find no support for the under-investment hypothesis for New Zealand listed firms and SOEs.[14]

[11] This measure is used in studies by Nance et al. (1993) and Main (1996).
[12] See Nance et al. (1993), Geczy et al. (1997).
[13] The asset growth/cash flow variable is calculated as the log of the ratio of the current year's change in net tangible assets plus depreciation to net income plus depreciation.
[14] Other growth proxies are not used, as there is no share (market) price for SOEs.

1.5.2 Other empirical evidence

Nance et al. (1993) and Mian (1996) examine whether firms with more growth opportunities in their investment opportunity sets are more likely to hedge. Using research and development to market value and the book-to-market ratio as their proxies for a firm's growth opportunity, Nance et al. (1993) find that hedging is greater for firms with more growth options, while Mian (1996) finds contradictory evidence across the different measures used.

Goldberg et al. (1998) replicating Nance et al.'s (1993) study with their own data find results that are consistent with Nance et al. (1993), but find a much greater significant positive relationship for derivative use in response to the research and development variable. In their own model specification, Goldberg et al. (1998) find no relationship between users of interest rate derivatives and growth opportunities, but do find that foreign exchange derivative users have more growth opportunities. In evaluating currency hedging, Geczy et al. (1997) find that derivative use is directly related to growth opportunities (research and development expenditure), which is consistent with the use of derivatives to reduce the under-investment problem.

In investigating the under-investment hypothesis, using a sample of non-financial firms in 1995 from Compustat, Gay and Nam (1998) use a Tobit model with five growth independent variables. They find significant positive relationships between a firm's derivative use and its growth opportunities.[15] Gay and Nam (1998) in an investigation into Froot et al.'s (1993) cash flow-investment relationship, find that firms with enhanced investment opportunities and relatively low cash flow are greater users of derivatives.

1.6 Information asymmetry

DeMarzo and Duffie (1991) argue that hedging with derivatives can benefit equity holders when managers have private information about the risks of a firm's expected payoffs.[16] Equity holders support managers' hedging because it reduces the noise concerning the variability of the firm's payoffs associated with the uninformed equity holder's information set. This reduced noise allows equity holders to make better optimisation decisions concerning their portfolios. In equilibrium, DeMarzo and Duffie (1991) show hedging to be optimal when the costs of hedging are less than the benefits of

[15] The five independent variables used are normalised research and development, market-to-book, Tobin's Q, price-to-earnings ratio and a market adjusted cumulative abnormal return.
[16] DeMarzo and Duffie (1995) argue that the informational effect of manager's hedging activity depends on the disclosure requirements and accounting information made available to the shareholders.

reduced noise in investors' information on the risks of the firm. From this model, equity holders of firms with greater informational asymmetry should obtain the largest benefit if the firm uses derivatives.

1.6.1 Empirical studies

In evaluating information asymmetry with a firm's decision to adopt derivatives, Geczy et al. (1997) use as their proxy measures the percentage of institutional ownership and the number of investment firms with analysts following a firm. Their logic in choosing the two proxies is based on an assumption that, with a greater number of analysts following a firm and a larger level of institutional ownership, the information concerning a firm's risks and payoffs is better known and more available. Since the proxies are positively related to the availability of information, Geczy et al. hypothesise that they are negatively related to the probability of hedging. They find no support for DeMarzo and Duffie's (1991) information asymmetry argument for hedging and conclude that information asymmetry between managers and shareholders is not an important incentive for hedging decisions.[17]

1.7 Managerial risk aversion

Smith and Stulz (1985) claim that since employees, suppliers and customers may not be able to fully diversify the risks inherent in their claim on the firm they may therefore require additional compensation for bearing this non-diversifiable risk.[18] Shapiro and Titman (1986) suggest that a firm can lower the indirect cost of financial distress by hedging. If a firm hedges to lower the probability of financial distress, then risk-averse stakeholders with undiversified claims, such as suppliers, customers and employees, will require a lower risk premium for contracting with the firm. With limited liability, the amount of risk that can be allocated to the shareholder is restricted by the company's capital stock. If a firm uses derivatives to reduce its earning's variability, thereby increasing the firm's value, the risk-premium and the extra compensation required by the contracting parties may be reduced. This requires the cost of hedging to be lower than the reduction in the extra compensation required.

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[17] Gezcy et al. (1997) report a high correlation between analyst following the firm, firm size and other variables. They test the joint significants of group coefficients using an F-test. This does not change their conclusion.

[18] Employees will demand higher wages if the probability of being laid off is greater. Suppliers set unfavourable terms in long-term contracts with firms whose prospects are unsure. If customers are concerned with a company's ability to service its products in the future or fulfill warranty obligations, they will be reluctant to purchase a firm's products.

Of all contracting parties, managers warrant special attention. As managers are risk averse, they will require extra compensation to bear the non-diversifiable risk that is inherent in their claim on the firm. Managers may demand higher salaries or even an equity stake in the firm if the risks of failure or insolvency are great. Shareholders hire managers because of the expectation that their special expertise will increase a firm's value. However, managers cannot use this expertise unless they have some discretion in the choice of their actions. Yet, unless faced with proper incentives, managers will not maximize shareholders' wealth. Therefore, a manager must be rewarded for the increase in firm value.

Stulz (1984) and Smith and Stulz (1985) argue that the risk attitude of management can explain a firm's hedging decision. As management make the hedging decisions their expected utility depends on the distribution of future firm value. If management hedges they change the distribution of future firm value and, thus, their expected utility. This is often achieved through a manager's compensation contract, which must be designed so that it increases the expected utility of the manager when the firm's value is increased.

In a simple two-period model, Smith and Stulz (1985) show that by hedging, management can change the distribution of a firm's payoffs. If their end-of-period wealth is a concave function of the firm's value, management's expected utility would be increased.[19] Therefore, management will completely hedge the firm, as their expected income will be maximized.[20] However, if management is faced with a convex wealth function but their expected utility remains concave, the optimal strategy will be to eliminate some, but not all, uncertainty through hedging. If management's expected utility function is convex, Jensen's Inequality indicates that management's utility will be maximized if the firm is not hedged. Compensation provisions like stock options or bonuses can make management's expected utility a convex function of firm value. In this situation, it may be in management's best interest to increase the riskiness of the firm. This is because management has downside protection in the form of their base salary, but can profit from the upside potential by exercising their call options.

Portfolio theory implies that, as long as instruments are fairly priced, hedging for risk management does not benefit investors. Investors can inexpensively manage the non-systematic risk of their portfolio through diversification. Therefore, a firm's required rate

[19] Since the utility of wealth is strictly concave, it follows from Jensen's Inequality that the utility of expected wealth is larger than the expected utility of wealth, i.e., $U(E[W_1]) > E[U(W_1)]$. Utility will be maximized if firm value is hedged completely.

[20] This result is equivalent to the proposition of Arrow (1963), in which a risk-averse individual offered fairly priced insurance fully insures (see also Huberman, Mayers and Smith (1983)).

of return does not depend on total risk but only on the systematic risk of its cash flows. For owners who hold well-diversified portfolios, hedging instruments that work mainly on diversifiable risks do not provide a lower discount rate. Nevertheless, some firms have owners that do not hold well-diversified portfolios. This is most likely the case in firms where ownership is concentrated. Thus, in closely held firms, the risk aversion of the firm's owners can provide an incentive for management to hedge and reduce the volatility of firm value (Mayers and Smith, 1982).

To capture management ownership concentration, researchers have used the percentage of the outstanding firm's shares that are owned by managers and their associates. The rationale for this measure is that the higher the percentage of managerial ownership the less diversified are the managers and the greater the need to use derivatives to lower their risk.

In summary, hedging programs depend on the way personal wealth is linked to firm value. In widely held firms, using derivatives to hedge depends on managerial incentive schemes and performance measures. Management is expected to hedge if the manager's compensation is linearly dependent on the value of the firm. However, management may hedge less if their compensation features have more option-like features, or it may be more advantageous for management to increase the risk of the firm if the incentives are option-like. In contrast, closely held firms are expected to engage in hedging programs.

1.7.1 Empirical studies

The empirical evidence to date has not readily supported management utility maximization. Empirical evidence concerning managerial option ownership shows it is unclear whether derivatives are used to reduce or increase risk. However, Tufano (1996), (analysing risk management strategies in the U. S. gold mining industry), and Geczy et al. (1997), both find a significant positive relationship between managerial option ownership and the use of derivatives. In evaluating the relationship between managerial share ownership and the use of derivatives, Tufano (1996) finds a significant positive relationship. Fok, Carroll and Chiou (1997) find a negative relationship, while Berkman and Bradbury (1996) and Geczy et al. (1997) find no significant relationship. As the relationship between managerial share ownership and the use of derivatives is unclear it will be left to empirical analysis to provide evidence if managers hedge to reduce the volatility of firm value therefore diversifying their risk.

Joseph and Hewins (1997) examine the hypothesis that firms use derivatives to minimize the riskiness of the firm because customers and suppliers are likely to demand

more substantial guarantees the more uncertain a firm's cash flow. They find that those firms that place emphasis on this motive exhibit less variability in their long-term income.

1.8 Firm size

The size of a firm may affect the level of incentive to use derivatives. Small firms (and start-up firms) are more likely to have volatile pre-tax income, which leads to a greater level of income in the progressive region of the tax schedule. The expected costs of financial distress are higher for small firms, as the costs of financial distress are relatively higher (see Warner, 1977).[21] Small firms can use derivatives to lower their income variability, which will minimize the present value of tax losses and lower the expected costs of financial distress. Therefore, small firms have the most to gain from using derivatives to reduce the volatility of their cash flows as long as the cost of using derivatives is not too large. However, the predicted impact of size may be indeterminate due to informational and transactional scale economies.

As transaction costs exhibit economies of scale, large firms are expected to gain more from derivative use as they are probably in a better position to bear these costs, as well as the cost of setting up a derivative program for risk management.[22] In this situation, it is expected that larger firms would be likely to use derivatives.[23] As there is no clear prediction concerning size, it remains for empirical research to provide evidence of whether a firm's derivative activity is related to economies of scale or to establish whether small firms use derivatives to minimize taxes and to minimize the expected cost of financial distress.

1.8.1 Evidence from New Zealand studies

Berkman and Bradbury (1996) find evidence that large firms are more likely to hedge with derivative securities than are small firms. This is also the result of survey-based studies by Berkman, Bradbury and Magan (1997) and Prevost, Rose and Miller (2000).[24] Berkman, Bradbury and Magan (1997) find that 100% of large NZ firms compared to 65% of large US firms, 70% of medium NZ firms compared to 30% of medium US firms, and 36% of small NZ firms compared to 12% of small US firms use

[21] Financial distress can lead to bankruptcy and reorganization or liquidation, and a firm in this situation will encounter direct legal costs (as well as indirect costs).
[22] As firm size is a function of scale economies in organization and production, firm size is considered in many studies as endogenous.
[23] This argument is backed by Bodnar, Hayt and Marston (1998) who find that 83% of large firms in the US use derivatives as opposed to 12% of small firms.
[24] These findings agree with those of Bodnar, Hayt and Marston (1998) in their survey of US firms.

financial derivatives. Prevost, Rose and Miller (2000) find similar results for large firms but find that 50% of small firms surveyed use some form of derivative security.

1.8.2 Evidence from other research

The empirical evidence from other countries presents strong support for economies of scale in relation to the size hypothesis. Nance et al. (1993), Mian (1996) and Geczy et al. (1997) find evidence that large firms rather than small firms are more likely to hedge with derivative securities. Goldberg et al. (1998) replicate Nance et al.'s (1993) study and find a much greater significant positive relationship for derivative use in response to size.

In summary, the results on firm size are consistent with the proposition that there are significant transaction costs as well as economies of scale associated with the use of derivatives, and that size is not an indicator for the costs of financial distress. However, as a large number of small firms in New Zealand use derivatives, size may not be an important factor. Empirical analysis is needed to explore this further.

1.9 Substitutes for Hedging

Nance et al. (1993) and Berkman and Bradbury (1996) hypothesise that hedging substitutes lower the likelihood of firms using off-balance sheet hedging instruments. They imply that the likelihood is lower due to: 1) the more alternative capital instruments are employed (i.e., the more convertible debt and/or the more preference stock the firm issues), 2) the more liquid the firm's assets, and 3) the smaller the firm's dividend payout.

The nature of a firm's operation will influence the need for derivative instruments. As New Zealand is a small open economy, local firms are reliant on imports or exports. This exposes New Zealand firms to a high degree of foreign currency risk, which may lead them to use derivatives to manage this risk.

1.9.1 Alternative capital instruments

Nance et al. (1993) suggest that the firm can control problems between shareholders and bondholders by restructuring assets and liabilities on its balance sheet instead of using financial instruments to reduce exposure to financial price movements. The firm can control agency problems by issuing convertible debt or preferred stock instead of straight debt. Convertible debt reduces the incentive to hedge by helping to control the conflict of interest between shareholders and bondholders. Hedging with financial instruments reduces the variance of the firm's cash flow, thereby reducing the variability of the firm's equity. In contrast, convertible debt includes an embedded option

on the firm's assets that makes the liability more sensitive to changes in firm value and reduces the sensitivity of equity value to firm value change.

The probability of financial distress can be reduced by issuing preferred stock instead of debt. Preferred stock is similar to debt as it pays periodic dividends rather than interest. However, reducing the debt-equity ratio by issuing preferred stock rather than debt can be unattractive as it reduces the debt-related tax shields and increases the firm's tax liability. While preferred stock does not produce tax shields, a firm can omit a preferred dividend payment without being forced into bankruptcy. Bankruptcy filing is effectively inevitable if a firm does not meet its interest payments on debt.

1.9.2 Liquidity and Dividends

Firms can also reduce the probability of default if they invest in more liquid assets. Assets with greater liquidity help to assure bondholders that there are funds available to make interest payments.

A firm's dividend policy will influence the need to hedge. A dividend restriction makes it more likely that funds will be available to 1) pay the bondholders which may reduce the agency conflict, or 2) make value-increasing investments therefore controlling the under-investment problem. The more often fixed claims are covered, the lower are the expected costs of financial distress and agency problems (see Smith and Warner, 1979). However, firms do not like to change their dividend policies (see Miller and Rock, 1985, and John and Williams, 1985) and therefore may require lower volatility in cash flows so that they can maintain their dividend payout.[25] [26] This means firms would use derivatives to smooth cash flow so they can maintain their dividend payout.

1.9.3 Empirical studies

In testing the relationship between derivative use and hedging substitutes, Nance et al. (1993) and Berkman and Bradbury (1996) find that firms that use hedging instruments have significantly less liquid assets and higher dividend yields. They find no significant difference in the use of convertible debt or preferred stock. Gay and Nam (1998) test the relationship between alternative capital and find no significant difference in the use of convertible debt or preferred stock between derivatives users and non-users.

[25] Rozeff (1982) shows that dividends can also lower agency costs but raise the transaction costs involved in external financing.
[26] For empirical analysis on the signaling nature of dividends see Benartzi, Michaely and Thaler (1997).

2 Variables, Hypothesis and Sample Selection for Re-testing Berkman and Bradbury (1996): Empirical Evidence on the Corporate Use of Derivatives.

There are two main directions that empirical studies of derivative use have followed. The first direction has been to determine which theory of hedging with derivatives best describes what is observed in the data (see Berkman and Bradbury, 1999; Geczy et al., 1997; Mian, 1996; Nance et al. 1993; Tufano, 1996; Graham and Rodgers, 2000; and others). The alternative approach has been to examine the impact of derivative use on a firm's risk or value (see Guay, 1999; Chan, 2000; Allayannis and Ofex; 2000 and Allayannis and Weston, 2001).

This chapter examines the first of these directions, by analysing which theory best explains the incentives for a firm's derivative use. The theory indicates that firms use derivatives to: firstly, reduce expected taxes when they face progressive tax rates, secondly, reduce the cost of financial distress and, thirdly, reduce agency costs. This research repeats Berkman and Bradbury's (1996) New Zealand empirical study. It uses the same hypotheses, data and a variable classification to determine which theory best describes the motivation for derivative use by New Zealand non-financial firms. The results are compared to Berkman and Bradbury's results to determine if the incentives for using derivatives have changed. Berkman and Bradbury evaluated firm data for the 1994 financial year; this research uses firm data for the 1999 financial year.

2.1 Variables and Hypotheses

2.2 Dependent Variable

As the ideal measure of derivatives use is unavailable, Berkman and Bradbury (1996) use the fair value and contract value of derivative contracts outstanding at balance date scaled by the market value of the firm to represent the level of derivative use.[27] According to the New Zealand Accounting Standard issued by the Institute of Chartered Accountants of New Zealand (ICANZ), Financial Reporting Standard 31: Disclosure of Information about Financial Instruments (FRS-31),[28] firms are required to disclose the

[27] The market value of the firm is defined in the independent variable section.
[28] FRS-31 came into effect for the fiscal year ending 31 December 1993.

nature and extent of their activities with respect to financial instruments for both on-balance sheet and off-balance sheet instruments. A firm is therefore required to disclose the fair value and contract (nominal) value amounts of derivative contracts outstanding at the balance sheet date in the "Notes to the Accounts" of its annual report.

The fair value variable is defined in the New Zealand Accounting Standard's FRS-31 as the amount for which an asset could be exchanged, or liability settled between knowledgeable, willing parties, in an arm's length transaction (see Definitions point 4.7). The fair value variable is defined by Berkman and Bradbury as the absolute value of the net gain or loss on all derivatives (forwards, futures, swaps, and options) outstanding at balance date, scaled by the market value of the firm. The fair value is an ex-post estimate of the net result of using derivatives which, according to Berkman and Bradbury, gives an unbiased measure of the extent that a firm manages its "value at risk" using derivatives. However, since this variable depends on the past movements of the risk being managed and the time elapsed since the inception of a derivative contract, both of which are unrelated to the actual hedge ratio of the derivative position, it has the potential to be very noisy.

The second variable used by Berkman and Bradbury is the contract (notional) value. This is defined as the sum of the contract values of all derivatives outstanding at balance date again scaled by the market value of the firm. The contract value variable does not have an ex post nature like the fair value although it, too, is imperfect as it aggregates short and long positions. The contract value gives users of financial reports an indication of the relative significance of the financial instruments outstanding at balance date that are not recognized in the financial statements. The contract value may not take into account the risk characteristics of the contract, as there is no information on the term, denomination and settlement price of the outstanding contracts.

One of the major imperfections of both of these variables is that they do not take into account the quantity of derivatives used during the year as firms may adjust their derivative contracts over time. This is because the amounts recorded in the financial reports are only the contract amounts or fair value of the contract amounts outstanding at balance date.

2.3 Independent Variables

2.3.1 Taxes

New Zealand's corporate tax rate is fixed at 33%. New Zealand firms do not have a progressive corporate tax schedule and there are no tax concessions such as investment tax credits. However, New Zealand firms do have tax preference items such as tax-loss carry forwards. If a firm has tax preference items, it is better off if it smooths its earnings. Firms can use derivatives to do this.

Firms with tax-loss carry forwards face an effective tax schedule that is convex. According to hedging theory, these firms are more likely to use derivative instruments to minimise the present value of the tax loss and reduce the variance in their taxable income. Berkman and Bradbury argue that firms will only ever hedge with derivatives to reduce the volatility of next year's assessable income, regardless of the total value of tax losses available. While, hedging with derivatives for periods greater than one year might reduce the volatility of future taxable income, it is likely to increase liquidity risk. This is due to the short-term nature of the commitments that are hedged with derivatives. However, in New Zealand, financial instruments are marked-to-market every year for tax purposes, so using derivatives to hedge for terms longer than one year might result in unwanted increases in the variability of after-tax cash flows. A positive relationship is expected for the tax-loss carry forward variable and the use of financial derivatives.

H_1: Firms that have tax-loss carry forwards are more likely to use derivative instruments.

To represent tax-loss carry forwards, Berkman and Bradbury use a dummy variable that equals one for firms with tax-loss carry forwards and zero otherwise. Berkman and Bradbury state that using the dummy variable avoids the scaling problem of Nance et al. (1993) and might be more appropriate.[29]

[29] Nance et al. use the value of tax-loss carry forwards available to offset taxes payable in subsequent years. They indicate that the appropriate scaling factor is the firm's expected taxable income. However, accounting literature suggests that earnings are non-stationary, and average earnings are undefined. Nance et al. scale by the value of the firm's equity and find no significance between users and non-users of derivatives.

2.3.2 Expected cost of financial distress

According to theory, using financial derivatives can reduce the variance of firm value and reduce the expected cost of financial distress. Berkman and Bradbury employ three proxies for the expected cost of financial distress: leverage, interest cover ratio, and firm size (size is dealt with separately in this research).

The greater the debt in a firm's capital structure the higher the probability of financial distress, therefore firms with higher leverage are expected to use derivative instruments more often to reduce the volatility of cash flows than firms with lower leverage.[30] A positive relationship is expected between the leverage measure and the use of derivatives.

H_2: Firms with high leverage are more likely use derivative instruments.

Bankruptcy models support the use of the interest coverage ratio as an indicator of the probability of financial distress. To avoid default, firms must make regular interest payments. The interest cover ratio is a representation of the ability of a firm to cover interest commitments from its earnings. Therefore, firms with a lower interest coverage ratio are expected to use derivatives more to help cover their interest commitments than firms with higher interest coverage ratios. Thus, a negative relationship is expected between interest coverage and derivative use.

H_3: Firms with low interest coverage ratios are more likely to use derivative instruments.

The leverage variable is measured as the book value of debt over the market value of the firm. Interest coverage is defined as the log of earnings before interest and tax over the interest expense.[31]

[30] Berkman and Bradbury (1996) state that as leverage also affects the under-investment problem, firms with higher leverage are expected to use more derivatives. Therefore it is uncertain whether a positive relationship between leverage and derivative use will proxy for costs of financial distress or for growth options.

[31] Earnings before interest and taxes are set equal to one if it is negative and interest is set equal to one if a firm has no debt. Setting the interest coverage ratio to one if the firm has negative earnings indicates that a firm has paid its interest commitment. There are 21 firms in this sample with negative earnings.

2.3.3 Ownership Structure

The proportion of equity held by directors is used by Berkman and Bradbury as the proxy for the ownership structure of the firm. The expectation is that directors who hold a greater proportion of shares are more concerned about the variability of firm value and are therefore more likely to use derivatives. Therefore a positive relationship is expected between managerial ownership and derivative use.

H_4: Firms with high managerial ownership are more likely to use derivative instruments.

Managerial ownership is measured as the proportion of shares beneficially held by directors and by associated persons of the director as recorded in the firm's annual report.[32]

2.3.4 Investment

To investigate the investment hypothesis, Berkman and Bradbury employed two variables. The first variable is the reciprocal of the price-earnings (PE) ratio and proxy's for the long-term growth prospects of the firm (Smith and Stulz, 1985). The PE ratio is a comparison of the price of one share of a firm at a given time to the annual earnings per share for the firm. A firm's market value per share (price) is an investor's assessment of what he or she is willing to pay for a share in this firm. This price is a representation of the earnings power of today's assets and the present value of future investment opportunities. Hence, the PE ratio is an indicator of the prospects of the firm, and a high PE ratio indicates a firm that is endowed with ample growth opportunities.

Berkman and Bradbury use the earnings-price ratio instead of the PE ratio as it avoids the outlier problems associated with small earnings. Therefore, the higher the long-term growth opportunity of the firm the smaller its earnings-price ratio. The expected relationship is that firms with more valuable growth options will use more derivatives. As a result, a negative relationship is predicted for the earnings price ratio.

H_5: Firms with a higher level of investment opportunity represented by a low earnings-price ratio are more likely to use derivative instruments.

[32] This is consistent with the ownership variables employed by Morck, Shleifer and Visnhy (1998), Short and Keasey (1999) and Bhabra and Maling (2000).

Froot et al. (1993) argue that risk management should have more of a short-term focus. Berkman and Bradbury's second investment variable also relates to this view, mainly that derivative use should have a single over-reaching goal to ensure that a company has enough internally-generated cash available to make value-enhancing investments. To proxy for the firm's ability to generate enough cash to finance current short-term growth, an asset growth to cash flow variable is used. The relationship is this: if firms use derivative instruments to smooth earnings they will always have enough internal generated cash to finance short-term asset growth. These firms should display a higher level of investment. Therefore, there should be a positive relationship between derivative use and the short-term growth variable.

H_6: Firms with higher asset growth to cash flow use derivative instruments enabling them to have a greater ability to make short-term investment.

Other researchers have employed the ratio of research and development expenditure to firm value as a proxy for investment opportunities. However, there are no reporting requirements for research and development for NZ firms. Consequently, firms do not report this information and, therefore, this variable cannot be used.

A firm's earnings-price ratio is calculated as earnings per share to market price per share. The asset growth to cash flow variable is measured as the log of the ratio of the current year's change in net tangible assets plus depreciation to net income plus depreciation.[33]

2.3.5 Size

Firm size may play a role in determining the use of derivative instruments. Small firms are expected to have a greater need to hedge with derivatives as their cash flows have greater volatility. However, due to economies of scales and the high fixed cost of expertise needed to manage a derivative program, large firms may be greater users of derivatives. As empirical evidence has shown a positive relationship between the size of a firm and its use of financial instruments, Berkman and Bradbury hypothesize that larger rather than smaller firms are expected to use derivative instruments.

[33] If the change in tangible assets plus depreciation is negative it is set equal to zero. If net income plus depreciation is negative it is set equal to one.

H_7: The larger the firm the more likely it is to use derivative instruments.

Size is defined as the market value of the firm which is calculated as the log of the sum of the market value of equity, book values of debt, and preference capital.

2.3.6 Hedging Substitutes

Following Nance et al. (1993), Berkman and Bradbury employ alternative capital instruments, liquidity and dividend payout to capture substitutes for derivatives.

A firm can reduce its agency cost to stakeholders by restructuring its balance sheet through issuing preferred stock or convertible debt rather than using financial derivatives.[34] The greater the alternative capital instruments in a firm's capital structure, the less need the firm has for derivative instruments. Therefore, a negative relationship is expected for alternative capital instruments and derivative use.

H_8: Firms that make less use of alternative capital instruments are expected to use derivative instruments.

The greater the liquidity of a firm, the greater the ability of the firm to cover its liabilities and investments. Consequently, it has a lower need for financial derivatives. A negative relationship is expected for the liquidity variable and derivative use.

H_9: Firms with low liquidity use derivative instruments.

The dividend policy of a firm will influence the need for derivatives. Dividend restrictions allow funds to be available for investment, allow for cover of liabilities and lower the need to change dividend policies in years when income is low. This leads to less dependence on the use of derivatives for hedging. As a result, a positive relationship is expected between derivative use and firms paying dividends.

H_{10}: The higher the firm's dividend payout the more the firm is expected to use derivative instruments.

[34] Using convertible debt gives bondholders the choice to convert the debt into equity.

The use of alternative instruments in the capital structure is measured as the value of convertible bonds plus preferred stock as a percentage of firm value. Liquidity is defined as the log of current assets minus inventory over current liabilities.[35] Dividend payout is calculated as dividend per share divided by earnings per share.[36]

2.3.7 Nature of operations

New Zealand relies heavily on imports and exports and this means that firms may have a significantly large exposure to foreign currency fluctuations. Therefore the nature of a firm's operation may influence its need to hedge with derivatives. Berkman and Bradbury include the proportion of overseas assets to total assets as a proxy for a firm's involvement in overseas activities and hypothesise that the more overseas assets a firm has, the greater its need to hedge with financial derivatives. They expected a positive relationship for this variable and derivative use.[37]

H_{11}: The more overseas asset a firm has the greater the need for derivative instruments.

The overseas assets variable is measured as the proportion of overseas assets to total assets and is obtained from geographical segment data in financial reports.

2.4 Sample

As with Berkman and Bradbury's research (1996), the data set contains all firms on the New Zealand Stock Exchange (NZSE) for the 1999 financial year. If the NZSE classifies a firm as a foreign firm (it is not New Zealand-owned) or as a financial service firm, it is excluded. Foreign firms are excluded as they are not subject to the same financial disclosure rules as local firms. Firms in the financial services sector are excluded

[35] This measure used by Berkman and Bradbury (1996) differs from Nance et al. (1993), who measure liquidity as current assets over current liabilities. Berkman and Bradbury exclude inventory from current assets, as the "quick ratio" is considered by accounting texts as a better measure of liquidity.
[36] Nance et al. (1993) use the dividend yield in testing their dividend hypothesis. As the dividend yield can proxy for growth opportunities and dividend restrictions, Berkman and Bradbury (1996) use dividend payout. This uses both a dividend payout effect and an earnings effect to avoid the problem.
[37] Berkman and Bradbury also tested foreign sales as proportion of total sales as a representation of a firm's overseas activity. This variable was found to be highly correlated to overseas assets and it gave similar relationships to derivative use as overseas assets.

because their financial characteristics and use of derivatives are very different from other firms.

Firms are classified as derivative users or non-derivative users according to information found in their annual reports. According to FRS-31 of the New Zealand Accounting Standard issued by ICANZ, firms are required to disclose the nature and extent of their activities with respect to financial instruments for both on-balance sheet and off-balance sheet instruments. Firms are required to disclose the fair value and contract (nominal) value amounts of derivative contracts outstanding at the balance sheet date in the "Notes to the Accounts". Therefore, firms with no disclosure of outstanding derivative contracts are classified as non-users. Some amount of noise may seem unavoidable in identifying derivative using and non-derivative using firms. This is due to a firm using derivatives during the year but having no outstanding positions at balance date. Therefore, a firm using derivatives may be erroneously classified as a non-derivative using firm.[38]

Firm accounting and market value of equity information for the 1999 year is required to form the dependent and independent variables. The accounting data is obtained from the Datex database held by the University of Otago library. The fair value and contract value information of off-balance sheet instruments is obtained from individual firm annual reports.[39] The stock price data for the 1999 balance date is obtained from the stock price database maintained by the Department of Finance and Quantitative Analysis at the University of Otago.

In 1999, there were 117 New Zealand owned non-financial firms listed on the NZSE; this is one more than in Berkman and Bradbury's sample. The major difference between the two samples is the number of representative firms from different industries. Berkman and Bradbury's largest industries are transportation and tourism (11), mining and exploration (10), the food industry (9), the retail sector (8), and agriculture, property and forestry (7 each). The largest industries for the 1999 sample are property (15), agriculture and fishing, goods and energy (11 each), tourism (9), retail sector (8), and forestry (6).

[38] For more information on mis-classification of derivatives users see the "change in dependent variables" in the Extensions section.

[39] The 1999 annual reports are obtained from the University of Otago, School of Business resource collection. Missing reports are obtained from pdf files on the Datex database.

Table 1 **Sectors (NZSE Sector Codes)**	Berkman and Bradbury	1999
Agriculture and Fishing (A01)	7	11
Building and Construction (A04)	NA[40]	3
Energy (A05)	NA	11
Food and Beverage (A06)	9	6
Forestry and Forest Products (A03)	7	6
Goods (Textiles-Apparel (A07) and Intermediate-Durables (A08))	NA	11
Leisure and Tourism (A12)	11	9
Media and Telecommunication (A14)	NA	6
Mining and Exploration (A02)	10	5
Ports (A11)	NA	6
Property (A09)	7	15
Retail (A13)	8	8
Transportation (A10)	11	4
Others	NA	16

3 Results

3.1 Descriptive Statistics

Table 2 provides descriptive statistics for the dependent variables. The dependent variables are the proportion of financial derivatives held by a firm on its balance date for the 1999 fiscal year to its market value and these represent the quantity of derivatives it used. These descriptive statistics are compared to the dependent variables descriptive statistics of Berkman and Bradbury (1996).

[Insert Table 2]

In Panel A, the fair value measure for the 1999 financial year ranges from 0% to 4% of the market value of a firm. This is a narrower range than Berkman and Bradbury's 0% to 8%, although the average values are similar at 0.3% of the market value of the firm. The contract value amount ranges from 0% to 95% of the market value of the firm, with an average of 16.5% of the market value of the firm. The contract value range is similar to

[40] NA refers to not reported by Berkman and Bradbury.

that observed by Berkman and Bradbury, however, the average value is higher than the 9.4% reported by them.[41]

Panel B reports the descriptive statistics for the fair value and contract value measures for the derivative-using firms only. The results for the 1999 financial year are compared to the results of Berkman and Bradbury. The major difference is in the number of firms disclosing fair and contract values (classified as derivative-using firms). The proportion of non-financial firms sampled using derivatives in New Zealand has increased from 47% of firms in 1994 (Berkman and Bradbury, 1996) to 61% of firms in 1999.[42] The fair value to market value range for 1999 is again narrower than Berkman and Bradbury's fair value measure, but the average values are similar. The contract value amount ranges from 0.07% to 95% of the market value of the firm, with an average of 27.6% of the market value of the firm. The contract value range is similar to that observed by Berkman and Bradbury (0.1% to 96%), however, the average value is higher than that reported by Berkman and Bradbury (22%). The results indicate that more firms are using derivative instruments, and the proportion of contracts held to the market value of the firms has increased.

Table 3 Panel A contains the descriptive statistics for the independent variables and compares these to the descriptive statistics of the Berkman and Bradbury study (Panel B). It is not possible to test if there are any significant differences between the variables in this research and those used by Berkman and Bradbury's study as their data set is unavailable.

[Insert Table 3]

The market value of the firm (firm value) is calculated as the log of the market value of equity plus the book value of debt and preference capital and proxy's for the size of a firm. The size of the firms in 1999 has increased since Berkman and Bradbury's study. This would be expected as managers of the firms are expected to make value enhancing investment decisions therefore increasing the value of a firm over time.

Leverage and the interest coverage ratio are proxy measures for the expected cost of financial distress. Leverage is measured as the proportion of debt to the market value of the firm. The leverage variables for 1999 are similar to those found by Berkman and Bradbury, with the average values being 25% (1999) and 20% (1994) of firm value and the

[41] It is unknown if the difference in the average values of the contract measure is significant as the Berkman and Bradbury data is not available for comparison.
[42] This supports the survey findings of Prevost, Rose and Miller (2000).

ranges being comparable. Interest coverage is measured as the log of earnings before interest and taxes to the interest expense of a firm. The average interest coverage ratio for 1999 is 1.22. This is higher than the 1.06 reported by Berkman and Bradbury and can be attributed to higher earnings for 1999 relative to 1994.[43]

Thirty-six firms (31%) have tax-loss carry forwards in 1999; this is fewer than the 38% (44 firms) in Berkman and Bradbury's study.

The two proxies that represent a firm's investment opportunity set are the earnings-price ratio and asset growth to cash flow. It appears that the asset growth to cash flow variable (the ability to generate enough cash for the firm's current investment program), is on average higher in 1999 (-0.472 for 1999 and -0.7 for 1994) with a smaller range (-5.342 – 1.892 in 1999 and -14.180 – 11.090 in 1994) and the earnings-price ratio is also greater in 1999 (0.027) than 1994 (0.000) with the range being considerably larger (-2.008 – 3.759 in 1999 and -1.790 – 0.6 in 1994).

The proxy for managerial ownership the proportion of shares beneficially held and held by associates of directors, has a lower average value (26.6% in 1999 compared with 31.0% in 1994) and a slightly narrower range (0% –92.3%) in 1999 than that found by Berkman and Bradbury (0% – 100%).

The proxies that represent the substitutes for hedging with derivatives - dividend payout, liquidity and alternative capital instruments - appear to have been used differently by firms in 1999 compared to their use by Berkman and Bradbury's firms. Firms in 1999 appear to have higher dividend payout ratios (73.3% of earnings in 1999 compared to 37% in 1994), be less liquid (0.014 in 1999 and 0.070 in 1994) and have made less use of alternative capital instruments in their capital structure; 1.7% of firm value in 1999 compared to 3% in 1994.

The proportion on average of overseas assets to total assets of firms in 1999 (10.1%) is slightly less than the proportion of overseas assets used by firms in Berkman and Bradbury's study (12%), although the range is similar.

Firms in 1999 appear to be larger, have better interest cover, slightly more leverage, less tax-loss carry forwards, less growth prospects, lower insider ownership, higher dividend payouts, be less liquid, make less use of alternative capital instruments in their capital structure, and have less assets overseas, than firms in Berkman and Bradbury's

[43] For the interest coverage ratio to be higher, earnings before interest and taxes have to be higher relative to the interest expense. It is not expected that the interest expense is higher as the average debt to firm value measures are similar. Therefore firms are not taking on more debt as a proportion of value. As firm values have risen so too has the value of their debt, but for the interest cover ratio to be larger earnings before interest and taxes need to have grown higher than the amount of interest paid on the extra debt.

research. However, these results may be attributed to different sample characteristics (see Table 1).

3.2 Pearson correlation matrix

[Insert Table 4]

Table 4 presents the correlation matrix for the independent variables. The highest correlation is 0.39 (between leverage and alternative capital instruments), and the lowest -0.30 (between asset growth to cash flow and interest cover). Only three correlations have absolute values greater than 0.3, which suggests that there is multicollinearity present in the data, although it is not severe.

3.3 Univariate Analysis

Univariate tests are undertaken to assess if there are differences between the two groups: derivative users and non-derivative users.

Table 5 Panel A reports the mean and the medians for the set of independent variables for the firms that have been classified as derivative users and non-users. A firm is classified as a derivative user if it reports a contract value of an outstanding derivative contract(s) at a firm's balance date in its annual report for 1999. The number of derivative users has increased between 1994 and 1999, with 70 firms (61%) classified as derivative users in 1999. This compares to 55 firms (47%) classified as derivative users in the Berkman and Bradbury study using 1994 data. The non-parametric Mann-Whitney U test is used to test the null hypothesis that the population relative frequency distribution for derivative users is the same as non-users.[44]

[Insert Table 5]

The Mann-Whitney U test is a non-parametric test between two independent samples (equivalent to an unpaired t-test).[45] According to Siegel (1956), it is the most

[44] In their study Berkman and Bradbury (1996) used a Mann-Whitney U test to evaluate the difference between the medians of the two groups. The variables marked ** in both panels of Table 5 were found to have significantly different medians by Berkman and Bradbury.

[45] A non-parametric test is used as the independent variables did not meet the criteria of a normal distribution under normality tests.

powerful of the non-parametric tests. It evaluates the distribution function of two independent samples that may have been drawn from the same population that differs only with respect to location. The null hypothesis is that the population relative frequency distributions for derivative-using firms and non derivative-using firms are identical for each of the proxies to be tested.

Two measures are used to represent the expected cost of financial distress, leverage and interest coverage ratio. The results in Table 5 indicate that derivative-using firms have significantly higher leverage and interest coverage ratio. The interest coverage ratio is significantly different between the two groups, but its relationship is contrary to expectation, with derivative users having higher interest cover than non-users. Derivative-using firms have significantly greater leverage than non-derivative using firms. This is the same relationship reported by Berkman and Bradbury.

Thirty-six firms (31%) had tax-loss carry forwards in 1999 compared with 44 firms (38%) in 1994. In relation to the tax-loss variable, Table 5 reports no significant difference between firms that use derivatives and firms that do not. In total, 30% of derivative-using firms have tax-loss carry forwards compared to 32% of non-derivative-using firms. This means that neither users nor non-users of derivatives are more likely to have tax-loss carry forwards. This differs from the results of Berkman and Bradbury who find evidence that firms with derivatives in 1994 are more likely to have tax-loss carry forwards. Tax-loss carry forwards appear less important today as an incentive to use derivatives.

For the investment opportunity set, Berkman and Bradbury use two variables. The first is an earning price ratio which represents the long-term growth prospects of the firm and the second is an asset growth to cash flow variable which proxy's for the firm's ability to generate enough cash to finance its current investment program (short-term growth). The results for these variables from the 1999 data are similar to the 1994 data. Firms that use derivatives have a significantly higher earnings price ratio than non-using firms and firms that use derivatives on average have a lower asset growth to cash flow ratio than non-using firms, although this is not significant. It is difficult to assess exactly what the asset growth to cash flow variable is indicating. This variable may indicate that a firm is financially constrained or alternatively, Berkman and Bradbury use it as a short term growth proxy that indicates the ability of a firm to fund its short term growth.

As a manager's wealth depends on the value of the firm, it is expected that managers of firms that are closely held are more concerned about the variability of firm value and are more likely to use derivatives. The expectation is that firms with a larger proportion of shares held by directors are more likely to use derivatives. To proxy for

managerial risk aversion, two measures were tested that represent the ownership structure of the firm. The first measure is the proportion of shares beneficially held and held by associates to the directors; the second measure is the percentage of beneficial shares owned by directors.[46] Contrary to expectations, the results in Table 4 indicate that there is no significant difference between the ownership levels of derivative or non-derivative using firms. This result is the same as that of Berkman and Bradbury who find that firms that use derivatives had a lower, but not significant, proportion of shares held by directors than non-derivative using firms.

To capture the substitutes for hedging activity, Berkman and Bradbury examine liquidity, dividend payout and alternative capital instruments in the capital structure. The result for liquidity indicates that derivative users are less liquid, but is not significantly less, than non-derivative users. Firms that use derivatives have significantly higher dividend payout ratios than non-users. The proportion of alternative capital instruments is not significantly different between the two groups although users of derivatives have a larger proportion of alternative capital instruments than non-derivative users. Berkman and Bradbury find that derivative users have less liquidity, higher dividend payout ratios and more alternative capital instruments (and these are all significant) than non-users.

Finally, Berkman and Bradbury include the proportion of overseas assets to represent a firm's involvement in overseas activities. The results in Table 5 report that derivative-using firms have a higher proportion of overseas assets than non-users. This is the same result as Berkman and Bradbury although they find this variable to be significantly different between the two groups while this study does not.

In conclusion, derivative-using firms in 1999 are larger, have higher interest cover ratios, more debt, less growth prospects and higher dividend payout ratios. The 1999 firms differ from the firms in Berkman and Bradbury's sample in respect to the interest cover ratio and tax-loss carry forwards which were found to not be significantly different.

3.4 Multivariate Analysis

3.4.1 Tobit Model

In using the fair and contract amounts as the dependent variable, previous studies have found that the dependent variables are left-censored (see Berkman and Bradbury, 1996; 1998; and Gay and Nam, 1998). The dependent variable is left-censored because it

[46] The second measure is not reported as the results are similar to the first measure and insignificant.

is bounded by 0. This is because, if a firm does not have any outstanding derivative contracts at balance date, the dependent variable is 0. Otherwise, if it does disclose the fair value and contract value of derivative contracts, the variable is then scaled by firm value and will be larger than 0. Following Berkman and Bradbury this, therefore, requires the use of a Tobit model where the dependent variable is defined as:

$$y_i^* = \beta x_i + \varepsilon_i$$
$$y_i = y_i^* \text{ if } y_i^* > 0 \text{ and}$$
$$yi = 0 \text{ otherwise} \qquad (1)$$

In Equation 1, y_i is the level of firm i derivative usage, taking the value y_i^* if firm i has derivative contracts outstanding at balance date, or zero if firm i has no contracts outstanding at balance date. Derivative use is measured in two ways: the fair value of the contracts outstanding at balance date, and the nominal or principal amount of the contracts outstanding at balance date, and both scaled by firm value. β is a vector of unknown parameters, x_i is the vector of independent variables, and ε_I are residuals that are independently and normally distributed, with mean zero and variance σ_ε^2.

Table 6, Model A reports the results of the Tobit regression using the fair value measure as the dependent variable. Model B reports the results for the Tobit regression using the contract amount measure as the dependent variable.

[Insert Table 6]

Model A of Table 6, reports that using the fair value as a measure of derivative activity, the coefficient for firm size, interest cover, leverage, managerial ownership, dividend payout and alternative capital instruments are all in the direction hypothesized. However, only the firm size coefficient is significant at the 5% level, while leverage is significant at a 10% level. There is no significant relationship between the investment coefficients and the level of derivative use, however the earnings price ratio coefficient is in the opposite direction to that hypothesised. The same relationship is found for the coefficients for tax-loss, liquidity and proportion of overseas assets.

These results differ from Berkman and Bradbury who report that firm size, interest cover, leverage, tax-loss and liquidity are significant at the 5% level and dividend payout and earnings-price ratio are significant at a 10% level.

Model B uses the contract amount as the measure of derivative use activity. The algebraic signs on the estimated firm value and leverage coefficients are in the direction hypothesized and are significant at a 5% level. Compared to Model A, there is a reversal of signs for the tax-loss, earnings-price ratio, asset growth to cash flow, managerial ownership and proportion of overseas assets coefficients. However, there is no significant relationship between these and the other coefficients and the level of derivative use.

The results of Model B are different than that of Berkman and Bradbury, who find the interest cover coefficient to be significant at a 5% level and they find no relation between the leverage coefficient and the level of derivative use.

Overall, the results in Table 6 provide support for the hypothesis on economies of scale as large firms use more derivatives, and for the hypothesis that firms use derivatives to lower the expected cost of financial distress. This is similar to the findings of Berkman and Bradbury. However, there is no support provided for the theory that New Zealand firms use derivatives to lower agency costs or to lower expected taxes (the tax hypothesis appears to be less important for firms in 1999 than the for firms sampled by Berkman and Bradbury). Furthermore, the results do not support the suggestion that firms use substitutes instead of derivatives to lower the agency cost, and that the location of assets (overseas) encourages a firm to use derivatives. Similar to Berkman and Bradbury the results provide no support for the investment hypothesis as asset growth to cash flow have the opposite sign to that hypothesized in Model B and the earnings-price ratio has the opposite sign to that hypothesized in Model A. With no clear result for the investment hypothesis further analysis is needed.

4 Extension

4.1 Change in independent variables

4.1.1 Investment

Froot et al. (1993) state that the ability to achieve a greater level of investment is the main aim of using derivatives. With this theory as a base, it is important to use an accurate proxy for a firm investment opportunity set (see Gay and Nam, 1998). Due to

negative earnings, the earnings price variable may not represent the investment opportunity set correctly. Guy and Nam (1998) investigate the underinvestment problem in relation to derivative use using five different independent variables to proxy for a firm's growth opportunities.[47] As the theory indicates that the incentive to use derivatives is not driven by investment alone, Gay and Nam (1998) use control variables in their regression analysis to represent these other incentives. This research uses the Tobit model to re-test the investment hypothesis by changing the independent variables that proxy for the investment growth of Berkman and Bradbury, while using the other Berkman and Bradbury variables to control for the other incentives to use derivatives.[48]

The first new variable is the market-to-book ratio, which is the ratio of stock price to per share book value of common equity.[49] This proxy is widely used in empirical analysis and shows how aggressively the stock of a firm is being priced. A market-to-book ratio higher than 1.0 indicates that the stock is currently selling for more than its book value. The market price of common equity is a representation of the earnings power of today's assets combined with the present value of future investment opportunities. The book value of common equity represents the cost to the firm of purchasing the original assets. This is a better measure than the earnings-price ratio as the book value is not negative. A positive relationship is expected between the market-to-book ratio and derivative use.

H_{12}: Firms that have a higher level of investment represented by the market-to-book ratio will use derivative instruments.

The second new variable that represents a firm's growth opportunity set is Tobin's *q*.[50] Tobin's *q* is the ratio of the market value of a firm's equity and debt to the current replacement cost of its assets. This ratio is similar to the market-to-book ratio, but has several important differences. The first of these differences is the denominator. Tobin's *q* includes all of the firm's debt and equity securities, not just its common equity. The denominator represents the replacement cost of all assets, not the value shown on the firm's balance sheet.

[47] The four proxies are: 1) Tobin's Q, 2) Market to Book, 3) P/E ratio, 4) R&D to market value and 5) Market cumulative abnormal return.
[48] The Tobit regression is repeated each time a new variable is tested.
[49] The market-to-book ratio is used so there is a positive relationship for market-to-book ratio and derivative use.
[50] See Tobin (1969).

Tobin (1969) argued that if a firm's *q* is greater than 1.0 it has a greater incentive to invest in new assets. However, if *q* is less than 1.0, it may be cheaper for a firm to acquire assets through a merger. Nevertheless, it is expected that firms that use derivatives have higher values of Tobin's *q* than non-derivative using firms.

H_{13}: Firms that have a higher Tobin's *q* therefore higher investment are more likely to use derivative instruments.

The market-to-book ratio is measured as the market price of common equity divided by the book value of common equity. Tobin's *q* is calculated using the Chung and Pruitt (1994) approximation method;

q = (price x number of shares outstanding + book value of long-term debt + net working capital + book value of preference shares) / total assets

Chung and Pruitt (1994) show that this approximation method explains 97% of the variation in *q* computed using the Lindenberg and Ross (1981) algorithm.

4.1.2 Dividends

The problem of negative earnings again becomes an issue when using Berkman and Bradbury's dividend variable. The difficulty is how to calculate the dividend payout ratio with respect to negative earnings, as the firm is paying out more than 100% of its earnings as a dividend. To correct for this, two other variables are used to proxy for the dividend hypothesis.

The first new measure is a dummy variable that equals 1 if a firm pays a dividend or 0 if it does not. This variable does not take into account the size of the dividend being paid. However, it is a representation that if firms do pay dividends, then they could use derivatives to maintain dividend payout ratios, in order to lower the expected costs of financial distress and to lessen agency problems. The expected relationship is positive between dividends paid and derivative use.

H_{14}: Firms that pay dividends are more likely to use derivative instruments

The second new variable is the reciprocal of Berkman and Bradbury's dividend payout. The earnings per share to dividend per share variable represent the ability of a

firm to cover its dividends from its earnings. Firms that use derivatives are expected to have smoother earnings and therefore a greater ability to cover their dividends out of their earnings, a positive relationship.

H_{15}: Firms that have a greater ability to cover dividend from their earnings use derivative instruments.

4.1.3 Univariate results for new independent variables.

Panel A of Table 7 displays the descriptive statistics for the new independent variables to be tested. Panel B reports the descriptive statistics for the two groups, users and non-users of derivatives as well as the results of the Mann-Whitney U test. The Mann-Whitney U test is used to evaluate if there is a difference between the two groups.

[Insert Table 7]

Panel B of Table 7 shows that the results for the new investment variables are mixed, with derivative-using firm's having a greater market-to book ratio but a lower Tobin's *q* than non-derivative-using firms. There is a significant difference between the two groups for the market-to-book ratio. In relation to the new dividend variables, firms that use derivatives have on average a greater ability to cover their dividends from their earnings. However, this is not significantly greater. A greater number of firms that use derivatives pay dividends (79% of derivative-using firms paid a dividend in the 1999 financial year compared with 40% of the non-derivative-using firms). Overseas revenues appear to be an incentive for firms to use derivatives. The results indicate that derivative-using firms have a significantly greater proportion of overseas revenues to total revenue.

4.1.4 Multivariate test results for new independent variables

The results from the multivariate analysis in Table 8 and 9 provide no support for the investment hypothesis. This is because the coefficients in Table 8 for both models, in relation to the market-to-book variable, are of the opposite sign to the hypothesis although they are not significant. Table 9 reports negative coefficients for the *q* variables, with the coefficient being significant at the 10% level in relation to the contract variable as the level of derivative use. There is no new relationship for the other variables tested in either of these new tests.

[Insert Table 8 and 9]

Tables 10 and 11 report the results for the new dividend variables.

[Insert Table 10]

In Table 10, the sign of the coefficient that represents whether a firm pays a dividend or not is in the direction hypothesised, however, it is not significant.

[Insert Table 11]

Table 11 reports the results for the variable that represents the ability of a firm to pays its dividend from its earnings. The coefficients in both Model A and B are in the direction hypothesised, with the coefficient in Model B (using the contract amount measure) being significant at a 5% level. This indicates that firms that use derivatives have a greater ability to cover their dividends from their earnings.

These results combined with the results from the earlier analysis lead to a conclusion that firms are not using derivatives to improve their growth opportunities, although it is not known whether a derivative-using firm would have fewer investment opportunities if it did not use derivatives. In relation to the new dividend variables, it can be concluded that firms that use derivatives in 1999 are better able to cover their dividend payments from their earnings.

4.2 Change in dependent variable

The fair value and contract amount are used to represent the level of derivative use of a firm. Firms are classified as derivative users if they have reported these variables in their financial statements. This classification may cause a selection bias of the dependent variables. This bias occurs because some firms are classified as non-derivative users when they may actually be derivative users. The reason for this is that a firm may use derivatives during the financial year but have no outstanding contracts at balance date. Misclassification results, as a firm will match its derivative use with its obligations. Therefore if a firm has no obligation that it needs to hedge around its balance date, it may have no outstanding contracts to report. Another reason relates to reporting accounting information; a firm may want to "window dress" its financial reports. Window dressing

refers to a firm changing or hiding its risk characteristics by changing the value of contracts in its financial statements.[51] Both these reasons would lead to a firm being misclassified and thus affect results.

Due to this misclassification much of the research relating to derivative use uses a binary dependent variable to represent derivative use (see Nance et al., 1993, Dolde, 1995, Geczy et al., 1997, and Goldberg et al., 1998). This binary dependent variable is equal to one if the firm uses derivatives and zero if it does not. Using a binary dependent variable requires the use of a Logit model. Hypotheses 1 through to 15 will be re-tested with the use of a Logit model with the new dependent variable classification.

The previous tests (Tobit model) classified a firm as a derivative user if it had reported derivative contract values in the notes of its 1999 annual report. To account for the misclassification of derivative users and non-users, firms are reclassified using additional information reported in their 1999 annual report. A firm will be classified as a derivative user if it meets either of the two following requirements reported in the notes of its 1999 annual report: 1) a firm has disclosed outstanding derivative contracts, 2) a firm reports in its "Statement of accounting policies" that it uses derivative financial instruments with off-balance sheet exposure, and reported outstanding derivative contracts in its annual report for the 1998 financial year.

4.2.1 Results of new dependent variable

Under the new criteria 83 firms are classified as derivative users. This compares to 71 firms for the Tobit model. Table 12 reports the results of univariate test for the firms classified as derivative or non-derivative users under the new criteria and the original independent variables.

[Insert Table 12]

Results of the Mann-Whitney U tests in Table 12 are the same as the results in Table 4 in relation to all the independent variables except the asset growth to cash flow variable and the earnings-price ratio. The asset growth to cash flow variable has the same relationship as found in Table 4 but is now significant at a 10% level. The major difference is in the results for the earnings-price ratio, with a total reversal in the findings.

[51] A firm may relinquish some or all of its derivative contracts before its balance date.

Firms that use derivatives now have a significantly lower earnings-price ratio and this agrees with the hypothesis.

This reversal in the findings indicates a problem with this variable. As there is only a difference of 12 firms between the two classifications for derivative users, the results for the earning-price ratio need to be queried. These results are driven by an outlier and are related to negative earnings that change classification from non-derivative users to derivative users under the criteria for classification.

[Insert Table 13]

Table 13 reports the results for the Logit regression model using the original independent variables. The coefficients for size (firm value), leverage, tax-loss earnings-price, asset growth, dividend payout and alternative capital instruments, are all in the direction hypothesized. Size and leverage are significant at a 5% level, with earnings-price and alternative capital instruments being significant at a level of 10%. Interest cover, liquidity and proportion of overseas assets fall in the opposite direction from that which has been hypothesised with liquidity being significant at a 5% level.

Like the Tobit model (Table 6), the results in Table 13 provide support for the hypothesis on economies of scale, that firms use derivatives to lower the expected cost of financial distress. The difference is that with the new classification of derivative users, support has been found for the investment hypothesis, with both the asset growth and earnings-price ratio having positive coefficients (the earnings-price coefficient being significant at a 5% level).[52] There is an ambiguous result for derivative use substitute variables. The coefficients for the substitute variables all display the same relationships as the Tobit regression. However, the alternative capital instruments coefficient is in the direction hypothesized and significant, while the liquidity coefficient is contrary to expectations and is significant in the opposite direction. Once again, no support is provided for the managerial ownership hypothesis.

As the Logit regression for the original independent variables gives the best McKelvey-Zavonia goodness of fit test statistic, the results of the Logit regressions for the new independent variables are not reported.[53] However, the relationships for Tobin's q, and both new dividend variables remain the same as the original Tobit regressions. The

[52] This result may be driven by the outlier.

[53] The McKelvey-Zavonia test statistic is a pseudo R^2 measure. Veall and Zimmermann (1996) recommend the use of the McKelvey-Zavonia R^2 as the best test statistic for goodness of fit when using binary dependent variables as they show it to be the best goodness of fit statistic to compare across different empirical models.

sign for the market-to-book coefficient is in the direction hypothesised but it is not significant.

5 Conclusion

Theoretical research argues that using derivative instruments for risk management can add value to a firm if there are capital market imperfections such as costs associated with financial distress, progressivity in tax rates, and conflicts of interest between fixed claimholders and shareholders. This study provides non-survey empirical evidence of the use of derivative financial instruments by New Zealand firms.

In line with theoretical models of derivative use for risk management, support is found for the economies of scale (size) hypothesis, as large firms use more derivatives and derivative use increases with leverage. This is similar to the findings of Berkman and Bradbury. However, there is no support for the theory that New Zealand firms use derivatives to lower agency costs or to lower expected taxes (the tax hypothesis appears to be less important for firms in 1999 than the firms sampled by Berkman and Bradbury). Furthermore, contrary to Berkman and Bradbury, the results do not support the suggestion that firms use substitutes instead of derivatives to lower agency cost. However, support is found for the theory that firms that use derivatives have a better ability to pay dividends from their earnings. Similar to Berkman and Bradbury, the results provide no support for the proportion of overseas assets to total assets and the investment hypotheseses. As the asset growth to cash flow coefficient has the opposite sign to that hypothesized in Model B, the earnings-price ratio has the opposite sign to that hypothesized in Model A The coefficients for Tobin's *q* and market-to-book have the wrong signs, although they are not significant.

The results are sensitive to the way in which derivative users are classified. Like the fair value and contract amount classification used in the Tobit model, the results for derivative and non-derivative users' classification under the Logit model provide support for the economies of scale hypothesis, and for the fact that derivative use increases with leverage. The difference is that, with the new classification of derivative users, support is found for the investment hypothesis, with both the asset growth, market-to-book and earnings-price ratio coefficients having the correct directional sign (the earnings-price coefficient is significant at a 5% level).

There is an ambiguous result for the derivative substitute variables. The coefficients for the dividend variable have the same relationships as the Tobit regression. However, the alternative capital instruments coefficient is in the direction hypothesized and significant, while the liquidity coefficient is contrary to expectations and is significant in the opposite direction. The relationships for Tobin's *q* and both new dividend variables remain the same as the original Tobit regressions. Again, no support is provided for the managerial ownership hypothesis.

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Table 2. Descriptive Statistics of the use of derivatives

The table contains descriptive statistics of the fair value and contract value for the financial derivative instruments held at a firm's balance date, scaled by the firm's market value and compares these with the values from Berkman and Bradbury (1996). Panel A contains the descriptive statistics for all firms in the sample. Panel B contains descriptive statistics for firms with derivative contracts only.

Panel A. All Sample Firms for financial year 1999 (N = 117)	Mean	Std. Dev.	Min.	Max.
Fair Value	0.0033	0.0077	0.0000	0.0417
Contract Value	0.1650	0.2275	0.0000	0.9511
All Sample Firms Berkman and Bradbury (1996) (N = 116)				
Fair Value	0.0030	0.0110	0.0000	0.0830
Contract Value	0.0940	0.1840	0.0000	0.9630

Panel B.	Mean	Std. Dev.	Min.	Max.
Firms with Derivative Instruments 1999 financial year (N=71)				
Fair Value	0.0054	0.0093	0.0000	0.0417
Contract Value	0.2758	0.2367	0.0007	0.9511
Firms with Derivative Instruments Berkman and Bradbury (1996) (N=55)				
Fair Value	0.0050	0.0130	0.0000	0.0830
Contract Value	0.2200	0.2270	0.0010	0.9630

Table 3. Descriptive Statistics of Independent Variables

This table provides the descriptive statistics for all firms in the sample and compares these statistics to that of Berkman and Bradbury (1996). The sample contains 117 NZ non-financial firms listed on the NZSE in 1999. Of these firms, 71 held derivative financial instruments at balance date. Berkman and Bradbury sample contains 116 NZ non-financial firms listed on the NZSE in 1994 with 55 firms using financail derivatives.

Panel A All Sample Firms for financial year 1999 (N = 117)	Mean	Std. Dev.	Median	Min.	Max.
Firm Value	18.464	1.978	18.353	14.250	23.616
Interest Cover	1.224	1.719	1.150	-8.006	8.505
Leverage	0.245	0.225	0.196	0.000	0.891
Tax loss	0.308	0.464	0.000	0.000	1.000
E/P Ratio	0.027	0.452	0.050	-2.008	3.759
Asset Growth/Cashflow	-0.472	1.316	0.000	-5.342	1.892
Managerial Share Ownership	0.266	0.261	0.195	0.000	0.923
Liquidity	0.014	1.381	0.044	-4.370	4.585
Dividend Payout	0.733	1.013	0.532	0.000	5.434
Alternative Capital Instruments	0.017	0.058	0.000	0.000	0.431
Proportion of Overseas Assets	0.101	0.240	0.000	0.000	0.998

Panel B All Sample Firms Berkman and Bradbury (1996) (N = 116)	Mean	Std. Dev.	Median	Min.	Max.
Firm Value	11.300	1.820	11.100	7.900	16.830
Interest Cover	1.060	3.660	1.480	-11.180	9.910
Leverage	0.200	0.220	0.140	0.000	0.930
Tax loss	0.380	0.490	0.000	0.000	1.000
E/P Ratio	0.000	0.270	0.050	-1.790	0.600
Asset Growth/Cashflow	-0.700	4.950	0.000	-14.180	11.090
Managerial Share Ownership	0.310	0.310	0.240	0.000	1.000
Liquidity	0.070	1.370	-0.110	-3.340	6.040
Dividend Payout	0.370	0.390	0.320	0.000	2.040
Alternative Capital Instruments	0.030	0.100	0.000	0.000	0.730
Proportion of Overseas Assets	0.120	0.240	0.000	0.000	1.000

Table 4. Correlation Matrix Independent Variables

This table reports the correlation coefficients and p-values for a sample of 117 NZ non-financial firms listed on the NZSE in 1999. Firms are classified as derivative or non-derivative users by information in their "Notes to Financial Statements' of their 1999 Annual Report.

	Firm Value	Interest Cover	Leverage	Tax loss	E/P Ratio	Asset Growth	Managerial Ownership	Liquidity	Dividend Payout	Alternative Instruments	Overseas Assets
Firm Value	1										
Interest Cover	0.2755	1									
	0.003										
Leverage	0.3611	-0.1747	1								
	0.000	0.060									
Tax loss	-0.1856	-0.2042	0.0674	1							
	0.045	0.027	0.470								
E/P Ratio	0.0734	0.1218	-0.0034	-0.1286	1						
	0.432	0.191	0.971	0.167							
Asset Growth/Cashflow	-0.0540	-0.3032	-0.0586	-0.0686	-0.0462	1					
	0.563	0.001	0.530	0.463	0.621						
Managerial Ownership	-0.1641	-0.1500	0.0184	0.1657	-0.0716	-0.0388	1				
	0.082	0.106	0.844	0.074	0.439	0.677					
Liquidity	-0.1896	-0.1091	-0.1542	0.0334	0.1094	0.1481	0.0342	1			
	0.041	0.242	0.097	0.721	0.240	0.110	0.714				
Dividend Payout	0.2509	0.0949	0.0960	-0.2219	0.0218	-0.0429	-0.0053	-0.0969	1		
	0.006	0.309	0.303	0.016	0.816	0.645	0.955	0.299			
Alternative Instruments	0.0923	0.0234	0.3906	0.1349	0.0334	-0.0079	-0.0524	-0.0302	-0.1245	1	
	0.322	0.803	0.000	0.147	0.721	0.932	0.575	0.747	0.181		
Overseas Assets	0.1006	-0.1571	0.1887	-0.0365	-0.0444	0.0673	-0.0416	0.0451	0.0620	-0.0615	1
	0.280	0.091	0.042	0.696	0.634	0.470	0.656	0.629	0.507	0.510	

Table 5. Results of Univariate Nonparametric Tests for Independent Variables

This table provides the descriptive statistics for the two groups, users and non-users of derivatives, and compares these statistics to those of Berkman and Bradbury (1996). The sample contains 117 NZ non-financial firms listed on the NZSE ir 1999. Of these firms, 71 held derivative financial instruments at balance date. Berkman and Bradbury's sample contains 116 NZ non-financial firms listed on the NZSE in 1994 with 55 firms using financial derivatives. Variables marked by ** are significantly different at a 5% level between users and non-users of derivatives for that variable in the Berkman and Bradbury study (* significant at a 5% level in 1999). The Z-statistic is the non-parametric Mann-Whitney U test statistic for the difference between the two groups of firms, users and non-users of derivatives (users classified by having outstanding contracts for the firm according to their 1999 Annual Reports).

Panel A

Firms for financial year 1999	Firms with Derivatives (N=71)		Firms without Derivatives (N=46)			
	Mean	Median	Mean	Median	Z-statistic	p-value
Firm Value **	19.265	19.006	17.228	17.229	5.552*	0.000
Interest Cover	1.5480	1.3235	0.7236	0.1449	2.284*	0.022
Leverage **	0.2861	0.2687	0.1811	0.1036	2.384*	0.017
Tax loss **	0.2958	0.0000	0.3261	0.0000	-0.346	0.730
E/P Ratio **	0.0376	0.0611	0.0138	0.0200	3.075*	0.002
Asset Growth/Cashflow	-0.5503	0.0000	-0.3523	0.0000	-1.417	0.125
Managerial Share Ownership	0.2600	0.2044	0.2740	0.1727	-0.028	0.156
Liquidity **	-0.0587	-0.0640	0.1251	0.1529	-0.686	0.492
Dividend Payout **	0.9179	0.7302	0.4478	0.0000	3.778*	0.000
Alternative Capital Instruments **	0.0167	0.0000	0.0166	0.0000	1.326	0.185
Proportion of Overseas Assets **	0.1076	0.0000	0.0902	0.0000	1.062	0.288

Panel B

Firms Berkman and Bradbury (1996)	Firms with Derivatives (N=55)		Firms without Derivatives (N=61)	
	Mean	Median	Mean	Median
Firm Value **	12.259	12.263	10.464	10.211
Interest Cover	0.473	1.249	1.603	1.820
Leverage **	0.268	0.222	0.145	0.058
Tax loss **	0.473	0.000	0.295	0.000
E/P Ratio **	0.028	3.362	-0.025	0.753
Asset Growth/Cashflow	-1.762	0.745	0.253	0.817
Managerial Share Ownership	0.281	0.104	0.337	0.320
Liquidity **	-0.261	-0.341	0.371	0.091
Dividend Payout **	0.468	0.479	0.271	0.000
Alternative Capital Instruments **	0.037	0.000	0.020	0.000
Proportion of Overseas Assets **	0.138	0.000	0.109	0.000

Table 6. Tobit Regression for the Determinants of Corporate Use of Derivatives

This table reports the results of the Tobit regression models for a sample of 117 NZ non-financial firms listed on the NZSE in 1999. Firms are classified as derivative or non-derivative users by information in their "Notes to Financial Statements' of their 1999 Annual Report. Model A uses the fair value of derivative contracts scaled by the firm value as the dependent variable. Model B uses the contract amount of derivative contracts scaled by the firm value as the dependent variable.

Variables		**Model A** (using Fair Value)				**Model B** (using Contract Value)			
	Predicted Sign	Coefficient Estimate	t-value	P-value		Coefficient Estimate	t-value	P-value	
Intercept		-0.07120	-4.36	0.0000	*	-1.41300	-3.89	0.0001	*
Firm Value	+	0.00337	3.83	0.0001	*	0.07060	3.60	0.0003	*
Interest Cover	-	0.00020	0.18	0.8600		0.02290	0.98	0.3271	
Leverage	+	0.01350	1.73	0.0838	**	0.43360	2.55	0.0107	*
Tax loss	+	-0.00221	-0.63	0.5271		0.02780	0.40	0.6878	
E/P Ratio	-	0.00092	0.19	0.8499		-0.09270	-0.82	0.4132	
Asset Growth/Cashflow	+	0.00037	0.33	0.7412		-0.01450	-0.61	0.5404	
Managerial Share Ownership	+	0.00283	0.52	0.6004		-0.01560	-0.14	0.8924	
Liquidity	-	0.00081	0.67	0.5043		0.02340	0.95	0.3432	
Dividend Payout	+	0.00137	0.98	0.3271		0.03760	1.23	0.2181	
Alternative Capital Instruments	-	-0.04590	-1.49	0.1357		-0.17380	-0.32	0.7488	
Proportion of Overseas Assets	+	0.00000	0.00	0.9995		-0.03460	-0.26	0.7949	

* signifanct at a 5% level
** signifanct at a 10% level

Table 7. Descriptive Statistics and Univariate Tests for New Independent Variables

This table provides the descriptive statistics for the new independent variables for the two groups, users and non-users of derivatives. Panel A contains the descriptive statistics for the 117 NZ non-financial firms listed on the NZSE in 1999. Panel B reports the Z-statistic for the non-parametric Mann-Whitney U test (* significant at a 5% level). The Mann-Whitney U test is a non-parametric tests for the difference between the two groups of firms, uses and non-users of derivatives (users classified by having outstanding contracts for the firm according to their 1999 Annual Reports).

Panel A

All Sample Firms for financial year 1999 (N = 117)	Mean	Std. Dev.	Median	Min.	Max.
Market-to-Book	3.119	3.910	1.649	0.076	21.223
Tobin's q	1.287	1.109	0.962	-0.796	7.866
Earnings cover of dividends	1.300	1.280	1.227	-0.963	9.922
Dividend paying firms	0.632	0.484	1.000	0.000	1.000
Proportion of Overseas Revenue	0.129	0.259	0.000	0.000	1.000

Panel B

Firms for financial year 1999	Firms with Derivatives (N=71)		Firms without Derivatives (N=46)			
	Mean	Median	Mean	Median	Z-statistic	p-value
Market-to-Book	3.752	2.454	2.142	0.730	3.644*	0.000
Tobin's q	1.2220	1.0025	1.3878	0.9118	-0.456	0.648
Earnings cover of dividends	1.3793	1.2506	1.1463	1.1290	0.632	0.527
Dividend paying firms	0.7887	1.0000	0.3913	0.0000	3.576*	0.000
Proportion of Overseas Revenue	0.1456	0.0000	0.1037	0.0000	2.148*	0.032

Table 8. Tobit Regression for the Determinants of Corporate Use of Derivatives (including Market-to-Book instead of E/P Ratio)

This table reports the results of the Tobit regression models for a sample of 117 NZ non-financial firms listed on the NZSE in 1999. Firms are classified as derivative or non-derivative users by information in their "Notes to Financial Statements' of their 1999 Annual Report. Model A uses the fair value of derivative contracts scaled by the firm value as the dependent variable. Model B uses the contract amount of derivative contracts scaled by the firm value as the dependent variable.

Variables		**Model A** (using Fair Value)				**Model B** (using Contract Value)			
	Predicted Sign	Coefficient Estimate	t-value	P-value		Coefficient Estimate	t-value	P-value	
Intercept		-0.07350	-4.35	0.0000	*	-1.40190	-3.93	0.0000	*
Firm Value	+	0.00354	3.78	0.0002	*	0.07130	3.58	0.0003	*
Interest Cover	-	0.00036	0.31	0.7600		0.02280	0.98	0.3290	
Leverage	+	0.01240	1.51	0.1306		0.39910	2.24	0.0253	*
Tax loss	+	-0.00233	-0.67	0.5045		0.02670	0.39	0.6984	
Asset Growth/Cashflow	+	0.00031	0.28	0.7819		-0.01440	-0.61	0.5433	
Managerial Share Ownership	+	0.00292	0.54	0.5882		-0.01130	-0.10	0.9220	
Liquidity	-	0.00076	0.63	0.5275		0.01910	0.78	0.4366	
Dividend Payout	+	0.00138	0.98	0.3252		0.03670	1.21	0.2272	
Alternative Capital Instruments	-	-0.04640	-1.50	0.1337		-0.20090	-0.37	0.7109	
Proportion of Overseas Assets	+	0.00003	0.01	0.9959		-0.02410	-0.18	0.8553	
Market-to-Book	+	-0.00022	-0.50	0.6195		-0.00548	-0.62	0.5385	

* signifanct at a 5% level

Table 9. Tobit Regression for the Determinants of Corporate Use of Derivatives (including Tobin's *q* instead of E/P Ratio)

This table reports the results of the Tobit regression models for a sample of 117 NZ non-financial firms listed on the NZSE in 1999. Firms are classified as derivative or non-derivative users by information in their "Notes to Financial Statements' of their 1999 Annual Report. Model A uses the fair value of derivative contracts scaled by the firm value as the dependent variable. Model B uses the contract amount of derivative contracts scaled by the firm value as the dependent variable.

Variables		**Model A** (using Fair Value)				**Model B** (using Contract Value)			
	Predicted Sign	Coefficient Estimate	t-value	P-value		Coefficient Estimate	t-value	P-value	
Intercept		-0.07240	-4.41	0.0000	*	-1.39870	-4.03	0.0000	*
Firm Value	+	0.00356	3.90	0.0000	*	0.07550	3.88	0.0001	*
Interest Cover	-	0.00037	0.32	0.7526		0.02750	1.15	0.2488	
Leverage	+	0.01180	1.44	0.1507		0.34470	1.97	0.0244	*
Tax loss	+	0.00249	-0.71	0.4776		0.01940	0.28	0.7767	
Asset Growth/Cashflow	+	0.00020	0.17	0.8655		-0.01950	-0.82	0.4097	
Managerial Share Ownership	+	0.00279	0.52	0.6049		-0.01640	-0.14	0.8859	
Liquidity	-	0.00098	0.81	0.4207		0.02980	1.21	0.2278	
Dividend Payout	+	0.00122	0.86	0.3876		0.02890	0.95	0.3410	
Alternative Capital Instruments	-	-0.04700	-1.51	0.1299		-0.23320	-0.43	0.6655	
Proportion of Overseas Assets	+	-0.00041	-0.07	0.9469		-0.03960	-0.30	0.7645	
Tobin's q	+	-0.00137	-0.80	0.4255		-0.06580	-1.84	0.0661	**

* signifanct at a 5% level
** signifanct at a 10% level

Table 10. Tobit Regression for the Determinants of Corporate Use of Derivatives (including Dividend dummy instead of Dividend Payout Ratio

Variables		Model A (using Fair Value)				Model B (using Contract Value)			
	Predicted Sign	Coefficient Estimate	t-value	P-value		Coefficient Estimate	t-value	P-value	
Intercept		-0.07110	-4.28	0.0000	*	-1.38460	-3.71	0.0002	*
Firm Value	+	0.00332	3.63	0.0003	*	0.06560	3.22	0.0013	*
Interest Cover	-	-0.00004	-0.04	0.9707		0.01620	0.69	0.4917	
Leverage	+	0.01440	1.83	0.0675	**	0.45990	2.69	0.0071	*
Tax loss	+	-0.00232	-0.65	0.5162		0.04120	0.58	0.5627	
Asset Growth/Cashflow	+	0.00048	0.09	0.9252		-0.12530	-1.03	0.3031	
E/P Ratio	-	0.00051	0.44	0.6633		-0.00801	-0.33	0.7417	
Managerial Share Ownership	+	0.00316	0.58	0.5612		-0.00387	-0.03	0.9734	
Liquidity	-	0.00098	0.78	0.4338		0.03260	1.25	0.2106	
Alternative Capital Instruments	-	-0.04840	-1.54	0.1224		-0.11830	-0.22	0.8290	
Proportion of Overseas Assets	+	-0.00005	-0.01	0.9942		-0.03270	-0.24	0.8079	
Dividend	+	0.00299	0.75	0.4546		0.13220	1.55	0.1215	

* signifanct at a 5% level
** signifanct at a 10% level

Table 11. Tobit Regression for the Determinants of Corporate Use of Derivatives (including EPS/DPS instead of Dividend Payout

Variables	Predicted Sign	Model A (using Fair Value) Coefficient Estimate	t-value	P-value		Model B (using Contract Value) Coefficient Estimate	t-value	P-value	
Intercept		-0.06650	-3.24	0.0012	*	-0.80450	-1.75	0.0803	*
Firm Value	+	0.00351	3.21	0.0013	*	0.05030	2.04	0.0417	*
Interest Cover	-	-0.00153	-0.87	0.3817		-0.03610	-1.11	0.2660	
Leverage	+	0.00076	0.07	0.9472		0.11220	0.45	0.6526	
Tax loss	+	-0.00502	-1.14	0.2559		0.02280	0.27	0.7897	
Asset Growth/Cashflow	+	-0.04400	-0.77	0.4403		-1.62130	-1.43	0.1517	
E/P Ratio	-	-0.00031	-0.27	0.7858		-0.02120	-0.87	0.3818	
Managerial Share Ownership	+	0.00746	1.25	0.2100		-0.02620	-0.20	0.8422	
Liquidity	-	0.00338	1.68	0.0925	**	0.06360	1.50	0.1341	
Alternative Capital Instruments	-	0.01660	0.42	0.6731		0.00327	0.00	0.9971	
Proportion of Overseas Assets	+	0.00046	0.07	0.9460		-0.00564	-0.04	0.9712	
EPS/DPS	+	0.00234	0.98	0.3258		0.10510	2.12	0.0342	*

* signifanct at a 5% level
** signifanct at a 10% level

Table 12. Univariate Nonparametric Tests for Independent Variables

The sample contains 117 NZ non-financial firms listed on the NZSE in 1999. Frirms are classified as derivative or non-derivative users by information in their "Notes to Financial Statements' of their 1999 Annual Report. Z-statistic is the non-parametric Mann-Whitney U test statistic for the difference between the two groups of firms, with and without derivatives.

Variables	Firms with Derivatives (N = 83)		Firms without Derivatives (N = 34)			
	Mean	Median	Mean	Median	Z-statistic	p-value
Firm Value **	19.127	18.954	16.846	16.920	5.679	0.000
Interest Cover	1.4453	1.2826	0.6832	0.0000	2.661	0.008
Leverage **	0.2930	0.2855	0.1272	0.0421	3.817	0.000
Tax loss	0.3012	0.0000	0.3235	0.0000	-0.237	0.813
E/P Ratio **	0.0129	0.0591	0.0658	0.0027	-2.996	0.003
Asset Growth/Cashflow	-0.5548	0.0000	-0.2715	0.0000	-1.709	0.087
Managerial Share Ownership	0.2520	0.1954	0.2986	0.2236	-0.549	0.583
Liquidity **	-0.0088	0.0441	0.0681	0.0272	-0.240	0.810
Dividend Payout **	0.8200	0.6535	0.5208	0.0000	2.697	0.007
Alternative Capital Instruments **	0.0178	0.0000	0.0139	0.0000	0.490	0.624
Proportion of Overseas Assets **	0.1012	0.0000	0.0998	0.0000	1.424	0.155

Table 13. Logit Regression for the Determinants of Corporate Use of Derivatives

The sample contains 117 NZ non-financial firms listed on the NZSE in 1999. Frirms are classified as derivative or non-derivative users by information in their "Notes to Financial Statements" of their 1999 Annual Report.

Variables	Predicted Sign	Coefficient Estimate	t-value	P-value	
Intercept		-17.9001	-3.83	0.0001	*
Firm Value	+	0.9769	3.77	0.0002	*
Interest Cover	-	0.271	1.21	0.2264	
Leverage	+	4.3199	2.53	0.0114	*
Tax loss	+	0.6188	1.02	0.3081	
E/P Ratio	-	-1.606	-1.69	0.0906	**
Asset Growth/Cashflow	+	0.0347	0.15	0.8779	
Managerial Share Ownership	+	-0.0917	0.09	0.9312	
Liquidity	-	0.4184	1.99	0.0463	*
Dividend Payout	+	0.0725	0.24	0.8138	
Alternative Capital Instruments	-	-8.8986	-1.85	0.0638	**
Proportion of Overseas Assets	+	-1.2607	-1.03	0.3019	
McKelvey-Zavonia R2		0.8552			

* signifanct at a 5% level
** signifanct at a 10% level