ELEMENTS OF CORPORATE DEBT POLICY: TAXATION AND CREDIT RATINGS

by

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Abstract

A firm will take into consideration several factors when establishing its debt policy. Two of these factors are the tax consequences of the debt and the credit rating that a bond issue will receive. As the integration of financial markets continues, these elements must often be viewed in an international context. This thesis aims to increase our understanding of the tax consequences of cross-border borrowings and the role of credit ratings in both domestic and global environments.

The first paper illustrates that the interest rate parity condition cannot hold on both a before and after tax basis. The cost of borrowing in alternative locations is rarely equivalent after taxes have been considered. The discrepancies between alternative costs of debt widen when foreign exchange gains are taxed differently than income. Using Shell Canada's New Zealand dollar transaction as an example, I illustrate the tax benefits of borrowing in foreign currencies and discuss how these benefits have changed under recent budget recommendations.

In order to secure cross-border debt, it is essential that companies obtain a bond rating from an agency viewed credibly by foreign investors. In the second paper, I examine the impact of Standard and Poor's acquisition of the Canadian Bond Rating Service on the securities of the rated firms. I suggest that the positive abnormal stock returns at the time of the acquisition are evidence of the benefit that a globally recognized rating agency may bring to Canadian firms.

The precise role of credit ratings is examined within the final chapter of this thesis. While some argue that a rating's primary function is to help investors set parameters for the institutions investing on their behalf, others believe that ratings provide additional information to the market. This chapter tests whether rating downgrades have valuable information content for equity securities. It does so in a unique way that depends on first estimating the likelihood of downgrade and then examining stock price reactions conditional on this likelihood. I find no evidence that information is revealed by rating changes.

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To my family - thank you. To my husband, Mark, the completion of this thesis is as much your success as mine.

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[1]Reproduced with the permission of the Canadian Tax Foundation from, Lynnette D. Purda, "Quantifying the Tax Benefits of Borrowing in Foreign Currencies" (2001) vol. 49, no.4 *Canadian Tax Journal* 925-44.

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1 Introduction

One of the key elements of a firm's financial policy is its choice of external funding. While traditional debt and equity options remain important sources of funds, firms are increasingly turning to innovative transactions to lower their overall cost of capital. An example of these innovations has been the increased use of cross-border financings. To locate sources of low cost funds, firms are expanding their search far beyond domestic borders alone.

While firms can choose between raising funds internationally through either debt or equity, the focus of this thesis is debt financing. With the increasingly global nature of both financial markets and the institutions that operate within them, it is important for firms to understand the environment in which they are borrowing funds. The essential characteristics of this environment may change depending on whether debt is obtained through banking relationships, private placements or bond issues. Of critical importance to bond issues, for instance, is the establishment of a credit rating. Important to any type of borrowing is the tax advantage of debt. These two components: credit ratings and tax consequences, are the primary elements analyzed within this study of corporate debt transactions. In the examination of both elements, I make reference to their role in increasingly globalized financial markets.

Academics and practitioners have long been aware of the tax consequences associated with borrowing. Modigliani and Miller pioneered the study of the tax advantages of corporate debt with their work in 1963. Since that time, researchers have sought to empirically demonstrate that the tax environment influences firms' corporate borrowing decisions. The results of this research have been mixed. Early studies found little conclusive evidence of a relation between taxation and capital structure. Titman and Wessels (1988) found no connection between the use of debt to generate tax savings and the existence of non-debt tax shields. In an international context, Rajan and Zingales (1995) found that establishing whether capital structure decisions were influenced by taxes was extremely sensitive to personal tax rate assumptions. More optimistically, MacKie-Mason (1990) found evidence of taxation impacting firms' *incremental* financing decisions and Graham (1996) linked simulated marginal tax rates to company leverage.

While academic research has not always agreed on the amount of influence taxation has on a firm's debt decisions, anecdotal evidence has suggested that firms are very capable of structuring their borrowings in tax advantaged ways. The second chapter of this thesis is motivated by a transaction undertaken by Shell Canada Ltd. As part of this transaction, Shell borrowed money in New Zealand funds while simultaneously arranging a series of US dollar forward contracts. The transaction was challenged by the Minister of Revenue as having tax avoidance as its primary aim. While the tax advantages of debt have been studied primarily

in a domestic context, Shell Canada has demonstrated that additional tax benefits may be generated by cross-border transactions.

Chapter 2 entitled "Quantifying the Tax Benefits of Borrowing in Foreign Currencies," begins by illustrating that interest rate parity cannot hold simultaneously on both a before and after-tax basis when interest is paid over multiple periods. Interest rate parity implies that differences in international interest rates are offset by foreign exchange movements, thereby equating the cost of borrowing worldwide. With the introduction of taxation, however, this equality no longer holds. This is particularly the case when foreign exchange gains and losses are taxed at different rates than income. At the time of Shell Canada's transaction, foreign exchange gains were favorably taxed, serving to reduce the after-tax cost of debt.

Using the Shell transaction as an example, I show the extent to which the cost of debt can be altered by borrowing in foreign currencies, particularly depreciating ones. I also illustrate the impact of the February 2000 budget recommendation, developed in response to the Minister's objections. This recommendation reduces but does not eliminate the tax advantages of borrowing in weak currencies.

In order to secure cross-border borrowings it is important to maintain a credible bond rating. The vast majority of fixed income investors represent institutions such as life insurance companies and pension funds. In the US, for instance, 69% of corporate bonds outstanding in 1999 were held by institutional investors. Households represented only 13% of ownership.[2] Often these institutions must comply with guidelines designed to ensure that they maintain a fiduciary duty towards their clients. These guidelines dictate the quality of the bonds that can be held by the fund. If left to themselves, institutions may disagree significantly about the quality of any one particular issue. As a result, credit ratings assigned by agencies such as Standard and Poor's (S&P), Moody's, and the now defunct Canadian Bond Rating Service (CBRS), are important elements of corporate borrowing. It is standard practice, for instance, for a pension mandate to declare that the fund can only hold bonds above a certain credit rating. It is therefore essential for firms to have a thorough understanding of both credit ratings and the agencies that provide them.

Chapters three and four seek to add to our understanding of credit ratings. At the centre of the examination is the debate over the exact functions that these ratings serve. As already suggested, ratings may be valuable in assisting investors to establish parameters for the institutions that invest on their behalf. An alternative, is that ratings convey additional information to the market about the creditworthiness of the issue. It is suggested that this information is above and beyond what is available from other public sources. The intuition is that credit

[2]Source: US Census Bureau, Statistical Abstract of the United States: 120th Edition, 2000 (page 523).

analysts meet with members of senior management when assessing the firm's credit quality. As a result, agencies may be privy to inside information that is implicitly incorporated into the rating assignment. Through the rating, investors may infer something about the quality of this information despite the fact that it is not explicitly revealed.

Chapter three analyzes the security price reactions to the announcement of Standard and Poor's acquisition of the Canadian Bond Rating Service. We would not expect to witness any reaction unless the possible functions of bond ratings are served differently by the two agencies. The acquisition forces us to ask whether or not investors are indifferent to the rating provider. I answer this question by examining abnormal returns of the bonds and stocks of the rated firms at the time of the acquisition announcement. While little reaction was found for the bond prices, the stocks demonstrated a significantly positive abnormal return. This was particularly the case for firms that did not have S&P ratings prior to the acquisition.

I explain the positive stock price returns by making reference to the increasing quantity of US dollar denominated debt being issued by Canadian firms. Interestingly, all firms with existing US debt prior to S&P's acquisition already maintained ratings from US-based agencies. I argue that in order to participate in cross-border debt financings, Canadian firms must obtain a rating from an agency viewed credibly by international investors. The acquisition of CBRS by S&P provides such a rating. Should the sample firms choose to access the US debt market in the future, they will already be armed with a rating that is acceptable to US institutions. This finding has implications beyond Canadian borders alone as rating agencies continue to become more global in their operations. Through acquisitions, alliances, and branch offices, credit rating agencies are becoming increasingly international in their scope.

While the analysis of S&P's acquisition of CBRS suggests that the primary role of credit ratings is to fulfill institutional requirements, chapter four explicitly tests the competing theory that ratings convey inside information related to the creditworthiness of the firm. A primary method of measuring the information content of ratings has been to observe security price movements surrounding rating changes. While little price reaction has been witnessed in response to rating upgrades, significant negative reactions for both bonds and stocks have been found for rating downgrades (see for instance Hand, Holthausen and Leftwich (1992) and Dichev and Piotroski (2001)). Complicating these observations however is the evidence of Wansley and Clauretie (1985) and Goh and Ederington (1993) that security prices are often in decline even prior to the downgrade announcement. This is perhaps not surprising, since downgrades are often made in response to changes in firm performance or economic events. It is difficult to separate whether the negative security returns witnessed are in reaction to deteriorating financial conditions or the rating changes themselves.

To help isolate the impact, and therefore the information content, of a rating change, chapter four develops a probit model to estimate the likelihood of downgrade based on public information related to the firm's financial position. If we can control for firm characteristics prior to downgrade, then perhaps we can better measure the information revealed by the downgrade itself. I examine stock price reactions to the rating change *conditional* on the prediction of downgrade.

Via the probit model, I am able to predict the likelihood of downgrade to some extent. Factors that are consistently important in this prediction include interest coverage and firm size. After conditioning on this model, I find little evidence of information revelation by rating downgrades. In the vast majority of cases, negative security returns can be explained by poor financial performance rather than inside information. Rating agencies are doing a good job of interpreting firm-specific *public* information and making rating adjustments accordingly.

In the few instances where inside knowledge appears to still be revealed, the likelihood of downgrade as predicted by the probit model is very low. It appears that it is only in situations where public information does not predict a downgrade and yet one occurs, that information is revealed. For these few situations I ask whether there are any systematic factors that may explain why some rating changes are more revealing than others. I find evidence that the timing of the rating change is important. During certain time periods, perhaps those coinciding with episodes of greater market uncertainty, rating changes appear to be more informative. In general, however, there is little evidence that ratings contain any information beyond what the public already knows.

Shell Canada's transaction provides only one example of taxation's influence on how firms structure their debt financings. Surveys of corporate executives by Graham and Harvey (2001) and Bancel and Mittoo (2002) provide evidence on the importance that firms place on their credit ratings. It is apparent that both of these elements; taxation and credit ratings, are key considerations for corporate borrowing decisions. This is the case regardless of whether these decisions are domestic or international in their scope.

2 Quantifying the Tax Benefits of Borrowing in Foreign Currencies[3]

The inflationary environment of the late 70's and early 80's, accompanied by its high interest rates, prompted research into possible methods for companies to reduce their overall cost of borrowing. Work by deFaro and Jucker (1973), Levi (1977), and Shapiro (1984) analyzed the interaction between currency movements, interest rates, and taxes with the goal of examining overseas borrowing as a possible way to lower the cost of debt. Some of the issues raised by these authors are being revisited today, even in the current environment of low interest rates.

There are several explanations for this re-examination. These explanations include the increased use of contracts designed to hedge future interest rates and currency movements, recent decisions by the Courts, and changing tax regulations in both Canada and the US. This chapter examines some of these factors by studying the effects of taxation on the interest rate parity condition and the cost of borrowing abroad. We demonstrate that given favorable tax treatment of capital gains, a firm can significantly lower its cost of debt by choosing to borrow in a weak currency. To illustrate this result, Shell Canada's New Zealand dollar debt and the resulting Supreme Court decision regarding this transaction, are examined. Although the legal and policy implications of this transaction have already received a great deal of attention[4], here the transaction is used simply for illustrative purposes. Shell's New Zealand dollar debt can be used to demonstrate a procedure for quantifying the benefits of borrowing abroad and to highlight the financial theory underlying international debt.

An analysis of the benefits of foreign borrowing by either multinational corporations or domestic firms must begin with a review of the theoretical relations between interest rates and foreign currencies. Therefore, this chapter begins by re-examining the interest rate parity condition on both a pre and after-tax basis. It is confirmed that the parity condition cannot hold in both instances. Next, the motivations underlying the renewed interest in foreign currency borrowings are examined. It is hypothesized that recent clarifications of the tax regulations in both Canada and the US may have served to increase the instances of tax-motivated borrowings. To illustrate the internal rate of return as a procedure for quantifying the tax benefits of foreign currency borrowings, Shell Canada's New Zealand dollar loan transaction is then examined. This examination occurs under two alternative scenarios. The first maintains the existing tax treatment for weak currency borrowings while the second analyzes the changes proposed by the February 2000 budget. It is found that significant alterations in the cost of debt are due

[3] Reproduced with the permission of the Canadian Tax Foundation from, Lynnette D. Purda, "Quantifying the Tax Benefits of Borrowing in Foreign Currencies" (2001) vol. 49, no.4 *Canadian Tax Journal* 925-44.

[4] See for instance Edgar (2000).

to variations in the tax treatment of capital gains and losses. Therefore, the chapter concludes with a review of differences in international capital gains taxation.

2.1 Interest Rate Parity

2.1.1 Pre-Tax Case

Although there may be incentives for both domestic and multinational firms to borrow abroad, the prospect of undertaking these transactions may initially appear daunting. Not only is there a new yield curve to analyze with potentially very different nominal interest rates, there is also the contemplation of future foreign exchange movements. Fortunately, interest rate parity (IRP) serves to simplify the analysis. IRP provides the link between movements in interest rates and foreign currencies.

Interest rate parity is the logical extension of the 'law of one price' to capital funds. The law of one price posits that the same basket of goods should sell for the same exchange-adjusted price in different countries. It is argued that if this is not the case, the possibility of arbitrage exists. Individuals would profit from buying goods in the country where they are cheapest and selling them to nations where they are more expensive. Extending this notion, interest rate parity states that the exchange-adjusted price of borrowing money, the effective interest rate, should also be equal across all countries. This implies that movements in the foreign exchange rate over time equate the cost of debt between nations.

To illustrate the parity concept in the absence of taxes, consider a US firm determining whether to borrow domestically in the US or internationally in the Canadian market. Assume that the Canadian dollar is expected to depreciate in the future. Initially, for simplicity's sake, a single period loan will be examined with a face value of one US dollar. We will denote the Canadian interest rate as r_c and the corresponding US rate as r_{us}. The exchange rate at the beginning of the period is assumed to be S_0, which is expressed in terms of the number of Canadian dollars per US dollar. The rate that is expected to apply at the end of the period, when the loan must be repaid, is denoted by $E(S_1)$. Following the work of deFaro and Jucker (1973), the effective cost of borrowing for both the US and Canadian dollar loans can be calculated. The effective cost of the Canadian loan will include the impact of the Canadian dollar's depreciation on the cost of debt.

If the firm borrows domestically in the US, the cost of the loan is easily found. The company receives one dollar at the beginning of the period and must repay $(1 + r_{us})$ at the end. This payment results in an effective cost of debt of r_{us}. For the Canadian dollar loan, the company initially receives an amount of S_0, which is equivalent to one US dollar. At the

end of the period, the required interest and principal payment, in US dollars, is equivalent to $\frac{S_0}{E(S_1)}(1+r_c)$. The effective cost of this loan in US dollars would be the rate r_e, such that:

$$(1+r_e) = \frac{S_0}{E(S_1)}(1+r_c) \tag{2.1}$$

To simplify this expression and determine the effective cost of the loan, the depreciation of the Canadian dollar will be denoted by d and defined as:

$$\frac{E(S_1)}{S_0} - 1 = d \tag{2.2}$$

Note that d will be positive in the case of a depreciating Canadian dollar and negative when the Canadian currency appreciates.

Solving for r_e in equation 2.1 and including the newly defined variable, d, we find an expression for the effective cost of borrowing that includes the nominal Canadian interest rate and the depreciation of the Canadian dollar. These two components - the foreign interest rate and the movement in the exchange rate - constitute the two elements comprising the cost of foreign borrowing. The expression for this cost, r_e, is presented in equation 2.3.

$$r_e = \frac{r_c - d}{1+d} \tag{2.3}$$

With an estimation for the value of d, the effective costs of the Canadian and US dollar loans can easily be compared. For instance, if $\frac{r_c-d}{1+d} < r_{us}$, the company should borrow in the Canadian market rather than in the US.

Interest rate parity, however, states that the cost of the loans should be the same regardless of where the borrowing takes place. This implies that $(1+r_{us}) = \frac{S_0}{E(S_1)}(1+r_c)$, or equivalently, $\frac{1+r_c}{1+r_{us}} = \frac{E(S_1)}{S_0}$.

Formally, IRP relates the difference between the current spot exchange rate, S_0, and the forward rate, F (rather than the expected spot rate $E(S_1)$), to the ratio of nominal interest rates. The form of this relationship is identical to what we have just derived if we replace $E(S_1)$ with F. This replacement implies that the forward rate is equivalent to the expected future spot rate. Dufey and Giddy (1994) review the evidence on the equivalence of these two terms, suggesting that a forward risk premium may exist such that the forward rate either under or overestimates the expected future spot rate. Research on this question, however, has found no evidence that the risk premium is either consistently positive or negative, or that it is large enough to be meaningful. Therefore, we will use the terms interchangeably, implying that $F = E(S_1)$.

Replacing the expected future spot rate with the forward rate as in equation 2.4 provides the formal definition of interest rate parity.

$$\frac{1+r_c}{1+r_{us}} = \frac{F}{S_0} \tag{2.4}$$

It can be verified that this condition is equivalent to the results derived above, in equation 2.3, by solving for the US interest rate. Noting that $\frac{F}{S_0}$ is equivalent to $1+d$ and solving for r_{us}, we find that $r_{us} = \frac{r_c - d}{1+d}$. Therefore, the effective cost of Canadian debt, $\frac{r_c - d}{1+d}$, is in fact equivalent to r_{us}, the cost of the US dollar loan. Under the interest rate parity condition, the company is indifferent to the source of its debt.

Whether interest rate parity holds in reality is an empirical question that depends on the market being studied. In the Eurocurrency market, which has few government regulations and taxes, the majority of evidence is supportive of IRP. Early research by Frenkel and Levich (1977) concluded that there is little possibility of arbitrage due to deviations from the IRP relation. This result is intuitively appealing since covered interest arbitrage is often used to explain why the interest rate parity condition should hold.

Covered interest arbitrage is the process of moving funds between securities denominated in various currencies in order to profit from different effective rates of interest. The transactions are 'covered' in the sense that hedging in the forward markets is taken into account. If there are arbitrage profits to be made, the demand for various securities, and correspondingly their prices, will increase to the point that they no longer provide abnormal returns. Instead, the securities will provide a return in line with the effective rates provided by equivalent securities denominated in different currencies. This implies that by seeking to find covered interest arbitrage opportunities, we ensure that the interest rate parity condition holds.

Comparing rates across domestic debt markets rather than in the Eurocurrency market, it is found that IRP does not hold as precisely. This is due to the existence of government regulations and taxes that may prevent parties from easily converting their funds from one currency to the next or entering into hedges in the forward market. Dufey and Giddy (1994) illustrate the impact of government regulations on interest rate parity by looking at the level of domestic bank reserve requirements. They suggest that these regulations result in differences between the effective cost of borrowing locally or in the Eurocurrency market. If a domestic bank is required to hold a greater proportion of its funds in reserve accounts, thereby limiting the revenue it can produce with these funds, it will adjust its borrowing and lending rates to take this extra cost into account. This adjustment may prevent interest rate parity from holding exactly.

2.1.2 After-Tax Case

Since financial executives have long known the tax benefits of borrowing, the cost of debt is best represented by an after-tax cost rather than by a pre-tax amount. If the interest rate parity condition equates the pre-tax cost of borrowing around the globe regardless of location and currency, what is the effect of taxes? The difficulty associated with this question is that no uniform answer exists. The tax treatment of interest and foreign exchange gains/losses varies significantly from country to country. Nevertheless, the work of Levi (1973) and Shapiro (1984) attempts to arrive at some general conclusions.

Levi (1973) observed that if firms from one country find securities of a particular currency to dominate all other alternatives on a pre-tax basis, firms from all countries will find that this option dominates before taxes. We must derive some reason then as to why we witness firms borrowing from several locations simultaneously and why firms of certain nationalities flock towards similar sources of funds. Differences in tax regulations provide such a justification. Given the two components of foreign borrowing costs - foreign interest rates, and exchange movements - Levi demonstrated that it is the national differences in the taxation of foreign exchange gains and losses that can significantly alter the interest rate parity relationship. For instance, given the Canadian and US tax environments at the time, Levi showed that Canadian firms may have preferred to route funds to the US for investment, even in the case of higher Canadian rates. This occurred because the US dollar was at a premium and the resulting foreign exchange gains from investing in US securities were taxed more leniently than investment income earned in Canada.

Similarly, Shapiro (1984) explicitly demonstrated that the interest rate parity condition cannot hold simultaneously on both a pre and after-tax basis if the security under consideration lasts for more than a single period. This can be seen from the effective borrowing costs derived in the previous section. Starting with the single-period case and proceeding to a multi-period loan, we can continue in our context of comparable US and Canadian dollar debt to confirm Shapiro's results.

To confirm that interest rate parity holds on an after-tax basis in the single period case, we begin by deriving the after-tax payments for the US and Canadian dollar loans. At the end of the period, the US loan requires after-tax payments of principal and interest of $1+r_{us}(1-T)$where T denotes the corporate tax rate applicable in the US. Similarly, the after-tax payments associated with the Canadian loan can be derived by assuming that the same corporate tax rate, T, applies and that the capital gain experienced due to the depreciation of the Canadian dollar is also taxed at this rate. The repayment required at the end of the period is then:

$$\begin{aligned} & \frac{S_0}{F} + \frac{S_0}{F}(r_c(1-T)) + T\left(1 - \frac{S_0}{F}\right) \\ = \; & \frac{1}{1+d}(1 + r_c(1-T)) + \frac{Td}{1+d} \end{aligned} \tag{2.5}$$

The last term in the equation, $\frac{Td}{1+d}$, represents the additional tax payments resulting from the foreign exchange gain. In many countries, the rate at which this gain is taxed is less than the rate applied to ordinary earnings. For interest rate parity to hold on an after-tax basis however, we must assume that the gain is taxed as ordinary income and both transactions are taxed at the same rate, T. If we are willing to make these assumptions, we can find that the effective cost of the Canadian loan, which is represented by the payments in equation 2.5, is equivalent to the cost of the US loan and does not depend on the tax rate, T. To see this, equate the payments required for each loan and solve for the nominal US rate, again following the insights of Shapiro (1984).

$$\begin{aligned} 1 + r_{us}(1-T) &= \frac{1}{1+d}(1 + r_c(1-T)) + \frac{Td}{1+d} \\ r_{us}(1-T) &= \frac{(r_c - d)(1-T)}{1+d} \end{aligned} \tag{2.6}$$

Simplifying this expression by dividing through by $(1-T)$, we find that the US rate is again equivalent to the effective rate for the Canadian dollar loan. The tax rate, T, is eliminated from the expression indicating that the parity condition is unchanged even in the presence of taxes. Therefore, in the case of a one period obligation with equal tax rates on both domestic and foreign loans, a firm is indifferent to the location in which it undertakes borrowing even on an after-tax basis.

The effective rates found above are equivalent to the loans' internal rates of return (IRR). The IRR of a loan is the discount rate that sets the net present value of the transaction equal to zero. When many cash flows are associated with the loan, as in the case of a transaction spanning many periods, finding the IRR is the most straightforward way of arriving at an all-in cost of borrowing. For a multi-period US dollar loan, the IRR is the value of k found in equation 2.7. This equation sums the loan payments for each period i in an N period loan. The value found for k represents the after-tax cost of debt associated with the transaction.

$$0 = -1 + \sum_{i=1}^{N} \frac{r_{us}(1-T)}{(1+k)^i} + \frac{1}{(1+k)^N} \tag{2.7}$$

To solve for the after-tax cost of debt (in US dollars) for a multi-period Canadian dollar loan, we make the simplifying assumption that the Canadian currency depreciates by the same amount in each period, i. In other words, $\frac{E(S_1)}{S_0} = 1 + d$, and $\frac{E(S_2)}{E(S_1)} = 1 + d$. This implies that $\frac{E(S_2)}{S_0} = (1+d)^2$ such that the depreciation of the dollar over two periods is simply the single period depreciation squared. Likewise for any period i, $\frac{E(S_i)}{S_0} = (1+d)^i$. With this assumption, finding the effective after-tax cost of the Canadian loan is equivalent to solving for r in the following equation:

$$0 = -1 + \sum_{i=1}^{N} \frac{\frac{r_c}{(1+d)^i}(1-T)}{(1+r)^i} + \frac{\frac{1}{(1+d)^N}}{(1+r)^N} + \frac{T\left(1 - \frac{1}{(1+d)^N}\right)}{(1+r)^N} \tag{2.8}$$

The summation in this equation represents the present value of the total after-tax interest payments over the course of the loan, measured in US dollars. The next term is the present value of the principal repayment, also in US dollars. The numerator of this term will be less than one since we are assuming that d is positive, indicating that the loan is repaid with less than the original amount received. The last term in the equation represents the capital gains tax that is realized when the loan is repaid. It is primarily this term that serves to prevent the internal rates of return on the US and Canadian dollar loans from being the same.

If k and r were equivalent, the effective costs of the transactions would be equal and the company would be indifferent between borrowing in Canada or the US. Shapiro (1984) demonstrated that for the multi-period, after-tax case, an equivalent cost of borrowing cannot be found to set $k = r$. This result is driven by the deferral of the capital gains tax until period N when the principal is repaid. Since we do not recognize the foreign exchange gain until this time, the present value of the tax payment declines and serves to reduce the cost of the Canadian dollar transaction below that of the US dollar loan. In general, the cost of borrowing domestically, in the US will be greater when depreciation is anticipated for the foreign currency. In the case of an appreciating foreign currency, the domestic borrowing cost would be lower.

Since the deferral of taxes on capital gains is the primary mechanism through which the effective costs of the two loans are altered, it should be noted how these costs behave with changes in the time period of the loan. For a foreign loan in a weak currency that results in a capital gain, the cost of the loan will continue to fall with increases in N, the maturity. The difference between the effective costs of the two loans will widen. If, however, a loan is undertaken in a strong currency that is expected to generate a capital loss, the cost of the

transaction will increase with increases in N. Delaying the recognition of a capital loss and the ability of this loss to reduce current taxes, increases the after-tax cost of the loan.

The impact of tax deferral on the cost of borrowing can also be seen by a counter-example. If movements in the foreign exchange rate were taxed at rate T on an accrual basis as opposed to on realization, the interest rate parity condition would hold on both a pre and after-tax basis. If this were the case, the effective costs of the two loans would remain the same even after taxes were taken into account. In other words, the internal rates of return would be identical and k would be equal to r.

At this point, some simplifications in the above analysis should be noted. For instance, the applicable corporate tax rate, T, has been assumed to be the same for loans occurring in either jurisdiction. As well, foreign exchange gains have been treated as capital gains and taxed at the full corporate rate. Altering these assumptions would serve to increase the discrepancies between the costs of borrowing in the two countries.

As will be explicitly illustrated in the analysis of Shell Canada's transaction, the above results encourage borrowing in a weak currency. The falling value of the weak currency allows the firm to repay the loan with fewer funds than were initially received. This foreign exchange gain, combined with the lenient taxation and deferral of capital gains, allows the borrower to reduce their after-tax cost of debt.

2.2 Foreign Currency Borrowing

2.2.1 Motivation for Renewed Interest

Clarifications of the tax consequences of foreign borrowings have been a primary motivator for renewed interest in this area. In Canada for instance, the recent ruling of the Supreme Court regarding Shell's New Zealand dollar transaction clarified the interpretation of foreign exchange gains and the definition of interest. The Court confirmed a company's ability to generate tax advantages by borrowing abroad, claiming, "it is not the courts' role to prevent taxpayers from relying on the sophisticated structure of their transactions." [5]

Similar sentiment was expressed in the Tax Court's judgment of Canadian Pacific Ltd.'s Australian dollar debentures. Here the issue to be decided was whether weak currency borrowings fell under the category of "avoidance transactions" as defined by the general anti-avoidance rule (GAAR). In order to be classified as an avoidance transaction, the transaction must be entered into with the primary motivation of obtaining a tax benefit. In the case of Canadian Pacific's weak currency borrowing, the Court ruled that the transaction was primarily under-

[5] *Shell Canada Ltd. v. Canada,* [1999] 3 S.C.R. 622.

taken to raise capital rather than reduce taxes. Admittedly, this capital was raised in the most tax-advantaged way. The opinion of the Court on whether strategic tax planning, such as weak currency borrowing, falls within the reach of GAAR, is clearly conveyed by the words of Bowman J. in Jabs Construction Ltd. v. R. regarding GAAR:

> Section 245 (GAAR) is an extreme sanction. It should not be used routinely every time the Minister gets upset just because a taxpayer structures a transaction in a tax effective way, or does not structure it in a manner that maximizes taxes.[6]

Canadians are not alone in recognizing the potential benefits of foreign currency borrowing, nor are we the only country to detail the regulations and interpretations relating to these transactions. Bourne Wahl (1989) noted that the 1986 US Tax Reform Act clarified the treatment of exchange gains and losses on foreign assets, particularly with respect to the timing of the recognition of these currency movements. The US taxes foreign exchange gains at the same rate as interest income. Therefore, if an anticipated gain is taxed on an accrual basis, taxes will not affect the borrowing decision. If instead, gains are taxed on realization, the effective after-tax cost of debt falls below the statutory rate due to the deferral of these tax payments.

It is interesting to note that hedged transactions arranged by US corporations are taxed on an accrual basis and therefore do not receive the benefit of deferral. This greatly reduces the incentive to borrow in depreciating currencies when hedges are employed. For transactions taxed on realization, however, the motivation to borrow in weak currencies and invest in strong ones, remains.

A second motivation for renewed interest in foreign borrowing is the increased use of hedging instruments. We have seen that the overall cost of foreign debt is dependent on differences in foreign exchange and interest rates as indicated by interest rate parity. The use of forward contracts can guarantee the rate of a currency's depreciation or appreciation to ensure that the parity condition holds on a pre-tax basis. The ease with which companies can now enter into these hedging arrangements enhances their ability to create foreign borrowing opportunities.

Familiarity with hedging instruments, changing regulations, and recent court decisions have all served to make companies aware of the benefits of foreign currency borrowings. Although these benefits are derived primarily from the tax treatment of foreign exchange gains and the failure of interest rate parity to hold on an after-tax basis, the precise mechanisms allowing each debt transaction to produce a reduced cost of debt differ. To provide some insight into these mechanisms and the Court's interpretation of their components, the Shell Canada New

[6] *Canadian Pacific Ltd. v. The Queen* 2000 DTC 2428 (TCC) citing *Jabs Construction Ltd. v. R.*, 99 DTC 729 (TCC).

Zealand dollar loan will be analyzed. This analysis will demonstrate how to quantify the benefits of foreign currency borrowing.

2.2.2 Shell Canada Transaction

In 1988, Shell Canada required approximately US$100 million for general business purposes. To raise these funds, the company chose to borrow the equivalent amount in New Zealand dollars for a five-year period. At the time, the current market rate of interest in New Zealand was 15.4%, which was the rate secured by Shell. This rate implied that Shell made semi-annual interest payments of NZ$11.55 million based on the New Zealand principal amount of NZ$150 million. The corresponding US rate was 9.1%, indicating by interest rate parity, that the New Zealand dollar was expected to depreciate from its value of NZ$1.5 per US$1. At the time of entering into the transaction, Shell Canada also entered into a series of forward contracts to guarantee the future value of the exchange rate for all interest payments and the eventual principal repayment. The exchange rates agreed to in these contracts were set in accordance with interest rate parity, thereby allowing Shell to effectively bring down the pre-tax cost of borrowing in New Zealand to the equivalent US rate.

Table 2.1 illustrates the equivalence of the New Zealand dollar loan, converted to US dollars (as in the Shell transaction) and a pure US dollar loan before the consideration of taxes. It outlines the semi-annual, pre-tax payments over the course of the five-year loan made under both transactions. Finding the internal rate of return of the loans as defined in the previous section, provides an all-in cost of borrowing for each transaction. The two transactions do in fact have the same overall cost on a pre-tax basis. This cost is calculated as 9.1%, the US market rate of interest.

The New Zealand dollar loan required higher interest payments in accordance with the greater New Zealand rate of 15.4% (or 7.7% on a semi-annual basis) compared with the US rate of 9.1% (or 4.55% semi-annually). The extent to which the New Zealand interest payments exceeded the pure US payments decreased each period due to the weakening New Zealand dollar. Fewer US dollars were required to fulfill the New Zealand dollar interest payments as time progressed.

Examining the principal repayment highlights the depreciation of the New Zealand currency. It was possible to repay the original US$100 million with a much smaller amount. Although the exact amount depended on the precise forward rates agreed to, I estimate a repayment amount of US$74.32 million based on currency depreciation at a rate consistent with interest rate parity. Combining this figure with the last interest payment results in an expenditure of US$80.03 million in the final period. Comparing these figures to the original loan amount of

US$100 million, demonstrates that it is the savings in principal repayment that serves to equate the two costs of borrowing despite the higher New Zealand interest rates.

By examining the cash flows associated with the pre-tax case, we can see how weak currency borrowing provides tax benefits. The first advantage arises from the higher interest payments and the resulting increase in annual tax shields. The present value of this benefit over the entire term of the loan can be calculated as:

$$PV\ Interest\ Tax\ Shield = \sum_{i=1}^{10} \frac{Int_i \times T}{(1+r)^i} \tag{2.9}$$

$$\begin{aligned} where\ &: \\ Int_i &= \text{Interest payments in US dollars} \\ T &= \text{Corporate tax rate} \\ r &= \text{US semi-annual interest rate} \end{aligned}$$

If we assume that the corporate tax rate for Shell Canada was 40%, we can compare the present value of the tax shields arising from the two transactions. I use the US interest rate to discount the tax shields since this is the cost of borrowing for each of the loans. Any benefit associated with these transactions is therefore discounted at this same rate.

The present value of the tax shields generated by the pure US dollar loan was $14.37 million. Borrowing in New Zealand while entering US dollar forward contracts provided tax shields of $20.95 million. Taxes payable over the course of the five-year loan could be reduced by over $6 million dollars while securing financing at the same overall cost of borrowing.

The second tax advantage apparent from the transaction's cash flows was due to the significant foreign exchange gain realized upon repayment of principal. In the case of Shell Canada's transaction, the company reported a US$21 million gain.[7] Due to the debentures classification as a capital asset, this was considered a capital gain. Treatment as a capital gain ensured that taxes were not paid until realization and that the tax rate applied was lower than the standard corporate rate. At the time of the Shell transaction, only 75% of capital gains were taxed. Subsequent changes to Canadian tax regulations have seen the reduction of this rate to 66.6% and eventually 50%.

By how much do these two tax advantages - increased tax shields and capital gains treatment

[7]The foreign exchange gain estimated here is slightly greater than the amount reported due to the unavailability of the exact forward exchange rates used in the transaction. The forward rates used here are those consistent with interest rate parity assuming that the New Zealand dollar depreciates at a constant rate each period.

- lower the overall cost of borrowing for the firm? For comparisons sake, first note the after-tax cost of straight borrowing (i.e. without a currency conversion) in the two countries at the time. Assuming a corporate tax rate of 40%, the after-tax cost of a pure US dollar debt transaction would have been 5.46%. This rate is found by multiplying the pre-tax rate by one minus the tax rate ($9.1 \times (1 - 0.4)$). The equivalent after-tax cost at the New Zealand market rate was 9.24% ($15.4 \times (1 - 0.4)$).

Establishing the after-tax cost of borrowing in New Zealand and simultaneously entering into US dollar forward rate agreements requires knowledge not only of the overall corporate tax rate but also of the treatment of the foreign exchange gain. If we treat 75% of capital gains as being taxable and solve for the IRR in this case, we can confirm Shapiro's (1984) insight that interest rate parity does not hold on an after-tax basis. If IRP were to continue holding, we would expect to find that the overall cost of this transaction was again equivalent to borrowing directly in the US at an after-tax rate of 5.46%. Instead, we find that the cost of borrowing falls to 4.69%.

Figure 2.1 compares a pure US dollar transaction and the New Zealand dollar arrangement, assuming that 75% of capital gains were taxed at maturity. Despite the fact that interest payments were always greater for the New Zealand dollar transaction, even after converting these payments to US dollars, the significant gain at the time of repayment reduced the cost of borrowing to less than the equivalent US after-tax rate. Even if this gain had been fully taxed at the corporate rate of 40%, some benefit would have remained. In this case, the internal rate of return would have been 5.19%, which is still below the comparable US after-tax rate of 5.46%.

Table 2.2 shows the overall cost of borrowing under the New Zealand dollar debt transaction assuming different tax treatments for the foreign exchange gain. If the gain had been tax free, as in the case of some countries, the after-tax cost of debt would have been only 3.12%. Of course, all of these scenarios hinge on the assumption that the firm is continually paying income taxes that the interest deductions can be used to reduce.

The second portion of Table 2.2 examines the opposite situation; borrowing in a strong currency. Not surprisingly, if borrowing in a weak currency was advantageous for Shell, borrowing in a strong currency would have been detrimental. Although the interest rate would have been less when borrowing in an appreciating currency, the exchange rate at which the corporation made these payments was increasing. In light of this movement, a loss would have been experienced upon repayment of the principal, causing the firm to repay the loan using more than the original amount received. How harmful this loss would have been depends on its tax treatment. If the firm had experienced capital gains in the same year, Canadian regulations would permit

the use of losses to reduce the tax payments related to these gains.

At the time of the Shell case, when capital gains were taxed at 75%, the ability to deduct a capital loss resulting from borrowing in the US while entering New Zealand dollar forwards, would have reduced the after-tax cost of borrowing from 11.65% to 10.20%. While the treatment of capital losses may in some instances lessen the disadvantages of borrowing in a currency that is expected to appreciate, the reduction in the case of the Shell transaction would not have been adequate to eliminate the advantages of weak currency borrowing.

It should be noted that the analysis thus far has dealt with corporations that are in a taxable position. It is a worthwhile exercise to consider how the analysis might change for a company undertaking foreign borrowing when the firm does not currently pay tax.

Strong currency borrowing for a company not paying taxes provides the firm with a lower nominal interest rate. The resulting lower interest payments may be extremely timely if the company is not taxable due to the recent suffering of losses. Unfortunately, the foreign exchange rates at which these interest payments are made become more harmful to the corporation as the currency appreciates. Foreign exchange losses will result.

If the firm is expecting to become taxable in the future, foreign exchange losses on interest payments and principal may eventually provide some benefit. These losses will accumulate and carry over to a time when the company may be taxable. Eventually, the carry-forwards can be used to reduce the company's capital gains tax. Meanwhile, during the years when the firm was not taxable, it benefited from a lower nominal interest rate as a direct consequence of interest rate parity.

Keeping with the assumption of a firm not currently paying taxes, what are the implications of borrowing in a weak currency? First, the firm would be required to pay interest at a higher rate at a time when it may already be suffering financially. Higher interest payments could result in the company accumulating additional non-capital losses at a time when it is least able to handle them. A second implication, however, is that these losses produce a tax benefit. Therefore, although higher interest payments initially appear detrimental, we must remember that like the foreign exchange losses incurred under strong currency borrowing, these losses can be carried forward to reduce future taxes. In fact, non-capital losses provide greater tax benefits than foreign exchange losses since they may be deducted at the full tax rate rather than the reduced capital gains rate.[8] Therefore, the advantages of borrowing in weak currencies may persist even for firms that are currently not paying taxes if they believe that they will become taxable in the future.

[8]I thank the editors of the Canadian Tax Journal for pointing out the benefits of weak currency borrowings for firms that are currently not paying taxes.

2.3 Supreme Court Ruling

The Shell transaction was challenged by the Minister of National Revenue on two counts. First, the Minister did not believe that interest payments in accordance with the New Zealand market rate of 15.4% should have been deducted for tax purposes. Instead, he claimed that since the transaction was in essence equivalent to a US dollar loan, the US rate of 9.1% provided the appropriate level of tax deductions. As we have already seen, deductions at 15.4% provide additional tax shields. Second, the Minister did not agree that the foreign exchange gain on the repayment of the principal amount was a capital gain. The Minister had reassessed the claimed gain as being on income account. As Table 2.2 illustrates, taxing the gain at the rate associated with regular income would have resulted in the cost of borrowing increasing to 5.19%. This cost would have increased even further if the gain had been taxed on an accrual basis rather than deferred.

The Supreme Court did not agree with the Minister's objections. The Court condoned the attempts of firms to lower their overall cost of capital by structuring transactions in depreciating currencies. With regards to the deduction of interest payments, the Court held that since the terms of Shell's transaction required the company to pay NZ$11.55 million semi-annually, in accordance with the New Zealand market rate, these payments qualified as interest and were therefore tax deductible. The fact that the payments were tied to US forward contracts in no way undermined their classification as interest. In terms of the capital gain treatment, the Court determined that the nature of a foreign exchange gain depends on the classification of the asset from which it arises. Since a five-year debenture is classified as a capital asset, there is no reason that a gain on this asset should not be treated as a capital gain.

The overwhelming sentiment put forth in the ruling of this case was that the Court "has never held that the economic realities of a situation can be used to re-characterize a taxpayer's bona fide legal relationships."[9] In other words, although the transaction was in many ways equivalent to a US dollar loan, the legal debt contracts with New Zealand lenders defined the tax treatment of interest and principal.

2.4 The 2000 Budget Proposal

With the Shell Canada ruling clarifying a taxpayer's legal right to structure a transaction in a tax-efficient manner, the Government sought specific legislation to define the tax implications of weak currency borrowings. A proposal in the February 2000 budget[10] addressed the tax treatment of these transactions. The proposal suggests that foreign borrowings of the type

[9] *Shell Canada Ltd. v. Canada.*, [1999] 3 S.C.R. 622.

[10] This proposal had its first reading in the House of Commons as Bill C-22 on March 21, 2001.

undertaken by Shell Canada and Canadian Pacific should be treated as equivalent to debt denominated in the currency in which the company earns its income. Three conditions would be implemented to achieve this aim:

1. interest expenses reducing tax payments would be limited to the amount payable on a loan undertaken in the company's operating currency

2. interest payments in excess of this limit would be deducted from the foreign exchange loss or gain realized upon principal repayment

3. foreign exchange gains and losses realized on principal repayment or arising from associated hedge transactions, would be taxed as income

The consequences of this proposal can be illustrated by once again referring to the Shell Canada transaction and the internal rate of return methodology. The after-tax cash flows that serve as the inputs to the IRR calculation would change in two primary ways due to the new proposal. The first impact would be a decrease in the allowable interest deductions while the second would be the treatment of the foreign exchange gain upon principal repayment.

Table 2.3 illustrates the first of these changes by comparing the allowable interest deductions under the previous regulations and the new proposal. We assume that Shell Canada has legitimate reasons for utilizing US dollars to undertake some of its business operations so that the prevailing US market interest rate determines the allowable interest deductions. This avoids the unnecessary complication of converting from NZ dollars to US currency and again to Canadian dollars.

Table 2.3 illustrates that under the NZ dollar transaction, Shell Canada paid over US$20 million in interest that would not be deductible for tax purposes under the budget proposal. As a result, a decrease in over US$6 million in tax shields would occur under the new regulations, equating the allowable deductions to the amount incurred under an equivalent US loan.

The excess interest payments would have a second impact under the new proposal. Disallowed interest payments incurred over the course of the loan would be deducted from the foreign exchange gain experienced upon principal repayment. Recall that the estimated repayment amount in US dollars was $74.32 million, well below the initial $100 million loan. The sum of the excess interest payments would be deducted from the foreign exchange gain and the difference taxed as income.

Making these alterations to the transaction results in the after tax cash flows presented in Table 2.4. Note that the allowed interest deduction of US$4.55 million is limited to generating tax savings of US$1.82 million per period ($4.55 million multiplied by the assumed corporate

tax rate of 40%). In other words, the difference between the pre and after-tax interest payments is always $1.82 million.

Based on these new cash flows, the after-tax internal rate of return under the proposed guidelines is 5.43%. This represents the effective cost of the transaction. Recall that if Shell Canada Ltd. had borrowed directly in the US, its cost of debt would have been 9.1% on a pre-tax basis and 5.46% on an after-tax basis ($9.1 \times (1 - 0.4)$). Having borrowed in New Zealand dollars and converting to US, the cost was reduced to 4.69% under the regulations at the time. Under the proposed regulations, the after-tax cost of the New Zealand dollar transaction would have been 5.43%. Although this cost is slightly less than the cost of directly borrowing in the US, the difference is only 3 basis points. In essence, the proposed regulations would meet the Government's aim of taxing weak currency borrowings according to their economic interpretation rather than their legal classification.

2.5 Empirical Evidence

Shell Canada's debt transaction and the similar arrangement undertaken by Canadian Pacific provide anecdotal evidence that firms are taking advantage of discrepancies in interest rates and taxation across national boundaries. Some recent empirical evidence suggests that these practices may not be isolated incidents. Instead, they may represent typical strategies of multi-national and domestic firms. Therefore, although the motivation for weak currency borrowings may have diminished as a result of the February 2000 budget proposal, there remains other ways in which companies can take advantage of international differences in interest/foreign exchange rates and tax regimes.

Jog and Tang (1997) focused on the debt levels of Canadian-based domestic and foreign controlled firms. They found that the increase in the Canadian tax rate relative to the US rate, which occurred in the mid 1980's, resulted in a significant increase in the amount of Canadian debt held by foreign controlled firms. Since the majority of these firms were US-owned, it appears that they were taking advantage of the greater interest tax shields generated by the higher Canadian tax rate. Previous work by Hogg and Mintz (1993) found similar evidence for a small sample of Canadian-based US subsidiaries.

Although these two studies focused exclusively on the interaction of debt and differential tax regulations for Canadian and US firms, the opportunities for international financing to reduce the overall cost of capital are in no way limited by geographic location. This is particularly true for multinational firms who, through their foreign-based affiliates, can easily shift debt from one country to another. For these firms it is important to become familiar with the characteristics of various tax jurisdictions.

2.6 International Treatment of Capital Gains

The benefit of placing debt in weak currencies increases with preferential capital gains treatment. Therefore, it is important to be aware of the countries that provide this treatment. Work by Fay and Hardin (1999) compares capital gains taxation across 120 different countries. They find that 55% of the countries surveyed treat capital gains as ordinary income while 20% do not tax these gains at all. Looking more closely at the second group gives an indication of where capital gains are treated most favorably. Twenty-seven percent of the countries surveyed from the Americas do not tax gains whereas in both the Asia/Pacific region and Europe, 13% of countries provide this favorable tax treatment. For Africa/Middle and Near East the figure is the highest at 28%. Fay and Hardin observe:

> ...in general, the more developed countries tend to tax capital gains at the normal corporate rate while most of the less developed nations either have no capital gains tax or special capital gains tax rates (usually lower than the ordinary corporate rates).

Countries without capital gains taxation include more than just the obvious tax havens. As one would expect, Bahamas, Channel Islands, Cayman Islands and the Isle of Man, all well know tax havens, exempt capital gains from taxation. These countries however are not alone in this treatment of capital gains. Hong Kong, New Zealand, Singapore, and South Africa also permit capital gains to be recognized tax-free. Other nations such as Ireland, Mexico, and Russia take an intermediate approach by taxing capital gains but calculating this gain as the difference between the final price and an inflation-adjusted initial cost. Until very recently, this method was also used by Australia. Now, however, indexed cost bases are frozen as of September 30, 1999 for assets purchased on or before September 21, 1999. Indexation is not permitted for assets purchased after this date. The Australian government justified this change by claiming a desire to bring Australian capital gains tax in line with other countries.

2.7 Summary

The recent clarification of the tax treatment surrounding foreign debt transactions has provided the motivation for a renewed interest in borrowing abroad. This paper has reviewed the financial theory underlying these transactions and used the internal rate of return to quantify their benefits. In general, we have seen that the failure of interest rate parity to hold on both a pre and after-tax basis allows firms to structure tax-motivated international transactions with lower effective costs than domestic borrowings. The increased use of hedging instruments assists firms in structuring these transactions.

The Shell Canada New Zealand dollar loan demonstrates the magnitude of the cost-reducing benefit that can be achieved by borrowing in foreign currencies. The corresponding Supreme Court ruling indicates that structuring a debt transaction to achieve these cost reductions is within a taxpayer's legal rights. This sentiment was confirmed by the Tax Court's ruling on Canadian Pacific's debt financing. The February 2000 budget proposal greatly reduces but does not entirely eliminate, the benefit of borrowing in weak currencies. The changing regulations, however, will likely serve as an incentive for firms to continue developing innovative transactions in search of lowering their overall cost of capital. It is a search that may continue to take them abroad.

Table 2.1
Pre-Tax Cash Flows (in millions of US $)

Period	US Loan	NZ Loan in US $
0	-$100	-$100
1	$4.55	$7.47
2	$4.55	$7.26
3	$4.55	$7.04
4	$4.55	$6.84
5	$4.55	$6.64
6	$4.55	$6.44
7	$4.55	$6.26
8	$4.55	$6.07
9	$4.55	$5.89
10	$104.55	$80.03

Table 2.1: Pre-Tax Cash Flows

The pre-tax cash flows of the pure US dollar loan and the New Zealand dollar loan transaction (converted to US dollars) are shown in the table above. It is apparent that higher interest payments were required for the NZ loan, however the capital gain upon principal repayment serves to equate the IRR of the two.

Table 2.2
Comparing the Cost of Foreign Borrowing

	Pre-Tax IRR	After-Tax IRR
Pure NZ Loan	15.40%	9.24%
Pure US Loan	9.10%	5.46%
NZ Loan in US dollars (weak currency)	9.10%	
a) no tax on capital gains		3.12%
b) 50% of gains taxed		4.18%
c) 66% of gains taxed		4.52%
d) 75% of gains taxed		4.69%
e) gains fully taxed		5.19%
US Loan in NZ dollars (strong currency)	15.40%	
a) no deduction of losses		11.65%
b) deduction allowed; gains taxed at 50%		10.70%
c) deduction allowed; gains taxed at 66%		10.37%
d) deduction allowed; gains taxed at 75%		10.20%
e) deduction allowed; gains fully taxed		9.70%

Table 2.2: Comparing the Cost of Foreign Borrowing

Table 2.2 shows the internal rates of return for strong and weak currency transactions. Various assumptions are made regarding the rate at which foreign exchange gains are taxed.

Table 2.3
Allowable Interest Deductions (millions of US $)

Period	NZ Loan Interest	Allowable Deductions	Excess Deductions
1	$7.47	$4.55	$2.92
2	$7.26	$4.55	$2.71
3	$7.04	$4.55	$2.49
4	$6.84	$4.55	$2.29
5	$6.64	$4.55	$2.09
6	$6.44	$4.55	$1.89
7	$6.26	$4.55	$1.71
8	$6.07	$4.55	$1.52
9	$5.89	$4.55	$1.34
10	$5.72	$4.55	$1.17
Total	$65.63	$45.50	$20.13
PV of Tax Shield	$20.95	$14.37	$6.58

Table 2.3: Allowable Interest Deductions

Table 2.3 shows the impact of the February 2000 budget recommendation on the allowable interest deductions in the case of foreign borrowing. Interest deductions are limited to the amount that would have occurred if the loan had been in the firm's operating currency. Excess deductions are subtracted from the foreign exchange gain experienced upon principal repayment.

Table 2.4
After-Tax Cash Flows Under the Budget Proposal
(in millions of US $)

Period	Pre-Tax Cash Flows	After-Tax Cash Flows
0	-$100	-$100
1	$7.47	$5.65
2	$7.26	$5.44
3	$7.04	$5.22
4	$6.84	$5.02
5	$6.64	$4.82
6	$6.44	$4.62
7	$6.26	$4.44
8	$6.07	$4.25
9	$5.89	$4.07
10	$5.72	$3.90
Principal Repayment	$74.32	$76.54
IRR	9.10%	5.43%

Table 2.4: After-Tax Cash Flows Under the Budget Proposal

It is apparent from Table 2.4 that the budget proposal does in fact meet its goals. Only a very small tax advantage now exists for firms borrowing in weak currencies. The after-tax IRR of the New Zealand dollar transaction is virtually equivalent to the after-tax IRR of a pure US dollar loan.

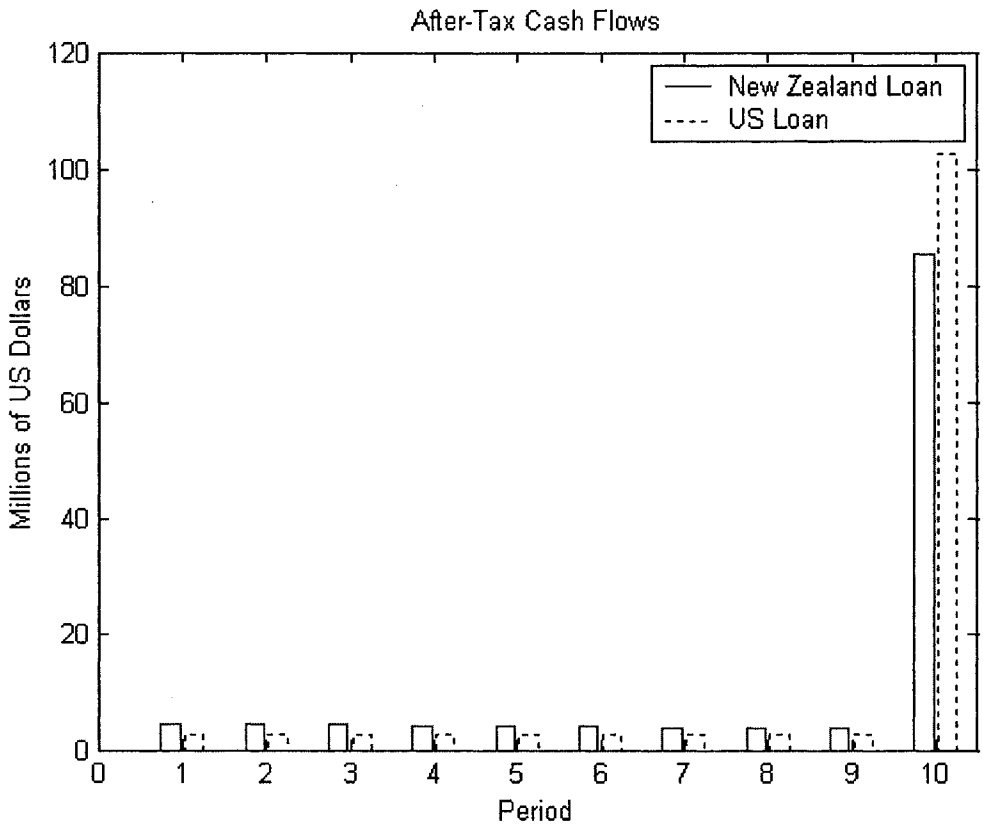

Figure 2.1: After-Tax Cash Flows

The after-tax cash flows, in US dollars, associated with Shell Canada's New Zealand dollar loan and a comparable US loan are pictured here. Although the New Zealand dollar transaction required greater interest payments in each period (which provided greater tax shields) the capital gain experienced upon repayment of the loan lowered the cost of debt below the after-tax rate.

3 A 'Pure' Test of Effective Ratings

This paper tests whether the market assigns different values to credit ratings from different agencies. It does so by taking advantage of the natural experiment provided by Standard and Poor's acquisition of the Canadian Bond Rating Service (CBRS). This acquisition, announced via press release on October 31, 2000, significantly altered the Canadian credit rating environment. At the time of the acquisition announcement it was stated that all CBRS ratings would gradually be replaced by the "harmonized" ratings from the newly merged firm. These ratings would be S&P ratings and Standard & Poor's methodology would prevail.

Did this change in rating agency impact firms with existing ratings from CBRS? On one hand, the basic fundamentals of the rated firms remained constant. In fact, a Standard and Poor's press release stated that any rating change resulting from the acquisition "should not be considered a ratings upgrade or ratings downgrade because the translation process is not related to any credit development."

This statement is consistent with the work of Cantor and Packer (1997) that finds evidence of significant differences in the cardinal rating scales used by rating agencies. According to S&P, we are simply witnessing a translation from one rating scale to another. This translation is analogous to measuring distance in either miles or kilometers - either way, the travel time is the same. It is only if ratings from different agencies are valued differently by investors that we would witness a significant price reaction in the securities of the rated firms.

Opposing the hypothesis of zero impact is the evidence produced by Kish, Hogan, and Olson (1999) in their comparison of Moody's and S&P ratings. Kish et al. found that when Moody's assigned a more favorable rating to a particular issue than S&P, the yield adjusted upwards to reflect the more conservative S&P rating. This adjustment did not occur in the reverse situation when S&P ratings exceeded Moody's. This indicates that investors may put more weight on an S&P rating than a competing one and confirms the results of Perry, Liu, and Evans (1988). Perry et al. found that differences in the yields between split rated issues and those with identical ratings were driven primarily by bonds with S&P ratings below their Moody's assessment.

The literature on split rated bonds, or those issues assigned different ratings by different agencies, provides further evidence that investors do not simply translate ratings from one agency's scale to another's. Ederington, Yawitz, and Roberts (1987) found that when two agencies assigned different ratings to the same issue, the market valued each rating equally. Similarly Jewell and Livingston (1998) observed that yields on split rated bonds tended to be an average yield lying somewhere between the two ratings. Both ratings contributed significantly to explaining the size of the issue's treasury spread.

Studies comparing ratings across agencies have primarily focused on the differences between alternative US-based raters. Here we have the added element of a Canadian rating agency being replaced by a US one. Prior to the merger announcement, both Moody's and S&P operated in the Canadian environment as did two domestic agencies. With S&P's expansion in the Canadian market through the acquisition, I ask whether nationality and/or international credibility influence how investors view ratings. This is an important question given the increasingly international strategy of rating agencies. Both S&P and Moody's have been expanding the number of offices located outside the US. S&P's approach has involved forming alliances with existing local raters whereas Moody's has sought to establish its own operations abroad (Lyons (1996)). Regardless of the approach taken, both companies are currently operating in over 15 countries worldwide. Clearly recognizing the trend towards globalized corporate debt markets, Moody's acknowledges that in 1999, the company maintained "ratings on 95% of the long-term cross-border debt issued worldwide."[11]

As evidence of this trend, I show that Canadian firms are increasingly accessing foreign debt markets and that in order to do so they require ratings acceptable to foreign investors. The addition of an S&P rating may provide a benefit for Canadian firms contemplating participation in the US market. This benefit, however, may be offset by S&P's reputation as a more conservative rater of Canadian firms.

In order to establish whether S&P ratings are valued differently than ratings from the Canadian Bond Rating Service, the security price reactions of the rated firms on the date of the acquisition announcement are examined. This approach differs significantly from most work on credit ratings. The important event here is with reference to the rating agency itself - the acquisition announcement - as opposed to rating announcements for the individual firms.

The prices of both the bonds and stocks of the rated firms are examined. Although the direct implications of credit ratings refer to debt instruments, the work of Hand, Holthausen, and Leftwich (1992), Goh and Ederington (1993), and more recently Dichev and Piotroski (2001) finds significant evidence of stock price reactions to credit rating announcements. In addition, working with stock data avoids some of the problems associated with the use of thinly traded bonds.

Although no reaction is identified by the bond prices as a whole, closer examination reveals that issues with initial S&P ratings that were significantly lower than their CBRS ratings experienced negative abnormal returns. Positive abnormal returns occurred on the date of the merger announcement for the common shares. No such returns are present for the matched sample of firms without initial CBRS ratings.

[11] Source: Moody's website.

A cross-sectional analysis is conducted to identify which firms benefitted most from the acquisition. If the addition of an S&P rating is positive for firms, we would expect that companies without prior S&P ratings would experience greater abnormal returns. I find evidence supporting this intuition. In addition, I argue that an S&P rating provides the credibility needed to attract foreign investors to relatively unknown Canadian firms. Supporting this, I find that the firms that experienced the greatest positive stock returns were small firms with little existing institutional ownership.

3.1 The Role of Bond Ratings in the Canadian Bond Market

Before establishing whether the replacement of CBRS by S&P impacted the securities of the rated firms, it is important to examine what the function of a bond rating is. We would only expect a meaningful price reaction if these ratings serve a useful function and the ability of S&P to provide this service differs from CBRS. I focus first on the argument that bond ratings possess meaningful information content that may differ from agency to agency. I then turn to the role of credit ratings in satisfying institutional guidelines. I argue that this is the more relevant function of bond ratings in explaining the market's reaction to the acquisition.

Academics have long sought to establish whether bond ratings possess information above and beyond what is available to individual investors through public sources. It is often argued that agencies receive sensitive private information from companies throughout the rating process and that this information is incorporated into the rating without being specifically revealed. Kliger and Sarig (2000) point out that two methods are typically used to try to establish whether ratings provide additional information to the market. The first method looks at security price reactions to the release of rating upgrades or downgrades. While several authors have noted the presence of negative returns upon the release of downgrades,[12] little reaction has been found upon upgrades.

Complicating the analysis however, is the fact that downgrades are triggered by economic events. It is therefore difficult to distinguish whether the negative reaction is a result of the downgrade itself or the economic event (Kliger and Sarig (2000)). Evidence of this problem is apparent in the findings of Wansley and Clauretie (1985) and Goh and Ederington (1993) which establish the presence of negative security returns prior to downgrades.

The second method for establishing whether credit ratings reveal information focuses on the ability of ratings to explain cross-sectional differences in yield spreads. While the size of this spread is related to the issue's rating, it is unclear whether the rating is proxying for financial variables such as leverage and profitability measures that could also explain the

[12] See for example Hand, Holthausen, and Leftwich (1992) and Dichev and Piotroski (2001).

spread. Ederington, Yawitz, and Roberts (1987) included both S&P and Moody's ratings along with accounting variables in a cross-sectional analysis of yields. They found that the yield was determined by more than just the assigned ratings, however, the ratings did provide some information beyond the accounting variables alone. In addition, the hypotheses that the market considers only Moody's ratings or only S&P ratings were both rejected. Ratings from both agencies had some explanatory power. Cantor, Packer and Cole (1997) also noted the importance of multiple ratings. For bond pricing models of split rated bonds they advocate incorporating both ratings into the model.

These empirical results emphasize the role of ratings from different agencies, particularly when these ratings differ. They are consistent with information received from institutional investors. In a survey conducted by CIBC World Markets shortly after the S&P/CBRS acquisition announcement, institutional investors indicated that the presence of multiple ratings makes an issue more attractive and all ratings contribute to determining the bond's yield. Although the Ontario Securities Commission[13] requires only one rating on a public bond offering, the survey suggests that an issue with a single rating would be attractive to only half of the market and almost one third could have institutional guidelines precluding them from buying it. In the same survey, 57% of institutions indicated that in the case of split ratings, they would assign the lower of the two ratings to the issue.

While the role of bond ratings in providing new information seems to remain under debate, the evidence on split ratings and the responses of institutional investors indicate that the primary function of bond ratings may be to satisfy institutional investment guidelines. In line with evidence of negative security reactions prior to rating downgrades, Wakeman (1984) argued that a "rating does not affect but merely reflects, the market's altered estimation of a bond's value." Consistent with the survey responses of the institutional investors, Wakeman reports that ratings are used to "check the performance of trustees and fund managers." Evidence of this is found in the use of bond ratings as inputs for regulatory requirements. For instance, the US-based National Association of Insurance Commissioners (NAIC) sets the amount of required reserves an insurance company must maintain according to the ratings on the bonds they hold.[14] Similarly, pension mandates usually state that the bonds within the fund have "a minimum rating of X by Moody's or S&P or a similar agency."

If ratings are important for institutional guidelines, then the replacement of CBRS ratings

[13]The body primarily responsible for establishing security regulations in Canada.

[14]For example, bonds with a Moody's rating of Ba or an S&P rating of BB require five times the reserve requirements as those with Moody's ratings of Baa or S&P ratings of BBB (Emery, Finnerty, and Stowe (1998)). For our purposes it is interesting to note that the NAIC judges the rating classifications of Moody's and S&P to correspond on a one-to-one basis, implying that there is no adjustment used in translating the ratings from one agency to another.

by S&P ratings would impact security prices not because it provides additional information, but because it alters how investors perceive the bonds. Suppose for instance that a firm initially maintained equivalent ratings from CBRS and a second agency. If it then receives a lower "harmonized" rating from S&P, so that the ratings are now split, the majority of institutions have stated that they would assign the lower rating. Even if S&P's transition process to harmonized ratings provides the market with no new information, we may witness price reactions for bonds and stocks. This will particularly be the case if the harmonized rating places the issue outside of the institution's investment guidelines.

Related to the regulatory characteristics of bond ratings I ask whether the nationality of the rating agency makes any difference to investors. To answer this question, we need to establish some of the characteristics of both the Canadian and global credit markets. I focus on the following three factors: 1) the Canadian public debt market has traditionally been very conservative; 2) cross-border financings have increased substantially in recent history; 3) institutional investors are the most significant players in the corporate debt market.

The Canadian corporate bond market is dominated by well-rated firms from stable industries such as utilities and financial institutions. Sixty percent of this market is made up of bonds with A ratings or better. Traditionally, this has prevented poorly-rated Canadian firms from issuing public debt, essentially blocking them from the market. More and more, however, these firms are finding an alternative source of funding through US dollar denominated debt. In 1999, Canadian firms had $150 billion of US dollar debt outstanding in comparison to $91 billion of Canadian dollar debt.[15] While only 4% of the Canadian market was represented by high yield bonds, 28% of US dollar debt issued by Canadian firms fell in this category. In contrast to the Canadian market, only 18% of US dollar issues had ratings of A or better.

The frequency with which Canadian firms are seeking to issue securities in foreign currencies has dramatically increased over recent history. This is in part a consequence of a movement in the early 1990s to synchronize corporate disclosure rules for US and Canadian regulators. It is therefore not surprising that a large proportion of Canadian debt is held by foreign investors. In 2002, for instance, over 59% of net new credit issues from Canadian sources were placed in the US.[16] The year before, in 2001, about half of the $52 billion raised from both Canadian corporate debt and equity issues was raised in foreign markets.[17]

Table 3.1 provides a breakdown of foreign versus domestic ownership of securities from 1997 - 2001. We see that even though Canadian holdings of foreign securities have continued to grow

[15] Figures are as of November 1999 and are expressed as Canadian dollar values. Market statistics are from RBC DS Global Markets.

[16] Source: Statistics Canada, CANSIM II, tables 176-0034 and 176-0035; Bank of Canada.

[17] Source: *"Canada's Securities Industry"*, July 2002, Department of Finance website.

during this time period, it is still less than half of the amount of foreign holdings of Canadian securities. By far the largest foreign holdings are in Canadian debt instruments, with 79% of foreign portfolio investment in these securities.

Contributing to Canadian companies increasing use of foreign debt has been the significant growth of the currency swap market. Figure 3.1 illustrates this growth by plotting the notional principal amount of Canadian dollar currency swaps during the early 1990s. In 1991, Canadian dollar currency swaps were written on a notional principal of $US 63.7 billion. By 1996, this value had grown to over $US 100 billion.[18] With the increased use of currency swaps comes an enhanced ability for Canadian firms to access the US debt market. It has become relatively straightforward for firms to issue debt in US funds and swap payments back into Canadian dollars.

The trend in globalization and financial market integration is by no means limited to the Canadian environment. In 1990, $217 billion or 12.7% of the US corporate debt market was held by foreign investors. By 1999 foreign holdings had increased to $817 billion or 18% of the market.[19] Faced with this evidence regarding the increasingly global nature of debt markets, it is not surprising that rating agencies have responded by expanding the scope of their operations. Both Standard and Poor's and Moody's have pursued a strategy of opening rating offices in foreign markets with the hopes of transferring their domestic reputation to the global environment.

An additional observation related to corporate debt markets (both Canadian and global) is their institutional nature. Life insurance companies alone hold 26.4% of corporate and foreign bonds in the US market whereas households represent only 13% of ownership.[20] In Canada, individuals have even smaller holdings, representing only 7.4% of corporate bond ownership.[21] As a result of the institutional nature of the corporate bond market, ratings as components of institutional guidelines, play a large role. When Canadian institutions were surveyed about their opinions on the nationality of the rating issuer, the majority responded that they required a rating from a Canadian firm. It is therefore likely that US investors also require US ratings. A Canadian rating may lack credibility for foreign investors. This would certainly appear to be the case as all firms with existing US dollar debt within the sample had ratings from either Moody's or Standard and Poor's prior to the acquisition.

Other indications that US rating providers are viewed more credibly than Canadian raters

[18] Source: Bank of International Settlements

[19] Source: US Census Bureau, *Statistical Abstract of the United States: 120th Edition*, 2000 (page 523).

[20] Source: US Census Bureau, *Statistical Abstract of the United States: 120th Edition*, 2000 (page 523).

[21] Source: Statistics Canada, *National Balance Sheet Accounts; System of National Accounts*, Annual Estimates, 1984-1993, Ottawa, March 1995.

comes surprisingly from the responses of Canadian institutions themselves. Again referring to the survey conducted by CIBC World Markets, some institutions indicated that if a bond had only one rating, they would prefer it to be from a US agency. In addition, six percent of respondents indicated that in the case of split ratings, a US rating would prevail.

Our observations regarding the functions of bond ratings in the Canadian environment allow us to formulate three hypotheses. One, S&P's acquisition of CBRS will have no impact on the securities of the rated firms since it neither conveys additional information nor impacts institutional guidelines related to debt holdings. Two, the acquisition will be viewed negatively by the market since S&P is reputed to be a more conservative rater than CBRS. Three, the acquisition will be viewed positively by the market. Canadian firms are increasingly raising funds in foreign markets and the acquisition provides them with a rating that is credible to US investors, primarily institutions. Should firms choose to access the US debt market in the future, they will already be armed with a suitable rating.

3.2 Data

Before merging with Standard and Poor's, CBRS provided ratings for over 460 entities. These entities included not only corporations but provincial governments, trust units, and public sector agencies. Selecting only corporations with debt ratings (rather than ratings for preferred shares or trust units) provided a sample of 106 firms for this study.

The corporations in this study represent a wide range of industries. Based on the first two digits of their SIC codes, the most commonly occurring industries were the radio, telephone, or television classification, crude petroleum and natural gas, and steel and aluminum. Over 28% of firms fell within these three groups. A complete break-down of industry classifications is provided in Table 3.2. Note that of the 106 firms, only 70 had adequate bond data to be included in the analysis.

The price movements of the 106 stocks and 70 bonds of the sample firms at the time of the acquisition announcement constitute the primary inputs for this study. Both the stock and bond prices were collected from the data provider *Bloomberg*. While the stock data from *Bloomberg* represents the daily closing prices from the Toronto Stock Exchange, the bond data does not always reflect a transaction price. Since many Canadian bonds are extremely thinly traded, the data available from *Bloomberg* and other quote-providing dealers often represents formulated rather than traded prices. Each data provider formulates their price quote using some combination of recent trading prices and bond characteristics such as maturity, rating, and yield. Since ratings are implicitly considered in these quotes, they are not ideal for measuring the impact of the S&P merger on bond prices. Despite these drawbacks, quote data has been

used by several researchers in the absence of traded prices.[22]

The use of common stocks avoids some of the problems associated with using thinly traded bonds in an event study methodology. For instance, during the 200-day estimation period employed in this study, 95 of the sample firms had stock prices available for each day in the estimation window. The 11 stocks with missing prices had on average available information for 185 of the 200 days in the estimation period. The stock with the least amount of trading data registered quotes for 161 days or 81% of the estimation period. In comparison, only 11 bonds had data for the entire 200 day window and the average number of days for which bonds had data was 172.

Table 3.3 provides the original CBRS ratings for the entire sample of firms. The most common rating for senior long-term debt, A-, represented 25% of the sample. The majority of firms in the sample possessed ratings from more than one agency. In fact, of the 106 sample firms, only 8 had ratings from CBRS alone. Most commonly, firms were also rated by the Dominion Bond Rating Service, a domestic Canadian rater, with 94 of the firms having both ratings. The originally small scale of S&P's Canadian operations before the acquisition is emphasized by the fact that only 52 of the sample firms held both CBRS and S&P ratings. Approximately 45% of firms were rated by all three agencies. Table 3.4 details the rating classifications of the sample firms from multiple agencies.

It is useful to compare S&P's pre-merger Canadian ratings with the ratings provided by the two domestic alternatives for Canadian firms. A study by Schroeder (1998) found that on a firm-by-firm basis, Canadian rating agencies provided higher ratings than US agencies. On average, Standard and Poor's ratings were 0.23 rating categories lower than those given by the Dominion Bond Rating Service (DBRS) for the same group of 115 Canadian firms. Even more generous than DBRS was CBRS, with ratings 0.55 categories higher than the equivalent DBRS ratings.

Is there a systematic reason for the differences in ratings for Canadian firms that are supplied by alternative rating agencies? Schroeder (1998) suggested that one factor is the agency's attitude towards size. Since Canadian firms and debt issues tend to be small compared to typical US companies, agencies that penalize heavily for size will be prejudiced against Canadian firms.

Industry biases can also impact the relative ratings among agencies. For instance, Standard and Poor's has traditionally been more conservative in its ratings of natural resource companies, particularly those in the oil and gas industry. For the 115 companies in Schroeder's study with ratings by both S&P and DBRS, 79% of the differences in ratings were explained by ratings in the natural resource sector.

[22] For an example of its use in the context of bond ratings see Ingram, Brooks, and Copeland (1983).

Support for S&P's conservative reputation can be found by comparing ratings across agencies for the same issue. For the 52 firms in this study with initial ratings from both CBRS and S&P, 29 or 56% were given lower ratings by S&P. Sixteen of the firms received the same rating from both agencies while only 7 of the companies were awarded higher ratings by S&P than CBRS. The differences between the ratings assigned by these two agencies are depicted in the matrix in Table 3.5. Entries within each cell indicate the number of firms with that particular combination of ratings from the two agencies. Figure 3.2 expands the analysis to include the 48 firms with ratings from both S&P and DBRS. It is apparent that on a firm-by-firm basis, S&P's rating scale appears more conservative than those of the Canadian agencies.

If investors were aware of S&P's conservative ratings, they may have anticipated that the acquisition would result in subsequent downgrades for firms originally rated by CBRS. This would particularly be the case for those issuers without prior S&P ratings. Although several studies have found evidence of negative security returns associated with credit downgrades (see for instance Wansley and Clauretie (1985), Hand, Holthausen, and Leftwich (1992)), it is important to recall the uniqueness of the rating changes here. S&P has emphasized that these rating changes are not an indication of a change in the firm's creditworthiness but rather a translation from the scale of one rating agency to another. If investors agree that this is simply a translation process without any implications for the rated firms, we would not expect to find a negative reaction to the acquisition announcement. However our discussion of the role of bond ratings for institutional investors suggests that even this translation may impact how institutions perceive these bonds.

3.3 Methodology

3.3.1 Bonds

Analyzing the impact of the S&P/CBRS merger on bonds presents two difficulties that are not associated with the stock analysis. First, bonds trade infrequently. As a result, the data used in this study is composed of a combination of both traded and quoted prices. Second, bond returns are impacted by movements in the term structure of interest rates. Fortunately this problem can be easily remedied by looking at the spread between corporate and government bonds to remove the impact of the yield curve. The first problem however, is more difficult to handle. Since missing data is common to almost all bonds in the study, I follow the method introduced by Hadjinicolaou and Kalay (1984) which accounts for infrequent trading. Problems associated with the fact that some of the data represents quotes rather than transaction prices unfortunately remain.

The essential measure required to calculate the Hadjinicolaou and Kalay test statistic is the standardized bond premium, BP. This premium is based on the average return model. To calculate it, I first find the difference between the return on the corporate bond and a treasury bond of similar maturity and coupon. If the bond is denominated in US dollars, a US treasury bond is used whereas if it is in Canadian currency, a government of Canada bond is employed. For each sample firm only one bond is selected to be included in the analysis. The amount of data available during the estimation period (which is equal to $T = 200$ days) and the ability to find a government bond with comparable maturity and coupon are key factors in determining this selection.

The maturities of the 70 bonds used in this study range from 1 to 27 years with the mean time to maturity being 6.3 years. The median maturity is slightly lower at 5.8 years and all but five bonds had maturities within the range of 4 to 14 years. The majority of the bonds were callable with only 24% being non-callable.

The calculation of the corporate bond return takes into account its infrequent trades and accrued interest. This return is a combination of the flat price, $F_{i,k}$ and coupon payments, $C_{i,k}$. The flat price includes the observed price plus any accrued interest and the return is calculated as:

$$R_{i,k} = \ln\left[\frac{(F_{i,k} + C_{i,k})}{F_{i,k-1}}\right] \tag{3.1}$$

where:

$R_{i,k} =$ Return for bond i between the closest two days with data
$F_{i,k} =$ Flat price for bond i at observation k
$C_{i,k} =$ Coupon payment, paid between observations k and $k-1$

It is important to note that the typical time subscript t has been replaced by the variable k. k serves as a counter for days with observable data as opposed to the actual number of days. Therefore the return, $R_{i,k}$ may in fact be a multi-period return if data is missing. In essence, $R_{i,k}$ represents the return between the two closest days with available data. The variable n_k in the next equation represents the number of days between two observed prices at times k and $k-1$. For instance, if the first price is observed on day one and the second price not until day three, n_k will be two.

Hadjinicolaou and Kalay derived measures for the mean and standard deviation of *daily* bond returns using these multi-day inputs and the returns on the corresponding treasury bonds. The measures for an individual bond's mean, μ_i and variance, σ_i^2 are:

$$\mu_i = \frac{1}{K_i - 1} \sum_{k=2}^{K_i} \frac{R_{i,k} - TB_k}{n_k} \tag{3.2}$$

and

$$\sigma_i^2 = \frac{1}{K_i - 2} \sum_{k=2}^{K_i} \left(\frac{R_{i,k} - TB_k}{\sqrt{n_k}} - \mu_i \sqrt{n_k} \right)^2 \tag{3.3}$$

where:

K_i	total number of observed prices for bond i
TB_k	return on a comparable treasury bond at the time of observation k
n_k	number of days between observations k and $k-1$

Using these variables, the standardized excess bond premium for bond i on each day with available data is calculated as:

$$BP_{i,k} = \frac{(R_{i,k} - TB_k) - \mu_i (n_k)}{\sigma_i \sqrt{n_k}} \tag{3.4}$$

With the standardized excess bond premiums calculated for every bond, the I bonds are aggregated to form the test statistic, denoted for Hadjinicolaou and Kalay as HK. The first step in this task is to calculate an average standardized bond premium for day t denoted by $\overline{BP_t}$. This average takes into account only bonds with available data at a particular time, therefore the composition of the portfolio of bonds upon which it is based, varies from day to day. In other words, the bond premium for each bond i at observation k is only included if the kth observation occurs at time t. The average bond premium is calculated as:

$$\overline{BP_t} = \frac{\sum_{i=1}^{I} BP_{i,k}}{m_t} \tag{3.5}$$

In the denominator, m_t represents the number of individual standardized excess bond premiums aggregated at time t. $\overline{BP_t}$ is calculated for each day in the estimation period in order to calculate a measure of standard deviation for the aggregate portfolio. The equations for both the standard deviation and ultimate test statistic when cross-sectional dependence among securities cannot be ruled out are provided below. The subscript τ indicates that the calculations are made during the event window rather than the estimation window which is denoted by t.

$$HK_\tau = \frac{\overline{BP_\tau}}{s_{BP}} \sim t_{T-1} \tag{3.6}$$

where:

$$s_{BP} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{200}\left(\overline{BP_t} - BP^*\right)^2} \tag{3.7}$$

and

$$BP^* = \sum_{t=1}^{200}\frac{1}{T}\overline{BP_t} \tag{3.8}$$

Using this statistic and the sign test as a robustness check allows us to measure bondholders' reaction to the S&P/CBRS merger announcement.

3.3.2 Stocks

In addition to the typical event study methodology based on the standardized residuals of a market model, the analysis here also relies on a seemingly unrelated regression (SUR).

SUR is particularly appropriate for the case of a clustered event, such as this one, where the calendar date of the event is the same for all firms involved. In clustered events, the residuals are likely to be heteroskedastic and cross-sectionally correlated, violating the standard event study assumptions of independent and identically distributed normal residuals (Collins and Dent (1984)).[23]

The seemingly unrelated regression follows the approach first advocated by Schipper and Thompson (1983) in their study of merger-related regulations. Here however, I use a finite sample version rather than the asymptotic test. This version is more appropriate when the number of firms is relatively large compared to the observation period.

The regression for the J stocks with T observation dates is:

$$r_{jt} = \alpha_j + \beta_j r_{mt} + \varpi_j \delta_t + e_{jt} \tag{3.9}$$

where r_{jt} represents the observed return for the stock of firm j at time t and r_{mt} represents the corresponding return on the equally-weighted market index from the *CFMRC TSE* database. The typical intercept and beta parameters for the jth firm are denoted by α_j and β_j while ϖ_j represents the coefficient on the event day indicator δ_t. This indicator is composed of a column vector with zeros everywhere except for ones corresponding to dates representing the event window. Rewriting this equation in simplified form to represent aggregating across the J firms gives equation 3.10.

[23] Brown and Warner (1985) cast doubt on the seriousness of this problem when a market model is used.

$$R = X\Gamma + E \tag{3.10}$$

R represents the $T \times J$ matrix of observed stock returns for the sample firms. X is the $T \times 3$ matrix consisting of a constant, the market returns, and the date indicator δ_t which in our case is the same for every firm. Γ is the $3 \times J$ matrix of the coefficient estimates $\widehat{\alpha}_j, \widehat{\beta}_j$, and $\widehat{\varpi}_j$ and E is the matrix of residual terms. The hypothesis that we are interested in testing is:

$$\varpi_j = 0 \qquad \forall j \tag{3.11}$$

This hypothesis is more likely to reject the null of zero abnormal returns than the typical event study methodology which relies on aggregating returns across securities. The sum of the parameters represents the influence of the event on the sample as a whole and may not capture any impact on security returns if this impact varies across firms. In our case, if firms without prior S&P ratings respond differently to the announcement than those with existing ratings, we are more likely to capture this effect through the use of this statistic.

The exact test from Anderson (1984) is given by:

$$\left(\frac{|\widehat{\sum_r}|}{|\widehat{\sum}|} - 1\right)\left(\frac{T-2-J}{J}\right) \tilde{} F_{J,T-2-J} \tag{3.12}$$

Letting $\widehat{\varpi}$ represent the vector of $\widehat{\varpi}_j$ coefficient estimates for the J firms, $\widehat{\sum_r}$ is the maximum likelihood estimator of the covariance matrix $\sum$ under the restriction $\widehat{\varpi} = 0$. For finite samples the appropriate test statistic is:

$$\left(\frac{T-2-J}{JT}\right)\frac{\widehat{\varpi}'\widehat{\sum^{-1}}\widehat{\varpi}}{\theta'(X'X)^{-1}\theta} \tilde{} F_{J,T-2-J} \tag{3.13}$$

where θ is the vector $[0\ 0\ 1]'$ which serves to isolate the $\widehat{\varpi}_j$ coefficient estimates. Using the simplified notation from equation 3.10, $\widehat{\sum}$ can be estimated by $\frac{(E'E)}{T}$.

In addition to the F-statistic based on the seemingly unrelated regression, I report the test of the merger announcement's price impact based on standardized abnormal returns. This statistic is shown below, where $\overline{SCAR}$ represents the mean standardized cumulative abnormal return across the J securities.

$$\left(\frac{J(T-4)}{T-2}\right)^{\frac{1}{2}} \overline{SCAR} \tilde{} N(0,1) \tag{3.14}$$

3.4 Identification of Abnormal Returns

3.4.1 Bond Results

Table 3.6 reports the abnormal returns on the announcement day for our sample of 70 bonds. Although the analysis is concerned with the security price reactions of all firms previously rated by CBRS, the sample companies were grouped according to three characteristics that may have impacted the market's reaction to the merger. These characteristics were whether the firm was originally well-rated by CBRS, whether it had an existing S&P rating prior to the merger, and whether this rating was lower than the previous CBRS rating.

Based on existing CBRS ratings, firms were grouped into either the "A Group" or the "B Group." Those securities with ratings in the A category (whether AAA, AA or simply A) were treated separately from those securities with ratings in the B category (BBB+ or below).[24] The reason behind this classification was that a downgrade resulting from the harmonization process may have a greater impact on those firms with initially low ratings. Movement from AA to A may not result in significant abnormal returns while a movement in the B category, for instance from an investment grade to non-investment grade rating may result in substantial price movement.

Whether the firm had an existing rating from S&P may also have influenced the market's reaction to the merger announcement. Any information that could be revealed by ratings from the newly merged firm was potentially already incorporated in the existing S&P rating. However, as seen in section 3.2, the S&P rating was likely lower than the CBRS rating, indicating that the merger could have been viewed as "bad news" for the firm. In the case of equivalent ratings from the two companies or when no prior S&P rating existed, there would be no indication of any news for the firm - positive or negative. I classify these companies as "no news" firms. I do not have a "good news" classification of sample firms since only 7 firms had prior S&P ratings that exceeded their original CBRS rating.

The analysis of the bond returns reveals little impact of the acquisition announcement. While Table 3.6 shows that the mean excess return for the bonds was negative, consistent with harsher S&P ratings resulting in greater yield spreads, the magnitude of this return was not statistically different from zero. Moreover, the majority of bonds had positive excess returns on announcement day. There was no evidence that any one category of bonds (whether it be those with B ratings or those without prior S&P ratings) responded differently to the acquisition

[24] It may be argued that aggregating bonds into investment grade or non-investment grade would be more appropriate than the A or B group categories selected here. In conversations with practitioners however, it was emphasized that the conservative nature of the Canadian market causes a large distinction to be made between securities with A group ratings versus B group ratings, even when the B rating remains investment grade.

announcement.

Looking more closely at the results for firms with initial S&P ratings and those in the "bad news" classification, reveals that the bond returns are very skewed. For example, the mean excess bond premium for firms with S&P ratings was -0.11%, much lower than for the entire sample of firms. Despite this low average, close to 63% of issues within this category experienced positive excess bond premiums on the acquisition date. This implies that the acquisition may have resulted in large negative reactions for a small number of issues. Likewise, the mean reaction within the "bad news" classification was -0.23% while over 54% of firms in this category experienced positive premiums.

To help explain this skewness I examine the securities most negatively impacted on the announcement date. This examination reveals that four of the worst six performers had initial S&P ratings and three of these were split such that the S&P rating was lower than the CBRS rating. Looking just at issues with S&P ratings that were significantly lower than the corresponding CBRS ratings provides even stronger evidence that the acquisition announcement had large negative consequences for a small number of firms. For the 10 issues with S&P ratings at least two notches below their CBRS ratings, the mean excess bond premium was -0.54%. This compares to an average of -0.05% for the sample as a whole.

3.4.2 Stock Results

The abnormal stock returns for the entire sample of firms and the various categories are reported in Table 3.7. The abnormal returns listed are measured according to the market model with the equally weighted portfolio of stocks listed on the Toronto Stock Exchange serving as the market proxy. The last two columns provide the F-stat for the test based on the SUR and the standard test statistic given in equation 3.14.

Table 3.7 shows that the mean cumulative abnormal return on the announcement day was positive across all categories of sample firms. This positive return averaged 1.60% for the entire sample. The table shows that this level of return was statistically significant according to both the SUR methodology and the standard approach.

As expected in the case of a clustered event, the standard event study statistic was far more likely to reject the null hypothesis of zero effect (Collins and Dent (1984)). While the tests based on the SUR failed to find significant results for any of the individual groupings of the sample firms, all categories were found to be statistically significant according to the standard methodology. Consistent with the hypothesis that S&P's expansion may make the US-dollar debt market attractive for certain companies, firms without prior S&P ratings and those with initially poor CBRS ratings (that may find issuing in the conservative Canadian

market difficult) experienced large average abnormal returns.

Figure 3.3 illustrates the mean cumulative abnormal returns for the entire sample on the days surrounding the acquisition announcement. It is apparent that a large gain occurred on the day prior to the announcement. Table 3.8 tests the significance of the cumulative abnormal returns (CAR) for the days surrounding the acquisition. It is found that the mean CAR over the two-day event window, day -1 to day 0, was 3%. This level of return is significant according to the SUR-based test at the one percent level. If this gain is associated with S&P's acquisition, it would indicate a leak of the acquisition. A second possibility, is that there is some additional factor impacting our sample securities that is not being captured by the market model.

The next sections explore the robustness of these positive abnormal returns and conduct a cross-sectional analysis to identify firm characteristics that may be associated with them.

Robustness Tests of Positive Stock Returns The results for day -1 lead us to question the reliability of our market model in capturing "normal" returns. A striking feature of this model is its low overall R^2 value and estimation of small firm betas. Figure 3.4 illustrates betas for several subindices of the Toronto Stock Exchange. This figure plots beta estimates based on 60 months of data for various TSE subindices from the beginning of 1994 to April 2001. It is clear that during the estimation period employed in this study, January to October 2000, the majority of stocks had falling beta estimates. This declining pattern indicates that beta estimates calculated with a small amount of historical data during that period (such as 200 days) would be significantly smaller than those based on price movements over the past five years.

The largest beta estimates during the period leading up to the merger announcement were for the communications subindex. This is not surprising since this group encompasses the dominant Canadian firms whose price movements can at times govern the behavior of the market index. At certain points during the estimation window, up to 34% of the Toronto Stock Exchange's entire worth was attributable to only two stocks.[25]

As a result of the low level of fit achieved with the traditional market model using an equally-weighted market proxy[26], various alternatives were examined. One such alternative, whose results are reported in Table 3.9, was the average return model. Although this model is

[25] See '10,000 TSE puts Canada in big time' *The Globe and Mail*, March 24, 2000.

[26] Altering the market proxy from an equally-weighted portfolio to a value-weighted portfolio made little difference. Although this proxy may be more relevant for firms with public debt issues (which tend to be larger than firms without such issues), the magnitude of the beta estimates did not increase significantly and the results for the announcement day returns did not change meaningfully (Table 9). Extending the forecast window to 300 days, marginally increased the beta estimates. Using this longer window to identify abnormal stock returns did not provide significantly different results from the 200-day window.

not ideal when the event date is identical for all firms, the incremental benefit of the market model is relatively insignificant due to its poor fit. Both models provide similar results in identifying abnormal stock returns.[27] The average return model identifies significant returns for the sample as a whole and across the individual categories. The mean abnormal return measured according to this method was 1.50%. Table 3.9 also provides the results based on a market model using a value-weighted index. Qualitatively, the results are the same as in the equally-weighted case.

Perhaps the most convincing evidence that these positive returns are associated with the S&P announcement comes from the use of a matched sample. The seemingly unrelated regression was conducted with a group of 106 firms *without* previous CBRS ratings. These firms were matched to our initial sample so that both groups would have the same industry composition.[28] The mean abnormal return for the group without debt ratings was not significantly different from zero. Expanding the event window to include both the announcement date and the preceding day, did not alter the results. The F-statistic in this case was only 1.08. It appears that the stocks of firms with CBRS ratings did react differently during the event window than firms without ratings and the market as a whole.

3.5 Cross-sectional Analysis of Security Returns

If the addition of a rating from Standard and Poor's is viewed by the market to be favorable, then intuitively the benefit should be particularly large for firms without prior S&P ratings. The analysis conducted in this section tests whether this was the case. As well, it controls for additional factors known to impact security reactions to credit rating changes.

One of these factors, pointed out most recently by Dichev and Piotroski (2001), is credit quality. Firms with initially poor ratings have been found to be more severely impacted by rating downgrades than those with initially strong ratings. Therefore I test whether the initial CBRS rating, whether it be in the A group or the B group, influenced how the firm's stock responded to the announcement. Since Standard and Poor's has been known to be particularly

[27] An alternative not reported here that also had similar results was the use of the S&P 500 as a market proxy. Although this index is not dominated by a small number of firms to the same extent as Canadian indices, it provided a very low degree of fit. Using a market model with a value-weighted proxy that set beta equal to 1, the market beta, had contrasting results. The use of this model was justified since statistical tests could not show that the estimated sample betas were significantly different from 1. While all other models identified the presence of positive abnormal stock returns, this model found negative price impacts. This result is intuitive since there was very little relation between most sample firms and the market proxies (hence the low beta estimates). Forcing a higher degree of correlation by setting beta equal to one, overestimated the predicted return in the case of positive market movements and resulted in negative abnormal returns.

[28] To a certain extent, the samples were also matched according to size. This proved difficult however since firms with publicly issued debt tend to be larger than those without.

conservative in its ratings of natural resource firms, I also test whether firms in this industry reacted differently.

Again, the complication of a clustered event had to be taken into consideration prior to conducting the analysis. Fortunately Karafiath (1994) addressed this problem using Monte Carlo simulations to compare the relative performance of competing methodologies in this situation. Despite the fact that the standard OLS assumptions are grossly violated in the case of a clustered event, Karafiath found that the OLS estimator continued to be well specified, particularly when the sample size exceeded 75. There was no advantage to taking cross-correlations into account. As such, the cross-sectional analysis relies on standard OLS regression techniques.

Taking into account the firm's initial rating, whether it had a prior S&P rating, and its industry, gives the following regression equation:

$$AR_{j,0} = \alpha + \gamma_1 \mathrm{B} + \gamma_2 \mathrm{S\&P} + \gamma_3 \mathrm{Resource} + \epsilon_{j,0} \tag{3.15}$$

where,

$AR_{j,0}$	Abnormal return for stock i upon announcement day
α	Constant
B	Dummy variable for CBRS ratings in the B category
S&P	Dummy variable for firms without prior S&P ratings
Resource	Dummy variable for natural resource firms
$\epsilon_{j,0}$	Residual term

Table 3.10 provides the results for this analysis. The top portion of the table deals with the abnormal returns for stocks on the announcement day while the bottom portion deals with the bonds. Although both the bond and stock equations include the variables from equation 3.15, the stock analysis includes an additional leverage variable. This variable measures the ratio of the company's long term debt to total assets. Although it is clear that the bonds themselves are directly impacted by changes in ratings or rating providers, it is intuitive that the reaction for the stocks may depend on the amount of leverage in the firm's capital structure.[29]

Given the sensitivity to the market model that I established for the stocks in the previous section, results are provided for abnormal returns based on the market model with a value-weighted index. Recall that this index identified the same abnormal returns as both the average return model and the use of the equally-weighted proxy but had higher overall beta estimates.

[29]The bond analysis also incorporated additional variables identifying whether or not the bond had a call provision and its time to maturity. Neither of these variables impacted the bond results significantly and therefore only the results based on equation 15 are reported.

In addition, the use of this proxy resulted in the largest R^2 value for the market model. Cross-sectional results for abnormal returns measured according to the equally-weighted index and average return model were qualitatively similar.

The dummy variable for the existence of a prior S&P rating indicates that firms without initial S&P opinions experienced positive abnormal returns on the acquisition announcement day. This result however was only significant at the 7% level. I question whether it is the addition of an S&P rating itself or the expansion of S&P's Canadian operations that drive the positive returns. In other words, does the fact that S&P is now a more dominant player in the Canadian market influence how its ratings are perceived? Or, is there something special about the timing of the acquisition that makes the firms react positively to the announcement? To try to distinguish between these explanations, I examine firms that had S&P ratings prior to the acquisition and establish the date at which they were first rated. I check for the presence of positive abnormal stock returns when their S&P ratings were first released. I find no evidence of such returns. The mean abnormal return for stocks upon the release of an S&P rating was close to zero at -0.12%. This level of abnormal return is neither economically or statistically significant.

These results indicate that perhaps there is benefit to having a well-established US rating agency active in the Canadian market. This benefit may be in addition to what individual firms experienced had they previously chosen to seek out an S&P rating. Also possible however is that an S&P rating is simply valued more now than in the past. Until recently, Canadian companies required ratings to satisfy Canadian institutional investors. More and more however, holders of Canadian debt are US investors. Ratings that are credible with foreign investors are essential to securing cross-border financing.

The only other variable with explanatory power in the cross-sectional analysis of stock returns is the natural resource indicator. Although S&P has traditionally been a conservative rater of this industry, firms in this sector experienced abnormally large positive returns on the acquisition day. These returns were significant at the 1% level.

Interestingly, the leverage variable enters the equation with a negative coefficient. Although this coefficient is not statistically significant, it implies that firms with less debt responded more favorably to the acquisition announcement. I would expect this result if these firms view S&P's expansion as opening the door to alternative sources of debt.

If S&P's expansion further facilitates cross-border transactions then firms that were previously unlikely to secure a high level of attention from foreign investors may benefit from the increased exposure the acquisition offers. I test this hypothesis by examining the relationship between variables that measure how visible the firm is to US investors and abnormal return.

These variables include whether the firm's stock was inter-listed in Canada and the US, its market capitalization, the number of analysts that cover it, and its proportion of institutional ownership. The intuition is that firms that were not previously well known to foreign investors will benefit more from the credibility that an S&P rating brings. The estimated equation is specified below.

$$AR_{j,0} = \alpha + \gamma_1 \text{Inst} + \gamma_2 \text{Mktcap} + \gamma_3 \text{Analyst} + \gamma_4 \text{US} + \epsilon_{j,0} \tag{3.16}$$

where,

$AR_{j,0}$	Abnormal return for stock j upon announcement day
α	Constant
Inst	Percent institutional holdings
Mktcap	Ln of market capitalization
Analyst	Number of analysts
US	Dummy variable for inter-listed security
$\epsilon_{j,0}$	Residual term

The results of this analysis are reported in Table 3.11. Since the dependent variables are likely to be correlated, I report the coefficients and test statistics for both the multiple regression and the individual regressions of abnormal returns on each variable. Evidence of this correlation is apparent in Figure 3.5 which illustrates the relationship between size and previous ratings.[30] From the figure it is clear that it was primarily larger firms that initially had S&P ratings and that these firms tended to be rated A or better.

Table 3.11 illustrates that there is some evidence of an inverse relation between the firm's initial level of exposure to foreign investors and its stock price reaction to the acquisition announcement. For example, the larger the percentage of shares already held by institutional investors, the smaller the price reaction. Market capitalization was also inversely related to abnormal returns in that smaller firms benefitted more from the acquisition announcement than larger firms. Examining the average market capitalization of firms with existing US dollar denominated debt provides some insight as to why this may be the case. Firms with existing US dollar debt (and therefore a rating from a US agency) are on average six times larger than those firms with strictly Canadian dollar debt. Recall also that natural resource firms responded positively to the acquisition announcement. These firms too tend to be smaller on average than

[30] Greene (1997) suggests a simple rule of thumb for identifying cases where multicollinearity is of concern. He suggests that we should view the precision of our estimates with skepticism whenever the overall R^2 of the regression is less than any of the individual R^2 measures. In our case, the overall R^2 of the equation is 0.19 which far exceeds any of the individual R^2 values indicating that the impact of multicollinearity is likely not severe.

other firms in our sample - in fact they are over 45% smaller. While some large firms have already participated in cross-border financings it appears that few small firms have yet to issue foreign debt. If the trend in cross-border financings extends to these smaller firms, they will now be armed with a credible US rating. Therefore, S&P's acquisition is particularly beneficial for these firms.

Returning to our discussion of the bond price reaction, the cross-sectional analysis for the excess premiums on announcement day is presented in the bottom half of Table 3.10. Again I test whether the initial CBRS rating, the existence of a prior S&P rating, and industry impact how the bonds reacted on announcement day. There is no indication that bond returns were influenced by these factors. This result is perhaps not surprising given our evidence that only bonds with very different initial ratings from S&P and CBRS experienced negative returns. Across the entire sample of bonds, little price reaction was witnessed.

3.6 Summary

Consistent with prior studies, the sample firms used here illustrate that S&P had more conservative ratings than CBRS. Despite this fact, no impact was witnessed overall for bond returns on announcement day. Closer examination reveals that a strong negative impact was present for those issues with split ratings when the S&P rating was at least two notches below the initial CBRS rating.

The sample firms experienced significantly positive abnormal stock returns. These results were robust to the use of seemingly unrelated regression and standard event study techniques. The use of a matched sample without CBRS ratings implies that these positive returns were directly related to the acquisition announcement. Further to this point, firms without prior S&P ratings experienced greater abnormal returns than firms with existing ratings.

I suggest that S&P's expansion in the Canadian market benefits Canadian firms. To explain this benefit I focus on the institutional nature of the bond market and the globalization of financial markets. I show that US dollar debt financing is becoming an increasingly popular source of funds for Canadian firms. The growth of the currency swap market and the coordination of security regulations across Canada and the US have assisted this trend. At this point, however, US dollar debt is typically issued by larger Canadian firms. It is important to note that all of these firms already maintained ratings from US agencies prior to the acquisition. In order to be attractive to foreign investors and satisfy institutional guidelines, a US-based rating has become essential. Standard and Poor's acquisition of CBRS provides a credible, institutionally recognized rating for our sample firms. Small firms with little institutional ownership may benefit significantly from the increased visibility and credibility that this brings. It is these firms

in particular that experienced the greatest returns when the acquisition was announced.

The natural experiment provided by S&P's acquisition of the Canadian Bond Rating Service provides us with insight into the value of credit ratings from alternative agencies. This insight is applicable to an increasingly large number of countries where traditionally US-based rating agencies are now operating. The observations from this study will only increase in relevance as the globalization of financial markets and their participants continues.

Table 3.1
Canada's International Investment Position
(millions of $C)

	1997	1998	1999	2000	2001
Cdn Portfolio Investments*	130,366	157,405	179,813	215,328	231,182
Portfolio Foreign Bonds	26,586	33,254	30,733	34,976	35,125
Portfolio Foreign Stocks	103,780	124,151	149,080	180,352	196,057
Foreign Portfolio Investments*	419,301	470,116	458,800	456,582	504,913
Portfolio Canadian Bonds	367,899	405,772	389,693	371,081	417,133
Portfolio Canadian Stocks	51,402	64,344	69,107	85,501	87,780

*Excludes money market instruments

Table 3.1: Canada's International Investment Position

Table 3.1 illustrates the recent increases in both Canadian holdings of foreign securities and foreign holdings of Canadian securities. It is interesting to note that the majority of foreign holdings are of Canadian bonds rather than Canadian stocks. Canadian corporations are increasingly participating in cross-border debt financings.

Table 3.2
Industry Classifications of Sample Firms

	Stocks	Bonds
Radio, Television, Telephone	11	6
Crude Petroleum and Natural Gas	10	7
Steel and Aluminum	9	6
Electric or Gas Transmission	7	5
Holding Companies	7	3
Ore Mining	5	4
Paper Mills	5	2
Real Estate, Building Operators, Developers	5	3
Schedule I Banks	5	5
Grocery Stores	3	2
Hotels and Motels	3	3
Newspapers, Periodicals, Printing	3	2
Sawmills	3	2
Securities Brokers and Dealers	3	2
Chemicals and Fertilizers	2	2
Department Stores	2	2
Life Insurance	2	0
Machinery	2	1
Motor Vehicles and Car Bodies	2	1
Petroleum Refining	2	1
Telephone and Telegraph Apparatus	2	0
Others	15	11
Total	106	70

Table 3.2: Industry Classifications of Sample Firms

Table 3.2 provides industry classifications for the sample firms based on the first two digits of their SIC codes.

Table 3.3
CBRS Ratings of Sample Firms

	Stocks	Bonds
AA	8	7
AA-	4	2
A+	10	7
A	10	8
A-	27	21
BBB+	12	7
BBB	12	12
BBB-	8	3
BB+	2	1
BB	7	1
BB-	3	0
B+	1	0
B	2	1
Total	106	70

Table 3.3: CBRS Ratings of Sample Firms

Table 3.3 provides the ratings given by CBRS to the senior long-term debt of the firms in this sample.

Table 3.4
Ratings of Sample Firms

	CBRS		S&P		DBRS	
	Firms	%	Firms	%	Firms	%
AAA	0	0.00%	1	1.92%	0	0.00%
AAA-	0	0.00%	0	0.00%	0	0.00%
AA+	0	0.00%	1	1.92%	0	0.00%
AA	8	7.55%	2	3.85%	1	1.06%
AA-	4	3.77%	4	7.69%	3	3.19%
A+	10	9.43%	2	3.85%	14	14.89%
A	10	9.43%	2	3.85%	10	10.64%
A-	27	25.47%	5	9.62%	12	12.77%
BBB+	12	11.32%	7	13.46%	20	21.28%
BBB	12	11.32%	10	19.23%	17	18.09%
Invst. Grade	83	78.29%	34	65.39%	77	81.92%
BBB-	8	7.55%	8	15.38%	8	8.51%
BB+	2	1.89%	3	5.77%	2	2.13%
BB	7	6.60%	0	0.00%	4	4.26%
BB-	3	2.83%	5	9.62%	1	1.06%
B+	1	0.94%	0	0.00%	1	1.06%
B	2	1.89%	1	1.92%	1	1.06%
B-	0	0.00%	1	1.92%	0	0.00%
Non-Invst Grade	23	21.70%	18	34.61%	17	18.08%
Total	106	100%	52	100%	94	100%

Table 3.4: Ratings of Sample Firms

Table 3.4 illustrates the number of sample firms that possessed ratings from multiple agencies. In addition, the break-down of the ratings provided by each agency is given.

Table 3.5
Ratings Matrix - CBRS vs S&P
(CBRS ratings horizontal)

	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-
AA+				1											
AA		1	1												
AA-		4													
A+				1				1							
A				1	1										
A-				1	2	2									
BBB+					3	2	2								
BBB						5	1	4							
BBB-						1	1	4	2						
BB+									1		2				
BB															
BB-										1	1	2	1		
B+															
B														1	
B-														1	

Table 3.5: Ratings Matrix - CBRS vs Standard and Poor's

Table 3.5 contrasts the ratings given by CBRS with those provided by S&P. Within each cell, the number of firms with that particular combination of ratings is provided. Firms falling on the diagonal have the same rating from both agencies. Numbers lying below the diagonal indicate that S&P rated the debt more harshly.

Table 3.6
Announcement Day Bond Returns

	No. of Bonds	Mean Excess Bond Prem.	Firms with Positive Ab. Ret.	HK Test	Sign Test
All Firms	70	-0.05%	59.70%	0.22	1.59
With S&P	36	-0.11%	62.86%	0.28	1.52
Without S&P	34	0.01%	56.25%	0.13	0.71
A Group	45	-0.08%	60.47%	0.29	1.37
B Group	25	0.00%	58.33%	0.05	0.82
Bad News	23	-0.23%	54.55%	0.01	0.43
No News	44	0.03%	61.90%	0.30	1.54

Table 3.6: Announcement Day Bond Returns

Table 3.6 tests the hypothesis that bond prices were impacted by the merger announcement. The third column gives the mean excess bond premium as defined by the difference between the bond's return and the return on a comparable treasury bond less the average value of this difference. No evidence of abnormal returns was found for the sample as a whole. Large negative returns however were apparent for those issues with existing Standard and Poor's ratings that were lower than their CBRS ratings.

Table 3.7
Announcement Day Stock Returns

	No. of Stocks	Mean Ab. Ret.	Firms with Positive Ab. Ret.	SUR Test	Std Test
All Firms	106	1.60%	74.53%	1.42*	5.88*
With S&P	52	1.32%	75.00%	1.03	3.38*
Without S&P	54	1.74%	68.52%	1.28	4.54*
A Group	59	1.08%	65.52%	1.41	3.05*
B Group	47	1.91%	81.25%	1.28	4.46*
Bad News	29	2.15%	82.14%	1.53	3.86*
No News	70	1.43%	70.42%	1.15	4.36*

*Indicates significance at the five percent level

Table 3.7: Announcement Day Stock Returns

Table 3.7 depicts the abnormal stock returns measured on the acquisition announcement date. These returns were positive for the entire sample of firms. Across all categories, the majority of firms experienced positive results which the typical test statistic based on standardized abnormal returns, found statistically significant. The test based on the seemingly unrelated regression identified significant results only for the sample as a whole.

Table 3.8
CARs Surrounding the Acquisition Announcement

Event Window	Mean CAR	SUR Test
Day -1 to Day 0	3.00%	1.60*
Day -1 to Day +1	3.30%	1.39*
Day -1 to Day +2	3.58%	1.07

*Indicates significance at the five percent level

Table 3.8: CARs Surrounding the Acquisition Announcement

Table 3.8 examines the mean cumulative abnormal return for the entire sample of firms on the days surrounding the event date. From the table we see that large abnormal returns occurred for the two-day event window, day -1 to day 0.

Table 3.9
Robustness of Announcement Day Returns

	Market Model - Value Weighted Proxy		
	Mean Ab. Ret.	Firms with Positive Ab. Ret.	Std. Test
All Firms	0.55%	53.77%	2.20*
With S&P	0.19%	46.15%	0.82
Without S&P	0.90%	61.11%	2.28*
A Group	0.36%	55.93%	1.08
B Group	0.80%	51.06%	2.10*
Bad News	0.73%	48.28%	1.61
No News	0.57%	57.14%	1.69

	Average Return Model		
	Mean Ab. Ret.	Firms with Positive Ab. Ret.	Std. Test
All Firms	1.50%	68.87%	5.41*
With S&P	1.34%	67.31%	3.47*
Without S&P	1.66%	70.37%	4.17*
A Group	1.18%	64.41%	3.40*
B Group	1.91%	74.47%	4.31*
Bad News	1.86%	72.41%	3.32*
No News	1.40%	65.71%	4.12*

*Indicates significance at the five percent level

Table 3.9: Robustness of Announcement Day Returns

Table 3.9 provides the mean day-zero abnormal stock returns and their test statistics based on the standardized abnormal returns. Consistent with the tests based on the equally-weighted index, significantly positive abnormal returns were identified when the value-weighted index was used. Use of the average return model also provided evidence of significantly positive returns.

Table 3.10
Cross-Sectional Analysis of Security Returns

	Abnormal Stock Returns (Value-Weighted Market Proxy)		
	Coefficient	T-Stat	Probability
B Group	0.69	1.16	0.25
Without S&P	0.99	1.80	0.07
Natural Resource	1.94	3.28*	0.00
Leverage	-0.01	-1.35	0.18

	Excess Bond Premiums		
	Coefficient	T-Stat	Probability
B Group	2.18	1.01	0.31
Without S&P	-2.30	-0.95	0.34
Natural Resource	1.74	0.88	0.38

*Indicates significance at the five percent level

Table 3.10: Cross-Sectional Analysis of Security Returns

Table 3.10 examines whether the positive stock reaction to the acquisition announcement varied with firm characteristics. Intuitively, if the market viewed the addition of a Standard and Poor's rating as positive news for the firm, we would expect firms without prior ratings from Standard and Poor's to respond more favorably than firms with an existing rating. I find support for this conjecture. In addition, firms in the natural resource sector experienced significant positive returns. There is no evidence to suggest that excess bond premiums are related to the above firm characteristics.

Table 3.11
Alternative Market Hypothesis

	Multiple Regressions		
	Coefficient	T-Stat	Probability
Market Capitalization	-0.82	-2.85*	0.01
US Listing	0.70	0.97	0.34
Number of Analysts	0.20	4.24*	0.00
Institutional Holdings	-0.03	-2.00*	0.05

	Individual Regressions		
	Coefficient	T-Stat	Probability
Market Capitalization	-0.28	-1.25	0.21
US Listing	0.29	0.48	0.63
Number of Analysts	0.09	3.11*	0.00
Institutional Holdings	-0.01	-0.97	0.33

*Indicates significance at the five percent level

Table 3.11: Alternative Market Hypothesis

Table 3.11 provides evidence of an inverse relationship between how well-known a firm may have initially been to foreign investors and the size of its abnormal returns upon the announcement of the acquisition. Smaller firms and those with fewer institutional investors responded more positively to the acquisition announcement.

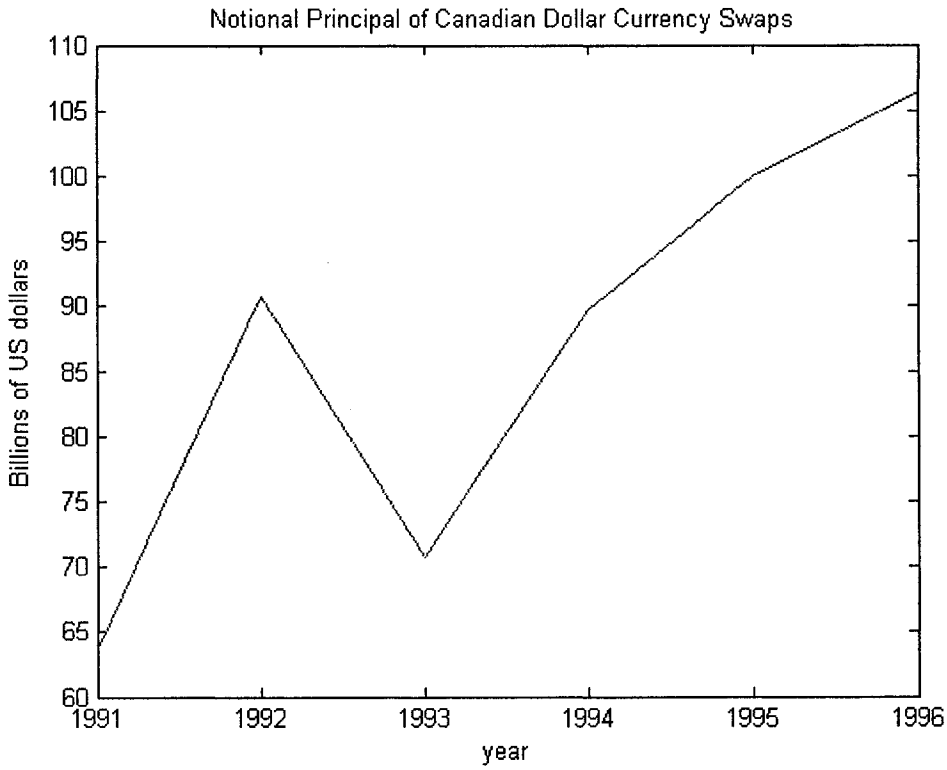

Figure 3.1: Notional Principal of Canadian Dollar Currency Swaps

Assisting the trend of cross-border debt financings has been the significant growth in the currency swap market. In 1991, Canadian dollar currency swaps had a notional principal of $63 billion US dollars. By 1996, this value had increased to over $100 billion.

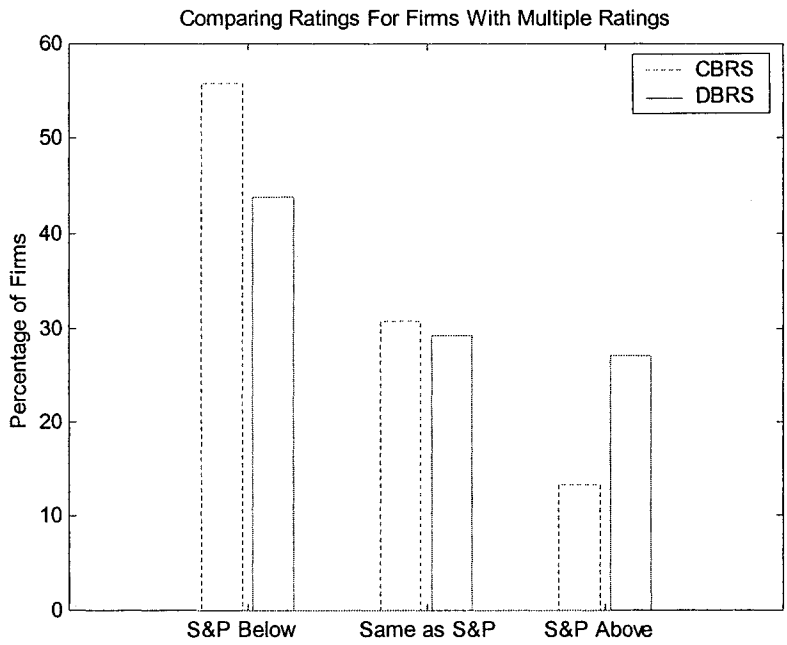

Figure 3.2: Comparing Ratings for Firms With Multiple Ratings

Differences in ratings between agencies are illustrated here. For the 52 firms with ratings by both CBRS and S&P and the 48 companies with ratings by both S&P and DBRS, the proportion of times that S&P provided lower, equal, or higher ratings is given. In general, S&P exhibited more conservative ratings than the other two agencies.

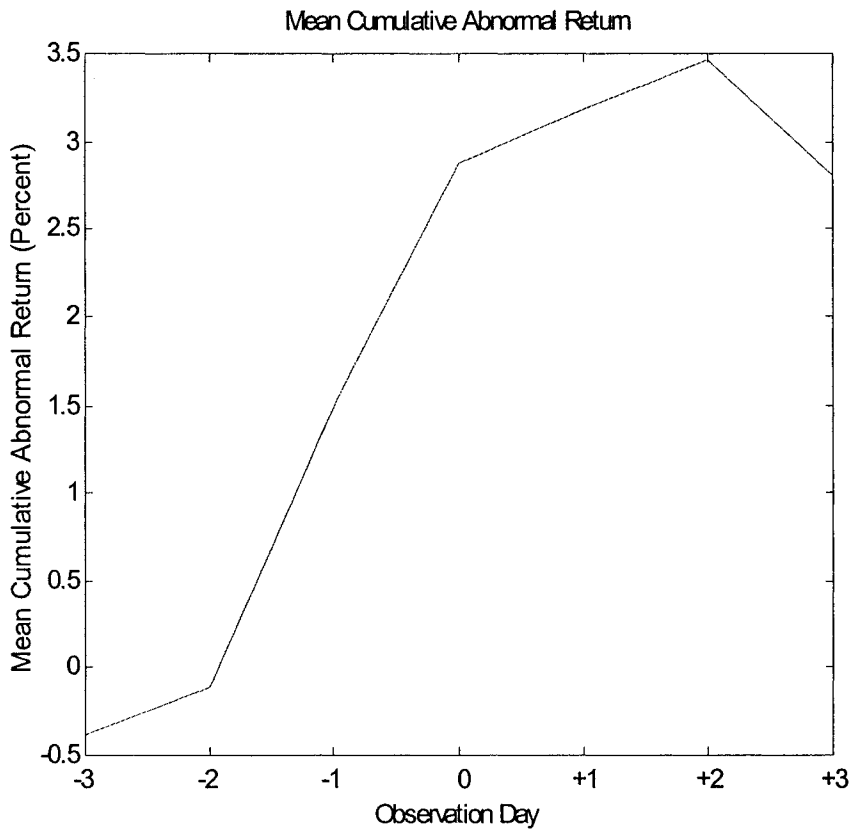

Figure 3.3: Mean Cumulative Abnormal Return

This figure illustrates the mean cumulative abnormal return on the dates surrounding the event day for our entire sample of 106 stocks. Although it is apparent that positive abnormal returns existed on the event day, more striking is the presence of large returns on day -1. This indicates either a leak of information regarding the acquisition or, more likely, the existence of additional factors influencing the sample firms that are not picked up by the market model.

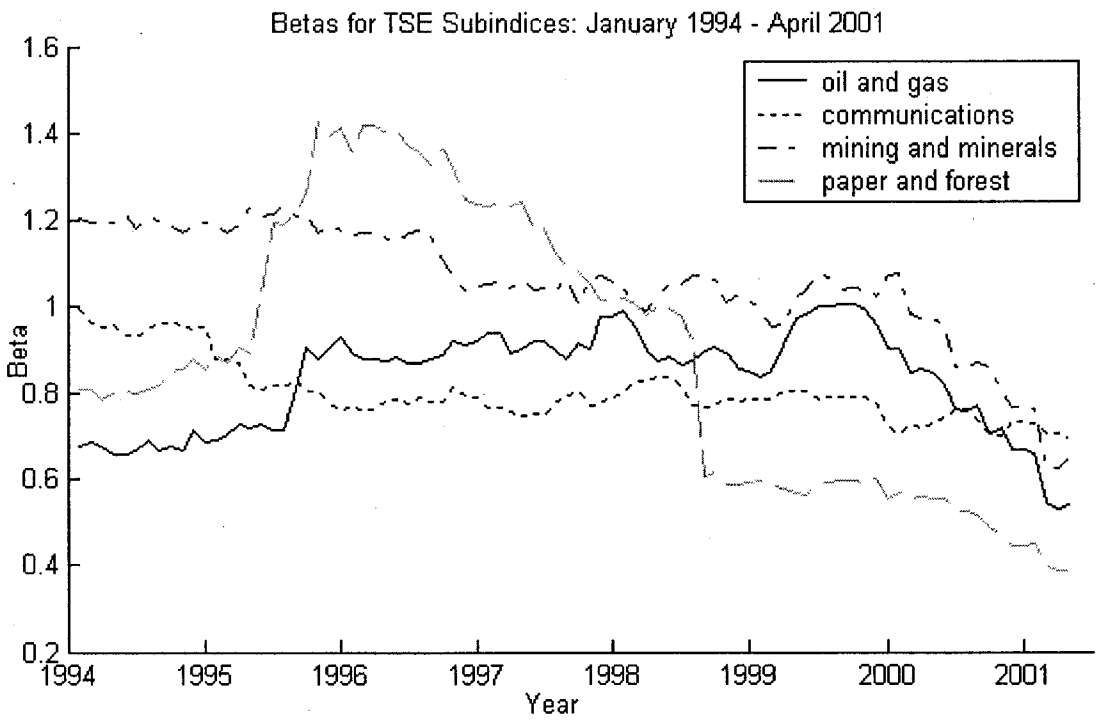

Figure 3.4: Betas for TSE Subindices

Betas for various TSE subindices are illustrated here. Each is based on five years of historical monthly data. It is apparent that during the estimation period employed in this study, beta values were falling for all subindices except the communications group. This group includes the dominant stocks in the Canadian market.

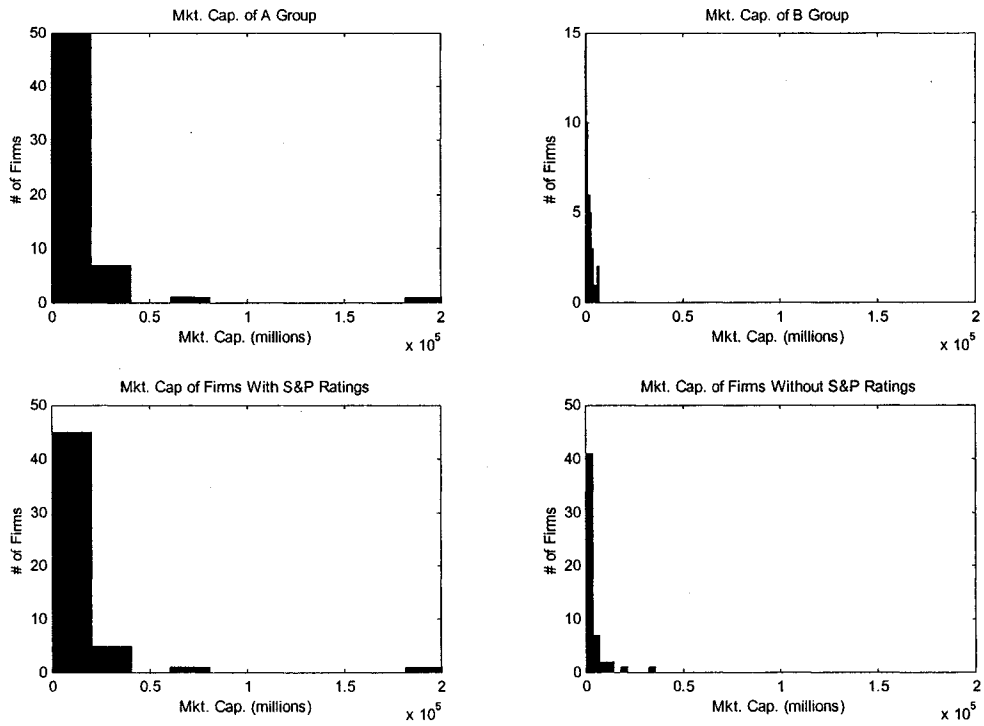

Figure 3.5: Relating Firm Size and Rating

The difference in firm size, as measured by market capitalization, across various categories is illustrated here. Firms with ratings in the A category and those with prior S&P ratings, tend to be much larger.

4 Controlling for Anticipation in Stock Price Reactions to Credit Downgrades

One of the biggest debates in the literature on credit ratings is whether or not ratings provide new information to the market. On one hand, there are those that argue that credit ratings provide a simple synthesis of public information regarding a firm's creditworthiness. This view suggests that companies such as Moody's and Standard & Poor's, analyze the same financial statements, press releases, and indenture covenants as any fixed income investor. On the other hand, it is often argued that agencies have access to a firm's private information since, as part of the rating process, credit analysts meet with senior management.

Although the revelation of inside information to analysts is prohibited by 'Regulation Fair Disclosure,' which was enacted in 2000, many have traditionally taken the exchange of this information for granted. For instance, Blume, Lim, and MacKinlay (1998) asked whether recent increases in the number of downgrades relative to upgrades were due to information "available privately to the rating agencies" that indicated an overall decline in credit quality. Similarly, in their comparison of bond rating changes to earnings estimates, Ederington and Goh (1998) argued that equity analysts may change their forecasts as a result of either upgrades or downgrades if they believe that these rating changes represent inside information unavailable to them.

The most popular method for trying to establish whether new information is revealed by credit ratings, is to examine the impact of rating changes on security prices. One of the difficulties associated with this method is that rating changes are triggered by firm performance. It is therefore difficult to distinguish whether any price reaction is the result of information from the rating change or an associated change in the company's financial position.

Evidence of this difficulty is found in the work of Wansley and Clauretie (1985) and Goh and Ederington (1993). Both of these studies found negative security returns *prior* to rating downgrades. This finding implies that negative returns may be due simply to a company's poor financial performance rather than their change in credit rating. A second possibility, is that rating changes simply lag stock performance.

A more precise measure of the information revealed by rating changes must acknowledge the existence of public information. This information may not only impact security returns in its own right, but may also lead the market to anticipate that a rating change is imminent. A small number of papers have attempted to model this anticipation by making limited use of firm-specific variables. This paper seeks to extend this literature by conducting a thorough analysis of stock reactions to rating downgrades *conditional* on previous information. In this

way we establish a clearer measure of the information revealed by the rating change itself. Although several papers have related the probability of rating changes to the performance of fixed income securities, this paper will explicitly model this probability and its relation to stock returns.

Some of the first steps towards measuring the market's anticipation of a rating change were made by Hsueh and Liu (1992) and Hand, Holthausen, and Leftwich (1992). Hsueh and Liu argued that rating changes are more informative for firms that are not followed closely by the market. Since there is less information readily available regarding these firms, any credit rating announcements provide a large incremental benefit. As a result, Hsueh and Liu incorporated a measure of the *quantity* of information available for a particular firm. The proxy they chose for this measure was the company's ownership dispersion. They argued that widely held firms with a large number of small shareholders would not be closely monitored and therefore would have more uncertainty surrounding them.

While ownership concentration and the quantity of information may be intuitively related through agency theory, the authors provided no evidence that this relationship was empirically sound. In other words, no support is provided to demonstrate that companies with more disperse ownerships have less information available about them. In addition, we question whether quantity of information is the best measure of expected rating changes rather than more specific measures of variables previously shown to be related to rating assignments.[31]

Hand, Holthausen, and Leftwich (1992) attempted to capture the market's anticipation of a rating change by classifying rating changes as either expected or unexpected depending on the issue's yield to maturity. If an issue had a yield to maturity that exceeded the median yield of bonds in its rating category, investors were said to expect a downgrade. Hand et al. argued that when the yield is greater than the median value it is because investors believe that the issue has a greater chance of default. A downgrade in this case provides little information to the market since an increase in credit risk has already been anticipated.

While the yield to maturity of an issue undoubtedly reflects a wide range of information, the measure used by Hand et al. provides only a broad classification. Either a rating change is expected or it is not. The method used in this paper will provide a more detailed analysis of firm-specific variables in order to explicitly model the probability of a rating change.

To establish the relationship between credit ratings and stock performance we will use the latent information approach of Acharya (1993). Rather than simply relying on changes in ratings, this method accounts for the fact that these changes were not complete surprises. It

[31] A large body of literature has evolved around the prediction of bond ratings. See Kaplan and Urwitz (1979) for a good review of the early papers in this area. A more recent analysis has been conducted by Blume, Lim, and MacKinlay (1998).

also allows us to include observations that a rating *did not* change and recognizes that even these may provide information to the market regarding knowledge possessed by rating agencies.

Our analysis will explore whether rating agencies maintain an informational advantage once we control for firm-specific characteristics and the likelihood of downgrade. We will focus on credit downgrades since only downgrades have been found to consistently impact equity returns. If bond ratings are merely capturing existing conditions rather than providing new information, we would expect the conditional method to place less significance on the rating change. If we can demonstrate that a link between credit ratings and stock prices remains, even after conditioning on existing public information, we have provided evidence that agencies have access to inside knowledge.

Our results are threefold. First, firm-specific financial and market data can be used with some success to predict rating downgrades. When our model predicts that a downgrade is likely and in fact one occurs, we find little evidence of abnormal returns upon announcement. Second, incorporating this data into the analysis eliminates almost all cases in which abnormal returns can be claimed to signal a rating agency's inside information. Third, where evidence of an informational advantage for agencies remains, we explore why this is the case. We discover that during certain time periods, rating downgrades may possess greater information content than is typically the case. We hypothesize that rating changes may be more informative during times of market uncertainty.

After discussing the link between credit ratings and stock prices in section one, section two of this chapter outlines the latent information methodology and how it will be employed in the case of credit downgrades. Section three describes the variables used to establish the expectation of a rating change. Section four describes the data, sections five and six, the results, and section seven concludes.

4.1 Linking Credit Ratings and Stock Prices

When a firm receives a rating change, the yield on its outstanding debt will reflect this change. A downgrade may impact both the current yield of the issue and the rate at which the company can issue debt in the future. How does this change influence the stock? Since the rating provides a measure of the riskiness of the firm's debt, the shareholders, as residual owners, may also be impacted.

Exactly how shareholders will be impacted may vary from case to case. It will depend on both the reason for the rating change and the firm's initial rating level. Goh and Ederington (1993) suggest that downgrades associated with increases in leverage, rather than poor performance, may not be viewed negatively by shareholders. They established that when the

reason provided for a downgrade was a negative evaluation of the firm's financial prospects, stock prices fell. However, when firm prospects remained strong but an increase in leverage resulted in a downward rating assessment, stock prices did not react. An increase in leverage when the firm's outlook is good, may simply serve to lower the company's weighted average cost of capital through the addition of inexpensive debt financing. If the company maintains a high level of obligation coverage and overall creditworthiness, shareholder risk may not be significantly increased.

The reason behind the rating change may play a significant role in the market's reaction to it. It is therefore important to evaluate stock reactions to credit downgrades conditional on the firm's financial health.

The issue's existing rating level may also make it difficult to predict the implications of rating changes for shareholders. Kliger and Sarig (2000) argue that since stockholders are owners of securities with option-like characteristics, an upward assessment of a firm's risk by rating agencies, may be viewed positively by those holding the common stock. While in general we believe (and the empirical evidence demonstrates) that a downgrade impacts the stock negatively, in the extreme case, when the firm is already close to default, option-like characteristics may prevail.

Especially relevant for this paper, Kwan (1996) established that stock and bond returns are similarly impacted by the revelation of firm-specific information. In contrast to most studies, which have looked at the relation between *aggregate* stock and bond returns, Kwan studied their correlation at the individual firm level. He found that the prices of equity and fixed income securities of the same firm tended to move in the same direction. We therefore use firm-specific financial and market variables to predict changes in credit risk and use this prediction to in turn evaluate stock returns. This approach allows us to provide more precise evidence on the informational content of rating changes for equity investors.

4.2 Latent Information Methodology

A clear advantage of using the latent information methodology is its recognition that a rating change is likely not a complete surprise to the market.[32] Although rating agencies have been argued to possess inside knowledge, much of the information upon which a rating is based is available to the public. The latent information method allows us to model the market's probability belief that a downgrade will occur. It recognizes that a rating change may be

[32]Several corporate events can be viewed similarly to be partially anticipated by the market. Examples of such situations in which the latent methodology has been applied include: the decision to force conversion of a convertible bond (Acharya (1988)); to acquire a firm (Eckbo, Maksimovic, and Williams (1990)); and to split shares and change dividend payments (Nayak and Prabhala (2001)).

due to both public and private information and establishes whether the private component is significant.

This section outlines the precise method that we will employ to establish whether private information is revealed by rating changes. We focus only on the decision to downgrade a firm's rating. The empirical literature has consistently found downgrades to have a significant impact for stock prices, while upgrades have resulted in little price reaction (see for instance Hand, Holthausen, and Leftwich (1992), Goh and Ederington (1993), and Dichev and Piotroski (2001)).

The conditional event study approach differs in its underlying assumptions from traditional event study methods in that it does not treat corporate events as entirely exogenous happenings. In other words, it formulates a decision process for each event and measures the impact of the announcement in relation to this process. In the case of credit rating downgrades we will denote our decision process by the variable $Rate_{it}$. This variable corresponds to the agency's view of whether firm i should be downgraded at time t. As long as $Rate_{it}$ maintains a certain level, the firm will avoid a downgrade. However when $Rate_{it}$ falls below this level, a downgrade will occur.

We can think of $Rate_{it}$ as being composed of two parts; public information available regarding the firm's financial health and any inside information that the rating agency is privy to. More formally,

$$Rate_{it} = \theta' X_{it-1} + \Psi_{it} \tag{4.1}$$

Here $\theta' X_{it-1}$ represents the market's expectation of a downgrade, conditional on firm-specific information contained in the vector X_{it-1}. Ψ_{it} represents the agency's inside information. While the market cannot observe the latent information contained in Ψ_{it}, it can witness whether or not a downgrade occurs. For simplicity, we assume that Ψ_{it} is a normal random variable.

Assume that the firm will maintain its current rating as long as $Rate_{it}$ exceeds zero. When $Rate_{it}$ falls below zero, a downgrade occurs. We can then define an indicator variable I_{dit} that will be equal to one whenever a downgrade occurs for firm i at time t.

$$\begin{aligned} I_{dit} &= 0 \text{ whenever } \theta' X_{it-1} + \Psi_{it} > 0 \\ &= 1 \text{ otherwise} \end{aligned} \tag{4.2}$$

Therefore, the market can infer something about the value of Ψ_{it}, the agency's inside information, depending on whether it observes a downgrade or not. Even the observation that a

downgrade *does not* occur provides some indication of the value of Ψ_{it}. For instance if there is no downgrade, it must be the case that $\Psi_{it} > -\theta' X_{it-1}$.

Having established a decision process for downgrades, we must relate this process to abnormal returns witnessed when a downgrade occurs. More specifically, we are interested in relating the abnormal returns experienced by firm i at time t (denoted by ε_{it}) to the rating agency's inside information regarding firm i, Following Acharya (1993) we specify this relationship as:

$$\varepsilon_{it} = \pi \Psi_{it} + \eta_{it} \tag{4.3}$$

where π is equal to $cov(\varepsilon_{it}, \Psi_{it})$ and η_{it} is noise that is independent of the event happening. More specifically, $E(\eta_{it}|I_{dit}) = 0$ regardless of whether I_{dit} equals zero or one. Now define a variable W_{it} which includes all firm-specific characteristics contained in the vector X_{it-1} *and* the market model parameter estimates a_i and b_i. These parameters are from the standard market model relationship, $R_{it} = a_i + b_i R_{mt} + \varepsilon_{it}$. Here R_{it} represents the return on stock i at time t and R_{mt} represents the corresponding time t return on the market portfolio.

With these relationships in hand, we can specify the expected abnormal return given that a downgrade does or does not occur. When the firm maintains its credit rating we note that its abnormal return depends on the firm's characteristics, it's market model parameter estimates, and the fact that a downgrade did not occur. We denote the expectation of the abnormal return as:

$$E(\varepsilon_{it}|I_{dit} = 0, W_{it}) \tag{4.4}$$

Substituting in our specified relationship from equation 4.3 into equation 4.4, we can rewrite this expectation in terms of the inside information Ψ_{it} as below:[33]

$$\pi E\left(\Psi_{it}|X_{it-1}, \Psi_{it} > -\theta' X_{it-1}\right) \tag{4.5}$$

Taking this expectation, we have the rate of change in equity value when a downgrade does not occur:

$$\pi E\left(\Psi_{it}|X_{it-1}, \Psi_{it} > -\theta' X_{it-1}\right) = \pi \frac{\phi(\theta' X_{it-1})}{\Phi(\theta' X_{it-1})} \tag{4.6}$$

Where ϕ and Φ are the standard normal density and cumulative density functions respec-

[33] Note that the expectation of excess returns depends on the coefficient estimates from the market model, a_i and b_i. The expectation of the value of the latent information, Ψ_{it}, however, need not depend on these parameters. This expectation is therefore conditional on X_{it-1} as opposed to W_{it}.

tively.[34] The cumulative density, $\Phi(\theta' X_{it-1})$, can be thought of as the probability that the downgrade *does not* occur. Therefore, the probability that a downgrade *does* occur is simply $1 - \Phi(\theta' X_{it-1})$. As a result, the rate of change in the value of equity when there is a downgrade can be expressed as:

$$E(\varepsilon_{it}|I_{dit} = 1, W_{it}) = -\pi \frac{\phi(\theta' X_{it-1})}{1 - \Phi(\theta' X_{it-1})} \tag{4.7}$$

Acharya (1993) points out that we can think of $\frac{\phi(\theta' X_{it-1})}{1-\Phi(\theta' X_{it-1})}$ and $\frac{\phi(\theta' X_{it-1})}{\Phi(\theta' X_{it-1})}$ used in equations 4.6 and 4.7 as providing the conditional means of inside information given that a downgrade does or does not occur. Coefficient π serves to translate these means into expected returns. In the case of credit ratings, we would expect these returns to be smaller when downgrades occur. In other words, we would expect a positive difference between the return when ratings are constant and the return when ratings decline. We can express this difference as:

$$E(\varepsilon_{it}|I_{dit} = 0, W_{it}) - E(\varepsilon_{it}|I_{dit} = 1, W_{it}) = \pi \left[\frac{\phi(\theta' X_{it-1})}{\Phi(\theta' X_{it-1})} + \frac{\phi(\theta' X_{it-1})}{1 - \Phi(\theta' X_{it-1})} \right] \tag{4.8}$$

For this difference to be positive, that is for negative returns to be consistent with unfavorable information revealed via a downgrade, π must be greater than zero.

With the expressions provided for abnormal return in equations 4.6 and 4.7 we can write the stock return for firm i at time t as:

$$R_{it} = a_i + b_i R_{mt} + \pi \frac{\phi(\theta' X_{it-1})}{\Phi(\theta' X_{it-1})}(1 - I_{dit}) - \pi \frac{\phi(\theta' X_{it-1})}{1 - \Phi(\theta' X_{it-1})} I_{dit} + v_{it} \tag{4.9}$$

where $E(v_{it}|W_{it}, I_{dit}) = 0$. Our goal is to establish whether the π coefficient in equation 4.9 reveals any evidence of inside information once the firm-specific characteristics and anticipation of downgrade are taken into account. The next section explains the estimation procedure that will provide this result.

[34] The term $\frac{\phi(\theta' X_{it-1})}{\Phi(\theta' X_{it-1})}$ is often referred to as the inverse Mills ratio.

4.2.1 Estimation

The estimation of equation 4.9 takes place in two steps.[35] The first utilizes firm-specific variables to explicitly estimate the anticipation of a rating change. This anticipation is estimated via a probit model that establishes the coefficient vector, θ'. The indicator variable I_{dit} forms the left-hand side of the equation and the firm-specific characteristics in X_{it-1} form the right-hand side.

We incorporate both cross-sectional and time varying inputs into our firm-specific variables. The crucial assumption that the inside information Ψ_{it} is iid normal ensures that the probit analysis extends easily to this framework. However, Prabhala (1997) shows that in general there is little impact on inferences for non-normal distributions of Ψ_{it}.

The precise variables used to estimate the probability of a downgrade are described in detail in the next section. For now, it suffices to say that the probit model will be estimated with quarterly financial information for firms with Moody's ratings between January 1988 and December 2000. All firms with outstanding ratings will be included in the sample, therefore, the number of observations will vary from quarter to quarter. By including all firms with ratings rather than focusing only on those with rating *changes*, we derive additional benefits from using the conditional method versus the typical event study approach (Prabhala (1997)). Firms are not included in the quarter in which their ratings are withdrawn.

The second step in the estimation procedure is to estimate the π coefficient in equation 4.9. This coefficient is estimated by ordinary least squares regression. To see how this is done, we rewrite equation 4.9 by combining the conditional returns. For ease of notation, denote $\theta' X_{it-1}$ as δ. We can then express the one day stock return for firm i at time t as:

$$R_{it} = a_i + b_i R_{mt} + \pi \left[\frac{\phi(\delta)}{\Phi(\delta)}(1 - I_{dit}) - \frac{\phi(\delta)}{1 - \Phi(\delta)} I_{dit} \right] + v_{it} \tag{4.10}$$

We then simplify the expression within the brackets so that the indicator variable, I_{dit}, is associated with only one term.

$$R_{it} = a_i + b_i R_{mt} + \pi \left[\frac{\phi(\delta)}{\Phi(\delta)} - \frac{\phi(\delta)}{\Phi(\delta)(1 - \Phi(\delta))} I_{dit} \right] + v_{it} \tag{4.11}$$

We estimate π by running OLS on this equation. If π is positive and statistically significant,

[35] This two step procedure is similar to the method proposed by Heckman (1974). Here however, an economic meaning is attached to the π coefficient; it represents the significance of private information. In addition, this method combines event and non-event information in the same regression, allowing for possible cross-sectional covariance of the error in the stock return. A detailed examination of the differences between the two methods can be found in Acharya (1988).

we infer that downgrades are associated with negative stock returns even after conditioning on firm-specific variables. This implies that rating agencies maintain an informational advantage over other investors.

Acharya (1993) conducted Monte Carlo simulations to compare this approach to traditional event study methods. He found that the latent information method performed at least as well as all other methods and could in fact reduced the instance of bias when both event and non-event periods were used. Eckbo, Maksimovic, and Williams (1990) advocate a similar procedure by arguing that standard approaches are inconsistent when the event is the result of a voluntary decision. This is definitely the case in a rating downgrade where the rating agency makes an informed decision based on both public and inside knowledge available at the time.

4.3 Variables

The firm-specific variables used to estimate the probability of a rating change include measures from financial statements and variables established by the market. In an early comparison of alternative methods for estimating bond ratings, Kaplan and Urwitz (1979) discovered that models including market variables performed far better than those relying on financial statements alone. As to which financial variables are included in the analysis, our choice is guided by both information from the rating agencies and previous research.

Before explaining our choices in detail, it is important to note a subtle characteristic of our analysis. Our goal is to estimate the likelihood of a rating *change* while the vast majority of studies in this area have focused on predicting the actual rating *level.* An exception, is the work of Bhandari, Soldofsky, and Boe (1983) who explicitly attempted to predict changes in ratings and therefore relied both on trends in financial variables and their absolute levels. We will follow their example and use the following variables to establish the probability of a rating change. The trend variables are measured as the slope of the regression of the variable against time. Note that our measures are based on quarterly financial statements. The notation Q_{-1} indicates that the measure is based on values from the previous quarter.

1. IC - Interest coverage as of Q_{-1}.
2. IC Trend - The trend in interest coverage over the prior two years, that is from Q_{-9} to Q_{-1}.
3. DR - Total debt to total asset ratio as of Q_{-1}.
4. DR Trend - The trend in debt ratio from Q_{-9} to Q_{-1}.

5. ROA - Return on assets as of Q_{-1}.

6. ROA Trend- The trend in return on assets from Q_{-9} to Q_{-1}.

7. BETA - The equity beta of the firm at the end of Q_{-1}

8. SIZE - The ln of firm market capitalization at the end of Q_{-1}

With these variables[36] we encompass many of the factors that Moody's and S&P claim to use in their rating procedures. For example, a 1998 Moody's report on rating methodology indicated that their analysts establish a rating by examining: industry trends; national, political, and regulatory environment; management quality; operating and competitive position; financial position and sources of liquidity; company structure; and special event risk. Almost all of these categories can be studied by examining public information about a firm, however, an assessment of management will benefit from the direct contact between credit analysts and senior company executives.

Since the vast majority of companies in our sample are based in the US, political environment is roughly the same for all. In order to examine industry and business trends, we keep track of the firm's four digit SIC code and use quarterly growth in real gross domestic product as a measurement of overall economic conditions. As for the remaining areas, we get some guidance from an S&P report by Chinn and Harvey (2000) on key financial ratios for industrial firms. Not surprisingly, the ratios reported by Chinn and Harvey reflect the same areas mentioned by Moody's. They are similar to the variables that we have chosen to the extent that they include return on capital measures, interest coverage and debt to capitalization ratios.

The use of equity beta is consistent with Schwendiman and Pinches' (1975) comparison of beta values across bond rating categories. They found that betas were significantly greater for firms with non-investment grade ratings than those with higher ratings. Similarly, Clark, Dellva, and Foster (1993) revealed a relationship between changes in credit ratings and changes in beta. Blume, Lim and MacKinlay (1998) argued that equity beta reflects both the variability of the firm's overall cash flow and the impact of its leverage and therefore should be included in an estimate of credit ratings.

Blume et al. also include firm size as an explanatory measure of credit ratings since it has been found to be positively related to rating level. Dichev and Piotroski (2001) found stock market reaction to downgrades more severe for small firms while Clark, Foster, and Ghani

[36]The financial ratios use a number of Compustat variables in their calculation. Specifically, interest coverage is equal to the sum of operating income after depreciation and interest expense over interest expense; return on assets is equal to income before extraordinary items over total assets; and the debt ratio is equal to total debt over total assets.

(1997) established that equity analysts were more likely to change their earnings estimates following a rating downgrade for small firms than for large firms. These studies imply that the quantity of information revealed by a rating change may depend on the size of the underlying firm. More explicitly, information asymmetries could be greater for small firms and therefore a change in the opinion of the rating agency may reveal more to the market.[37]

The inclusion of trends is useful not only for forecasting a change in rating but also for incorporating more of the firm's history into the analysis. The rating agencies emphasize that their opinions are based on long-term outlooks for the issues that they rate. For instance, Moody's states that five or more years of historical financial data in addition to forecasts covering the next three to five years, are used in establishing a rating.

We expect that downgrades will be more likely for firms with decreasing trends in interest coverage and return on assets. An increasing trend in the debt ratio may also be indicative of a decline in creditworthiness.

Return on assets, defined here as net income before extraordinary items over assets, reflects the firm's profitability and earnings. Some researchers have connected earnings to changes in debt ratings and the resulting stock price performance. Dichev and Piotroski (2001) asked whether poor stock performance following downgrades was associated with negative earning changes. Like Ederington and Goh (1998), they concluded that stock market reactions to negative rating changes appear to be at least partially independent from reactions to earnings announcements. This study will provide further evidence on this issue by explicitly conditioning on several financial variables rather than earnings alone.

4.4 Data

The set of rating changes that we will use was provided by Moody's Rating Services and includes all companies with ratings assigned by the US branch of Moody's since 1988. A key advantage to this data is that it includes not only information for companies that experienced rating changes but also for those with consistent ratings. As a result, we have a significant amount of non-event data. In addition, we have the exact dates of the rating changes whereas many databases update rating information only quarterly or even less frequently.

Information in the data set reflects senior unsecured long-term ratings. Since the data is company-based rather than issue-specific, some of the ratings are actual ones whereas others are implied ratings that attempt to estimate what the issuer's senior unsecured long-term debt would be rated. Carty (1997) describes the process used by Moody's to estimate these implied

[37] For an example of the differential rating treatment between small and large firms in the Canadian environment see Schroder (1998).

ratings. It is based on "an issuer's other rated debt (and) a simple notching algorithm intended to reflect observed ratings relationships". One of the advantages of using corporate ratings over individual issue ratings as pointed out by Bhandari, Soldofsky, and Boe (1983) is that any corporate rating change will reflect a change in the financial condition of the company rather than a change in the indenture provisions.

The original data from Moody's provided the rating history for 1,273 firms between 1988 and 2000. Since our study relies on the availability of financial and market data, we searched Compustat, Bloomberg, and CRSP for information on each firm. Companies with data listed in these sources numbered 762, or almost 60% of the data. Of these firms, only 540 had financial and market data overlapping the time period in which they were rated by Moody's. As a result, we were left with 42.42% of the original sample. A large proportion of the companies lost from the sample were those that issue debt but have no publicly traded equity.

Despite this large reduction in the number of companies, we were able to gather 14,481 quarters of financial statement and market data for our smaller number of firms. This implies that on average, our companies had rating histories for approximately 27 quarters or 6.7 years. The longest rating history in our sample covered the entire 12 year period.

The number of rating changes occurring for these firms during the sample period was 782. Of these, 408 or 52% were downgrades while the remaining, 374 changes were upgrades. These changes included both across category changes (from Aaa to Aa for instance) and those within categories (from Aa1 to Aa2). Fifty-three percent of downgrades occurred across categories while only 42% of upgrades resulted in a category change.

Tables 4.1 and 4.2 provide details of these rating changes. The first table lists the rating changes by year for the years 1990 to 2000. This period encompasses the bulk of our available data and all but one rating change. From Table 4.1, we see that the largest proportion of the sample's downgrades took place in 1991. Our business trend data shows that these downgrades coincided with a significant decline in real gross domestic product associated with the later half of 1990 and the first quarter of 1991. When we move to estimating the likelihood of downgrades, we will use this data to construct a dummy variable equal to one for quarters with GDP growth in the bottom 25th percentile of our sample time period. Portions of 1990 and 1991 will be identified by this dummy variable.

Turning to upgrades, we notice that the largest proportion of credit rating improvements occurred in 1994. Not surprisingly, half of this year had GDP growth in the top 25 percentile of the sample's entire range. Interestingly, 1998 had a large proportion of both the sample's upgrades and downgrades despite the fact that GDP grew steadily throughout that year. Although 8.6% of our quarterly observations were from 1999, no rating changes occurred within

our sample during that year.

Table 4.2 details rating changes according to their ending rating level. Where applicable, the rating changes are split between those that occurred within the same rating category and those that resulted from a jump between rating categories. For example, a downgrade to Baa1 has obviously resulted from an across category downgrade. The firm must have previously maintained an A-level rating. A downgrade to Baa2, however, may have resulted from a within category change if the downgrade was only by one notch or an across category downgrade for two or more notches.

Table 4.2 illustrates that the bulk of our data maintained ratings between A2 and Baa3. Interestingly, the majority of rating changes occurred within the non-investment grade rating categories, namely Baa3 and below. Over 63% of our entire sample of downgrades and 55% of upgrades left firms with below investment grade ratings. Combining upgrades and downgrades, approximately 60% of the rating changes occurred for non-investment grade rated debt.

Not only does our sample cover a large range of rating levels and time periods, it also includes companies from a wide spectrum of industries. In total, our sample includes companies with 264 different SIC codes. Table 4.3 provides information on the most common of these codes, those representing 5 companies or more. In total, the companies in this table represent just over a third of our entire observations. The three most frequent industries include electric services, crude petroleum and natural gas, and combination utility services. Together, these three industries represent 58 of our 540 companies with data. We are sensitive to the fact that utility and electric companies, due to their regulated history, may have significantly different characteristics than the rest of our sample. Table 4.3 notes that 9.77% of the observations occurred for companies in these two industries. If we choose to exclude firms in these industries from our estimation procedures, we would lose 37 or 9.04% of the sample's total number of downgrades.

Concerns regarding industry-specific differences apply equally to financial companies whose debt to assets ratio, for instance, may vary considerably from the typical industrial firm. Our entire sample, however contains very few financial service firms, therefore, these differences are unlikely to influence our results.

A final note on our data should be made. It is surprising to find the extent to which common financial variables such as those used in our analysis can be unavailable. Despite the fact that we have 14,481 firm-quarter observations with some available financial or market data, this data is complete for only 9,373 firm-quarters. In other words, the full probit model with all variables can be run on only 9,373 observations. Eliminating the trend variables which require the previous eight quarters of data, increases our observations to 11,855. Since there

are significant data gains to be had, we estimate both this reduced model, excluding the trend variables, and the full specification.

4.5 Predicting Downgrades with Public Information

4.5.1 Analysis of Data Used in Prediction

Using quarterly financial data for our sample firms, a probit model is used to assess the relationship between known public information and the probability of a rating downgrade. As described in Section 4.3, the variables used to predict rating changes include interest coverage, debt ratio, return on assets, size, equity beta and trends relating to some of these measures. Table 4.4 provides averages for these measures, summarized by rating category.

From Table 4.4 we begin to see the relationship between a firm's equity and fixed income securities. Consistent with Schwendiman and Pinches (1975), we see that in general, equity beta increases as we move from well-rated to poorly-rated firms. Companies with Aaa ratings have an average beta of 0.25 and all investment grade rating categories have average beta estimates at or below 0.60. Firms with Caa ratings have a much higher average beta measure of 1.85. It is clear that as bondholders' claims become more risky, the equityholders' claims become less secure as well.

Equity betas reported in Table 4.4 are based on three years of monthly data rather than the traditional 60 month period. Although both beta values were calculated for each firm, the three year version was used in the interest of keeping the greatest amount of data possible. The requirement to have both two years of historic quarterly data for use in calculating the trend variables and five years of stock history would have significantly reduced the number of observations with full information.[38] In addition, Figure 4.1 demonstrates that the relationship between the two beta estimates tends to be fairly close. The median correlation between a firm's three-year and five-year beta measures was 0.68 for firms in our sample. In addition, 25% of companies had correlations in excess of 0.82. Results of the probit model are qualitatively similar regardless of which beta measure is used.

Interest coverage values were adjusted in two ways following Blume, Lim, and MacKinlay (1998). Occasionally, either very large or very small interest coverage measures appeared in the data. These measures were often difficult to interpret. Negative interest coverage values, for instance, occurred when operating earnings were negative or when the company received more

[38] In the interest of utilizing as many data points as possible, we tried using year over year changes in debt ratios, interest coverage and return on assets in lieu of the trend measures. We found that the trend variables contributed significantly more to the estimate of rating downgrades and therefore continued to use them regardless of the more stringent data requirements.

interest income than it expensed. Since negative values are not particularly meaningful, we set all interest coverage measures that were less than zero equal to zero.

A second adjustment to interest coverage was required since companies with negligible interest expenses have extremely large measures of interest coverage. To eliminate some of these outliers, we set any interest coverage amount greater than 100 equal to 100. These adjustments were not made to the raw interest coverage ratios when calculating the trend measures. Therefore, we retained an indication of whether the company's credit risk was increasing or decreasing over time.[39]

The average measures reported in Table 4.4 behave consistently with expectations. Interest coverage declines from an average value of over 32 times for Aaa rated firms to a value between 2 and 4 times for any rating category below Ba2. Correspondingly, the debt to asset ratio is always less than 30% for investment grade ratings but hovers between 40 and 50 percent for those with non-investment grade ratings.

The net income to assets measure generally declines as we move from well-rated to poorly-rated debt, however, this trend is less apparent in the lower part of the rating spectrum. This is in part because we see a large range of values for net income to assets within a single rating category. For instance, the mean value of ROA for firms with Aa2 ratings is 1.73% yet the maximum value is in excess of 4%. At the same time, negative measures do occur for companies with this rating.

The final column in Table 4.4 reports the average market capitalization (in ln form) for each rating category. We see that well-rated firms tend to be much larger than those with poor ratings.

It is interesting to note how the variables we use to predict the likelihood of downgrade varied over time during our sample period. Figure 4.2 plots quarterly averages between 1990 and 2000 for interest coverage, debt to assets, and return on assets. From this figure, we see that interest coverage trended upwards throughout the 1990s and correspondingly the debt to asset ratio of our sample firms declined. No clear trend is apparent for the average return on asset measure despite a small upward movement towards the end of our sample period in the late 1990s.

Since we are concerned that different industries, particularly those with utility-like characteristics, may be treated differently by rating agencies, we repeat the analysis from Table

[39] A likelihood ratio test was conducted to determine whether an interest trend variable based on interest coverage values adjusted according to Blume, Lim and MacKinlay's (1998) method contributed significant explanatory to the estimation of the likelihood of downgrade. The chi-squared statistic for this test was no where near significant as opposed to conducting the same test with the trend variable calculated on the unadjusted interest coverage measures. In this instance the chi-squared statistic was 10.57.

4.4 for these firms. Using SIC codes to identify either electric or utility services, we find the average value of our financial variables within each rating category for these firms alone. There are subtle differences. For a given rating category, utilities appear to be given greater leniency for their interest coverage and leverage measures. In addition, equity betas tend to be much smaller for these firms than for the sample as a whole.[40]

Despite these subtle differences, the general trends present in Table 4.4 are also present for the subset of utilities. In the interest of maintaining as many observations as possible, we check whether our estimate of the anticipation of downgrade is altered significantly when utility firms are excluded from the sample. The results are both qualitatively and quantitatively similar regardless of whether these firms are excluded or not. For that reason, we retain the utilities and present our estimation results in the section below.

4.5.2 Prediction Results

Tables 4.5, 4.6, and 4.7 show the results for the probit models used to measure the probability of a rating downgrade. Table 4.5 examines the results for the entire sample, Table 4.6 includes only those downgrade that occurred across rating categories, and Table 4.7 separately examines the results for investment grade and non-investment grade debt. The top portion of Table 4.5 shows the results for the full model, based on all eight explanatory variables, while the bottom portion focuses on the reduced model. The reduced model excludes the trend variables for interest coverage, return on assets, and debt to assets, focusing only on the lagged values of these measures, in addition to market capitalization and beta. Eliminating the trends increases the number of observations with full data by close to 25%. Surprisingly, despite this large increase, the overall fit of the model does not increase significantly. The pseudo R^2 measure[41] is virtually the same under both specifications.

All of the models in Tables 4.5 through 4.7 indicate that our variables have some predictive power in anticipating rating downgrades. The likelihood ratio tests of the joint hypothesis that all coefficients are zero are always rejected at the one percent level. Having said this, the pseudo R^2 values are quite low, due in part to the unbalanced nature of our data. Our data is unbalanced in the sense that the occurrence of a rating downgrade is a relatively rare event. For the entire sample only 2.82% of our observations constitute downgrades. In dealing with unbalanced data we have two options. As Maddala (1992) points out "either we have to get a very large data set...or we have to sample the two groups at different sampling rates."

[40] These results are available in detail from the author.

[41] The pseudo R^2 is defined as $1 - \frac{L_1}{L_o}$ where L_0 is the log likelihood of the model that includes only the constant term and L_1 is the log likelihood of the full model. This measure is taken from Judge, Griffiths, Hill, Lűtkepohl, and Lee (1985).

Luckily our data set is in fact relatively large and our sampling costs trivial. Therefore, we follow Nayak and Prabhala's (2001) lead in the case of the latent information approach and continue to employ standard maximum likelihood methods on the entire sample. While the use of these methods continues to provide reasonable coefficient estimates, typical summaries of the predictive power of the model may not be applicable.

Robust standard errors[42] are provided for all three tables. We note that for the full model presented in the top half of Table 4.5, interest coverage, net income to assets, size, and the interest coverage trend variable are all significant at the five percent level. With the exception of the trend in interest coverage, all behave as expected. Higher levels of interest coverage and profitability are negatively associated with the likelihood of downgrade. Consistent with the work of Blume, Lim and MacKinlay (1998), among others, firm size is also relevant for credit ratings. In particular, small firms are more likely to experience downgrades than large firms. The interest trend variable enters the model in an unexpected way, with increases in interest coverage being positively related to downgrades. The estimated coefficient on this variable, however, is extremely small and it does not contribute a great deal to our estimate of $\theta' X_{it-1}$.

Although not significant when robust standard errors are employed, the debt ratio also enters the model in a surprising way. Lower levels of debt to assets are seen to be associated with a greater likelihood of downgrade. To examine this result we calculate the correlation among our explanatory variables. We find that strong negative correlation exists between size and the debt to assets ratio (-0.40). Interestingly, if we use debt to assets as the only predictor of downgrades, the result produces an intuitive relation. In isolation, increases in leverage result in a higher probability of downgrade. With the addition of size as a second explanatory variable, however, the initial results return. We believe that the negative relation between leverage and the likelihood of downgrade results in part from the correlation between size and debt to assets.[43]

It is difficult to compare the full and reduced models directly with one another due to the large difference in their number of observations. While the full model benefits from more information, the reduced model benefits from additional observations. In both specifications, return on assets and size enter the model negatively and significantly. In the reduced form, the debt ratio is also significant, however, as in the full model, it's negative relation to the likelihood of downgrades is surprising.

For both models, we include the use of a non-firm-specific variable related to the overall

[42] These standard errors are based on the work of White (1980, 1982)

[43] Although we have demonstrated that multicollinearity exists, we do not adjust our models. Our goal is to use these variables together to estimate the likelihood of downgrades based on public information rather than to discover their individual contribution to this estimate.

economic conditions in each quarter. It is intuitive that these conditions may influence when rating changes take place. We examine two separate forms of this variable, both based on GDP measures. The first of these forms is simply the real quarterly GDP growth rate. The second form, which has already been described, is a dummy variable equal to one for the bottom 25th percentile of quarterly GDP growth. Despite the fact that several of the sample's downgrades coincide with quarters identified to have low GDP growth, neither form of the variable contributes significant explanatory power to our model. Likelihood ratio tests were conducted to show this formally with neither the test for GDP growth nor the low growth indicator producing a χ^2 statistic in excess of 0.4.

Moving to Table 4.6, we conduct a separate examination of the rating downgrades that occurred across rating categories. We ignore rating changes from Aa1 to Aa2 for example, and focus only on rating changes such as Aa3 to A1. Therefore, the rating category itself, not just the numerical modifier must change in order for a downgrade to be recorded. This serves to further increase the unbalanced nature of our data, as the number of observations in which our event occurs declines. It seems reasonable, however, that across category rating changes take place when firm characteristics change more dramatically than in the case of within category downgrades. Therefore our probit model may provide more explanatory power in this setting.

The results show that the pseudo R^2 measure does in fact improve for across category downgrades, however the improvement is only slight. Consistent with the full model results based on all downgrades, size and the trend in interest coverage are significant predictors of downgrades. The profitability measure, return on assets, however, is no longer statistically significant when only across category downgrades are used. Results for the reduced model are similar, regardless of whether the entire set of downgrades or only those across categories are employed. In both cases, the debt ratio, return on assets, and size are significant at the five percent level. It appears, therefore, that the factors capable of predicting downgrades are the same regardless of the magnitude of the downgrade. Due to this consistency, we will use all downgrades, both within and across rating categories, in our analysis.

As a final examination of the ability of publicly known information to predict rating downgrades, we ask whether this prediction depends on the credit quality of the firm. More specifically, does the model apply equally to firms with investment grade ratings as it does to firms with non-investment grade ratings? Table 4.7 conducts this analysis. The first half of the table is devoted to downgrades occurring for firms with investment grade debt, while the bottom portion of the table examines non-investment grade rated firms. The most striking difference between the two portions is the degree of fit each produces as measured by the pseudo R^2. It is interesting that despite the fact that almost 2.5 times more observations are available

for investment grade firms, the pseudo R^2 measure for the *non-investment* grade firms is the highest of any of the specifications that we have presented so far. Meanwhile the pseudo R^2 for *investment* grade firms is the lowest.

Looking at the break-down of downgrades by rating category gives us an indication of why this is the case. Over half of all downgrades took place among firms without investment grade ratings despite the fact that investment grade companies represent the majority of observations in the sample. More specifically, 4% of non-investment grade observations represent downgrades, while the proportion of downgraded investment grade firm-quarters is only 2%. Since our non-investment grade observations include a higher proportion of downgrades, our model provides us with a more precise picture of how firm-specific information relates to these downgrades.

When split into investment grade versus non-investment grade categories, the predictive ability of size diminishes. In all other specifications, market capitalization entered the model inversely and significantly, implying that smaller firms have a higher likelihood of downgrade. What size may be proxying for however, is firm quality. The degree to which rating quality and size are related can be seen by their correlation of -0.75. With firms split according to quality, in the sense of investment grade versus non-investment grade ratings, size no longer has a predictive role.

Ignoring size, the results for investment grade rated firms are somewhat similar to the results for the full model across all observations. Again, both interest coverage and the trend in interest coverage over time prove significant in establishing the likelihood of a rating downgrade. Return on assets however is no longer significant. Moving to the non-investment grade firms, we find very different results from our previous model specifications. For the first time, beta illustrates some predictive power, with firms with larger betas being less likely to experience rating downgrades. As noted in Figure 4.1, well-rated firms tend to have larger betas. The correlation between rating level and beta is 0.46.

Concluding the first stage of our analysis we note that firm size is critically linked to both rating level and the likelihood of downgrade. When trends are included, the interest coverage trend consistently associates improving levels of interest coverage with a smaller likelihood of downgrade. The only exception to this statement involves predicting downgrades for non-investment grade firms. These firms act very differently than firms with investment-grade ratings and the entire sample as a whole.

In proceeding to the next section of our analysis, we use the most general of our results from the probit models. Recall that for the reduced form of the model we had 11,855 quarterly firm observations with complete data, whereas for the full model we had 9,373 observations.

This data availability translates into having full data for 327 downgrades if the reduced model is used and 209 downgrades in the case of the full model. This is a reduction from the 408 downgrades for which we have at least partial data, or have full data available in some quarters but not the quarter containing the downgrade.

We continue to present our analysis for both the full and reduced model despite the fact that the reduced model does not benefit from the information provided by the trend variables. We also refrain from splitting the data according to rating level. While it is interesting to note the differences in our ability to predict downgrades for investment grade and non-investment grade debt, some firms will cross from one category to another during the course of our analysis and those with multiple downgrades may have downgrades occurring in both investment grade and non-investment grade categories. In addition, we do not distinguish whether downgrades occurred across or within rating categories since our firm-specific variables have some explanatory power even in the case of within category downgrades. We therefore continue to include all downgrades in our analysis.

In keeping with the most general model possible, the coefficients used in establishing our measure of the likelihood of downgrade, $\theta' X_{it-1}$ will be based on the results presented in Table 4.5.

4.6 Revealing Evidence of Inside Information

For each downgrade, we examine the daily stock returns from 200 days prior to the downgrade to 200 days after the downgrade. In the case of multiple downgrades occurring within this window, we change the time period to be 200 days prior to the first downgrade and 200 days following the last. The occurrence of multiple downgrades is relatively common. Approximately 21% of downgrades with adequate data for the full model and 32% of downgrades within the reduced model represent multiple downgrades.

For each firm experiencing a downgrade, we calculate $\delta = \theta' X_{it-1}$ during the quarters covered by the daily stock returns. Recall that θ' represents the vector of coefficients from the probit model in Table 4.5 and X_{it-1} represents the firm-specific characteristics. The δ measure is used to relate stock returns to the revelation of inside information through the estimate of π in equation 4.9 which was:

$$R_{it} = a_i + b_i R_{mt} + \pi \left[\frac{\phi(\delta)}{\Phi(\delta)} - \frac{\phi(\delta)}{\Phi(\delta)(1-\Phi(\delta))} I_{dit} \right] + \upsilon_{it}$$

Recall that a downgrade occurs if $\theta' X_{it-1} + \Psi_{it} < 0$ or in other words if $\delta < -\Psi_{it}$ where Ψ_{it} represents the rating agency's inside information. For a downgrade to occur it appears

that δ must be relatively small. Table 4.8 describes the distribution of δ estimates for both the reduced and full models. From this table we see that δ is almost always negative. This is not surprising since most of the coefficients in our probit model are also negative. For example interest coverage is negatively related to the probability of downgrade, as is return on assets and size. The more negative the δ estimate, the more likely that a downgrade will occur.

Figure 4.3 examines the relationship between δ, our estimate of the likelihood of downgrade, and the actual excess returns that occurred upon downgrade announcement. We would like to establish some comfort in our measure of δ as an indicator of the market's expectations of a rating change and as a result would hope to see that anticipated downgrades are associated with zero abnormal returns upon announcement. The stock price should already incorporate the impact of the downgrade if it is expected.

The top half of Figure 4.3 plots the δ estimates and downgrades where full data, including trends, is available while the bottom half of the figure illustrates the results for the reduced model. We see for both the full and reduced models that cases of large negative abnormal returns upon downgrade announcements are in fact associated with higher levels of δ. When δ is high, a downgrade is unanticipated and therefore catches the market by surprise. Interestingly, cases of large *positive* abnormal returns upon announcement are also associated with higher levels of δ. As δ becomes greater, and less indicative of an expected downgrade, stock price reactions upon rating changes tend to be more varied. In cases where δ is small, it appears that the market correctly anticipates a downgrade and excess returns are low.

The next step in our analysis is to establish how the market's anticipation of a downgrade is related to information revealed by the rating change. For this step we estimate π in equation 4.9 using OLS regression. This is done separately for each event window (and the 200 days both before and after it). There are two main reasons for this. The first is that many of our sample firms experience multiple downgrades in a relatively short time frame and as a result, we do not have the same number of days in each case. The second is that we are interested in whether or not inside information is revealed for each firm experiencing a downgrade.[44] In cases where we find evidence of this information despite conditioning on firm-specific data, we would like to ask whether there are any systematic reasons why agencies maintain an informational

[44]The traditional method of establishing whether information is revealed by a downgrade revolves around the statistical significance of the abnormal returns witnessed for the stock at announcement day. These results are aggregated over the entire number of stocks to get an overall impression of information revelation. In order to compare our approach, which involves testing each downgraded firm individually, with the traditional approach, we test for the statistical significance of excess returns at each downgrade. Using this approach, we find many more cases of information revelation than we do under either the full or reduced form models that include firm-specific information. This provides further evidence that conditioning on publicly available variables removes virtually all evidence of a rating agency's informational advantage.

advantage over investors.

We present the results of our test for inside information revealed by rating changes in Table 4.9. Since our analysis is done for each event individually, we provide the percentiles of the distribution of test statistics. These percentiles are based on the fraction of test statistics that are lower than the test statistic given. Remember that for significant inside information to be revealed by a rating change, we require a positive π coefficient that is statistically significant.

The first portion of Table 4.9 is based on the statistics for the full model while the bottom portion of the table, repeats the analysis using the reduced model. The first row of the table provides the estimate of the π coefficient, the third and fourth rows the test statistic and P value respectively. The results focus on a one-day event window, where this day coincides with the downgrade announcement. Although not reported here, the results were also found for a seven-day window, from day -1 to day +5, a full business week following the announcement, and a three-day window from day -1 to day +1. Extending the event window reveals little evidence of inside information and is consistent with the one-day results.

Focusing on the one-day results in Table 4.9 we see that even at the 90th percentile, we do not find test statistics that are significant and indicative of rating agencies possessing an informational advantage. This is true for both the full and reduced model, excluding the trend variables. In fact for the full model, only 4.3% of downgrades show evidence of inside information once we have explicitly modeled the likelihood of a downgrade. For the reduced model, this proportion is slightly higher at 6.7%. This is not surprising since the reduced model uses less firm-specific information when measuring the probability of downgrade. These results indicate that once we incorporate publicly known measures of firm performance, little evidence of information revelation remains for rating downgrades.

It is interesting to note the values of δ for the rare cases in which information is revealed by the downgrade. We compare the value of $\delta = \theta' X_{it-1}$ for those downgrades in which information is revealed to the sample overall. From Table 4.8 we note that the mean values of δ are -1.94 and -1.84 for the full and reduced models respectively. The significant results for the full model have a mean δ of -1.76. This is high compared to the sample as a whole in which 75% of the downgrades have δ estimates that are smaller than -1.80 and a full 25% are smaller than -2.00. Remember that small δ are consistent with expected downgrades.

Similar observations can be made by looking at the reduced model. Significant results here have an average δ of -1.58 and a full 40% of the significant downgrades have delta estimates in the 95th percentile. It does appear that large δ values, or *unanticipated* downgrades, are associated with information revelation. While overall we find little evidence of information being revealed by rating changes, when our model does not predict downgrades and yet a downgrade

occurs, some statistically significant results remain. We further explore the characteristics of the significant results in the section below.

4.6.1 Examining Cases of Information Revelation

While the small number of significant results that we witness may be merely due to chance, we would like to explore this further by seeing whether downgrades with information content have anything in common. We have already noted that the delta estimates in these cases tend to be larger than the sample as a whole, indicating that the downgrade was a surprise for these firms. In addition, however, we would like to examine other factors that may contribute to rating agencies having informational advantages. The two factors that we consider are the timing of the downgrade and whether additional downgrades took place shortly after the initial decline in rating.

Figure 4.4 examines whether rating agencies maintain greater informational advantages during certain time periods. It is intuitive for instance that individuals may place more weight on ratings as indicators of firm performance during uncertain economic times. The top portion of Figure 4.4 plots the test statistics for the significance of inside information according to the full model versus the year in which the downgrade occurred. The bottom portion of the figure does the same for the reduced model. We can see from this figure that a relatively large number of downgrades occurring in 1992 show evidence of information revelation. To a slightly less extent, the same can be said for 1997.

Table 4.10 conducts a more rigorous examination of whether agencies possessed inside information during 1992 and 1997. In this table we report the results of a regression of year dummies for 1992 and 1997 on the test statistics found for the entire sample of downgrades. In addition, we include a dummy variable indicating whether the downgrade was part of a series of multiple downgrades or not. The dummy variable equals one if the company experiences more than one downgrade within a 200 day period and zero otherwise. If downgrades follow one another in quick succession, it is likely due to new information being released that the rating agency was not aware of at the time of their initial assessment. If this information is publicly disclosed, then the agency will not maintain an informational advantage.

Table 4.10 shows that timing may play a role in determining whether an informational advantage is maintained by rating agencies. This is particularly the case in the full model which includes the trend variables. Here, both dummies for 1992 and 1997 indicate that information was more likely to be revealed within these years. Looking back to these years, we note that both had above average levels of GDP growth, however 1992 also experienced a high number of downgrades. Inflation and unemployment levels were both relatively high in this year, perhaps

contributing to greater market uncertainty. 1997 is more difficult to explain since a relatively low proportion of our sample downgrades are from this year. GDP, inflation, and unemployment rates were all at reasonable levels during this period. The fact that the Asian crisis coincided with 1997 however may have increased the degree of market uncertainty in that year.

Neither year variable is significant when the reduced model is used and in fact the R^2 value declines significantly for this regression. It appears that there is no link between information revelation and year of downgrade when the reduced form of the model, excluding the trend variables is used.

The indicator for multiple downgrades provides us with no evidence that the market views the information content revealed by one of a series of downgrades any differently than it views individual downgrades.[45]

4.7 Implications and Conclusion

We have seen that to a certain extent, we are able to predict the likelihood of downgrades using a small number of publicly available inputs such as leverage and profitability measures. Including more information about a firm's past, in the form of trend variables, increases our predictive ability but applies more stringent data requirements, thereby limiting the size of our sample.

Once our model of downgrade prediction is in place, we test whether information is revealed by rating downgrades. We find that when our model predicts a high chance of downgrade, little evidence of negative abnormal returns is found. Where the model does not predict a downgrade, excess returns are much more varied upon downgrade announcement, both positively and negatively. Overall, whether the full or reduced model is employed, we find little evidence of inside information being revealed by negative rating announcements. This is the case regardless of the event window, whether it be one day, three days, or seven days.

When inside information appears to still be revealed by rating downgrades, we verify whether this is due to chance or whether there are systematic reasons that would make these downgrades more informative than others. We test whether the timing of the downgrade or whether it is part of a series of downgrades has implications for the information revealed. We find evidence of more

[45] We also asked whether the firm's industry played a role in establishing the informational content of a downgrade. A quick glance at the cases with evidence of significant information showed a slight concentration of firms with SIC codes in the 3000 range. These firms represent companies in the manufacturing industry. As a result, we constructed two dummy variables, one indicating that firms were involved in manufacturing and the second indicating that the company's first two digits of its SIC code were 35. The code 35 describes industrial machinery and equipment. It includes the manufacturing of computers and other technical devices. We independently include each of these dummy variables in our regressions. We find no evidence of a relationship between industry and the informational content of downgrades.

informative downgrades during certain time periods when the full model is used. Intuitively we would expect that rating changes provide investors with more information during uncertain market conditions.

The implications of our analysis are twofold. One, we should be careful of attributing too much emphasis to the knowledge of rating agencies. For the vast majority of cases, rating agencies act in a manner that is consistent with publicly available information regarding the financial health of a firm. While agencies may assist investors in compiling all of this information, overall, they do not possess any advantage in using it. A firm's stock may decline following a downgrade not so much because the downgrade reveals information but rather because the stock price reflects the fact that the firm is performing poorly. Rating agencies may not have new information but they are doing an accurate job of assessing the financial health of the firm and reflecting this health in their rating assignments.

The second implication is that excess returns may still be witnessed upon rating downgrades when the downgrade is unanticipated by the market. While negative abnormal returns are definitely apparent in some of these situations we can see that in general abnormal returns are more likely when downgrades are unanticipated. We must keep in mind that we cannot distinguish whether evidence of information revelation is due to an agency's inside information or to the exclusion of an important variable in our model of downgrade anticipation. At the very least, however, we have provided ample reason to question the claim that rating agencies possess informational advantages.

Table 4.1
Rating Changes by Year, 1990-2000

	# of Obs.	Downgrades			Upgrades		
		Within	Across	Combined (% of all down)	Within	Across	Combined (% of all up)
1990	988	23	26	12.01%	10	9	5.08%
1991	1236	28	44	17.65%	10	13	6.15%
1992	1375	21	30	12.50%	23	19	11.23%
1993	1502	22	19	10.05%	21	21	11.23%
1994	1522	18	19	9.07%	35	18	14.17%
1995	1544	21	20	10.04%	34	16	13.37%
1996	1588	24	21	11.03%	28	21	13.10%
1997	1551	15	15	7.35%	23	22	12.03%
1998	1483	18	23	10.05%	32	19	13.64%
1999	1245	0	0	0.00%	0	0	0.00%
2000	417	0	0	0.00%	0	0	0.00%
Total	14511	190	217	99.75%	216	158	100.00%

Table 4.1: Rating Changes by Year

Table 4.1 indicates when rating changes took place for our sample firms. Rating changes across categories where the rating letter changes (i.e. from A3 to Baa1) are identified separately from those changes that took place within categories, where only the numerical modifier changed (i.e. from Baa3 to Baa2).

Table 4.2
Rating Changes by Category

	# of Obs.	Downgrades			Upgrades		
		Within	Across	Combined (% of all down)	Within	Across	Combined (% of all up)
Aaa	82	–	–	0.00%	–	0	0.00%
Aa1	97	–	1	0.25%	0	0	0.00%
Aa2	329	3	0	0.74%	1	0	0.27%
Aa3	590	6	0	1.47%	–	4	1.07%
A1	806	–	5	1.23%	15	0	4.01%
A2	1503	14	6	4.90%	28	6	9.09%
A3	1498	37	2	9.56%	–	35	9.36%
Baa1	1371	–	38	9.31%	34	2	9.63%
Baa2	1566	23	15	9.31%	33	9	11.23%
Baa3	1422	33	3	8.82%	–	36	9.63%
Ba1	874	–	29	7.11%	29	4	8.82%
Ba2	790	13	8	5.15%	27	10	9.89%
Ba3	990	19	5	5.88%	–	33	8.82%
B1	788	–	24	5.88%	33	3	9.63%
B2	709	16	24	9.80%	15	4	5.08%
B3	607	26	8	8.33%	–	11	2.94%
Caa	369	–	40	9.80%	–	1	0.27%
Ca	89	–	9	2.21%	–	1	0.27%
C	1	–	1	0.25%	–	–	0.00%
D or missing	30						
Total	14511	190	218	100.00%	215	159	100.00%

Table 4.2: Rating Changes by Category

Table 4.2 describes rating changes by ending rating category for our sample. Again, within category rating changes are distinguished from those that occurred across categories.

Table 4.3
Significant Industries Within the Sample

Industry	# of Co's	% of Observations
Electric Services	29	6.21%
Crude Petroleum and Natural Gas	15	3.02%
Combination Utility Services	14	3.56%
Department Stores	13	2.34%
Petroleum Refining	12	2.66%
Holding Offices	10	1.96%
Electronic Computers	9	1.85%
Natural Gas Distribution	8	1.49%
Blast Furnaces and Steel Mills	8	1.18%
Pharmaceutical Preparations	8	1.14%
General Contractors, Single Family Homes	7	1.42%
Natural Gas Transmission and Distribution	7	1.41%
Air Transport and Air Courier	6	1.23%
Newspapers	6	1.09%
Motor Vehicle Parts and Accessories	5	1.08%
Aircraft	5	1.02%
Hotels and Motels	5	0.72%

Table 4.3: Significant Industries Within the Sample

Table 4.3 describes the significant industries within our sample. We are cognizant of the fact that utilities and financial companies may behave quite differently from the sample as a whole, however excluding these firms does not change our results. The coefficients of the probit model estimating the likelihood of downgrade remain qualitatively and quantitatively similar regardless of whether these firms are included or not.

Table 4.4
Mean Financial Variables by Rating

	Int. Coverage	Debt/Assets	Net Income/Assets	Beta	Ln Mkt Cap
Aaa	32.87x	7.59%	3.79%	0.25	17.93
Aa1	16.86x	12.02%	3.14%	0.36	17.23
Aa2	10.67x	17.90%	1.70%	0.35	16.70
AA3	12.04x	20.47%	1.73%	0.40	15.32
A1	8.78x	22.68%	1.62%	0.46	15.73
A2	7.65x	22.30%	1.37%	0.59	15.36
A3	6.34x	24.56%	1.20%	0.60	14.85
Baa1	5.31x	26.19%	0.98%	0.57	14.76
Baa2	5.33x	28.53%	0.91%	0.60	14.41
Baa3	4.58x	30.74%	0.70%	0.76	14.25
Ba1	5.68x	29.75%	0.67%	0.83	13.91
Ba2	4.59x	41.32%	0.70%	1.13	13.36
Ba3	3.33x	40.57%	0.23%	1.24	12.75
B1	2.22x	46.88%	1.14%	1.11	12.47
B2	2.54x	48.78%	-0.96%	1.28	11.83
B3	2.27x	53.06%	-1.82%	1.59	11.17
Caa	2.26x	38.28%	-4.06%	1.85	10.40
Ca	3.49x	44.16%	-2.92%	1.10	9.71

Table 4.4: Mean Financial Variables by Rating

Table 4.4 provides mean values for some of the firm-specific variables used to predict the likelihood of downgrade. All act in an intuitive fashion with well-rated firms having higher levels of interest coverage and return on assets. Poorly-rated firms have more debt in their capital structure, are smaller and have higher beta values.

Table 4.5
Predicting Downgrades Using a Probit Model - All Downgrades
(A) Full Model

	Coef.	Std. Err.	z	P>|z|	Robust Std. Err.	z	P>|z|
Interest Coverage	-0.03	0.01	-3.37	0.00	0.01	-2.84	0.00
Debt/Assets	-0.43	0.19	-2.30	0.02	0.22	-1.95	0.05
Net Income/Assets	-2.44	1.13	-2.16	0.03	1.20	-2.04	0.04
Beta	-0.07	0.05	-1.51	0.13	0.05	-1.44	0.15
Ln Mkt. Cap.	-0.06	0.02	-3.21	0.00	0.02	-3.06	0.00
Int. Coverage Trend	0.04E-3	0.01E-3	3.93	0.00	0.02E-3	2.88	0.00
Debt/Assets Trend	1.98	1.87	1.06	0.29	1.90	1.04	0.30
Net Inc./Assets Trend	-19.74	10.12	-1.95	0.05	10.23	-1.93	0.05
Constant	-0.83	0.30	-2.81	0.00	0.31	-2.68	0.01
Likelihood Ratio (χ^2)	89.67				$P > \chi^2$	0.00	
Pseudo R^2	0.04				*Observations*	9373	

(B) Reduced Model - Excluding Trends

	Coef.	Std. Err.	z	$P>\|z\|$	Robust Std. Err.	z	$P>\|z\|$
Interest Coverage	-0.02	0.01	-3.56	0.00	0.01	-1.57	0.12
Debt/Assets	-0.35	0.14	-2.58	0.01	0.16	-2.28	0.02
Net Income/Assets	-3.45	0.54	-6.34	0.00	0.96	-3.59	0.00
Beta	-0.01	0.04	-0.36	0.72	0.04	-0.35	0.78
Ln Mkt. Cap.	-0.07	0.02	-4.74	0.00	0.02	-4.26	0.00
Constant	-0.68	0.23	-2.90	0.00	0.24	-2.81	0.00
Likelihood Ratio (χ^2)	120.12				$P > \chi^2$	0.00	
Pseudo R^2	0.04				*Observations*	11855	

Table 4.5: Predicting Downgrades Using a Probit Model - All Downgrades

Table 4.5 uses firm-specific variables to estimate the coefficients of a probit model predicting downgrades. The dependent variable in this model is the indicator variable, I_{dit}, which equals 1 when a downgrade occurs for firm i at time t and 0 otherwise. The independent variables in the model are the firm-specific characteristics in the X_{it-1} vector. The coefficient estimates provided by this model form the vector θ so that the anticipation of a downgrade can be expressed as $\delta = \theta' X_{it-1}$. We see that interest coverage, leverage, return on assets and size contribute significantly to predicting downgrades.

Table 4.6
Predicting Downgrades Using a Probit Model - Across Category Downgrades
(A) Full Model

	Coef.	Std. Err.	z	P>$\|z\|$	Robust Std. Err.	z	P>$\|z\|$
Interest Coverage	-0.02	0.01	-2.04	0.04	0.01	-1.88	0.06
Debt/Assets	-0.52	0.25	-2.08	0.04	0.27	-1.89	0.06
Net Income/Assets	-1.71	1.39	-1.23	0.22	1.42	-1.20	0.23
Beta	-0.10	0.06	-1.56	0.12	0.06	-1.50	0.14
Ln Mkt. Cap.	-0.10	0.02	-4.03	0.00	0.03	-3.83	0.00
Int. Coverage Trend	0.04E-3	0.01E-3	3.71	0.00	0.01E-3	3.11	0.00
Debt/Assets Trend	0.71	2.41	0.30	0.77	2.23	0.32	0.75
Net Inc./Assets Trend	-22.93	12.97	-1.77	0.08	12.64	-1.81	0.07
Constant	-0.59	0.38	-1.56	0.12	0.39	-1.50	0.13
Likelihood Ratio (χ^2)	63.14				$P > \chi^2$	0.00	
Pseudo R^2	0.06				*Observations*	9373	

(B) Reduced Model - Excluding Trends

	Coef.	Std. Err.	z	$P > \|z\|$	Robust Std. Err.	z	$P > \|z\|$
Interest Coverage	-0.01	0.01	-1.92	0.05	0.01	-0.87	0.39
Debt/Assets	-0.46	0.18	-2.57	0.01	0.20	-2.33	0.02
Net Income/Assets	-2.92	0.62	-4.74	0.00	0.91	-3.22	0.00
Beta	0.06E-2	0.04	0.01	0.99	0.05	0.01	0.99
Ln Mkt. Cap.	-0.11	0.19	-5.67	0.00	0.02	-5.21	0.00
Constant	-0.48	0.29	-1.64	0.10	0.30	-1.60	0.11
Likelihood Ratio (χ^2)	88.20				$P > \chi^2$	0.00	
Pseudo R^2	0.05				*Observations*	11855	

Table 4.6: Predicting Downgrades Using a Probit Model - Across Category Downgrades

Table 4.6 provides the coefficients of a probit model estimating across category downgrades. For a downgrade to be identified as being across categories, the rating category itself must change, for instance from Aa3 to A1, rather than merely the numerical modifier (from Aa2 to Aa3). As in the case of all downgrades (Table 4.5) interest coverage, leverage, and size help predict the probability of downgrade.

Table 4.7
Predicting Downgrades Using a Probit Model - All Downgrades
(A) Investment Grade Debt

	Coef.	Std. Err.	z	P>|z|	Robust Std. Err.	z	P>|z|
Interest Coverage	-0.02	0.01	-2.65	0.01	0.01	-2.52	0.01
Debt/Assets	-0.78	0.41	-1.90	0.06	0.41	-1.89	0.06
Net Income/Assets	-3.91	2.06	-1.90	0.06	2.61	-1.50	0.13
Beta	0.02	0.09	0.26	0.80	0.08	0.28	0.78
Ln Mkt. Cap.	0.02E-2	0.03	0.01	0.99	0.03	0.01	0.99
Int. Coverage Trend	0.04E-3	0.01E-3	3.76	0.00	0.01E-3	3.14	0.00
Debt/Assets Trend	10.29	3.54	2.90	0.00	3.60	2.86	0.00
Net Inc./Assets Trend	1.78	17.79	0.10	0.92	20.92	0.09	0.94
Constant	-1.76	0.51	-3.47	0.00	0.46	-3.82	0.00
Likelihood Ratio (χ^2)	33.96				$P > \chi^2$	0.00	
Pseudo R^2	0.03				*Observations*	6644	

(B) Non-Investment Grade Debt

	Coef.	Std. Err.	z	$P>\|z\|$	Robust Std. Err.	z	$P>\|z\|$
Interest Coverage	-0.04	0.02	-2.31	0.02	-0.04	-1.24	0.21
Debt/Assets	-0.41	0.21	-1.94	0.05	0.25	-1.66	0.10
Net Income/Assets	-1.35	1.29	-1.04	0.30	1.10	-1.23	0.22
Beta	-0.18	0.06	-2.90	0.00	0.07	-2.46	0.01
Ln Mkt. Cap.	-0.56	0.03	-1.80	0.07	0.03	-1.65	0.10
Int. Coverage Trend	-0.09E-3	0.12E-2	-0.08	0.94	0.02E-2	-0.50	0.62
Debt/Assets Trend	-0.59	2.17	-0.27	0.78	1.88	-0.32	0.75
Net Inc./Assets Trend	-32.29	12.03	-2.68	0.01	10.15	-3.18	0.00
Constant	-0.70	0.41	-1.69	0.09	0.43	-1.61	0.12
Likelihood Ratio (χ^2)	54.57				$P > \chi^2$	0.00	
Pseudo R^2	0.07				*Observations*	2729	

Table 4.7: Predicting Downgrades - Investment Grade vs Non-Investment Grade

Table 4.7 estimates the coefficients of a probit model predicting the likelihood of downgrade when these downgrades are separated into investment grade and non-investment grade categories. As always, interest coverage maintains explanatory power however, the results are somewhat different from the sample as a whole. For the first time size loses its explanatory power indicating that size may be proxying for overall firm quality.

Table 4.8
Anticipation of Downgrades: Percentiles of $\delta = \theta' X_{it-1}$

	Full Model	Reduced Model
Minimum	-2.73	-3.80
10th Percentile	-2.21	-2.10
20th Percentile	-2.12	-2.01
30th Percentile	-2.05	-1.96
40th Percentile	-2.01	-1.91
50th Percentile	-1.96	-1.87
60th Percentile	-1.90	-1.82
70th Percentile	-1.85	-1.77
80th Percentile	-1.78	-1.68
90th Percentile	-1.65	-1.56
Maximum	0.79	2.17
Mean	-1.94	-1.85
Std. Deviation	0.26	0.27
Observations	69769	102191

Table 4.8: Anticipation of Downgrades

Table 4.8 describes the distribution of δ which is equal to the vector of coefficients (θ) estimated by the probit models in Table 4.5, multiplied by the firm-specific variables, X_{it-1}. These variables include the trend in interest coverage, net income to assets, and debt to assets in the full model but exclude these trends in the reduced form. We can see that δ is almost always negative. This is intuitive since many of the firm-specific characteristics are negatively related to the likelihood of downgrade. For instance size, interest coverage, and return on assets all have negative coefficient estimates. The smaller the δ estimate, the more likely a downgrade is to occur.

Table 4.9
Estimating π to find Evidence of Information Revelation
(A) Full Model - One Day

	Percentiles								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
π coefficient	-0.014	-0.003	-0.002	-0.001	0.001	0.002	0.002	0.004	0.008
Std. Error	0.011	0.003	0.007	0.006	0.012	0.005	0.003	0.004	0.006
T-Stat	-1.30	-0.75	-0.36	-0.13	0.12	0.45	0.70	1.03	1.48
$P > \|t\|$	0.19	0.45	0.72	0.89	0.91	0.65	0.49	0.30	0.14
CAR (%)	2.62	-3.32	0.66	-0.78	-1.86	-0.32	1.40	-0.95	-1.94

(B) Reduced Model - One Day

	Percentiles								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
π coefficient	-0.013	-0.002	-0.002	-0.000	0.002	0.002	0.005	0.009	0.025
Std. Error	0.010	0.004	0.007	0.003	0.011	0.004	0.007	0.007	0.014
T-Stat	-1.29	-0.54	-0.23	-0.07	0.21	0.52	0.70	1.24	1.73
$P > \|t\|$	0.20	0.59	0.82	0.95	0.83	0.60	0.48	0.22	0.09
CAR (%)	3.36	2.02	0.37	0.37	0.54	-3.32	-1.09	-0.80	-6.68

Table 4.9: Evidence of Information Revelation

Table 4.9 presents estimates of the π coefficient from the equation:

$$R_{it} = a_i + b_i R_{mt} + \pi \left[\frac{\phi(\delta)}{\Phi(\delta)} - \frac{\phi(\delta)}{\Phi(\delta)(1-\Phi(\delta))} I_{dit} \right] + \upsilon_{it}$$

Since the above regression is run individually for each event window (here the announcement day) and the days surrounding it, we present the percentiles of the t-stat that tests whether π is greater than zero. A statistically significant positive π coefficient is associated with information being revealed by a downgrade despite the fact that we have conditioned on firm-specific variables. We find very little evidence of rating agencies possessing an informational advantage since π is rarely significantly positive.

Table 4.10
Information Revelation for Multiple Downgrades and Certain Years
$t\text{-}stat_i = a_o + a_1(mult) + a_2(1992) + a_3(1997) + e_i$
(A) Full Model

	Coef.	Std. Err.	t	$P > \|t\|$	Robust Std. Err.	t	$P > \|t\|$
Multiple (a_1)	-0.20	0.25	-0.79	0.43	0.24	-0.81	0.42
1992 (a_2)	0.77	0.26	2.97	0.00	0.33	2.30	0.02
1997 (a_3)	0.74	0.30	2.44	0.02	0.31	2.42	0.02
Constant (a_0)	-0.04	0.13	-0.31	0.76	0.11	-0.34	0.73
F-Stat	4.30				3.45		
Prob > F	0.01				0.02		
R^2	0.07				0.07		

(B) Reduced Model - Excluding Trends

	Coef.	Std. Err.	t	$P > \|t\|$	Robust Std. Err.	t	$P > \|t\|$
Multiple (a_1)	0.20	0.20	0.97	0.33	0.24	0.83	0.41
1992 (a_2)	0.37	0.29	1.26	0.21	0.32	1.16	0.25
1997 (a_3)	0.37	0.32	1.16	0.25	0.29	1.24	0.22
Constant (a_0)	0.15	0.11	1.35	0.18	0.10	1.53	0.13
F-Stat	1.19				1.25		
Prob > F	0.32				0.29		
R^2	0.01				0.01		

Table 4.10: Information Revelation for Multiple Downgrades and Certain Years

Table 4.10 presents estimates of the coefficients from the following regression:

$$t\text{-}stat_i = a_o + a_1(mult) + a_2(1992) + a_3(1997) + e_i$$

Here *mult* is a dummy variable indicating that a downgrade is part of a series of downgrades taking place within a relatively short time span. 1992 and 1997 are dummies indicating that a downgrade took place in these years respectively. T-stat is the test statistic revealing whether a downgrade had significant information content or not. In other words, this is the test statistic of the π coefficient from equation 4.9, the percentiles of which are presented in Table 4.9. We find that when the full model is used, higher test statistics are associated with downgrades occurring in 1992 and 1997. This implies that downgrades may have more information content during certain time periods.

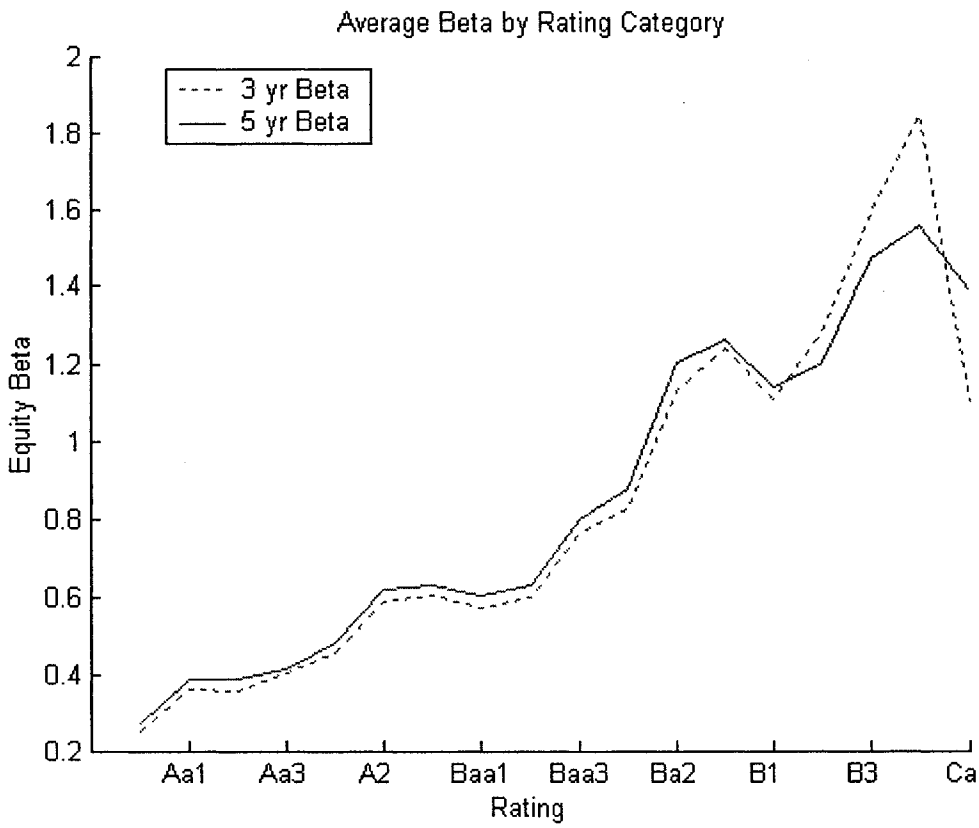

Figure 4.1: Average Beta by Rating Category

This figure plots equity beta measures calculated using both 36 and 60 months of data. We can see that for both measures, average equity betas increase as we move from high debt rating categories to low. This reflects similarities in the risk faced by a company's fixed income and equity investors. The three year beta measure is used throughout our analysis in the interest of reducing the number of observations with missing data points. Results are qualitatively similar if the five year measure is employed.

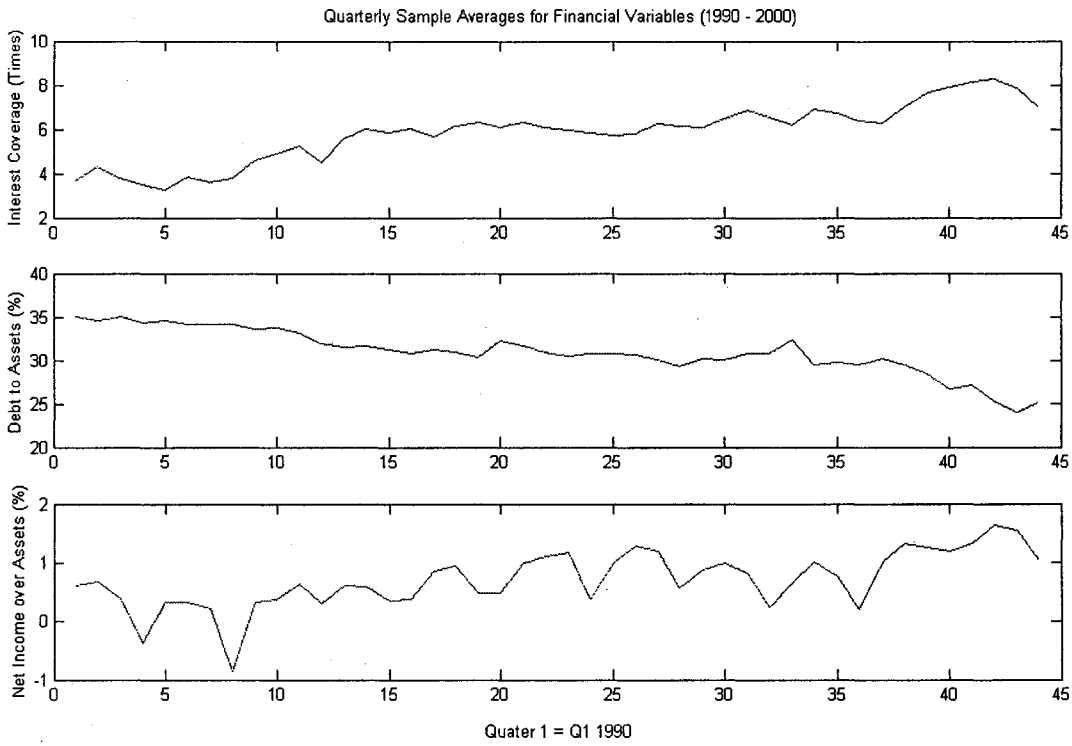

Figure 4.2: Quarterly Sample Averages

The average values for interest coverage, debt to assets, and net income to assets for our sample firms in each quarter between 1990 and year-end 2000 are illustrated above. Debt to assets was seen to decline in the late 1990s with a corresponding increase in average interest coverage. No consistent trend is apparent for the net income to assets ratio which fluctuated quite freely within a very narrow range.

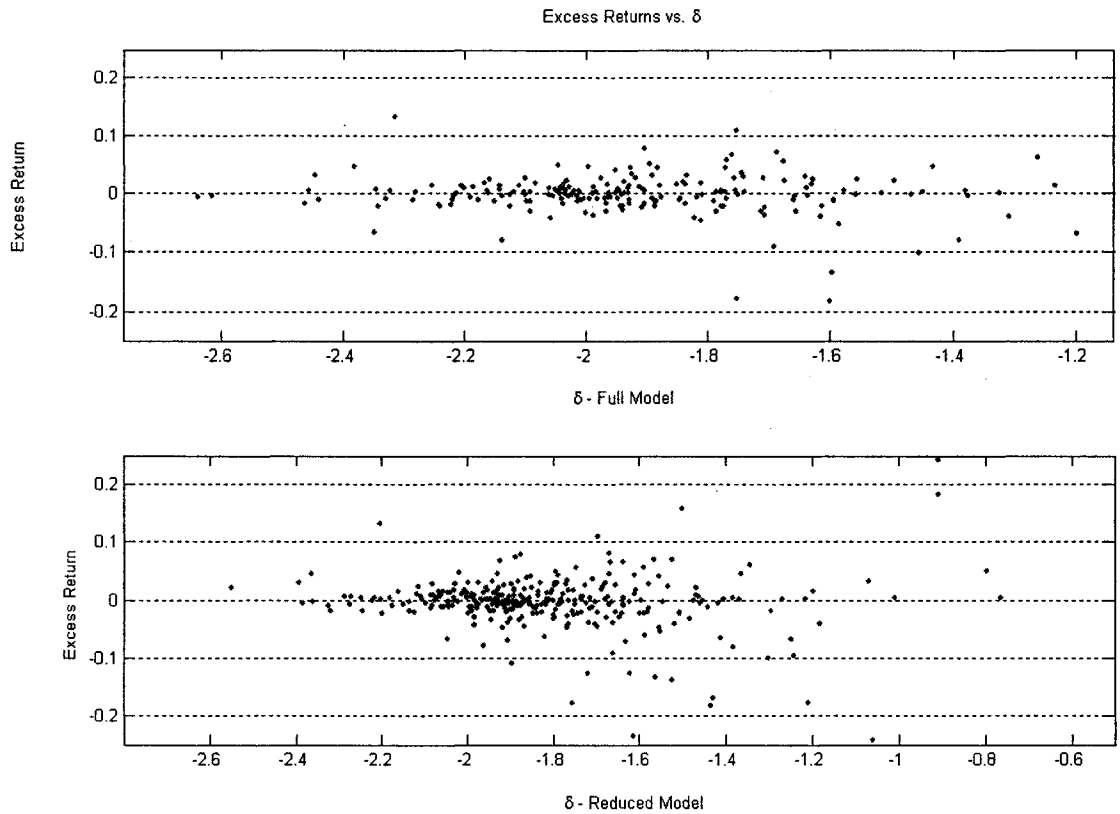

Figure 4.3: Excess Returns vs δ

δ measures the anticipation of a rating downgrade and is equal to the coefficients from the probit model predicting downgrade (θ), multiplied by firm-specific characteristics (X_{it-1}). In symbols $\delta = \theta' X_{it-1}$. Small δ measures are associated with expected downgrades. We note that for small levels of δ, downgrade announcements do not result in significant negative returns. However, when δ is large and the rating change is unanticipated, large negative abnormal returns may occur.

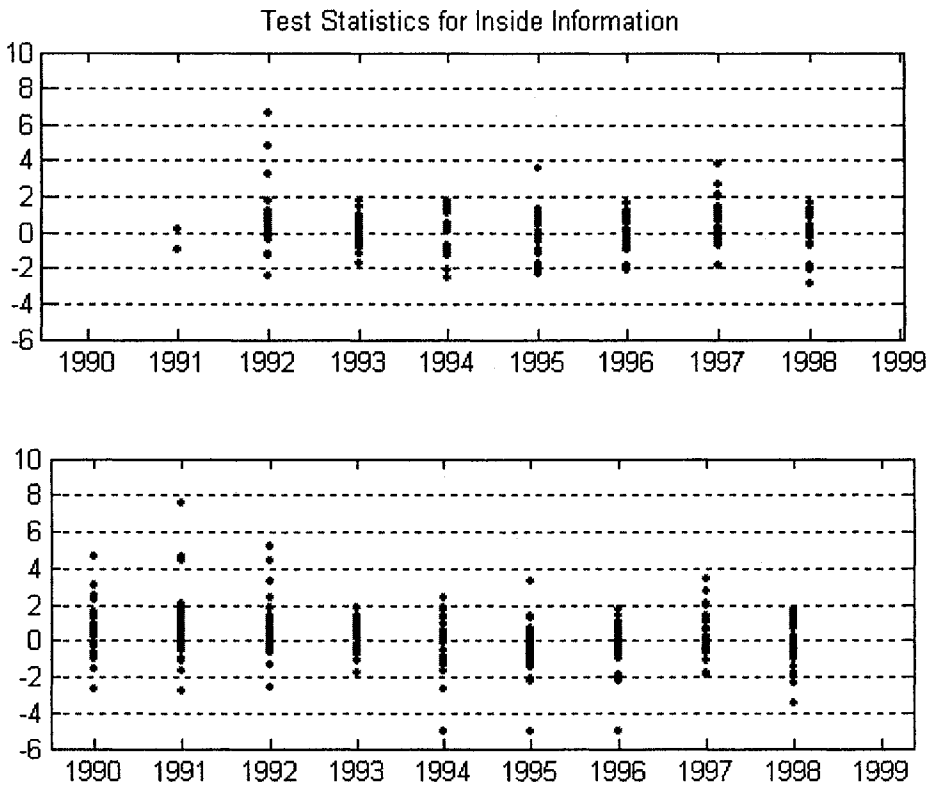

Figure 4.4: Information Revelation vs Year of Change

This figure plots the test statistics for the π coefficient versus the year in which the downgrade occurred. The top panel represents the full model including trends while the bottom panel represents the reduced model. Test statistics greater than 2 indicate that the downgrade had significant information content despite controlling for firm-specific factors. We see that more downgrades occurring in 1992 show evidence of information content than in any other year. We hypothesize that rating agencies may maintain informational advantages during periods of market uncertainty.

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January 20, 2003

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