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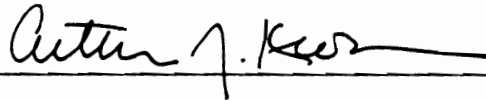
by

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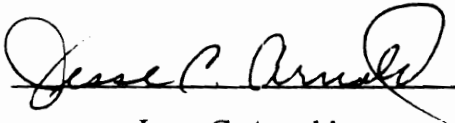
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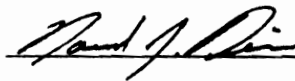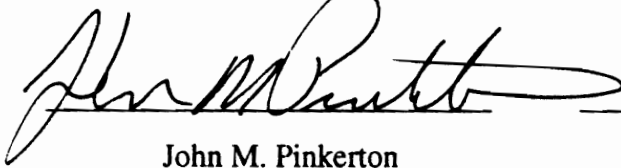
in

Finance, Insurance, and Business Law

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An Empirical Study of Equity Repurchase Decisions and Market Reaction

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(ABSTRACT)

This study is an empirical investigation of the managements' motivations behind corporate equity repurchases in the open market, via private repurchase, or through self tender offer. The hypotheses concerning motivations for stock repurchases investigated in this dissertation include (1) signalling undervaluation of stock prices; (2) free cash flows; and (3) increasing leverage. A series of statistical analysis and tests are conducted against the empirical implications concerning the three decision variables in a repurchase decision process: (1) whether to repurchase; (2) what method (self tender, open market, and private repurchase) to use; and (3) the size and the price of repurchase under each motivational hypothesis, using the sample of all repurchases announced from January, 1986 through April, 1989.

The motivational proxies are (1) the percentage changes of the *median* (and *mean*) earnings forecasts in the *first, second, third* months after the announcement of a repurchase program from the month prior to the repurchase for signalling hypothesis; (2) Tobin's Q, the ratio of a firm's total market value to the market-value replacement costs of its assets, based on the *Lindenburg-Ross Algorithm* for the free cash flow hypothesis (another measure is also used in this dissertation, that is, the net cash flow after taxes and dividends relative to the market value of a firm's common stock); and (3) the *market-value* based debt-equity ratios for the increasing leverage hypothesis.

The empirical portion of this study is composed of four sections: (1) a comparison study

of subsamples of repurchases with their control samples of non-repurchasing firms constructed by the criteria of data availability in both the I/B/E/S and the COMPUSTAT database, three-digit industry code, and the market value of common stocks; (2) a comparison study of the three repurchasing methods; (3) the determination of the terms of repurchases; and (4) the market reaction to the announcement of repurchase and its relationship with the motivational proxies.

The major conclusions of this study are as follows:

1. The signalling hypothesis is supported for the sample of open market repurchases which occurred over the 1987 crash period (from October 19 to November 9, 1987).

2. The free cash flow hypothesis is supported for the sample of ordinary open market repurchases which occurred outside the 1987 crash period.

3. None of the three motivations investigated in this study is supported for the sample of private repurchases.

4. The results are not conclusive for the sample of self tender offers, though the signalling hypothesis and the free cash flow hypothesis are not rejected.

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I wish to express my deep gratitude to my parents for the support they have given me through the years. I wish to express my appreciation to my wife, Xiaodan, whose patience, understanding, and encouragement through this process has made it all possible.

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Chapter One   Introduction

Stock repurchases and dividends are the two major ways to distribute cash back to shareholders. However, stock repurchases have received much less attention from financial economists than dividends, despite the fact that the magnitude of cash paid out through stock repurchase programs has been roughly one-third to one-half of the magnitude of dividends distributed in recent years. Moreover, most, if not all, empirical studies dealing with stock repurchases examine the issue from one of the two perspectives: (1) the financial or accounting characteristics of repurchasing firms; and (2) the market's reaction to the announcements of stock repurchases. Although these studies provide contributions to the understanding of the circumstances underlying a firm's decision to launch a repurchase program, a common shortcoming of these studies is their ignorance of the fact that a repurchase decision has at least three interrelated dimensions: (1) whether to repurchase; (2) what combination of the three repurchase methods to use; and (3) the terms of the chosen repurchase methods. In order to fully understand the motivations for stock repurchases and how well the markets interpret them, it is necessary to investigate how a firm makes these decisions simultaneously in the cost-benefit analysis framework in which all three of these decision variables are endogenously determined. This is the motivation for this dissertation.

There are nearly a dozen theories in the literature for the motivations behind management's decision to repurchase stock. Of these, the three most plausible explanations involve: (1) signalling undervaluation; (2) free cash flow; and (3) increasing leverage. The typical empirical study of stock repurchases investigates the market reaction to a sample of stock

repurchases and then attributes its findings to a particular hypothesis of motivation for stock repurchases . Unfortunately, without careful control, these statistical findings could also be claimed to be supportive of other alleged motivations. Unlike these studies, the purpose of the current study is to distinguish which one or combination of the three possible explanations mentioned above is consistent with the set of stock repurchases which occurred from 1986 to 1989. The conclusions from the carefully controlled statistical analysis should shed light on the question of the motivation for stock repurchases. The result will also aid investors in recognizing the true motivation for a stock repurchase through analysis of the firm's financial characteristics, thereby allowing them to respond appropriately.

Our cost-benefit analysis of stock repurchase decisions is based on two basic and widely accepted assumptions: (1) management works to maximize their own expected utility under market constraints; and (2) markets are rational and able to recognize the motivation behind actions taken by the management, in our case, the decisions of a stock repurchase program. We argue that the benefits of stock repurchases to the management are correspondent to their motivations, and the costs depend on their choice of the three repurchase decision variables mentioned above. The economic rule of maximizing net gains leads us to establish testable implications of relationship between the three decision variables and the three alleged motivations for stock repurchases. The second assumption of rational markets implies that the markets can recognize the motivation behind a stock repurchase program by looking at financial variables of the firm. In other words, each of the three motivations can be represented by some set of distinct financial variables in our statistical analysis. Hence, we rely on the rationality assumptions on both the management and the market to establish testable implications between the stock repurchase decisions and some financial variables representing the three alleged motivations for stock repurchases. It is acknowledged that the financial variables used in our empirical study can be different from these used by the market to recognize the motivations of stock repurchase programs. Therefore, the choice of the financial variables in our study is also a test of the validity of these financial variables in representing motivations for stock repurchases. Given the difficulties in coming up with good measurements of agency costs and informational asymmetry, the investigation of the validity of the financial variables used in the literature to measure agency

costs or informational gap can be significant contributions in their own right.

The focus of this dissertation is on the empirical tests of the implications drawn from the cost-benefit analysis concerning the relationship between the stock repurchase decisions and the financial variables representing the three alleged motivations for stock repurchases. Our data set contains all repurchases announced in the period from 1986 to 1989, totaling more than 3000 repurchases as opposed to 15 to 200 repurchases in samples used in previous studies. This data set gives us tremendous advantages in conducting efficient statistical analysis. The basic methodology used in the current study is logit and multi-choice logit regressions with stock repurchase decisions as dependent variables and financial variables representing the three alleged motivations for stock repurchases as independent variables. In constructing and computing the independent variables, we also take pains to make our approximations as accurate as possible to reduce statistical errors inherent with any proxies in regressions. For example, we use the Lindenburg and Ross Algorithm to compute Tobin's Q rather than using the book values of debt and assets of the firm. In short, the large sample of stock repurchases and carefully controlled statistical analysis should yield convincing results on the issue.

The remainder of the dissertation is organized as follows. Chapter Two describes how stock repurchases are conducted and reviews the theoretical and empirical literature related to the three major explanations of motivations for stock repurchases. Chapter Three discusses issues in stock repurchases and presents the empirical implications to be tested in this study dealing with the relationship between the three repurchase decision variables and the financial variables representing the three alleged motivations for stock repurchases, based on the cost-benefit framework. Chapter Four discusses the methodology and econometric issues. Chapter Five depicts our data set and presents the results of our statistical tests and their interpretations. The last chapter, Chapter Six, is a summary of the conclusions and their supporting results.

Chapter Two   Literature Review

2.1 Introduction

The purpose of this chapter is to review the literature dealing with motivations of stock repurchases, concentrating on the recent studies related to the three major alleged motivations for stock repurchases: (1) signalling undervaluation; (2) free cash flow; and (3) leverage increase. The reviewed literature can be grouped into three categories: theoretical models of stock repurchases, empirical studies, and surveys of managers on the motivations of stock repurchases. It is not our intention to cover all issues regarding stock repurchases, simply because we want to focus on those which are most relevant to the widely alleged and debated motivations for stock repurchases, which are the subject of this dissertation. More discussions on related literature will be presented in Chapter Four, where independent variables representing the three major motivations for stock repurchases are constructed.

2.2 Methods of Stock Repurchases

Stock repurchases occur whenever a firm exchanges cash for shares of its own common stock held by its shareholders. There are basically three approaches used to buy back shares from shareholders: (1) self-tender offers; (2) open market repurchases; and (3) privately negotiated repurchases from one shareholder or a group of shareholders.

In a self-tender offer, the repurchasing firm usually announces its repurchasing plan in public, specifying the number of shares to be repurchased, the tender offer price at which it will repurchase shares, and the period of time during which the offer is in effect. The number of shares specified in the offer usually is the maximum number of shares that the company is going to purchase. The firm usually reserves the right to extend the offer beyond the initially announced expiration date and to purchase shares tendered in excess of the amount specified in the initial public announcement of the tender offer. If the number of shares tendered by shareholders exceeds this maximum number and the firm wants to purchase this number of shares as promised, the purchases are generally made from each tendering shareholder on a pro rata basis. If, on the contrary, fewer shares have been tendered during the initial offer period, the company may choose to extend the expiration date. When the offer is extended, all shares tendered before the initial expiration date will usually be purchased and those tendered during the extended period will be purchased either on the first-come, first-served basis, or on a pro rata basis. Officers and directors of the repurchasing firm are usually explicitly forbidden from participating in the tender offer. It is obvious that the tender offer price must be higher than the prevailing market price; otherwise, the firm would find no shares tendered at all.

Open market repurchases are much more common than self-tender offers. Repurchasing firms are not required to disclose their repurchases publicly although they frequently announce

their repurchase programs in advance or report them after the transactions have been finished. Since the transactions are conducted in the market and the implementation of the repurchasing program may last as long as two years, the repurchasing prices are simply market prices, which are beyond the control of the management. The firm is not bound by the announced repurchase program. For example, more than 800 companies announced open market repurchase plans in the three weeks following the stock market crash in October, 1987, but many of the announcements were never implemented.

Private repurchases are conducted with one or a group of shareholders through direct negotiations on the terms of the repurchase such as the repurchase price and number of shares to be repurchased. Either the company or the shareholders may initiate the negotiation for repurchase. It is possible that the transaction price is close to, or even below the market price if for some reason the selling shareholder wants to download their holdings to the company.

Our data set contains all repurchases which occurred in the 1986–1989 period, including self-tender offers, open market repurchases, and privately negotiated repurchases. This provides us with an unique opportunity to examine the information about the motivation for stock repurchases revealed through the choice of the repurchasing method and the terms of the repurchases. A detailed discussion is presented in Chapter Three on the advantages and disadvantages to the management considering a stock repurchase program in the cost-benefit framework.

2.3   Theories of Stock Repurchase Motivations

Theoretical studies of stock repurchases have been concentrated on the question of why firms repurchase their own shares at all. There have appeared in the literature at least ten different explanations on the motivations behind stock repurchase programs. Most of them are either inconsistent with basic finance theories or have been empirically disapproved. For example, Dann (1981) finds that there was no significant announcement date returns experienced by owners of straight debt and straight preferred stock of repurchasing firms and concludes that the bondholder expropriation hypothesis of stock repurchases does not hold. However, the past empirical studies of stock repurchases have not been able to conclusively support or reject any of the following three hypotheses on motivations of stock repurchases: (1) signalling undervaluation; (2) free cash flow; and (3) leverage increase. In this section we discuss the theoretical arguments for these hypotheses, while the related empirical evidence is the topic of the next section.

2.3.1   Signalling Undervaluation Hypothesis

The positive significant abnormal returns in the announcement period of self-tenders (15 percent, on average, reported by Masulis (1980), Dann (1981), Vermaelen (1981), and Rosenfeld (1982)) and the high premium of self-tender offer prices over market prices lead many researchers to establish signalling models for self-tender offers (Vermaelen (1984), Choi (1986), Ofer and Thakor (1987), Hertzel (1988), and Constantinides and Grundy (1989)). All these models deal either with repurchase tender offers alone or with other financial policies such as

dividends or investments. Yoo (1987) explicitly models open market repurchases as a signal of undervaluation. It seems that private repurchases are not believed by researchers to be used for the purpose of signalling undervaluation.

Vermaelen (1984) argues that self-tender offers are credible signals of stock price undervaluation because insiders or management hold shares and do not participate in the tendering of shares. If there is no insider information conveyed through the announcement of a tender offer, and therefore the total market value of the firm is unaltered after the tender offer is concluded, the untendering shareholders will find that the value of those untendered shares has been reduced and that there is a wealth transfer from untendering shareholders to the shareholders of those tendered shares in the form of the tendering premium.

When a shareholder tenders all his holdings, his net gain is exactly the tendering premium. If the percentage of a shareholder's shares accepted for repurchase by the company is equal to the fraction of shares repurchased in the whole by the company, then his wealth is unaltered. This quantity of wealth transfer in a tender offer is loosely defined as dilution costs. The total dilution costs of a self tender offer are an increasing function of both the tendering premium and the fraction of shares tendered and are borne by all shareholders who hold untendered shares. Since decision makers of a tender offer bind themselves not to tender their own holdings in the company, they bear a proportional burden of the dilution costs according to their holdings. This share of dilution costs borne by management is the signalling cost of conveying their private information to the market about the undervaluation of the stock. Of course, it is first assumed that it is to management's benefit to signal out this information at their own cost.

Although the signal in Vermaelen's model is the fraction of shares to be repurchased at a specific tender price, it is logical to argue that the fraction of shares to be repurchased and the premium of the tendering price over market price work together to convey information of undervaluation since the dilution costs, or the signalling cost, depend on both these factors.

Ofer and Thakor (1987) present a model which deals with signalling by either dividends or self-tender offers. They formalize the observations that the market reacts more strongly to self-tender offer announcements than dividend increase announcements and that self-tender offers are

much less frequent than dividend distributions. The basic conclusion of their model is that a firm chooses either self-tender offer or dividend as a signal of stock undervaluation, depending on the degree of undervaluation. Self-tender offers are used in the case of a large informational gap while dividends are chosen for signalling of a smaller informational gap. Of course, the definition of the degree of undervaluation can at best be qualitative.

Yoo (1987) presents a model in which higher quality firms repurchase through self-tender offers, medium quality firms repurchase in the open market, and the remaining lower quality firms do no signal at all. Since there is no premium in open market repurchases, there are no dilution costs to the unselling shareholders. The lack of dilution costs to the management makes the signal much less credible to the market than self-tender offers. Another reason why signalling through open market repurchases is less credible is that the management has total discretion over the implementation of the announced repurchase programs. They can change the terms of the program, implement it flexibly, or even cancel it without notice.

Therefore, Yoo argues that the bigger the informational gap between insiders and the market, the more likely the firm is to use a tender offer instead of an open market repurchase to signal their private information. When the information gap is small, the firm will use an open market repurchase as a signal. If an open market repurchase is a signal of undervaluation, the fraction of shares to be repurchased in the announcement determines the strength of the signal.

Constantinides and Grundy (1989) examine the signalling role of open market stock repurchases coupled with the issue of a senior security in a general setting of optimal investment and financing. The informational asymmetry is on the dimension of insider information about the firm's investment prospects that the outside stockholders and the market do not have. The risk-neutral management owns a certain fraction of the stock of the all-equity firm but cannot sell its stock in the model period nor purchase any of the securities to be issued by the firm. Since the firm does not have sufficient financial slack to invest optimally, outside financing is necessary. The management's objective is to maximize the value of its shares by choosing the level of investment by the firm and the mode of its outside financing. They conclude that a signalling equilibrium with optimal investment requires that the firm issue a security whose proceeds partly finance investment and partly finance a stock repurchase. Hence, the model justifies the use of stock repurchases for signalling purposes that is not based on a repurchase premium over the

equilibrium stock price.

Although Asquith and Mullins (1986) argue that all cash payouts to shareholders are positive signals, the findings of Bradley and Wakeman (1983) and Dann and DeAngelo (1983a) of negative abnormal returns around the announcements of targeted private repurchases do not support their signalling hypothesis of targeted private repurchases. The lack of control over the terms of a private repurchase and the possible initiation of negotiations by the selling shareholders make signalling by private repurchases not credible to the market. Notably, greenmails, or targeted private repurchases from a current or potential take-over bidder, are anything but signals of undervaluation and are widely accepted as a defense strategy for corporate control.

In summary, both self-tender offers and open market repurchases have been modelled in the literature as signalling devices for conveying insiders' information about the firm's stock undervaluation or good investment opportunities to the market. All these models are conceived on the observations documented widely in the literature that there are permanent positive abnormal returns in the announcement periods of self-tender offers and open market repurchases. In a self-tender offer, the fraction of shares to be repurchased and the tendering premium work together to convey the private information while in an open market repurchase announcement the signal strength is determined solely by the fraction of shares to be repurchased, since the transaction price is the prevailing market price.

2.3.2   Free Cash Flow Hypothesis

Jensen and Meckling (1976) pioneered the theoretical thinking of financial markets from the perspective of agency costs. Jensen (1986) argues that firms with free cash flow have a tendency to invest in zero or negative present value projects. Managers' promotion opportunities are closely associated with the organizational growth of firms. Top managers of a large firm enjoy tremendous satisfaction from the prestige and perks of being in these influential positions.

These reasons motivate management to overinvest, resulting in the firm growing beyond the optimal size at the shareholders' expenses. At the same time, shareholders believe that they themselves can manage their cash better if it is distributed back to them from the firm. In a complete market, basic financial theory argues, individual investors can efficiently diversify their positions so that it is usually not optimal for a firm to invest in new project for the sake of diversification. The free cash flow problem is this consequence of the shareholder-management conflict and the agency costs associated with it are suboptimal investments in negative NPV projects.

The standard agency theory contends that the owner-manager is the bearer of agency costs and the beneficiary of any reduction of agency costs, since investors discount the offering price for the shares in anticipation of the agency costs. The interest of the owner-manager is maximized when the agency costs are reduced to a certain optimal level. The implication of this argument for the free cash flow problem is that the management of firms with free cash flows will distribute cash back to shareholders in order to reduce the concomitant agency costs. Hence, the free cash flow theory provides another plausible explanation for the motivation of stock repurchases.

As compared with the payment of dividends, stock repurchases as a means of distributing cash back to shareholders have the advantage of lowering shareholders' tax burdens, since dividends are taxed as ordinary income while selling shareholders in a stock repurchase program are taxed only on their capital gains. Tax considerations may be the reason propelling management to use stock repurchases instead of dividends as means of reducing free cash. One may argue that the negative effect of dividend reductions on stock prices makes the payment of dividend or an increase in dividend an effective signal to the market of management's commitment to reduce agency costs associated with possible future free cash flows, while stock repurchases can only reduce agency costs associated with the current free cash flow.

Two deciding factors in the management's decision to repurchase shares to reduce free cash are (1) the magnitude of free cash flow; and (2) the costs of implementing the repurchase program. The first factor determines the benefits achieved through reduction of free cash flow and is self-revealing. These two factors together will dictate whether the firm will launch a repurchase program as well as the method to be used and the terms of the repurchase program, if such a

program is launched. It seems that no single repurchasing method is precluded as a possible means of reducing free cash.

2.3.3 Leverage Increase Hypothesis

Capital structure is a central and still controversial issue in corporate finance (Harris and Raviv (1991)). The core of this issue is the question of the existence of an optimal capital structure for a particular firm or industry. It seems that only carefully designed and controlled empirical studies can resolve the issue.

The leverage increase hypothesis for stock repurchases is based on the presumption that an optimal structure does exist industrywide and also on the fact that many self-tender offers and open market repurchases are accompanied by issues of new debt. It is maintained that it is beneficial to both the firm and its management to increase its leverage if the debt-equity ratio is below the optimal level. Stock repurchases, especially when financed with debt, are a simple and relatively inexpensive way to increase firms' debt-equity ratios. It is natural to assume that its stock price will go up when a firm's debt-equity ratio is increased toward its optimal level, though the determination of the optimal level itself is a very critical and difficult problem.

The repurchasing decision for the purpose of increasing leverage depends on two important factors: (1) the gap between the optimal leverage and the current leverage of the firm; and (2) the costs of repurchase. The decision issue will be discussed in more detail in Chapter Three, while the specifications of the variable which measures the gap between the optimal leverage and the current leverage of firms are the topic of Chapter Four.

2.4 Empirical Studies of Stock Repurchases

Despite the existence of numerous empirical studies dealing with stock repurchases in the literature over the last ten years, it is an undeniable fact that the very question of why firms repurchase remains unanswered and that the resolution of this issue requires direct assaults. The truth is that almost all past empirical studies have focused on the market reaction of different samples to the announcements of stock repurchases. Findings from this approach surely tell us something about whether certain types of repurchases are assessed as good or bad by the market. However, it is highly inappropriate to infer the management's motivation for repurchases solely on the basis of the results of an event study of market reactions because positive reactions to the announcement of certain repurchases, say, self-tender offers, could be explained by any one or a combination of the following hypotheses: (1) signalling undervaluation; (2) reduction of free cash flow; and (3) leverage increase.

Two econometric issues further complicate the problem of empirically identifying the motivations for stock repurchases. The first problem is the difficulty of identifying and obtaining accurate measurement of quantitative proxies for informational asymmetry, agency costs associated with free cash flow, and optimal debt-equity level. Another problem which brings into question the conclusions of many empirical studies of stock repurchases is their small sample size, which may have introduced large selection bias into the analysis.

2.4.1   Empirical Studies of Self-Tender Offers

Self-tender offers are probably the most widely studied form of stock repurchases in the literature since they satisfy the requirements of event studies better than open market and private repurchases do.

Masulis (1980) applies event study methodology to study the price effects on tendering firms' securities of tender offers during the announcement period. The final data sample in his study includes 199 self-tender offers by NYSE and ASE listed firms over the period 1963–1978. These self-tender offers sought to repurchase an average of 16 percent of shares outstanding at an average premium of 23 percent. The findings of 17 percent abnormal returns[1] over the two-day announcement period for the whole sample and even higher abnormal returns for those tender offers with at least 50 percent debt financing[2] lead him to declare support for the hypotheses of personal tax savings over cash dividends and corporate tax shield increase from debt financing. However, his conclusions have been questioned by other researchers on the ground that the abnormal returns can also be explained by the signalling hypothesis.

There is no surprising finding in Dann (1981) since the data set of self-tender offers in his study is almost identical to the one in Masulis (1980). The 143 self-tender offers studied by Dann occurred in the 1962–1976 period at an average 22.46 percent offering premium and with an average of 15.3 percent as the target fraction of shares to be acquired. Dann also finds abnormal returns of 15.41 percent in the two-day announcement period which he attributes to the new information conveyed by the announcement of tender offers, though he admits that it is not clear what the nature of the new information is and why managers choose to convey this information by means of a costly common stock repurchase. The major contribution of this study is the finding that the price impact on convertible and non-convertible debt and preferred stocks is

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[1]The mean adjusted model was used in his study while our choice of market model in this dissertation may not yield same magnitude of abnormal returns.

[2] The abnormal returns are 21.9 percent and 17.1 percent respectively, for the subsamples of 138 offers with at least 50 percent debt financing and 61 offers with at most 50 percent financing.

different angles, presents one of the strong pieces of evidence supporting the signalling hypothesis. On average, the stocks of tendering firms experienced positive abnormal returns of 15.22 percent over the three day announcement period (-1,1). He maintains that the strongest evidence in support of the signalling hypothesis comes from the observation that predominantly small firms engage in repurchase via tender offer. This conclusion is based on the assumption that small firms have fewer channels to convey management's inside information to the market. However, no firm tests have been done on the difference in market sizes for difference repurchasing samples. Using two models of earnings forecast, it is found that the average standardized prediction error of earnings is significantly positive in the announcement year, year + 1, year + 3, and year + 5 and the results are quite robust regarding the model specifications. This finding is also alleged by the author as supporting evidence in favor of the signalling hypothesis.

In a later paper, Vermaelen (1984) presents a signalling model of self tenders based on the assumption of managerial incentives and finds a positive and significant relationship between the so-called value of information, expressed as an "abnormal return" per share, and tendering terms, represented by the tendering premium and the fraction of shares repurchased, through OLS regression with the same data set as in his 1981 paper. The result is not surprising since we have already seen that self tenders have much higher abnormal returns in the announcement period than open market repurchases, while the former has a very high tendering premium and fraction of shares to be repurchased, and the latter has a much lower fraction of shares repurchased and no premium at all. In addition, if self tenders are motivated by other value enhancing reasons, it should be expected that the price increase in common stocks of tendering firms is a positive function of the tendering terms. Hence, the evidence is strong, but does not provide exclusive support to the signalling hypothesis.

Rao, Moyer, and Sivaramakrishnan (1990) investigate the effect of self tender and open market repurchase announcements on the composite analysts' forecasts of earnings, whose revision, they argue, is a better proxy for market expectations of firms' future earnings prospects. The purpose of their study is to identify whether the information conveyed by the announcements of self tenders and open market repurchase programs is reflected in future earnings forecasts.

Their sample of 26 self tenders from 1981 to 1986 has an 8.3 percent significant abnormal return. Using the median forecasts for the current fiscal year and the next fiscal year in IBES data set, they report positive and significant market adjusted earnings forecast revisions in the case of next year forecasts. The market adjusted forecast revision for the current fiscal year is positive but not significant, while the simple earnings forecast revisions for either of current and next fiscal year are also not statistically significant. It is concluded by the authors that the evidence is supportive of the signalling hypothesis of self tenders, and the information signalled is the earnings prospects relative to the market. However, the question remains as to why the information conveyed affects the next year's earnings prospects instead of the current fiscal year's. In the final test, they failed to find the expected association between the abnormal return in the announcement period and the earnings forecast revisions, blaming the small sample size. Therefore, their results do not provide convincing evidence in support of the joint hypothesis that the self tenders are motivated by signalling the future earnings prospects and that the analysts' composite forecast is a good proxy for the markets' expectation of them.

In summary, researchers have found that the tendering premium is usually very high (around 20 percent), the fraction of shares to be repurchased in their announcements is also high (around 16 percent), and there are significant and positive abnormal returns in the announcement period (around 14 percent). The positive abnormal returns plus the premium paid to the tendering shareholders are called the value of information. As the name implies, it is generally attributed to the signalling role of tendering offers through the terms of offers such as premium and fraction of shares sought. However, the question remains: what is the exact nature of information signalled via a tender offer? Furthermore, due to the lack of a well controlled comparative study, the evidence does not necessarily reject other plausible hypotheses concerning motivations of stock repurchases, such as free cash flow.

2.4.2 Empirical Studies of Open Market Repurchases

While the open market repurchase is the most frequently used method of buying back common stock by firms, we seem to know even less about it than we do about the other two types of repurchases, namely, self tenders and private repurchases. Positive, significant abnormal returns have been documented for stocks in the open market repurchase announcement periods, though the magnitude (around 3 percent) is much smaller than in the case of self tenders. It is also widely known that the fraction of shares bought in open market repurchase programs is about 6 percent, much smaller that self tenders, which on average buy back 15 percent of shares outstanding. This abnormal return is again attributed by many researchers to the signalling role of open market repurchases. However, there seem to be no widely accepted signalling models of open market repurchases yet in the literature. Even the casual observation that self tenders are used predominantly by smaller firms needs to be tested in a controlled manner.

While his focus is on self tenders, Vermaelen (1981) also examines the market reaction to the announcements of 243 open market repurchases made by 198 companies from 1970 to April, 1978. Based on the finding of abnormal returns of 3.37 percent in the two-day announcements, he claims that the evidence is strongly in support of the information hypothesis, while admitting the results are less conclusive than those found with self tenders. An interesting result is the finding of a 7.08 percent price decline in the two-month period preceding the announcement of an open market repurchase.

Netter and Mitchell (1989) examine open market stock repurchase programs announced by about 600 NYSE, AMSE, and OTC companies during October 19-30, 1987. Arguing that these repurchases immediately after the stock market crash were mainly motivated by management's desire to signal that their stock prices had declined below their true risk adjusted values after the extraordinary market declines around October 19, 1987, they use this unique opportunity to study signalling motivation of open market repurchases. The final sample in their study includes 346 NYSE and AMEX firms and 184 OTC firms with the average fraction of shares to be repurchased in their announcements of 5.63 percent and 7.02 percent for NYSE and

AMEX firms and OTC firms, respectively. This is very similar to the figure reported by Dann (1981) and Vermaelen (1981). They report that in the two-day announcement period the abnormal return is 3.45 percent for NYSE and AMEX firms and 6.21 percent for OTC firms. They also find that during the window (2, 4) following the announcement, the average abnormal returns are 3.45 percent for NYSE and AMEX firms and 10.57 percent for OTC firms. It is concluded that the data support the argument that firms announced open-market repurchase programs to signal that their stocks were undervalued as a result of the crash, and the market responded positively to the announcement.

Rao, Moyer, and Sivaramakrishnan's (1990) study also includes 175 open market repurchases from 1981 to 1986. The event study on this sample confirms other past studies, finding an average of 2.8 percent significant abnormal return in the two-day announcement period, following a 5.9 percent price decline in the period (-57, -4). They find no significant earnings revisions following the announcements, under various model specifications, and no relationship between the market reactions and the earnings forecast revisions. They conclude that not all open market repurchases are for signalling purposes.

2.4.3 Empirical Studies of Private Repurchases

Private repurchases actually have two variants: greenmails and non-greenmails. Greenmails are negotiated repurchases from a current or potential take-over bidder, usually accompanied by a standstill agreement, which is a voluntary contract between an issuing corporation and a substantial stockholder which limits the stockholder's ownership of voting shares to some maximum (less than controlling) percentage for a stipulated number of years. Non-greenmail private repurchases are those targeted repurchases from a restricted group of shareholders without the explicit purpose of defending corporate control. Most studies on private repurchases focus on the greenmails.

Bradley and Wakeman (1983) presents event studies on a sample of single block

repurchases consisting of 86 repurchases from insiders, individuals unaffiliated with the firm and other corporations in the period of 1974-1980. Twenty-four of these blocks were repurchased at discounts from the market price, reflecting the fact that all private repurchases are not greenmails for the purpose of defending corporate control and may in fact be initiated by the selling shareholders. The median block size and premium are around 8.5 percent and 3 percent, respectively. The sample of 61 remaining repurchases with positive premiums experienced significant -2.85 percent abnormal returns during the three-day announcement period. This sample is further divided into two subsamples, one including 21 repurchases suspected to be associated with the termination of a take-over attempt by the seller, and another with 40 'non-merger' repurchases. The 'merger' group of repurchases had a significant price decline of 7.14 percent in the three-day announcement period, while the 'non-merger' group had a slight price decline of 1.40 percent with a t-statistic of -1.97. Based on these findings, the authors conclude that the defense of corporate control through privately negotiated repurchases are undertaken for the managers' interest at a substantial loss to non-participating shareholders.

Dann and DeAngelo (1983) reports results of an event study on a sample of 81 observations containing 19 standstill agreements without negotiated repurchases, 11 standstills accompanied by negotiated repurchases, and 51 negotiated cash repurchases without standstill agreements. The medians of fraction of shares repurchased and premium are about 8 percent and 10 percent, respectively. For the 41 premium repurchases, the transaction price exceeds the market price by 16.4 percent on average. This sizable premium is the same order of magnitude as the effective average premium received by tendering shareholders in repurchase tender offers. The two-day portfolio prediction error is -1.76 percent for all 41 premium repurchases and -1.16 percent for the 34 premium repurchases without standstill agreements. Both of these two prediction errors are significant at an 1 percent significance level. The principal conclusion of this study is that the negative average price impact associated with negotiated premium repurchases is inconsistent with the prediction of the stockholder interests hypothesis that these transactions benefit non-participating stockholders on average.

The similar results of stock price decline at the announcements of privately negotiated premium repurchases (including greenmails) have also been documented by other studies such as Klein and Rosenfild (1988) and Mikkelson and Ruback (1988) and will not be reviewed in detail

here because the methodology and results are basically the same as in Bradley and Wakeman (1983) and Dann and DeAngelo (1983). The authors of these studies conclude that privately negotiated premium repurchases are not undertaken for value-enhancing purposes, such as informational signalling and leverage increase, because the wealth of non-participating shareholders is reduced at the announcement of these repurchases.

2.5 Survey of Managements' View On Repurchases

Maintaining that studies confined to indirect evidence obtained from cross-sectional comparisons of firm characteristics or from event studies of market reaction to repurchase announcements are unable to reveal the motivation behind a repurchase, some researchers (Baker, Gallagher, and Morgan (1981), and Wansley, Lane, and Sarkar (1989)) use survey methods to obtain evidence about managerial attitudes toward possible reasons underlying repurchase decisions. While caution is needed when interpreting survey results due to non-response bias and incorrect response bias associated with any survey, the views of managements on motivations of stock repurchases do shed some light on the motivation issue.

Wansley, Lane, and Sarkar (1989) report responses on motivations behind stock repurchases from the chief financial officers (CFO's) of 140 large U.S. corporations. Forty-two of the respondents have not repurchased shares while the remaining ninety-eight have repurchased in the last few years. Only twenty-two of the repurchasing companies used self tenders. The relatively small sample makes interpreting the results even more difficult.

The most important reasons given by both repurchasing and nonrepurchasing managers are consistent with the information hypothesis: (1) 'because management felt that the stock was undervalued'; and (2) 'as a method to signal investors of confidence in the future level of earnings and stock prices'. While the ranking of reasons for repurchases which are consistent with the information hypothesis is basically the same for both groups of respondents, these groups do disagree on the relative importance of reasons corresponding to leverage and free cash flow hypotheses. For repurchasers, leverage considerations ('repurchases as a means to increase the firm's leverage') precede reasons associated with free cash ('because the company had excess

cash' and 'because the company lacked sufficient investment opportunities to use available cash'). However, the nonrepurchasers think that the reasons associated with the free cash flow hypothesis are the second most important and that leverage considerations rank only 11th. Hence, WLS concludes that (1) managers do use share repurchase to signal their confidence in the firm, which management believes is not incorporated in stock price; (2) managers agree with the use of repurchase by the firm with excess cash and insufficient investment opportunities; and (2) only weak support is found for repurchases to increase leverage from repurchasers.

The disagreement among repurchasers and nonrepurchasers on the leverage and excess cash considerations can probably be explained by the response biases. However, we notice that authors did not survey or report how managements choose the repurchase method to be used once the repurchase decision has been made. This is one untouched question in the literature.

Chapter Three

A Framework of Stock Repurchase Decisions and Market Reaction

In this chapter we present a cost-benefit framework in which testable implications are inferred concerning the three repurchase decision variables and the consequent market reactions for each of the three major alleged motivations for stock repurchases: (1) signalling undervaluation; (2) free cash flow; and (3) leverage increase. The analytical framework is based on the basic economic principle for decision-making which proposes that net benefits are maximized when marginal benefits equal marginal costs. In the case when the gross benefits derived from a economic action is fixed, the decision rule then becomes how to minimize the costs. When a firm's management makes decisions on a stock repurchase program, the very basic economic principle to maximize net benefits is still applicable.

A cost-benefit analytical structure has three fundamental factors: the decision maker, the benefits, and the costs of each action to the decision maker. We assume that the decision maker of stock repurchases is management, whose purpose is to maximize their own expected utility. This assumption does not necessarily imply that shareholders' interests are always hurt by management's actions. On the contrary, as many authors have pointed out in the literature, the management's interest is aligned with that of shareholders in most situations by inside-the-firm discipline and market forces. Of course, the assumption itself acknowledges the possibility that the management may take actions to service their own interest at the shareholders' expense. For

example, greenmails are generally believed to be detrimental to shareholders.

We argue that the benefits of a stock repurchase program to the decision maker correspond to the alleged or speculated motivations. In Chapter Two we reviewed the literature on the theoretical arguments for these three major motivations for stock repurchases. The basic premise for our empirical study is the rational market assumption which states that the market can correctly identify management's motivations for repurchases by observing the firm's relevant financial characteristics. Put another way, each motivation for repurchases is represented by one or several financial variables. Thus, the finding of a significant association between a repurchase decision variable and a certain financial variable can be interpreted as a direct test of the represented motivation for stock repurchases.

Self tenders, open market repurchases, and private repurchases are the three repurchase mechanisms which have different impacts on management in terms of costs incurred. Some or all of the four types of costs are borne by the management using a particular repurchase mechanism: (1) risk-increase costs; (2) dilution costs; (3) transaction costs; and (4) liquidity costs. Given that these alternative mechanisms co-exist, it must follow from the survivor principle that each of them enjoys a comparative advantage over others, given certain motivation for repurchase, or certain characteristics of the repurchasing firm. The cost-benefit analysis implies that the management will choose the most cost competitive method to achieve its purpose.

This chapter has two parts: the first three sections discuss in some detail the three factors of the analytical framework of stock repurchase decisions as outlined above. The first section is devoted to a discussion of two assumptions concerning the behavior of the management and the market. These are the managerial-incentive assumption and the rational market assumption. In the second section we will discuss the explicit and implicit costs to the management in stock repurchase programs using different repurchase mechanisms. The third section will discuss characteristics of each of the three repurchase methods. Understanding these characteristics other than costs enables us to recognize the advantages of each particular repurchase mechanism in achieving the management's purpose.

The second part of the chapter includes three sections, each of which presents our arguments for the stock repurchase decision process under one of the three motivations for stock repurchases. We will endeavor to show how motivations and cost considerations interact to

endogenously determine all three decision variables and how the market will respond to these decisions, provided that the market is rational and able to correctly infer the motivation from observable characteristics. The testable implications are also introduced in these sections.

At the end of the chapter is a summary of our testable hypotheses concerning the three stock repurchase decision variables and the consequent market reaction to the repurchase announcements under each of the three alleged motivations for repurchases. These hypotheses will provide predictions on the regression coefficients in the next chapter and will be tested in the empirical part of the paper.

3.1 Regularity Assumptions

Any economic model or framework of analysis has to make certain regularity assumptions, explicitly or implicitly, on the behavior of decision makers and the model structure. In order to clarify our arguments, we explicitly present two assumptions before the framework of the stock repurchase decision process is discussed.

3.1.1 Managerial-Incentive Assumption

The existence of an agency problem is assumed between management and shareholders in the sense that management does not necessarily act in the interest of shareholders in all situations. The agency argument has been widely accepted by financial economists because it can convincingly explain many puzzling financial phenomena. Unfortunately, the agency theory has not been sufficiently tested in empirical studies due to the difficulties in specifying and measuring agency costs.

We not only study the possible role of free cash flow in motivating stock repurchases, but also adopt the view that management pursues the purpose of maximizing its expected utility under intra-firm discipline, and capital and labor market constraints. Therefore, their actions may or may not be in the best interest of shareholders. Our empirical tests on stock repurchases will contribute new evidence to support or reject the agency theory.

3.1.2 Rational-Market Assumption

Rational expectations are assumed in our analytical framework of the stock repurchase decision process in the sense that the management that is intending to repurchase shares will take into consideration the expected market reaction to its decision assuming that the financial market is able to correctly interpret the intention or motivation for the repurchase. Put more simply, the market cannot be cheated by firms.

The important implication of this assumption for our empirical study on stock repurchases is that the market can infer the motivations for stock repurchases from the analysis of corresponding financial characteristics. For example, the signalling motivation is represented by the informational asymmetry variables. Of course, the financial variables which are used by the market to determine management's intentions may not be identical to what we use in our empirical studies. Hence, what is being tested in this approach is always a joint hypothesis about the rationality of the market and the validity of the financial variables.

3.2 Costs of Stock Repurchases

The management intending to repurchase shares may incur some or all of the following types of costs according to the methods used.

3.2.1 Risk-Increase Costs

Assuming that management has substantial insider holdings, then the reduction in the firm's number of shares outstanding through a repurchase will increase the management's insider holdings, resulting in a suboptimal diversification of the management's personal portfolios. Of course, the management may incur costs to rebalance its personal portfolios by selling a certain number of its own firm's stock back to the market, provided the transaction is not prohibited by law as informed insider trading.

Therefore, the risk-increase costs are defined as the lesser of the transaction costs incurred in rebalancing personal portfolios or the premium required for increased exposure to the unsystematic risk. The risk-increase costs are independent of the repurchase method used, since the management usually refrains itself from participating in self tenders, with these costs being an increasing function of the percentage of shares repurchased. It follows that the risk-increase costs will not affect the choice of repurchase methods. Also notice that these costs are borne both by the managers with substantial insider holdings and by non-selling shareholders. However, these costs will still affect the decision of whether to repurchase and how much to repurchase, since it is assumed that management acts to maximize its own expected utility.

3.2.2 Dilution Costs

In self-tender and private repurchases, the offering price or transaction price is normally higher than the prevailing market stock price to insure the success of the tender offer or negotiation. The premium of offering price or transaction price over market price as a percentage is loosely defined in the literature as the dilution costs incurred by non-participating shareholders, including manager-insiders, because of the nonproportional reduction of the firm's value. Open market repurchases do not result in dilution costs since the firm simply pays the market price for the repurchased shares.

We define:

Pm	the prevailing stock price in the market.
Pr	the tendering price in a self-tender repurchase or the transaction price in a negotiated repurchase.
N	the number of shares outstanding before the repurchase.
m	the number of shares repurchased.
$(Pr - Pm)/Pm$	the premium of a self-tender or a privately negotiated repurchase
m/N	the fraction of shares repurchased relative to the total number of shares outstanding before the repurchase.

The total dilution costs in a self-tender or a private repurchase relative to the total market value before the transaction, or Dc, is defined in the literature as the product of the premium and the percentage of shares repurchased, or, $(Pr - Pm)/Pm \times m/N$. Dc can be interpreted as the extra wealth transferred from the non-participating shareholders to the participating shareholders relative to the market value of the firm. Simple algebra leads to the conclusion that the market price per share in the market would decline by $Dc/(1-m/N)$ if the total market value of the firm

was not altered by the transaction.

Since both the premium and the percentage of shares repurchased will affect the welfare of those non-participating shareholders, either of them alone is a good measure of the dilution costs. Compared with Dc, we argue that the theoretic percentage price decline, or, $Dc/(1-m/N)$, is a better and more relevant measure of dilution costs for the management and shareholders making repurchase and tendering decisions. Thus, we will use DCr to represent the new measure of dilution costs $Dc/(1-m/N)$. For example, if the premium is 25% and the percentage of shares sought in a self tender offer is 20%, then the traditional measure of the dilution costs will be 25%×20% = 5%, which represents the total dilution costs relative to the market value of the firm prior to the transaction. But decision makers will be more concerned with the impact of the stock repurchase program on the stock price per share, which would decline by 5%/(1-20%) = 6.25%, if the repurchase program did not change the perception of the market about the firm value.

3.2.3 Transaction Costs

The transaction costs for a particular repurchase program may include some or all of the following expenses: (1) brokerage fees and commissions; (2) legal or accounting fees; and (3) mailing and other miscellaneous costs. The management does not directly bear these costs. It would seem that the transaction costs are the highest for self-tender repurchases and the lowest for open market repurchases. Moreover, it is obvious that transaction costs are an increasing function of the size of repurchase.

3.2.4 Liquidity Costs

When a firm does not have sufficient cash to finance a repurchase program, it will incur liquidity costs comprised of all transaction costs and agency costs associated with debt financing

and lack of internal funds for investments. The magnitude of these costs is hard to measure and dependent upon the financial situation of the repurchasing firm and its investment opportunity set. These liquidity costs are not directly correlated with the choice of repurchase methods, but may be positively associated with the size of repurchase.

To this point we have discussed four types of costs incurred in stock repurchases to manager-insiders or the whole firm. Open market repurchases are less costly to management and current shareholders since they do not incur dilution costs as in the case of self-tender and premium private repurchases.

The costs to the management of using different repurchase methods, given a certain level of insider holdings, are probably of the order of magnitude as summarized below:

Costs	Repurchase Methods		
	Self Tender	*Open Market*	*Private*
Risk-Increase	same	same	same
Dilution	high	none	medium
Transaction	high	low	medium
Liquidity	same	same	same

3.3 Characteristics of the Three Repurchase Methods

In this section we discuss in some detail the characteristics of each of the three repurchase methods, which will enable us to better understand how the management makes decisions on repurchases.

3.3.1 Self-tender Repurchases

The major decision variables relevant in a self-tender repurchase are as follows:

- ° the tendering price, or the premium over the prevailing market price.
- ° the size of repurchase, or the percentage of shares to be repurchased.
- ° the tendering period, which may be extended upon the results of the initial offer.

Under the self-tender repurchase method it is possible to buy back a large quantity of shares from shareholders at relatively high costs. The characteristics of self-tender repurchases are as follows:

- ° the management clearly defines the terms of repurchase and is bound by these terms once announced.
- ° all current shareholders have a fair chance to participate in the repurchase program and

sufficient time to make a tendering decision.

°   tendering shareholders do not pay any brokerage fees, but untendering shareholders incur significant dilution costs, depending on the fraction of shares repurchased, the tendering premium, and their holdings of untendered shares.

°   the management usually refrains from tendering their own holdings, so they will bear part of the dilution costs according to the size of their inside-holdings.

°   there is no limit to the number of shares to be repurchased so long as the premium is high enough and not objected to by other creditors.

3.3.2   Open Market Repurchases

When the management decides to repurchase shares in the open market, the following decision variables need to be determined as well:

°   the size of repurchase, or the fraction of shares to be repurchased.

°   whether and how to announce the repurchase program.

°   how to implement the program, for example, the timing of the repurchase.

Open market repurchases are a low-cost and quick way to buy back a small quantity of shares from the market because

°   the management has complete discretion in announcing, implementing, and even canceling the repurchase program.

°   there are no dilution costs to nonselling shareholders including the insider-managers.

°   the transaction costs are low since the firm only pays ordinary brokerage fees.

3.3.3 Private Repurchases

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The difference between a self-tender and a private repurchase is that the former is a public offer while the latter is limited to one or a small group of shareholders. If the seller is a current or potential takeover bidder, the targeted private repurchase is generally called greenmail and may or may not be accompanied by a standstill agreement which specifies that over a certain period of time, for example, five years, the seller cannot hold a significant number of shares of the repurchasing corporation and launch a takeover. Of course, all privately negotiated repurchases are not greenmails. Sometimes, it is very difficult to determine whether a private repurchase is a greenmail.

The characteristics of private repurchases are as follows:

°   the premium could be very high, close to zero, or even negative, depending on how the repurchase is initiated and the relative bargaining powers of concerned parties in the repurchase process. There are also dilution costs to nonparticipating shareholders and the manager-insiders as well if the premium is positive.

°   the size of repurchase is not necessarily a decision variable since it may depend on the shareholders' holding distribution and bargaining power.

°   non-participating shareholders may be hurt since they are excluded in the repurchase and may even be unaware of the transaction at all.

3.4 Signalling Undervaluation and Repurchase Decisions

In Chapter Two we discussed in detail the theoretical speculations and empirical evidence in the literature on the motivations for stock repurchases and the subsequent market reaction to them. In this section and in following sections, we will investigate the relationship between each of the three motivations and the resulting repurchase decisions for a firm of certain characteristics, provided that the motivation, which is assumed to be represented by some observable financial variables, is strong enough for the firm to launch a stock repurchase program. Market reaction is also hypothesized depending upon firm characteristics and the repurchase decision.

If a firm's stock price is believed by management to be undervalued, the management may be willing to incur costs to repurchase its shares under the managerial-incentive assumption. The repurchase will be a signal to the market conveying the management's private information of stock price undervaluation, with the market recognizing the signalling role of the stock repurchase by observing the relevant characteristics, or signalling variables. In all dissipative signalling models of stock repurchases, in equilibrium the firms with more favorable information on stock value are willing to incur higher costs to signal the information to the market, with the market confirming the firms' expectations by responding more favorably to their announcements.

3.4.1 Self-tender Repurchases and Signalling

Self-tender repurchases are clearly the best signalling device, especially if the informational gap is large, because

° the manager-insiders incur high dilution costs as well as other potential costs, which makes the signal credible to the market.

° the management has little discretion once the terms of the repurchase are announced.

° the terms of a self tender repurchase clearly correspond to signal strength.

If a self tender is assumed to be motivated by signalling undervaluation, what roles do the premium and the fraction of shares sought play in the signalling equilibrium? Although both of them may be considered as signals, the interrelatedness between these two decision variables suggests that the composite measure of dilution costs, or, $Dc/(1-m/N)$, could summarize the information contents in these variables and be monotonically associated with the signal strength.

3.4.2 Open Market Repurchases and Signalling

Open market repurchases are also primarily believed to be motivated by signalling of undervaluation, although Yoon's model (1987) seems to the only one which explicitly establishes the role of open market repurchases in a signalling equilibrium. The credibility of open market repurchases as a signal could be due to the transaction costs, risk-increase costs, and possibly, liquidity costs, incurred. We would expect open market repurchases to be used as a signalling mechanism only in cases when the informational gap is small enough so that it is not cost effective to use self-tender repurchases to signal the private information concerning stock price undervaluation, because:

° the management does not incur any dilution costs and the transaction costs per share repurchased are not necessarily increasing with the size of repurchase.

° the repurchase decision is not binding on the management, which results in the signal's being less credible.

○ an open market repurchase program is usually executed over a long period, making the signal strength unclear to the market.

3.4.3 Privately Negotiated Repurchases and Signalling

Clearly, privately negotiated repurchases are not suitable for the purpose of signalling undervaluation of stock price, because:

○ the terms of private repurchases are not directly controllable by the management. They depend on the bargaining powers of both the firm and the seller or sellers. Whether there are takeover threats or contests for corporate control will surely affect the terms as well.

○ it is unfair to non-participating shareholders. Moreover, in extreme cases, the management may directly gain from the transaction at the expense of these shareholders. Therefore, even if private repurchases could be used as signals, the market will have difficulty interpreting the information contents.

○ furthermore, self-tender repurchases can always play a better role in signalling than private repurchases for all situations.

3.4.4 Summary of the Decision to Repurchase for Signalling

Our major hypotheses concerning the signalling motivation of stock repurchases and the repurchase decision can be described as follows:

(H1.1) If a firm's management believes that the market price of its shares is undervalued and is considering repurchasing shares to signal the private information, it will engage in a

self tender if the informational gap is large, or an open market repurchase program if the informational gap is small. However, the firm will not buy back its shares simultaneously through open market and self-tender repurchases for the purpose of signalling because doing this would make the signal very confusing and, as a result, unrecognizable by the market. Furthermore, the firm will not engage in privately negotiated repurchases.

(H1.2) The signal strength could be measured by the dilution costs $Dc/(1-m/N)$ in the case of self tenders and the fraction of shares the firm intends to repurchase in the case of open market repurchases. Moreover, it should be empirically observable that the signal strength is positively associated with the magnitude of the variables or financial characteristics which represent the informational gap.

3.4.5 The Effects of Firm Size on the Repurchase Decisions

Holding the informational gap constant, some other factors will indirectly affect a firm's decision to repurchase stocks through costs or constraints. We will discuss the effect of firm size in this study. Small-sized firms have been contended in the literature to be more willing to incur higher costs in making repurchase decisions to signal favorable information than large firms, because:

° small firms are followed much less closely by investors and financial analysts. Hence, it is more likely for small firms' stocks to be undervalued by the market, and

° small firms in general lack alternative signalling mechanisms.

Hence, we have the following hypothesis:

(H1.3)   Holding other things constant, a smaller firm is more likely to repurchase its shares, favor the use of self tenders despite the much higher costs than open market repurchases, and use a stronger signal.

3.4.6 Market Reaction to the Announcements of Repurchases for Signalling

If we assume a signalling equilibrium in which firms use repurchases to reveal their private information of share price undervaluation to the market, then the decisions on whether to repurchase, the repurchase method, and the signal strength by all firms should optimally reflect the informational asymmetry structure. This is a hypothesis to be tested in our empirical study. However, in order to examine the rational market reaction to the announcements of repurchases, we must first assume its validity.

By the rational market assumption, the market can recognize the informational asymmetry structure by observing certain informational variables or financial characteristics, hence we get the following hypothesis:

(H1.4)   the market reaction to the announcement of a repurchase program for the purpose of signalling stock price undervaluation is a positive and increasing function of the informational variable.

Several past empirical studies have regressed abnormal returns of repurchasing firms' stocks in the repurchase announcement period against such independent variables as tendering premium, firm size, and insider holdings. The interpretation of the results obtained in these studies urges strong cautions because use of signal strength in the regression is correct only on the implicit assumption that the data set contains only signalling motivated repurchases. However, this assumption is very hard to verify and consequently has never been checked!

In the present study we will endeavor to identify a clean sample of signalling motivated repurchases through scrutinizing certain financial characteristics and study the relationship between market reaction and possible signal strength. The conclusions are expected to be equivalent to the relationships between market reaction and signalling variables, since in a signalling equilibrium the signal structure fully reveals and reflects the informational asymmetry structure.

The use of indices such as firm size and insider holdings as independent variables in these types of regression is conceptually misspecified, because in making signalling decisions the management has already taken these factors into consideration, and hence the choice of repurchase method and signal strength such as fraction of shares sought and the premium in a self tender offer must have already captured the effect of these factors on the stock responses.

3.5 *Free Cash Flow and Repurchase Decisions*

When a firm has large amount of free cash flow, and the management's insider holdings are low, the cash payouts to shareholders through repurchases will reduce the agency costs associated with the free cash flow. Since, in general, agency costs are borne by the insider-managers, reducing agency costs is in the interest of the management, while the shareholders are better off as well with the firm's market value enhanced.

If management decides to repurchase its shares in order to reduce the free cash flow, it will try to minimize the costs incurred for any given amount of cash payouts. The costs will include transaction costs, risk-increase costs, and possibly dilution costs if either self-tender or premium private repurchase methods are used.

3.5.1 Open Market Repurchases and Free Cash Flow

Open market repurchases are the best approach to reduce free cash flow since management and current shareholders do not incur dilution costs and the transactions costs are minimal. The repurchase program may be implemented over a relatively long period, for example, two years. The size of repurchase relative to the firm's market value should be a positive function of the size of the free cash flow relative to the firm's market value. Unlike the stock repurchases for signalling purposes, open market repurchases for reducing free cash flow may not be announced, or may be announced after the transaction is finished in order to prevent increasing the share price at which stocks are bought back from the market.

3.5.2 Self-Tender Repurchases and Free Cash Flow

A self-tender repurchase is a less preferred method to dispose of free cash flow relative to an open market repurchase due to the dilution costs incurred by the management and the non-participating shareholders.

However, one circumstance may provoke the management to the use of a self-tender repurchase - the case in which the management wants to emphasize the aim of the repurchase as being a means of paying out free cash flow. In this case, when the management decides to make a self tender offer to shareholders, the premium should be set as low as possible to reduce dilution costs. However, it should not be set so low as to affect the success of the tender offer itself, especially if the fraction of shares sought is relatively large.

Again the total cash payouts relative to the firm's market value should be a positive function of the size of the free cash flow relative the the firm's market value.

3.5.3 Privately Negotiated Repurchases and Free Cash Flows

Private repurchases are not a good means of disposing free cash flow since a high premium is usually demanded by the seller or sellers for the solicited shares. Also a lack of full control over terms of the repurchase makes the management less likely to systematically use this method. Still, we cannot exclude the possibility of private repurchases to be used to reduce the free cash flow if the management happens to be able to buy back the desired fraction of shares from one or a group of shareholders at minimal premium for whatever the reasons.

3.5.4 Summary of the Repurchases Decision

Our major hypotheses concerning repurchases motivated by free cash flow can be described as follows:

(H2.1)   a firm with a large amount of free cash flow relative to its market value will pay out cash to shareholders primarily through open market repurchases. However, self tender offers and private repurchases may also play a complementary role in reducing the free cash flow if the management can succeed in the offer or negotiations with a minimal premium to the sellers. Hence, it is possible that we may observe the simultaneous use of open market repurchases, low-premium self-tender and private repurchases.

(H2.2)   the size of total cash payouts to shareholders relative to the firm's market value is a positively increasing function of the size of the free cash flow relative to the firm's market value.

3.5.5 Market Reaction to the Announcements of Repurchases

(H2.3)   It is expected that the market will respond favorably to the announcement of stock repurchases motivated by reducing agency costs associated with free cash flow. The magnitude of response is a positive function of the reduction in free cash flow.

3.6   Capital Structure Change and Repurchase Decision

Stock repurchases may be used to increase firms' debt-equity ratios, as suggested by many executives. This motivation for stock repurchases may be represented by debt-equity ratios. We would suspect that a stock repurchase by a firm with low debt-equity ratio and/or financed with new debt has a capital structure adjustment motivation, provided the financial characteristics do not suggest other, more plausible motivations.

As with repurchases motivated by reducing free cash flow, those firms that repurchase for the purpose of increasing debt-equity ratios will try to minimize costs incurred in the repurchase, which include transaction costs, risk-increase costs, and, if a self-tender or private repurchase is to be used, dilution costs. The liquidity costs would seem to be unavoidable since it is expected that the repurchases would be financed with new debt.

3.6.1   Open Market Repurchases and Capital Structure Change

An open market repurchase is the best approach to adjust a firm's capital structure because of its low costs and flexibility of implementation. The arguments previously presented for the use of open market repurchases as a means to reduce free cash flow are applicable to the present case. It is expected that the size of repurchase is negatively associated with the firm's current debt-equity ratio.

3.6.2 Self-tender Repurchases and Capital Structure Change

The self-tender repurchase is a less preferred method to increasing firms' debt-equity ratios relative to the open market repurchase due to the high dilution costs. Again, all the arguments presented in Section 3.5.2 are applicable, and, as such, they will not be repeated.

3.6.3 Privately Negotiated Repurchases and Capital Structure Change

Again, all the arguments presented in Section 3.5.3 are applicable, and, as such, they will not be repeated.

3.6.4 Summary of the Repurchases Decision

Our major hypotheses concerning repurchases motivated by increasing firms' debt-equity ratios can be described as follows:

(H3.1)   a firm with a low debt-equity ratio will repurchase its shares primarily through an open market repurchase. However, self-tender and private repurchases may also be used if the management can succeed in the offer or negotiations with a minimal premium to the sellers. In addition, the repurchase is normally financed with new debt if the firm lacks

cash. Hence, we may observe the simultaneous use of an open market repurchase, low-premium self-tender and private repurchases.

(H3.2)   the size of repurchase is a negative function of the firm's current debt-equity ratio.

3.6.5   Market Reaction to the Announcements of Repurchases

Since the manager-insiders incur risk-increase costs to increase their firm's debt-equity ratio, the stock price must go up to compensate management under the managerial-incentive assumption. Otherwise the managerial decision to repurchase would be irrational. The following are the major theories which maintain that buying back a firm's shares using the proceeds of new debt issues will increase the firm's market value:

- °   taxation advantage of debts;
- °   signalling effects of debts by Ross (1977) and
- °   reduction of free cash flow by Jensen (1986).

(H3.3)   It is expected that the magnitude of the market's response to the announcement of repurchases motivated by increasing a firm's debt-equity ratio is a positively increasing function of increase in the debt-equity ratio.

Summary

We have discussed how the management makes decisions on (1) whether to repurchase; (2) what combination of repurchase methods to use; and (3) the terms of repurchases in a cost-benefit framework under each of the three major motivations for repurchases. Since the motivations for repurchases are assumed to be represented by certain observable financial characteristics, we will examine the testable implications of these hypothesized motivations for repurchases.

We argue that self tenders are most suitable for signalling undervaluation, since their high dilution costs to the manager-insiders make the signal credible to the market. However, if the informational gap is small, an open market repurchase may be used to convey the management's insider information of stock price undervaluation. But the management will not engage simultaneously in open market and self-tender repurchases for the signalling purpose.

Open market repurchases are the best approach to dispose of free cash flow and/or to increase firms' leverage due to their relatively low costs and flexibility in implementation. Self-tender and premium private repurchases may be complementary methods to dispose of free cash flow and/or to increase firms' leverage since the management incurs dilution costs. Therefore, we may observe simultaneous use of open market, self-tender, and private repurchase methods for the purpose of disposing of free cash flow or increasing leverage.

The market reaction to the announcement of a stock repurchase program motivated for signalling undervaluation, reducing free cash flow, and increasing leverage is in general favorable, provided that the management chose the repurchase method and determined the terms of repurchase in the most cost-competitive manner.

Chapter Four   Methodology

In Chapter Three we presented testable hypotheses on stock repurchases and the relevant theoretical arguments. In this chapter an examination of the methodological approach to be used in testing these hypotheses is presented.

The first part of this chapter defines proxies of informational asymmetry, free cash flow, and capital structure to be used in our empirical study. These proxies or variables are firms' measurable financial characteristics. The second part of the chapter discusses statistical techniques to be utilized to find the associations between the three repurchase decision variables and the financial characteristics or proxies discussed in the first section of the chapter. We will also study what financial characteristic contributes most significantly to the abnormal returns in stock repurchase announcement period. Our statistical analysis and tests of repurchases consists basically of four components:

° A logit regression is run on the repurchase sample and a non-repurchase sample (control sample) to determine what motivates a repurchase. The dependent variable of the logit regression will be 1 if the observation is from the repurchase sample and otherwise 0, while the independent variables are those proxies for different motivations. The repurchase sample will be further separated into self-tender, open market, and private repurchase subsamples. Thus, logit regressions on these subsamples will enable us to find differences between the financial variables for the repurchase samples and control samples, identifying motivations for each group of repurchases, given the assumption

that motivations are correctly proxied and measured.

° A multiple-choice logit model is applied to the repurchase sample which contains self tenders, open market repurchases, and privately negotiated repurchases to study how a repurchase method is chosen by the management, given the financial characteristics and the decision to repurchase. The dependent variable is an index of repurchase method, while the independent variables are the proxies for motivations for repurchases.

° The fraction of shares repurchased, the premium, and the dilution costs in self tenders and private repurchases, as defined in Section 3.2.2, are regressed on the proxies to find what determines the terms of repurchases.

° The abnormal returns in the announcement period are regressed on the proxies to determine what financial characteristics are responsible for the market reaction.

Since we can easily transfer the hypotheses discussed in the previous chapter into predictions on the regression coefficients, the statistical tests on these coefficients are actually a direct test of the joint hypothesis of these three major hypotheses concerning motivations for stock repurchases and the assumption that we have correctly identified and measured proxies for these motivations.

4.1 Econometric Specifications

In this section we will specify variables which correspond to each of the three major repurchase motivations discussed in the previous chapter. Our statistical tests presented later will be based on the assumption that the motivations can be recognized by the market from observing relevant variables. Hence, correct identification and proper econometric specifications of the variables are critical to the validity of our statistical tests.

4.1.1 Signalling Variable -- Earnings Forecast Revisions

Expected future payoffs and an appropriate discount rate are the two basic factors present in nearly all valuation models in financial economics. Since it is much more difficult to define and measure the discount rate for a particular security than the expected future payoffs, it is natural that the informational asymmetry is usually assumed on the dimension of expected future payoffs of securities in most theoretical signalling models. Consequently, correct identification and accurate measurement of the proxy for the expected future payoffs in an informational structure are of vital importance in an empirical study of signalling models.

Many theoretical signalling models in the literature assume a significant role to financial announcements in conveying information on the future earnings perspective of the firm. This approach is employed in the papers of Vermaelen (1984), Ambarish, John and Williams (1987), Ofer and Thakor (1987), and Constantinedes and Grundy (1989). A direct test of these signalling models could be accomplished by examining revisions in market expectations of earnings around

the signalling events, provided that we can accurately approximate market expectations of firms' future earnings. As a proxy of the market's assessment of changes in firms' future cash flow stream, many studies have employed individual or composite earnings forecasts by analysts. Moreover, it has been shown by many authors (see Rao, Moyer, and Sivaramakrishnan (1990) for related literature) that there is a significant association between composite analyst forecast revisions and subsequent security returns.

Recently, there have been a number of studies utilizing composite earnings forecasts to test various financial signalling models. For example, Ofer and Thakor (1987) use composite earnings forecasts to test whether unexpected dividend changes serve as a signal of future earnings expectations. In addition, both Jain (1987) and Rao, Moyer and Sivaramakrishnan (1990) found limited evidence of a positive association between self-tender repurchase announcements and the upward revisions of composite earnings forecast. Thus, we will use the composite forecast revisions (reported in I/B/E/S data tape) around stock repurchase announcements to identify signalling-motivated repurchases.

It is not valid to use realized earnings to test a signalling model concerning financial announcements because earnings are affected by the accounting methods used and many material events may have happened during the period of time the realized earnings are assembled and reported. Furthermore, we are attempting to measure the inside information conveyed to the market by stock repurchase announcements instead of actual earnings realized.

In this study, it is assumed that market expectations of earnings are proxied by the mean or median composite analyst forecasts contained in the I/B/E/S historical summary tapes. The I/B/E/S tapes report median and mean forecasts by a number of analysts following a particular firm for various intervals of time such as the current fiscal year and the next fiscal year. We will use forecasts for the current fiscal year since it has the greatest number of analysts covering each firm. It may also be true that some events such as announcements of stock repurchases have the greatest impact on market expectations of earnings for the current fiscal year.

The I/B/E/S is in monthly format and its report date is usually the day before third Friday. We therefore use the day before third Friday as the cutoff point in determining the repurchase event month for a given announcement. That is, depending on whether an announcement in July

was made before or after (including at) the day before the third Friday of July, July or August would be the event month, or month 0.

We use up to four months following the announcements of repurchases of earnings revisions relative to the month before the announcement of repurchases because it has been documented that only a portion of the forecasts are updated monthly, resulting in composite analyst data in the I/B/E/S database for any given month containing some outdated forecasts. We also use the average of earnings forecasts over the four months after the repurchase announcements in order to address the same problem.

Another issue is whether the mean or median forecasts should be used as the proxy for market expectations with arguments in the literature favoring use of either one over another. We will simply use both of them to see whether the results will be different.

In our study the earnings forecast revisions are defined as simple percentage change of earnings forecast in month t ($t=0, 1, 2, 3$) relative to the month -1. However, calculations of percentage changes need special attention when the earnings per share is negative or very small. For instance, if earnings per share changes from \$0.01 to \$0.09, the percentage change would be 300% which is, of course, not comparable with a change from \$0.30 to \$2.70. The earnings forecast revisions for the firm i are defined as follows:

(1.1)   for $t = 0, 1, 2, 3$,

If $EF_{i,-1} >= \$.10$ then $EFC_{i,t} = EF_{i,t} / EF_{i,-1} - 1$;

If $EF_{i,-1} <= -\$.10$ then $EFC_{i,t} = 1 - EF_{i,t} / EF_{i,-1}$;

If $|EF_{i,-1}| <= \$.10$ and $EF_{i,t} >= \$0.20$ then $EFC_{i,t} = 1.00$;

If $|EF_{i,-1}| <= \$.10$ and $EF_{i,t} <= -\$0.20$ then $EFC_{i,t} = -1.00$;

If $|EF_{i,-1}| <= \$.10$ and $|EF_{i,t}| <= \$0.20$ then $EFC_{i,t} = EF_{i,t} - EF_{i,-1}$;

Where $EF_{i,t}$ = mean or median of composite analysts' earnings forecast for the firm i in month t.

    $EFC_{i,t}$ = earnings forecast revision for the firm i from month -1 to month t.

4.1.2 Free Cash Flow Variables

There are two proxies commonly used in the literature for free cash flow: (1) Tobin's Q; and (2) post-tax net cash flow to a firm relative to the market value of its common stock. In the current study, we use both of them.

4.1.2.1 Tobin's Q

Tobin's Q has two related meanings:

Marginal Q   the ratio of the market value of a firm's new additional investment goods to their replacement costs.

Average Q   the ratio of the market value of existing capital to its replacement costs.

Hayashi (1982) discusses the neoclassical interpretation of Tobin's marginal Q and average Q in economics. The optimal investment criteria is that a firm with a marginal Q greater than unity should invest until its marginal Q declines to unity. It is inferred from this investment rule that overinvestment is associated with a marginal Q less than unity (Lang and Litzenberger (1989)). Hence free cash flow can be measured by Tobin's Q: the more the Q is below unity, the larger the magnitude of the free cash flow.

Since the marginal Q is not operational and the average Tobin's Q is consistent in direction with the marginal Tobin's Q, the average Q is used to proxy for free cash flow in studies of Hasbrouck (1985), Morck, Shleifer, and Vishny (1988), and Lang, Stulz, and Walkling (1989). It is assumed now that the lower the average Tobin's Q is, the larger the magnitude of free cash flow. Still, the approximations of the market value of a firm's long-term debt and the replacement costs of assets in place pose significant computational challenges in the calculation of the average

Tobin's Q. In the current study, we will use the algorithm developed by Lindenberg and Ross (1981) to compute average Q. A detailed discussion of this algorithm methodology can be found in their original paper. Here we briefly describe its implementation in this study using the COMPUSTAT database with some minor modifications . Another problem with the calculation of Q is that Q may fluctuate from year to year with some randomness. We address this problem by computing Q for three fiscal years prior to the announcement of stock repurchases and then taking the average of the three Qs.

The annual 350-item files in the database COMPUSTAT are used to get data items for firms while the market-wide information such as average long-term bond yields are obtained from another source which will be mentioned below. Since the data items are reported in COMPUSTAT on a fiscal year basis, care is taken to get the Tobin's Q for the *fiscal* year prior to a firm's repurchase announcement.

The market value of a firm is defined as the sum of the market value of its common stock, the market value of its preferred stock, and the market value of total debt. The market value of a firm's common stock can be easily calculated as the product of the number of shares outstanding and the fiscal year-end close price (both items are available in COMPUSTAT files).

The market value of a firm's preferred stock is approximated as the total dividends on preferred stock divided by the average preferred stock yield in the market which is available in Moody's Bond Record. However, our calculations show that there is little effect on the Tobin's Q if the book value of preferred stocks is substituted for the market value of preferred stock. The reason is that preferred stocks comprise a very small percentage of a firm's total value.

The market value of a firm's total debt is the sum of the market value of its short-term debt and the market value of its long-term debt. The value of the short-term debt is taken as the face value of the debt which will mature within one year (COMPUSTAT item #5), since the face value will not deviate much from its market value. However, it is much more difficult to compute the market value of long-term debt.

In order to get approximations of the market value of a firm's long-term debt at *year t* using data available in COMPUSTAT files, two assumptions are made: (1) all long-term bonds are issued for a single maturity of *twenty* years, and (2) the interest rate of a firm's long-term debt

at any *year k* is the average bond yield in the market at the same year with the same rating. Since the rating for a firm's bonds is available in COMPUSTAT (item #280), it is easy to compute the approximate market price at *year t* of a unit bond issued at *year k* using the average bond yield obtained from Standard & Poor's Bond Guide. The next step is to get the maturity structure or distribution of a firm's long-term debt at year t. The percentage of a firm's total long-term debt which was issued at year k (k=t-18 to t) is defined as the ratio of the long-term debt issued at the year k (COMPUSTAT item #111) to the sum of all new issues of long-term debts from year t-18 to year t. Given a firm's total long-term debt (COMPUSTAT item #9), it is easy to get the approximation of its market value using the approximate market prices of unit bonds and the maturity distribution.

The measurement of replacement cost is even more difficult than that of the market value of long-term debt. The Lindenburg-Ross methodology for the adjustment of plant and equipment and inventories is adopted with the following modifications:

(1) The base year for the recursive calculation[3] is *1970* since only 20 years of data are available in the 1990 COMPUSTAT files.

(2) The rate of cost-reducing technical progress is assumed to be zero since the data is not available.

(3) The GNP deflator for nonresidential fixed investment is obtained from the Predicasts' Basebook for 1970 through 1988 and from the Survey of Current Business for 1989.

(4) The Wholesale Price Index for inventories is obtained from the Predicasts' Basebook for 1970 through 1984 and from the Survey of Current Business for 1985 to 1989.

Since all other information needed for the calculation of replacement cost is available in the COMPUSTAT files, it is not difficult to code a program to get approximations of the replacement cost of a firm's total assets. Then the calculation of Tobin's Q follows as the market value of the firm divided by the replacement cost of its assets. It is also noted that the market value-based long-term debt-equity ratio and total debt-equity ratio are easily obtained after the approximations for the market value of long-term debt are done.

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[3]Equation (18) in Lindenberg and Ross (1981).

4.1.2.2 Post-tax Cash Flow

In their empirical study on free cash flow and going private transactions, Lehn and Poulsen (1989) uses accounting data to measure the magnitude of free cash flow: the higher the current post-tax cash flow relative to the market value of equity, the larger the magnitude of free cash flow. The definition of firm i's post-tax cash flow in year t and its computational formula using COMPUSTAT 350-item annual data files is as follows:

$$AFCF_{i,t} = (INC_{i,t} - TAX_{i,t} - INTEXP_{i,t} - DIVDPS_{i,t} - DIVDCOM_{i,t}) / EQUITY_{i,t} \quad (1.2)$$

for t = -3, -2, -1 where t=0 is the year in which the repurchase is announced.

Where

$AFCF_{i,t}$	firm i's free cash flow in year t relative to its market value of equity
$INC_{i,t}$	operating income before depreciation, or, COMPUSTAT item #13.
$TAX_{i,t}$	total income tax minus change in deferred taxes from the previous year to the current year, or, COMPUSTAT item #16 - item #35.
$INTEXP_{i,t}$	gross interest expenses on short- and long-term debts, or, COMPUSTAT item #15.
$DIVDPS_{i,t}$	total preferred dividends, or, COMPUSTAT item #19.
$DIVDPS_{i,t}$	total dividends on common stocks, or, COMPUSTAT item #21.
$EQUITY_{i,t}$	market value of common stocks at the fiscal year end, or, COMPUSTAT item #25 time item #199.

4.1.3 Capital Structure Variable

The capital structure variable is assumed to be proxied by either the ratio of long term debt to equity or the ratio of total debt to equity with all variables measured at market prices or

approximated as market values. The algorithm for computations of the market value of long-term debt is the one suggested by Lindenberg and Ross (1981) which is discussed briefly in the previous section. The market value of short-term debt or long-term debt maturing within one year is assumed to be equal to its book value. We can also compute the ratios for several years prior to the announcement of the repurchase and take the average of them.

4.1.4 Summary of Motivational Variables

Below is a short summary of financial variables used to represent the three major motivations for stock repurchases in this study:

Signalling	earnings forecast percentage changes using I/B/E/S monthly mean or median forecasts.
Free Cash Flow	average Tobin's Q or post-tax net cash flow relative to the firm's market value of common stocks using 350-item COMPUSTAT data files.
Leverage Increase	ratio of market value approximations of long-term or total debt to the market value of common stocks by Lindenberg and Ross(1981) methodology using 350-item COMPUSTAT data files.

4.2 Methodology

In this section we will specify empirical methods of testing the hypotheses discussed in Chapter Three concerning the repurchase decision process and translate these hypotheses into statistical tests of parameters or coefficients of regressions. Employed are various statistical techniques including binomial logit regression, multiple-choice logit regression, ordinary-least-squares (OLS) regression, parametric and non-parametric sample location tests, and, finally, the standard event study methodology. This cluster of statistical analyses are concerted on a single tune: what is the true motivation behind a stock repurchase program.

With a data set of all self tender, open market, and privately negotiated repurchases occurring in the period of 1986-April, 1989, we are able to divide the whole sample into subsamples of sufficient size according to the repurchase method. Then various statistical procedures can be applied on the subsamples. The test procedures are organized to study the three dimensions of the stock repurchase decision and the market reaction to the announcement of stock repurchases in the following order: (1) whether to repurchase; (2) the method to be used; (3) the fraction of shares to be repurchased or the premium in a self-tender or privately negotiated repurchase; and (4) the market reaction and its relationship with the motivations for repurchases.

It is widely believed that most of the open market repurchase announcements made in the few weeks following the October, 1987 stock market crash were motivated primarily by firms attempting to stabilize their stock prices. Thus, whenever applicable, we will group the sample of open market repurchases into subsamples with and without these announcements in our statistical analysis in order to distinguish these open market repurchases with distinct motivation from ordinary open market repurchases.

4.2.1 Logit Regression and Decision to Repurchase

Each repurchase in the sample is matched with one non-repurchasing firm according to the time, the three-digit industry code, and the market value of common stocks. Those chosen non-repurchasing firms then form the control sample. Different control samples are constructed for each of the samples of all repurchases, self tender offers, open market repurchases, and privately negotiated repurchases.

First a binomial logit regression is used on a repurchasing sample and its control sample to identify financial variables or proxies for repurchasing motivations which are statistically significant in increasing a given firm's probability to repurchase shares. Then mean differences of the financial characteristics representing the repurchase motivations between a repurchasing sample and a control sample are tested using pairwise parametric and non-parametric procedures (PROC UNIVARIATE in SAS) to confirm the results obtained in the logit regression.

The logit regression is specified as follows:

$$ln[P_1 / P_0] = \alpha_0 + \alpha_1 EFC + \alpha_{2.1}Q + \alpha_3 D/E \qquad (2.1A)$$

or

$$ln[P_1 / P_0] = \alpha_0 + \alpha_1 EFC + \alpha_{2.2}AFCF + \alpha_3 D/E \qquad (2.1B)$$

where

P_1	the probability that a given firm will repurchase.
P_0	the probability that a given firm will not repurchase, which equals $1-P_1$.
EFC	a given firm's earnings forecast revisions as defined in Section 4.1.1.
Q	a given firm's average Tobin's Q as discussed in Section 4.1.2.1. The smaller this quantity is, the larger the amount of free cash flow.

AFCF   a given firm's post-tax net cash flow relative to its market value of common

stocks as discussed in Section 4.1.2.2. The larger this quantity is, the larger

the amount of free cash flow.

D/E_i firm i's market value approximation ratio of long-term debt or total debt to

equity.

The maximum likelihood estimation and approximate χ^2 test are applied to the logit regression to get ML estimates and test statistic for the regression coefficients. When interpreting the results, one should be cautioned that estimated coefficients do not indicate the increase in the probability of the event occurring given a one unit increase in the corresponding independent variable. The coefficients reflect the effect of a change in an independent variable upon the quantity $\ln[P_1/(1-P_1)]$. As a matter of fact, the amount of the increase in the probability depends upon all the independent variables and their coefficients. Thus, while the sign of the coefficients does indicate the direction of the change, the magnitude is not a linear function of the coefficients.

Since the logit regression methodology and the interpretation of results are fairly standard and readily available, they are not discussed in detail further here. The procedure used is LOGISTIC in SAS Version 6.6, with the documentation and reference contained in SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 2.

The predictions of signs of coefficients by the various hypotheses discussed in Chapter 3 can be summarized as follows:

Hypotheses	**Predictions**			
	All Buy-Backs	*Open-Market*	*Self Tender*	*Private*
(H1.1)	$\alpha_1 >= 0$	$\alpha_1 >= 0$	$\alpha_1 > 0$	$\alpha_1 = 0$
(H2.1)	$\alpha_{2.1} <= 0$	$\alpha_{2.1} < 0$	$\alpha_{2.1} <= 0$	$\alpha_{2.1} <= 0$
(H2.1)	$\alpha_{2.2} >= 0$	$\alpha_{2.2} > 0$	$\alpha_{2.2} >= 0$	$\alpha_{2.2} >= 0$
(H3.1)	$\alpha_3 <= 0$	$\alpha_3 < 0$	$\alpha_3 <= 0$	$\alpha_3 <= 0$

4.2.2 Multiple-Choice Logit Regression and Choice of Repurchase Methods

Upon making the decision to repurchase, the firm must then determine the repurchase methods to be used. Since the decision whether to use a self tender offer, open market, and private repurchase method is a multiple choice problem, we can readily use multiple-choice logit regression (multinomial logit regression) to test our hypotheses concerning the choice of repurchase methods. The data set to be used in the multinomial logit regression is the whole repurchasing sample including all three types of repurchases. The dependent variable is an index variable with three values: 1 if it is an open market repurchase, 2 if a private repurchase, and 3 if a self tender offer. The independent variables are the motivational variables.

We will also use binomial logit regression on open market versus private, open market versus self tender, and private versus self tender to confirm the results obtained through the multinomial logit regression. Parametric and non-parametric sample location tests will also be used to find out what financial variables are distinct for each type of repurchase. The results from this statistical analysis, if consistent, will give us a clear picture about what determines a firm's choice of a particular method.

The multiple-choice logit regression is specified as follows:

$$ln[P_o / P_s] = \beta_{10} + \beta_{11} lnSIZE + \beta_{12} EFC + \beta_{13} Q + \beta_{14} D/E$$

and   (2.2)

$$ln[P_p / P_s] = \beta_{20} + \beta_{21} lnSIZE + \beta_{22} EFC + \beta_{23} Q + \beta_{24} D/E$$

where

P_o the probability that a repurchasing firm will use the open-market method.

P_p the probability that a given firm will use the private-repurchase method.

P_s	the probability that a given firm will use the self-tender method[4].
lnSIZE	log of a given firm's market value of its common stock.
EFC	a given firm's earnings forecast revisions as defined in Section 4.1.1.
Q	a given firm's average Tobin's Q as discussed in Section 4.1.2.1. The smaller this quantity is, the larger the amount of free cash flow.
D/E	a given firm's market value approximation ratio of long-term debt or total debt to equity.

Since multinomial logit regression is a generalization of binomial logit regression, they share the same methodology as the maximum likelihood estimation and asymptotic χ^2 test. The interpretation of results from the multinomial logit model is also similar to interpretations of results from the binomial logit model and will not be repeated here. The procedure used is CATMOD in SAS Version 6.6, whose documentation and reference are contained in SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 1.

The predictions of signs of coefficients by various hypotheses discussed in Chapter 3 can be summarized as follows:

Hypotheses	Predictions
(H1.1)	$\beta_{11} \geq 0$ and $\beta_{21} < 0$
(H1.3)	$\beta_{12} \geq 0$
(H2.1)	$\beta_{13} < 0$ and $\beta_{23} < 0$
(H3.1)	$\beta_{14} < 0$ and $\beta_{24} < 0$

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[4]Notice that $P_o + P_p + P_s \equiv 1$.

4.2.3 Determination of Fraction of Shares Repurchased in Open Market Repurchases

The single most important term of open market repurchases is the fraction or percentage of shares to be repurchased relative to the total number of shares outstanding before the repurchase. It is assumed that the stronger the motivation for an open market repurchase is, the larger will be the fraction of shares sought in an open market repurchase. An ordinary-least-square (OLS) regression is run on the sample of open market repurchases with the fraction of shares repurchased as the dependent variable and the proxies for repurchasing motivations as independent variables.

The OLS regression is specified as follows:

$$FRAC = \gamma_0 + \gamma_1 lnSIZE + \gamma_2 EFC + \gamma_3 Q + \gamma_4 D/E \qquad (2.3)$$

where

FRAC	fraction of shares to be repurchases, which equals *m/M*.
m	the number of shares to be repurchased in the announcement of a given firm's open market repurchase program.
M	a given firm's total number of shares outstanding before the open market repurchase program is implemented.
lnSIZE	log of a given firm's market value of common stocks.
Q	a given firm's average Tobin's Q as discussed in Section 4.1.2.1. The smaller this quantity is, the larger the amount of free cash flow.
D/E	a given firm's market value approximation ratio of long-term debt or total debt to equity.

The predictions of signs of coefficients by various hypotheses discussed in Chapter 3 can be summarized as follows:

Hypotheses	Predictions
(H1.2)	$\gamma_1 >= 0$
(H1.3)	$\gamma_2 <= 0$
(H2.2)	$\gamma_3 < 0$
(H3.2)	$\gamma_4 < 0$

For self tenders and privately negotiated repurchases, the repurchasing premium is probably as important, if not more, than the fraction of shares sought. Thus, we are less like to find any significant coefficients if the same OLS regression is run on samples of self tenders and private repurchases.

4.2.4 Dilution Costs in Self Tender Offers

If management decides to repurchase shares through a self-tender offer, it must determine both the fraction of shares to be repurchased and the premium. These two decision variables are interrelated to the extent that a higher premium is demanded in order to repurchase a larger fraction of shares. Given a certain level of insider holdings, a good composite measure of these two variables is the dilution cost discussed in the previous chapter, or, DC_r .

Unfortunately, the interpretation of this dilution cost depends on the invalid assumption of an uniform level of insider holdings across firms since DC_r measures the theoretical decline of price per share if the repurchase did not alter the market value of the firm. The 'true' dilution costs to manger-insiders are the product of DC_r times insider holdings. Since we do not have sufficient data on insider holdings of firms which have repurchased through self tender offers, we will use DC_r in our regression as specified as follows:

$$DC_r = \theta_0 + \theta_1 lnSIZE + \theta_2 EFC + \theta_3 Q + \theta_4 D/E \qquad\qquad (2.4)$$

where

DC_r	dilution costs of a self tender or private repurchase defined as the quantity (Premium * Fraction / (1 - Fraction)).
$lnSIZE$	log of a given firm's market value of its common stock.
Q_i	a given firm's average Tobin's Q as discussed in Section 4.1.2.1. The smaller this quantity is, the larger the amount of free cash flow.
D/E_i	a given firm's market value approximation ratio of long-term debt or total debt to equity.

The predictions of signs of coefficients by various hypotheses discussed in Chapter 3 can be summarized as follows:

Hypotheses	Predictions
(H1.2)	$\theta_1 >= 0$
(H1.3)	$\theta_2 <= 0$
(H2.2)	$\theta_3 < 0$
(H3.2)	$\theta_4 < 0$

This regression is also run on the sample of private repurchases.

4.2.5 Market Reaction and Financial Characteristics

There have been numerous studies dealing with the market reaction to the announcements of stock repurchases. Most of them simply computed abnormal returns in the announcement period and then declared the results as supportive evidence to some hypothesis such as signalling. The problem with the methodology used in these studies is that the sample may be mixed up with repurchases with different motivations. Therefore, it is not appropriate to attribute the market reaction to some particular motivation.

We will try to differentiate the three major competing hypotheses concerning the repurchase motivations by regressing the abnormal returns in the announcement period on the set of financial characteristics. The regression would be able to find the dominating factors causing the abnormal price movement in the announcement period. Based on the market rationality assumption, the motivation for stock repurchases is recognizable by observing certain financial variables. This is the idea behind our regression of abnormal returns on proxies for repurchasing motivations.

The first step is to use the market model to get abnormal return in the announcement period for each repurchasing firm.

4.2.5.1 The Standard Event Study Methodology

The standard event study methodology is used to compute the abnormal returns over the announcement period for stock repurchases. Since repurchases in our sample concentrated in 1986-1989, we adopt the procedure used in Mikkelson and Partch (1986) to avoid a possible clustering effect.

Average daily prediction errors, or excess returns, are measured around the

announcement of the repurchases. The prediction error for the common stock of firm i on day t (t=0 is the announcement date) is defined as

$$PE_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \qquad (t = -50, 20) \qquad (2.5.1)$$

where

R_{it} the rate of return for the common stock of firm i on day t which equals item variable RET(.) in CRSP data files.

R_{mt} the rate of return for the CRSP equally weighted index on day t.

α_i, β_i the coefficients of ordinary least square estimates of firm i's market model parameters. The estimation period is (-150,-51).

The average interval prediction errors or cumulative excess returns are computed for three intervals:(-50, -2), (-1, 1), and (2, 10), which yields *CAR(-50, -2)*, *CAR(-1, 1)*, and *CAR(2, 10)*. The asymptotically normally distributed Z-statistic is computed in a manner similar to that of Mikkelson and Partch (1986). These statistics are expected to be consistent with the results reported in past empirical studies on stock repurchases although the magnitude may be different since many others use the mean-adjusted model instead of the risk-adjusted market model.

4.2.5.2 Market Reaction and Motivations for Repurchases

Ordinary-least-squares (OLS) regressions are run on subsamples of self tenders, open market repurchases, and private repurchases with the cumulative excess return *CAR(-1,1)* around the announcement period used as the dependent variable and the motivational proxies as the independent variables.

Since abnormal returns are computed for short time interval (three days), and some motivational proxies such as Tobin's Q are obtained using annual data, the OLS regression may

fail in the model's goodness-of-fit test and thus does not have enough power to detect the expected association. The regression is specified as follows:

$$CAR(-1, 1) = \omega_0 + \omega_1 EFC + \omega_2 Q + \omega_3 D/E \qquad (2.5.2)$$

where

CAR(-1, 1)	a given firm's cumulative excess return in interval (-1, 1).
EFC	a given firm's earnings forecast revisions as defined in Section 4.1.1.
Q	a given firm's average Tobin's Q as discussed in Section 4.1.2.1. The smaller this quantity is, the larger the amount of free cash flow.
D/E$_i$	firm i's market value approximation ratio of long-term debt or total debt to equity.

The predictions of signs of the regression coefficients by various hypotheses discussed in Chapter 3 can be summarized as follows:

Hypotheses	**Predictions**			
	All Buy-Backs	*Open-Market*	*Self Tender*	*Private*
(H1.4)	$\omega_1 \geq 0$	$\omega_1 \geq 0$	$\omega_1 > 0$	$\omega_1 = 0$
(H2.3)	$\omega_2 \leq 0$	$\omega_2 < 0$	$\omega_2 \leq 0$	$\omega_2 \leq 0$
(H3.3)	$\omega_3 \leq 0$	$\omega_3 < 0$	$\omega_3 \leq 0$	$\omega_3 \leq 0$

Chapter Five   Data and Results

This chapter first describes the data set of stock repurchases that occurred from January 1986 through April, 1989. Simple descriptive statistics are computed on each subsample. Four sections then follow reporting results of the statistical analysis and tests in the order of presentations of the methodology given in the previous chapter. The construction of the subsamples used in a specific type of statistical analysis is discussed in each section, preceding presentations of results.

Before we begin to present results of various types of statistical analysis, an explanation is due on the use of different samples in various stages of statistical analysis in this study. The reason is that each type of statistical analysis may require data available in different databases such as COMPUSTAT, I/B/E/S, and CRSP. In order to have the maximum number of observations in each study, we keep all data points available in the databases required in each particular step of the analysis, resulting in different subsamples across the whole study. One may argue that the final samples may not represent good sampling of the population of repurchases that occurred over the January, 1986 though April, 1989 period. This criticism of the sampling technique is valid to all empirical studies that involve sampling. To counter this criticism, we will get simple descriptive statistics on each subsample of repurchases and compare them with the population parameters reported in Table 1 and Table 3, to show that our final samples for analysis are good statistical representatives of the entire stock repurchases population. A summary of this study will be the subject of the next chapter.

5.1 Data

From January, 1986 to April, 1989, there were a total of 3141 stock repurchase announcements made by 2078 exchange-listed and OTC companies. The overwhelming majority are the 2695 open market repurchases by 1892 corporations, while there are only 121 self tender offers and 325 privately negotiated repurchases. The data set contains company identification information, announcement date, and terms of repurchase such as fraction of shares sought, offering price for self tenders, and transaction prices for private repurchases.

Table 1 reports simple statistics of the terms of repurchase for each type of repurchases. The mean fraction of shares to be repurchased is 22.50 percent for self tender offers, 10.61 percent for private repurchases, and only 7.02 percent for open market repurchases. They are of the same order of magnitude with those reported in past studies. The medians are slightly smaller than the means of fractions of shares sought in all three types of repurchases.

The top section of Table 2 shows the distribution of the number of repurchases for each year and the bottom section reports repurchases that occurred over the period of one, two, and three weeks immediately following the stock market crash on October 19, 1987. The striking fact is that there were huge number of open market repurchases announced during the crash period. Approximately half (50.1%) of all open market repurchases that occurred in 1987 were announced within two weeks after the stock market crash.

We reviewed the study of Netter and Mitchell (1989) which examined about 600 open market repurchase announcements over the period October 19 through October 30, 1987 in Chapter Two. These open market repurchases were believed to be motivated by the management's desire to signal that their stock prices had declined below their true risk adjusted values after the extraordinary market declines surrounding October 19, 1987. Thus, these open market repurchases may have different motivations from an ordinary open market repurchase.

This simple fact no doubt demonstrates the signalling role an open market repurchase could play, especially in extraordinary circumstances. Also notice that the number of self tender offers and private repurchases did not increase during the crash period because firms were unwilling to commit themselves to repurchases at fixed prices of self tender offers and private repurchases while prices were changing rapidly.

Since those open market repurchases that occurred in the 1987 crash period comprise a distinct sample, our statistical analysis will be applied to this subsample of open market repurchases as well as the sample of all open market repurchases and the sample of open market repurchases that occurred outside the crash period. Table 3 reports the comparison of simple statistics of open market repurchase announcements that occurred during the three-week crash period of October 19 through November 9, 1987 and those announcements made outside this time window. It is obvious that these two subsamples have almost an identical mean and median fraction of shares to be repurchased while the maximum repurchase is larger during the crash period than outside the crash period.

The sample of open market repurchases that occurred outside the 1987 crash period is further grouped into two subsamples: those made before October 19, 1987 and those made after November 9, 1987. It is evident that these subsamples of open market repurchases all have approximately equal mean and median fractions of shares sought.

5.2 Results of the Comparison Study on Repurchasing and Non-repurchasing Firms

This section reports results on logit regression for the repurchasing samples and control samples. A description of how the control samples are constructed precedes presentations of regression coefficient estimates and tests. The comparison study is done on each group of open market, self tender, and private repurchases. Thus these results will be presented separately as well. All p-values of tests against the null hypothesis that the coefficient is zero are reported as two-tailed tests, which result in more conservative conclusions regarding these coefficients.

Since there is one-to-one correspondence between repurchasing firms and matching non-repurchasing firms, pairwise tests on the hypothesis that the mean difference between the motivational variables for repurchasing and non-repurchasing firms is zero would in general confirm the results obtained through the logit regression (although the latter takes into consideration the interactions of independent variables). As such we will also report the results of these pairwise tests for some cases.

The methodology and interpretation of logit regression were discussed in Section 4.2.1. The pairwise tests are conducted on the difference between the motivational variables for each repurchasing firm and its matching non-repurchasing firm. Then this "difference" variable is tested on the hypothesis that its mean is zero by a t-test and a Wilcoxon signed rank test, using PROC UNIVARIATE in SAS.

5.2.1 Construction of Control Samples

The construction of control samples is of vital importance to the validity of results obtained in a comparison study of repurchasing and non-repurchasing corporations. Since the calculation of the Tobin's Q, the debt-equity ratio, and the earnings forecast changes involves COMPUSTAT and I/B/E/S databases, both the final repurchasing sample and control sample consist of firms which are included in both of these databases.

For each of the subsamples of (1) self tenders, (2) private repurchases, (3) all open market repurchases, (4) open market repurchases announced in the 1987 crash period, (5) open market repurchases announced outside the crash period, (6) open market repurchases announced before October 19, 1987, and (7) open market repurchases announced after November 9, 1987, we construct a separate control sample of firms which did not repurchase using any method over the 1986-April, 1989 period. Each observation in an repurchasing subsample is first matched by all non-repurchasing firms according to the criteria of inclusion in both databases as of the announcement day of the repurchasing firm, the three-digit SIC industry code (item DNUM in COMPUSTAT), and less than fifty percent absolute difference between the average market values of the common stocks over the 1983-1989 period. The final matching firm will be the one with the minimum absolute difference between the average market value of common stocks.

It is possible that a repurchasing firm may have missing data for the independent variables, or does not have a matching firm satisfying the three criteria specified above. If that is the case, such a firm will be deleted from our repurchasing sample. The procedure may also result in a non-repurchasing firm matched to several repurchasing firms in a same repurchasing subsample. This is allowed since a firm may have multiple repurchases over the period from January, 1986 through April, 1989. Moreover, the matching up of the date for computation of financial variables eliminates any discrepancy among a pair of repurchasing and non-repurchasing firms in terms of timing.

Although we do not include the exchange listed as a criterion for the construction of control samples, we calculate the percentage of firms listed on the New York and American Stock

Exchanges for each repurchasing subsample and its control sample and report them along with the main results in the presentations of our comparison study of repurchasing and non-repurchasing samples.

We first report findings based on the following independent variables: the *median* earnings forecast change in the *second* month, or $EFC_{i,t}$ (t=2), from the month prior to the announcement of repurchase, the *average* of annual Tobin's Q over the *three* fiscal years prior to the repurchase, and the *average* of annual *market-value long-term* debt-equity ratio over the *three* years prior to the repurchase in the order of open market repurchases, private repurchases, and self tenders. Later we will also report results based on combinations of other independent variables and show that all the results are consistent.

5.2.2 Results on Open Market Repurchases

5.2.2.1 Results From Logit Regression

Table 4 reports the coefficient estimates and their p-values for the χ^2 tests of the logit regression (2.1.A) for the open market, private, and self tender repurchases subsamples and their control samples. The discussions of the results of the private and self tender repurchases will be the topic of the next two sections.

There are 413 open market repurchases and an equal number of control firms used in this regression with no missing value for the independent variables. Although this only represents about 15 percent of all open market repurchases, as shown in Table 1, the sample is sufficient for our statistic analysis. The entry "Chi-Square (DF=3) " is the quantity of -2ln[likelihood function] measuring the importance of the three independent variables in the regression and equals 16.064. Since it is has a χ^2 distribution with three degrees of freedom, the p-value is 0.001. Thus, the null hypothesis that the coefficients of all three independent variables are zero is rejected at the one percent significance level.

The coefficient estimate for the variable EFC_t (t=2) is 0.476 and its two-tailed test against

the hypothesis that the coefficient is zero is significant at the 5 percent significance level. Thus, there is a positive association between upward earnings forecast revisions and the event that a firm repurchases through the open market. Put another way, there is a significant difference between the upward earnings forecast revisions for repurchasing firms and non-repurchasing firms.

Since firms with lower Tobin's Qs have a larger amount of free cash flow in relative terms, the free cash flow hypothesis of stock repurchases predicts a negative coefficient for the variable Tobin's Q in the logit regression. The results for the sample of open market repurchases supports this hypothesis. The maximum likelihood estimate is -.328 with a p-value of 0.002. Thus, a firm with a lower Tobin's Q is more likely to repurchase in open market than a firm with a high Tobin's Q.

The estimate of the coefficient for the long-term debt-equity ratio is -0.393 with a p-value of 0.015 and is consistent with the prediction of the leverage hypothesis of stock repurchases that a firm with a lower debt-equity ratio is more likely to repurchase shares in order to increase its debt-equity ratio.

It seems that all three major hypotheses on motivations for stock repurchases are supported in the case of open market repurchases in the logit regression. However, this sample of open market repurchases includes the open market repurchases announced in the 1987 crash period in addition to those outside the crash period. As discussed before, they may have different motivations. Thus, the logit regression is run on the subsample of open market repurchases which occurred from October 19 to November 9, 1987, on the subsample of open market repurchases made outside the three-week crash period window, on the subsample of those open market repurchases which occurred prior to October 19, 1987, and on the subsample of open market repurchases that occurred after November 9, 1987 and their control samples. The results are reported in Table 5.

All the four subsamples have a sufficient number of observations and the logit regressions exhibit a high degree of fit. Although the coefficients of the independent variables have the same signs across the four subsamples, it is obvious that they are not all significant in a statistical sense. It is a striking finding that the positive relationship between the upward earnings

forecast revisions and the event of open market repurchases is significant at the 5 percent significance level only for those repurchases which occurred *in* the 1987 crash period, while the negative coefficient for Tobin's Q is significant only for those repurchases that occurred *not* in the crash period. Three major conclusions can be drawn from these results:

(1) The signalling hypothesis of stock repurchases is supported for those open market repurchases which occurred in the three weeks following the October 19, 1987 stock market crash. The coefficient estimate for the variable of earnings forecast revisions is 1.792 with a p-value of 0.009.

(2) The free cash flow hypothesis of stock repurchases is supported for those open market repurchases which did not occur in the three-week crash period of 1987. The coefficient and p-value are -0.465 and 0.001 for the subsample of open market repurchases which occurred either before October 19 or After November 9, 1987. They are -.571 and 0.007 for the subsample of open market repurchases which occurred before October 19, 1987. As for the subsample of open market repurchases that occurred after November 9, 1987, the coefficient estimate and p-value for the Tobin's Q are -0.383 and 0.029.

(3) Since the results are so consistent with our predictions presented in Section 4.2.1, these results support the ability of earnings forecast revisions and Tobin's Q to act as good proxies, respectively, for the signalling and free cash flow motivations.

While these results are robust for various specifications of independent variables and statistical tests, the results for the debt-equity ratio do not yield consistent conclusions. In Table 5 it is evident that the coefficient of the D/E Ratio is not significant for the subsample of open market repurchases that occurred in the 1987 crash period. However, for the subsample of open market repurchases which did *not* occur in the crash period, the coefficient estimate is -0.561 with a p-value of 0.012. This subsample is further grouped into the subsample of open market repurchases which occurred before October 19, 1987 and the subsample of open market repurchase which occurred after November 9, 1987. It is apparent that the coefficient of D/E Ratio is significant only for the subsample of open market repurchases which occurred after November 9, 1987. As we will show later, the significance of D/E Ratio in this subsample may be

caused by the interactions between this variable and the Tobin's Q due to the significant price declines over the crash period.

We now turn to the pairwise tests on the three independent variables between repurchasing firms and control firms in order to find more evidence in support of the conclusions drawn from the results of logistic regressions reached in this section.

5.2.2.2 Results From Pairwise Tests

Table 6 through Table 10 report the descriptive statistics of repurchasing and non-repurchasing firms and results of pairwise tests on the differences between repurchasing and non-repurchasing firms for each of the following open market repurchase subsamples and their control samples: (1) all open market repurchases; (2) open market repurchases which occurred from October 19 to November 9, 1987; (3) open market repurchases which occurred either before October 19, 1987 or after November 9, 1987, (4) open market repurchases which occurred before October 19, 1987, and finally, (5) open market repurchases that occurred after November 9, 1987. Of course, these are the same subsamples whose logit regression results were presented and discussed in the previous section.

The mean fractions of shares sought in these subsamples of open market repurchases vary from 7.19 percent to 7.65 percent. They are very close to the mean fraction of shares sought in the open market repurchase population of 7.02 percent as shown in Table 1. The median fractions of shares sought in these subsamples vary from 5.10 to 6.00 percent, again, not much different from the median of 5.30 percent for the general population. Thus, it appears that these subsamples are good representatives of the population.

These tables also report the medians and means of firm size, or the market value of common stocks calculated using the closing price at the end of the fiscal year prior to repurchases for both the repurchasing subsamples and their control samples. It is evident that the open market repurchasing firms in these different subsamples are of near equal median and mean firm sizes, again providing support that these subsamples are likely to have similar distributional parameters to the open market repurchases population.

The entry "Firm Size Difference" in these tables refers to the absolute percentage difference between a repurchasing firm and its matching non-repurchasing firm. The means vary from 16.03 percent to 19.32 percent, while the medians vary from 11.80 percent to 15.38 percent. The t-test and non-parametric Wilcoxon sign test show that the firm sizes are not significantly different between each repurchasing subsample and its control sample.

The entry "Exchange Index" calculates the percentage of firms in a particular subsample which are listed in American Stock Exchange or New York Stock Exchange. It can be seen that a little more than half of repurchases in each subsample were made by NYSE and AMSE, and this index is not significantly different between each repurchasing subsample and its control sample.

For the three motivational variables of EFC, Tobin's Q, and D/E Ratio, the mean and median are reported for both the repurchasing subsample and its control sample. Also reported are the mean and median of the difference of these variables between the repurchasing sample and its control sample[5]. The SAS procedure PROC UNIVARIATE on the difference variable also provides a t-test and a Wilcoxon signed rank test on the hypothesis that the mean of the difference variable is zero. The p-values presented here are for two-tailed tests.

The results reported in Table 6 through Table 10 are consistent with the results obtained from the logit regression as shown in Table 4 and Table 5, except for the variable D/E Ratio. For example, the difference variable of the earnings forecast revisions between the subsample of open market repurchases announced from October 19 to November 9, 1987, as reported in Table 7, has a mean of 12.41 percent at the significance level of 1 percent. And neither the Tobin's Q nor the D/E Ratio in this table show any evidence of significant difference between repurchasing and non-repurchasing firms. The conclusion drawn from Table 7 is exactly the same as the one drawn from the logit regression over the crash period for open market repurchases, confirming the results in support of the signalling hypothesis over this period.

Similarly, Table 8 through Table 10 demonstrate the significantly negative difference of Tobin's Q for the open market repurchases that occurred outside the three-week window of 1987 crash and the matching non-repurchasing firms, supporting the free cash flow hypothesis of open

[5]Notice that the median of the difference variable may not be equal to the difference of the medians. However, they should be sufficiently close.

In discussing the results shown on Table 5 concerning the D/E Ratio variable in the logit regression on the two subsamples of open market repurchases which occurred outside the 1987 crash period, we reported the puzzling finding that the D/E Ratio has a significantly negative coefficient for open market repurchases which occurred after November 9, 1987, while the D/E Ratio has a negative but not significant coefficient for open market repurchases made before October 19, 1987. The pairwise tests do not find any significant difference for the D/E ratios between each subsample of open market repurchases and their control samples. As a matter of fact, the mean of the D/E Ratio difference variable is very close to zero in every case.

The evidence leads to the rejection of the leverage increase hypothesis for stock repurchases. Later, we will also use the total-debt to equity ratios and also book-value debt-equity ratios in our logit regression and pairwise tests with the results being reported and discussed in Section 5.2.5.3.

In summary, the findings from both the logit regression and the pairwise tests on different subsamples of open market repurchases and their control samples consistently support the signalling hypothesis for the open market repurchases which occurred over the 1987 crash period, and the free cash flow hypothesis for other open market repurchases. The leverage hypothesis is definitely rejected for the sample of open market repurchases that occurred in the 1987 crash period and also for the sample of open market repurchases made before October 19, 1987.

5.2.3   Results on Private Repurchases

In order to facilitate comparisons of open market repurchases, private repurchases, and self tender offers, Table 4 contains results of logit regression on private repurchases, self tender offers and their control samples, as well as the open market repurchase sample and its control sample. This section discusses findings on private repurchases while the next section focuses on self tender offers.

Only 45 private repurchasing firms make up the final sample along with 45 matching non-repurchasing firms. This represents 14 percent of the total private repurchases that occurred over the January, 1986 - April, 1989 period. The simple statistics on the fraction of shares sought reported in Table 11 are very close to that on the entire private repurchases population as shown in Table 1. Thus, the final sample of private repurchases seems to be a good representative of the population despite its relatively small size. It is also noted from Table 11 that there are no significant differences for firm size and exchange index among the private repurchasing sample and its control sample.

The column of private repurchases in Table 4 clearly shows that the hypothesis that all coefficients are zero is not rejected in the logit model, although signs of the coefficients for the EFC and the Tobin's Q are consistent with the predictions made by the signalling hypothesis and the free cash flow hypotheses. Table 11 reveals that the difference between the earnings forecast revisions for repurchasing firms and non-repurchasing firms is positive. This difference is insignificant by a t-test but significant at the 5 percent significance level by a nonparametric test (Wilcoxon ranked sign test). In addition, the negative difference for Tobin's Q between the repurchasing and non-repurchasing firms is close to being significant at the 10 percent significance level.

Both the logit regression and pairwise test provide consistent results concerning the variable D/E Ratio. The repurchasing firms have slightly higher debt-equity ratios than their matching nor-repurchasing firms, but the difference is not significant.

These results seem to confirm the widely accepted theory that private repurchases are not for the purposes of signalling, reducing free cash flow, or increasing leverage. Instead, private repurchases are most likely to be motivated for the purpose of defending firms' corporate control. Unfortunately, the relatively small size of the final sample with necessary data availability makes it impossible to get statistically sound conclusions by classifying this sample further into greenmails and non-greenmails and applying statistical analysis on them.

5.2.4 Results on Self Tender Offers

The results of logit regression for self tender offers and their control sample is reported in Table 4 along with those for open market repurchases and private repurchases, while the results of pairwise tests are provided in Table 12.

The simple statistics on the fraction of shares sought in self tenders for the final sample as reported in Table 12 are very close to those on the self tenders population reported in Table 1. However, the small sample size of only 20 self tenders and 20 matching non-repurchasing firms may be the cause for our study's failure to find a significant relationship between the self tender announcements and the three motivational variables.

From Table 4 it is evident that no one independent variable is statistically significantly associated with the self tender sample, though the signs of the coefficient estimates are consistent with the predictions made by the signalling, the free cash flow, and the leverage hypotheses of stock repurchases. The p-value of the coefficient of Tobin's Q is 0.101 for a two-tailed test. The hypothesis that this coefficient is negative is not rejected at 5 percent significance level if a one-tailed test is applied, suggesting evidence in support of the free cash flow hypothesis.

The pairwise tests provide essentially the same results. The Tobin's Q is on average a little smaller for the sample of self tender offers than for the control sample. The mean of the difference variable for debt-equity ratios is slightly smaller than 0 while the median is slightly greater than 0.

The mean and median of the difference variable for the earnings forecast revisions between the repurchasing sample and the control sample is found to be large in magnitude (11.39 percent and 10.06 percent, respectively). The standard t-test, on the assumption of a normal distribution of this difference variable, is statistically insignificant with a p-value of 0.192. However, given the small sample of 20 observations, it is more appropriate to accept the conclusion based on the non-parametric test, or the Wilcoxon ranked sign test, which happens to be significant at the 5 percent significant level. Thus weak supporting evidence is found favoring the signalling hypothesis. It is speculated that the small sample size is the reason why the logit

regression failed to find a significant relationship between self tenders and upward earnings forecast revisions.

5.2.5 Results For Other Independent Variables

The results presented in the previous sections are for the following independent variables: (1) the *median* earnings forecast revisions in the *second* month after the repurchase; (2) the *average* of yearly Tobin's Q over the *three* years prior to the repurchase; and (3) the *three-year average* of *market-value long-term* debt-equity ratios. Several variants of each motivational variable have been used or suggested in the financial literature. To ensure that our previous results are indeed robust under various variable specifications, we conduct the same logit regression and pairwise tests on all repurchasing subsamples and their control sample, as before, while changing one independent variable at a time.

The basic conclusions drawn in the previous section hold very well for almost all combinations of independent variables. However, only a portion of these results are reported because of the consistence of all the results. Notice that under each table brief descriptions of the independent variables responsible for that particular table of results are provided.

5.2.5.1 Results For Different Earnings Forecast Revisions Variables

Table 13 through Table 21 present results for various specifications of the earnings forecast revisions while using the same three-year average of Tobin's Q and three-year average of market-value long-term debt-equity ratio as before. Only the results from logit regression are reported since the pairwise tests confirm these results.

Tables 13 and 14 are identical to Tables 4 and 5 except that these two tables contain results of logit regression using the median earnings forecast revisions in the *first* month after the repurchase instead of the *second* month. It is obvious that the earnings forecast change in the first

month after the repurchase has already picked up the information conveyed by the announcements of open market repurchases in the 1987 crash period. But the coefficient of earnings forecast revisions in the first month after the repurchase is still not significant for the sample of self tenders, with a p-value of 0.135. As argued before, the small sample size makes any statistical test powerless. As expected, the Tobin's Q is the most important factor motivating a firm to launch an ordinary open market repurchase outside the 1987 crash period.

When the earnings forecast revisions in the *third* month is substituted in the logit regression, its coefficient is 1.221 with a p-value of 0.032 for the sample of open market repurchases announced in the 1987 crash period as seen in Table 15. This provides further support to the signalling motivation hypothesis for open market repurchases over the crash period.

The average of a firm's *median* earning forecast over the *four months* after the repurchase announcement is calculated and then the percentage difference between this average and the median earnings forecast in the month immediately prior to the announcement is used in our logit regression. The results are reported in Tables 16 and 17. Not surprisingly, this variable is significantly positive with a two-tailed p-value of 0.004 for the sample of open market repurchases that occurred in the 1987 crash period, confirming the results discussed above on the significance of the earnings forecast changes in the first, second, and third month after the repurchase.

The relative merits of using the *mean* or *median* earnings forecast in I/B/E/S database have been discussed in the literature. Around a significant event such as a share repurchase, we expect that both the median and mean earnings forecast revisions will reflect the new information conveyed by the event. That is exactly the inference we can draw from the results of logit regression on various repurchase samples and their control sample using the *mean* earnings forecast revisions in the *first* and *second* months and the *average* of four months after the repurchase. These results are presented in Table 18 through Table 21. All three different specifications of the mean earnings forecast revisions are significant for firms announcing open market repurchases over the 1987 crash period.

In summary, it is found that both the median and mean earnings forecast revisions in the

first, second, third, and over the four months after the repurchase are all significant in explaining the difference between firms announcing open market repurchases in the 1987 crash period and their matched non-repurchasing firms. These robust results make the conclusion stronger that these open market repurchasing firms were indeed motivated by the management's desire to convey private information of price undervaluation in the few weeks immediately following the crash to the market.

5.2.5.2 Results For Different Free Cash Flow Variables

Table 22 through Table 24 present results of the logit regression on various subsamples of open market repurchases and their control samples for three different measures of free cash flow with the other two independent variables being the *median* earnings forecast revisions in the *second* month after the repurchase and the *three-year average* of *market-value long-term* debt-equity ratio.

Instead of the *three-year average* of Tobin's Q prior to the repurchase, the Tobin's Q for the fiscal year immediately prior to the repurchase is used in logit regression and the results are presented in Table 22. The coefficient of this measure of Tobin's Q is significantly negative for the subsamples of open market repurchases which occurred outside the 1987 crash period, providing similar results to those found using a *three-year average* of Tobin's Q.

As discussed in Chapter Four, another proxy for the free cash flow found in the literature is the firm's post-tax net cash flow relative to the market value of its common stock. The results of the logit regression (2.1B) on various open market subsamples and their control samples are reported in Tables 23 and 24. The proxies for the signalling motivation and the leverage motivation of stock repurchases remain the same as before. Table 23 shows the results for the logit regression using the *three-year average* of firms' post-tax net cash flow relative to the market value of their common stocks while Table 24 calculates the AFCF over the year prior to the repurchase.

In each case, the results are quite similar. The signs of the coefficients of the variable AFCF are positive as predicted by the free cash flows for the subsamples of open market repurchases made outside the three-week time window following the October 19, 1987 stock

market crash. However, only the coefficient of the *three-year average* of AFCF is significant for the subsample of open market repurchases that occurred after November 9, 1987 at the 10 percent significance level (the p-value is 0.087) as shown in Table 23.

5.2.5.3 Results For Different Debt-Equity Ratios

Table 25 through Table 29 present the results of the logit regression and pairwise tests on various open market repurchase subsamples and their control samples using different measures of the debt-equity ratio along with the *median* earnings forecast revisions in the *second* month and the *three-year average* of Tobin's Q as the proxies for the signalling motivation and free cash flow motivation, respectively. These debt-equity ratios are calculated as *market-value* or *book-value, long-term* or *total* debt relative to the market value of equity at the closing price at the end of the fiscal year.

Table 25 contains the results with the *market-value* of *long-term* debt-equity ratio for *the* year immediately prior to the repurchase instead of the three-year average being the proxy for the leverage motivation of share repurchases. These results are very similar to those reported in Table 5 with the three-year average of the market-value of long-term debt-equity ratio as the proxy. The coefficient is significantly negative at the 10 percent significance level for the subsample of open market repurchase made after November 9, 1987 while it is still negative but not significant for the open market repurchases made before October 19, 1987.

Table 26 shows that both the Tobin's Q and the *three-year average* of the market-value of total debt-equity ratio are significant in explaining a firm's decision to initiate open market repurchases outside the 1987 crash period. It seems that the repurchases that were announced before October 19, 1987 or after November 9, 1987 have dual motivations of reducing free cash flow and increasing leverage. However, the pairwise tests with their results shown in Table 27 for the subsample of open market repurchase that occurred before October 19, 1987 and its control sample find that only the Tobin's Q for the repurchasing firms is significantly lower than that of their matching non-repurchasing firms. The difference of the market-value of total debt-equity

ratios between repurchasing firms and non-repurchasing firms is statistically insignificant.

Thus, the conclusion for the market-value of total debt-equity ratio seems to be the same as for the market-value of long-term debt-equity ratio (reported in Tables 5, 8 and 9). The coefficient of either *total* debt- or *long-term* debt-equity ratio in the logit provides support for the leverage hypothesis while the statistical mean test (pairwise test, to be more accurate) does not find any significant difference between repurchasing firms and non-repurchasing firms. Since logit regression takes into consideration interactions among independent variables, the results provide only weak evidence of support for the leverage hypothesis of stock repurchases. Since the free cash flow hypothesis is strongly supported with robust results for open market repurchases which occurred before October 19, 1987 or after November 9, 1987, the evidence suggests that a firm with a large amount of free cash flow is much more likely to launch an ordinary open market repurchase program in order to get rid of the free cash when its debt-equity ratio is also low at the same time.

Tables 28 and 29 demonstrate that the long-term- or total debt-equity ratios calculated using *book-value* of debts yield the same results as using *market-value* in the logit regression. This could be explained if the low leverage *per se* is not the motivation of share repurchases, but is a necessary condition for the free cash-rich firms to get rid of the free cash flow through open market repurchases.

5.2.6 Summary

Following is a brief summary of the major results obtained in this comparison study of firms having stock repurchases over the January, 1986 through April, 1989 period and their matching non-repurchasing firms using logit regression and the pairwise tests technique:

(1)   For the open market repurchases that occurred from October 19, 1987 to November 9, 1987, the earnings forecast revisions are significantly higher than for their control firms and its coefficient in the logit regression is also significantly positive. The evidence seems to provide strong support for the signalling hypothesis for the large number of open market repurchases that occurred in the stock market crash period. The results are robust whether the earnings forecast revisions are calculated using the median or mean forecasts in the first, second, third, or average over the four months after the repurchase.

(2)   The free cash flow hypothesis for ordinary open market repurchases is strongly supported by the findings that the Tobin's Q is significantly lower for firms having open market repurchases outside the 1987 crash period than for the matching sample of non-repurchasing firms. Moreover, the coefficient of Tobin's Q in the logit regression is also significantly negative at a 1 percent significance level.

(3)   The results on the debt-equity ratio are mixed. The results from the logit regression on the subsample of open market repurchases that occurred after November 9, 1987 suggests evidence in support of the leverage hypothesis for share repurchases. However, no significant difference was found for the debt-equity ratio between the repurchasing sample and the control sample. Thus, it seems more likely that a firm with large amounts of free cash will reduce its free cash flow through open market repurchases when its debt-equity ratio is low. Finally, the results do not change, no matter how the debt-equity ratio is

measured.

(4) Weak evidence is found suggesting that firms which repurchased shares through self tender offers over the January, 1986 - April, 1989 period have higher earnings forecast revisions following the repurchase and lower Tobin's Q prior to the repurchase than their matching non-repurchasing firms. However, the small sample size of around 20 after the construction of control sample results in very low power for our statistical analysis. For this reason no statistically significant results are found.

(5) No evidence is found to support any one of the three major hypotheses for share repurchases in the case of private repurchases. The results seem to confirm the argument that private repurchases are instituted for the purpose of corporate control or some other reason.

5.3 Results From the Repurchase Method Choice Study

Given a firm's decision to repurchase, what method is to be used? What are the differences among the three types of repurchase in terms of the financial variables used as proxies for motivations of repurchases? In this section we report results of our comparison study of the choice of repurchase method using multinomial logit regression, binomial logit regression, and parametric and nonparametric sample mean test techniques.

Included in the final sample in this section are all those repurchases made over the 1983 - April 1989 period for which all the three motivational variables are available. Since the results reported in the previous section are very robust under various specifications of the motivational variables, only the following variables are used in this step of study: (1) the *median* earnings forecast revision in the *second* month after the repurchase; (2) the *average* of yearly Tobin's Q for the *three* fiscal years prior to repurchase; and (3) the *average* of yearly *market-value long-term* debt-equity ratio over the *three* fiscal years prior to the repurchase. The resulting sample size is larger than in the last section after the construction of control samples.

When interpreting the results reported in this section, cautions are deemed necessary. First, variations in the motivational variables among different repurchasing samples may be caused by other factors such as industry, market trend, or simply timing of the repurchase. Unlike a control study which reduces the variations due to industry or market trends to a large extent, conclusions based on the unadjusted variables may be biased toward a direction unknown. However, if the three types of repurchases have similar distributions over time, industry, exchange listed, and firm size, then it is not too dangerous to accept the conclusions albeit still with some caution. This seems to be the case in our study.

Another reason calling for caution is that the comparison study of repurchasing and non-repurchasing firms did not find uniform motivations among the three types of repurchases. It is evident that the open market repurchases which occurred in the 1987 crash period were for signalling purposes, while other open market repurchases were motivated by management's desire to reduce free cash flow. Not any of the three hypotheses for stock repurchases investigated in this study are supported in the case of private repurchases. Unfortunately, the small number of self tenders in the final sample after constructing its control sample rendered any statistical test powerless, though there is some weak evidence in support of the signalling hypothesis and the free cash flow hypothesis. Thus, the results reported in this section must be interpreted in close reference to the results reported in the last section.

5.3.1 Tests of Firm Size Difference

Vermaelen (1981) argues that the strongest evidence in support of the signalling hypothesis comes from the observation that predominantly small firms engage in repurchases via tender offer, since small firms are likely to have private information and lack of an alternative signalling mechanism. Unfortunately, his observation has been accepted by many without confirmation from rigorous statistical tests.

This section starts with a report on the results of statistical tests on the difference in the firm size among the following four subsamples of repurchases: (1) open market repurchases which occurred in the three weeks following the 1987 stock market crash (from October 19 to November 9); (2) open market repurchases which occurred outside the 1987 crash period; (3) private repurchases; and (4) self tenders. The variable "Firm Size" is defined as the average of a firm's market value of its common stock over the 1983-1989 period using the closing price at the fiscal year end (COMPUSTAT item #25 times item #199). Other definitions of the "Firm Size" have also been used including the three-year average of the market values of firms' common

stock prior to the repurchase, and the market value of firms' common stocks for the year prior to the repurchase. For all definitions of the variable "Firm Size", the results are consistent that the difference for the variable "Firm Size" is statistically insignificant for self tender offers and for open market repurchases. For this reason, only the results for the first definition of the variable "Firm Size" are reported.

Table 30 presents the summary statistics for the four repurchasing subsamples. The lower portion contains information on sample size, exchange index (i.e. the percentage of firms in the subsample listed in the New York Stock Exchange and American Stock Exchange), mean and median of the firm size, and descriptive statistics on the fraction of shares sought. The top portion of Table 30 reports the mean and median for the motivational proxies for each subsample.

The sample sizes are roughly twice that available when control samples were used in Tables 4 and 5, making the statistical tests more powerful. The summary statistics of the fraction of shares sought are very close to those reported in Tables 1 and 3 for the entire repurchase population.

The medians of firm size are almost identical for all four subsamples, rousing suspicion that there is no significant difference among the different types of repurchases in terms of firm size. While the means do vary much across subsamples, however, the mean of firm size in a sample may be misleading since a single very large firm can inflate the sample mean significantly. Also notice that the difference of the variable "exchange index" is small among the four subsamples as well.

We use the SAS procedure PROC NPAR1WAY to test the null hypothesis that the means and medians of firm size and exchange index among these four subsamples are the same. The results are shown in Table 31. The lower portion of Table 31 provides the p-values of various tests on the null hypothesis. It is evident that the null hypothesis cannot be rejected at the 10 percent significance level.

Thus, it is fairly safe to say that Vermaelen's observation may be incorrect. One may argue that only 38 self tenders in the sample are not sufficient to yield conclusive evidence in tests. Anticipating these doubts, we will do the test again using CRSP data on the hypothesis that firm size is not statistically significantly different between open market repurchases and self tender offers, where firm size is defined as the market value of common stocks ten days prior to

the announcement of repurchase. Here again, the results (as shown in Tables 45 and 46) confirm our expectations.

5.3.2 Comparison of the Three Types of Repurchases

We now turn to the differences in the motivational variables between the different repurchasing subsamples. The impression from the top portion of Table 30 is that the firms employing open market repurchases have higher Tobin's Q and lower D/E ratio than those using private repurchases and self tenders. There seems to be little difference between the private subsample and the self tender subsample.

Table 32 reports the maximum likelihood estimates and asymptotic χ^2 tests on the motivational variables used in the multiple-choice logit regression as specified in (2.2). For the sake of comparison, we also apply binomial logit regression on each pair of repurchase subsamples with the results shown in Table 33. A casual comparison of these two tables demonstrates striking similarities, which is after all expected since multiple-choice logit regression is a straightforward generalization of binomial logit regression. Nonparametric tests confirm the results obtained in the logit regressions and consequently are not reported here.

It is evident from both tables that the choice of the open market method over the other two methods of repurchasing shares is driven by the high Tobin's Q. The coefficient of the Tobin's Q in logit regressions concerning the open market repurchase versus either the private repurchase or self tenders is positive at a significance level of 5 percent. This confirms our observation from Table 29 which shows that the open market sample has a higher Tobin's Q than both the private or self tender samples.

Also notice that the coefficient estimate of the variable *LnSize* is 0.166, significant at 5 percent significance level in the binomial logit regression of the open market repurchase versus the private repurchase. This implies that firms having open market repurchases are generally

larger than firms employing private repurchases.

When those repurchases which occurred over the 1987 crash period were deleted from the samples, similar results are obtained from the multinomial and binomial logit regression and are shown in Table 34 for the case of binomial logit regression. However, there is indeed one notable difference. The coefficient estimate of *EFC* in the binomial logit regression of the open market repurchase versus the private repurchase is -1.767, significantly different from zero at a 5 percent significance level. The binomial logit regression is also run on the subsample of open market repurchases that occurred in the 1987 crash period versus the private repurchase sample and also versus the self tender sample with the results presented in Table 35. It is found that the only significant variable is the Tobin's Q. It also seems that the private repurchases in our sample have higher earnings forecast revisions than the subsample of open market repurchases that occurred outside the 1987 crash period.

Given the assumption that the lower Tobin's Q means more free cash flow for a firm and the results obtained from Section 5.2.2 that an ordinary open market repurchase is for the purpose of reducing the free cash flow, the findings that firms which repurchase shares via private negotiations and self tenders have even lower Tobin's Q than the group of repurchasers in the open market are interesting. Unfortunately, simple deduction does not yield convincing conclusions. When examining the evidence reported in this section as well as from the control study, the following explanation seems plausible:

(1)   Since there is no evidence showing that a private repurchase is motivated by any of the motivations investigated in this study, it is likely that its low Tobin's Q may attract corporate raiders resulting in the firm taking measures including private repurchase to maintain its corporate control.

(2)   In light of the weak evidence in support of the signalling hypothesis and the free cash flow hypothesis for self tender repurchases as discussed before, the findings that self tender offers have even lower Tobin's Q than ordinary open market repurchases seem consistent with the hypothesis that self tenders are also for the purpose of getting rid of the free cash flow.Thus, the choice of its use over the open market repurchase may be because of the larger amount of free cash flow.

5.3.3 Comparison of Open Market Repurchases During and Outside the 1987 Crash Period

In Section 5.2, We presented evidence in support of the signalling hypothesis for the open market repurchases which occurred over the October 19 - November 9, 1987 period and of the free cash flow hypothesis for ordinary open market repurchases outside the 1987 crash period. Here additional evidence consistent with these conclusions is presented from the logit regression on the sample of open market repurchases.

The event is designated as the date of the repurchase. If an open market repurchase was announced either before October 19 or after November 9, 1987, then the dependent variable is 0, otherwise 1. The independent variables are the proxies for repurchase motivations. While the methodology may not be strong on theoretical grounds, it can be used to effectively detect the difference between the two groups of open market repurchases in terms of the motivational variables.

The results are presented in Table 36. The maximum likelihood estimates are obtained for the coefficients and the asymptotic χ^2 tests are applied to these estimates. The coefficient estimates are 0.789 with a p-value of 0.071 for the variable *EFC*, and 0.217 with a p-value of 0.074 for the Tobin's Q. Since the p-values are for two-tailed test, it is evident that the hypothesis that the coefficients are negative or zero is be rejected at the significance level of 5 percent. Thus, it appears that the open market repurchases which occurred around the 1987 crash period are associated with significantly higher earnings forecast revisions and higher Tobin's Q than other open market repurchases. Consequently, it can be inferred that open market repurchases made in the crash period were for signalling purposes and others were for reducing free cash flow.

5.4 OLS Regression of the Fraction of Shares Sought on Motivational Variables

The fraction of shares to be repurchased is the most important decision variable once a firm has decided to initiate an open market repurchase. It is likely that this quantity will also be influenced by the motivation behind the repurchase. This is the rationale for our ordinary-least-squares (OLS) regression of the fraction of shares sought on the proxies for repurchase motivations as specified in (2.3). Two separate regressions are run with and without the independent variable *LnSize*, which is the log of the average market value of each firm's common stock over the 1983-1989 period.

Tables 37 and 38 provide the OLS coefficient estimates and the p-values of the two-tailed t-test on these estimates for the two subsamples of open market repurchases which occurred outside or during the 1987 crash period. The coefficient for the independent variable *LnSize* are -0.340 and -0.671, respectively, for the two subsamples, and are significant at the 5 percent level. This may merely reflect the fact that large firms repurchase less in relative terms since they have a large number of shares outstanding. Alternatively, the firm size could be a proxy for informational asymmetry, with greater informational asymmetry associated with smaller firms. If this is the case, the negative association between the fraction of shares sought and firm size is a piece of evidence, however weak, in support of the signalling hypothesis for stock repurchase. However, this inference is not particularly plausible given the other evidence, for instance, the strong evidence in support of the free cash flow hypothesis for open market repurchases which occurred outside the 1987 crash period.

Further support for the free cash flow hypothesis is provided in Table 37 with the finding that the coefficient of the Tobin's Q is significantly negative at the 5 percent level for the subsample of open market repurchases which occurred either before October 19, 1987 or after November 9, 1987. Recall lower Tobin's Q means more free cash flow.

None of the coefficients for the independent variables except *LnSize* are significantly different from zero for the subsample of open market repurchases which occurred in the 1987 crash period, as shown in Table 38. The finding of insignificance for the *EFC* in the regressions is also interesting, but must be viewed with caution as it may simply be the consequence of misspecification of the regression itself. Given the fringed activity accompanying the crash, the signalling process may have simply involved the act of initiating an open market repurchase. That is, only the act of repurchasing not the size of the repurchase was of importance. Furthermore, the expectation that Tobin's Q is not important in determining the fraction of shares sought in this case since the 1987 crash repurchases were not for the purpose of reducing free cash flow is confirmed. This is in contrast with the subsample of open market repurchases that occurred outside the 1987 crash period where the free cash flow hypothesis is supported.

Though probably more important than the fraction of shares sought in decisions of private repurchases and self tender offers, the transaction price or tendering price is also likely to be determined after the decision is made on the fraction of shares sought. This reasoning provides the rational for our OLS regression of the fraction of shares sought on motivational variables for the samples of private repurchases and self tenders, with the results presented in Table 39 and Table 40, respectively.

As expected, no variables turn out to be significantly different from zero for the sample of private repurchases as shown in Table 39. This confirms the conclusion reached in previous sections that private repurchases are not motivated by any of the three major hypotheses investigated in this study.

Despite the small sample size of 38, the results presented in Table 40 for the sample self tender offers seem consistent with the free cash flow hypothesis for stock repurchases. The coefficients for the *Tobin's Q* are significantly negative at the 10 percent level for a two-tailed test. Combining the results in the comparison studies with control sample and with open market repurchases, it supports the hypothesis that Tobin's Q may be a significant factor in a firm's decision to offer a self tender to its shareholders. A final observation is that the variable *LnSize* is not significantly different from zero for either the private repurchase sample or the self tender offer sample, contrary to results for the open market repurchase subsamples.

5.5 Cumulative Prediction Errors and Related Issues of Repurchasing Firms

This section presents the results of conventional event study examining the market reaction to the announcement of stock repurchase and related issues, including tests of mean differences of the market values of firms' common stocks among different types of repurchases, and the association between the market reaction and the proxies for repurchase motivations.

For the first group of statistical tests reported in this section, which do not involve the motivational proxies, the sample used for analysis is composed of all repurchases available in the CRSP database. Since the 1990 NASDAQ data file was not available when this study was conducted, those repurchases made by OTC firms in 1989 have been deleted from the final sample. Fortunately, this resulted in the loss of only a small number of observations because the original repurchases population ended in April of 1989.

An attempt is also made to try to determine the statistical association between the premium, dilution costs for private and self tender repurchases, and the market reaction to each type of repurchase with the financial variables used as proxies for the motivations for repurchases. The sample for this type of analysis requires the data available on CRSP, I/B/E/S, and COMPUSTAT, resulting in a dramatic reduction in the number of observations in the sample. Fortunately, except in the case of self tender offers, the sample size is sufficiently large to test statistically.

5.5.1 The Cumulative Prediction Errors

As discussed in Section 4.2.5.1, we apply the procedure used in Mikkelson and Partch (1986) to estimate and test the cumulative prediction errors for the share repurchase announcement. The market model parameters are first estimated using CRSP data over the period (-150, -51).

Table 41 contains statistics concerning the samples used and the cumulative prediction errors before the repurchase announcement, around the repurchase announcement, and after the repurchase announcement. Compared with the population statistics shown in Table 1, it is obvious that an overwhelming majority of repurchasing firms are listed in the CRSP database. For instance, out of 2,695 all open market repurchases which occurred over the January, 1986 through April, 1989 period, 2,382 are available for our analysis of market reaction. Hence, it appears that the results of statistical analysis on these final samples contain reliable information about the repurchase population. This observation is derived from the almost identical descriptive statistics of the fraction of shares sought between the final samples as shown in the lower portion of Table 41 and the population as shown in Table 1.

The item "Market Value" in Table 41 and subsequent tables refers to the market value of a firm's common stock ten days prior to the repurchase announcement. It seems that both the mean and median of the market value of the private repurchase subsample are much smaller than that of open market repurchases and self tender offers. This observation is confirmed statistically and the results will be reported later in this section.

The statistics on the cumulative prediction errors for each type of repurchase confirm results presented in past studies. Notice that the "Z Statistic" obeys an asymptotically normal distribution and has a value of 1.96 at the significance level of 5 percent for a two-tailed test .

The sample of 109 self tender offers has the largest cumulative prediction error (7.95 percent) in the announcement period (-1, 1) , which is significant of course. A little more than 84 percent of announcements for self tender offers had positive market reactions over this period.

The cumulative prediction errors for each period are not significantly different from zero

for the sample of private repurchases, confirming the hypothesis that on average private repurchases are not used for value enhancing purposes such as signalling or reducing free cash flow.

The results over the whole sample of open market repurchases are reported in Table 41 while the results over the two subsamples of open market repurchases in and outside of the 1987 crash period are presented in Table 42, allowing a comparison between the three types of repurchases as well as between the two subsamples of open market repurchases.

For an average open market repurchasing firm, the market reacted favorably to the announcement with a significant abnormal return of 3.39 percent over the three-day announcement period. This is much smaller in absolute terms than the 7.95 percent for the self tender sample. However, it must be remembered that the average fraction of shares sought in a self tender offer was approximately three times the fraction sought in an open market repurchase.

It is evident from Table 42 that market reaction to open market repurchases which occurred in the 1987 crash period is larger (4.21%) than for the "non-crash repurchases" which occurred during other times (3.02%). It is interesting to find that the cumulative prediction errors over the period (2, 10) after the repurchase announcement are still significantly positive for both the open market repurchase subsamples, though much larger for the "crash repurchases" (1.98%) than the "non-crash repurchases" (0.49%).

Another interesting finding is the significant price decline of 2.64 percent over the period (-50, -2) for the subsample of open market repurchases which occurred outside the 1987 crash period. Recall that Rao, Moyer, Sivaramakrishnan (1990) also find a -5.7 percent of price decline in the period (-57, -4) for a sample of 175 open market repurchases that occurred from 1981 to 1986. The price decline before the repurchase may be due to the negative assessment of the free cash flow problem by the market on the firm and may in turn trigger the firm to launch an open market repurchase program to get rid of it.

The differences between cumulative prediction errors for the samples of self tenders, open market repurchases which occurred over the 1987 crash period, and open market repurchases made during other times seem to confirm the conclusions drawn in previous sections concerning motivations behind these groups of repurchases. Open market repurchases which occurred during the 1987 crash period were for the purposes of signalling price undervaluation

while ordinary open market repurchases which occurred outside the 1987 crash period were to reduce free cash flow. The self tender offers, on the other hand, are likely to have dual purposes.

Table 43 and Table 44 present the abnormal returns for firms listed on the New York and American Stock Exchanges (NYAM) and for OTC firms (NASDAQ), respectively. Two findings stand out. First, the absolute magnitude of abnormal returns over any period for open market repurchases and self tender offers are larger for NASDAQ firms than for NYAM firms, leading to the inference that market reactions are inversely related to the firm size. This is the so-called small-firm effect.

Another interesting result is that market reaction to private repurchase announcements was significantly negative for NYAM firms (-0.79 percent with Z-Statistic of -2.56) but positive for NASDAQ firms (1.20 percent with Z-Statistic of 2.39). One possible explanation could be different motivations for these two subsamples of private repurchases. Another plausible explanation or speculation relies on the observation that smaller firms or OTC firms are more likely to be takeover targets. When a private repurchase is for the purpose of defending corporate control, it may signal information to the market that the management faces a takeover threat and the repurchase may push up the bidding price but not be able to defeat the potential bid in the long run. Facing the same situation, large firms may be more capable of defending corporate control more effectively.

5.5.2 Tests of Market Model Parameters Change

At present, there has been no formal modelling of the riskiness of the firm in any financial signalling theory as the dimension of informational asymmetry. However, the possibility cannot be excluded theoretically that management may believe that the stock is undervalued because the specific risk of their firm is overestimated in the market.

Several empirical studies involving informational asymmetry have attempted to proxy the informational gap by some measure of non-market risk. Among them is the study of Booth and

Smith (1986) who use the ratio of non-market risk to market risk as a proxy of insider information. They maintain that non-market risk is expected to be correlated with potential firm-specific information while admitting that non-market risk should not be entirely firm-specific.

However, since the ratio of unsystematic risk to systematic risk brings too much noise into the measurement, we examine changes in the R-square for the market model brought by the repurchase announcement. Notice that the R-square is interpreted as the percentage of total variance of the dependent variable explained by the market return variable in the market model. The lower the R-square for a specific firm over a specific period, the more firm-specific risk the firm has. Thus, a finding that a firm's R-square increases after an event such as the repurchase announcement may reflect a reduction in firm-specific risk perceived by the market. If true, the event may be conveying private information to the market.

We apply the standard market model over the periods (-150, -50) and (51, 150), which are equally distanced away from the event day of repurchase announcement. Both the β and R-square for each period are computed using the CRSP database and their changes are simply the differences between the parameters in the period (51, 150) and in the period (-150, -51). The mean and t-test statistic of these parameter changes for each subsample of repurchases are presented in Table 45.

Confirming the conclusion reached earlier that open market repurchases announced over the 1987 crash period were for the purpose of signalling, it is evident from Table 45 that only this group of repurchases have a significant increase in R-square, from 0.119 to 0.168. Thus, open market repurchases made from October 19 to November 9, 1987 were associated with higher earnings forecast change and significant decrease of firm-specific risk.

Another interesting, but hard to interpret, finding is that β dropped significantly for the subsamples of open market repurchases and self tender offers. This may be due to the reduction in firms' systematic risk.

5.5.3 Tests of Mean Difference of Market Value Among Repurchase Samples

In Section 5.3.1 we report the finding that there are no significant differences among the three types of repurchases in terms of firm size, which was defined as the average of a firm's market values of its common stock over the 1983-1989 period. It is also found in the binomial logit regressions as shown in Table 33 and Table 34 that firms having open market repurchases tend to be larger than private repurchasers.

Defined as the market value of common stocks ten days prior to the repurchase announcement, firms' market value differences between each type of repurchase are tested against each other with the results shown in Table 46 and Table 47. While Table 46 concerns all repurchases which occurred over the January, 1986 - April 1989 period available in 1990 CRSP NYAM files and 1989 CRSP NASDAQ files, Table 47 presents results for those repurchases which occurred outside the 1987 Crash period. A casual comparison reveals that the results provided in the two tables are almost identical. This is not surprising since we have shown that open market repurchases are very similar in terms of firm size, no matter when they occurred.

It is evident from either table that an average firm engaging in an open market repurchase is a little more than two times as large as an average private repurchaser when measured ten days prior to the announcement. The difference is significant at a 1 percent significance level by both parametric and nonparametric tests.

It is also obvious that while the mean of the market values of firms having open market repurchases is a bit larger than that of firms with self tenders, the median of the former is smaller than the latter. Thus, it is not surprising to find that firms engaging in self tender offer are not on average smaller than firms engaging in open market repurchases. This finding is consistent with that reported in Section 5.3.1. As such, it is safe to reject the notion that self tender offers are predominantly made by smaller firms compared with open market repurchasers. Thus, the casual observation can no longer be used as evidence in support of the signalling hypothesis as claimed by Masulis (1981), unless the hypothesis that open market repurchases with the purpose of

reducing free cash flow are predominantly made by small firms is also true. However, it seems that the free cash flow problem is more likely be associated with large firms which lack profitable investment opportunities. Of course, the final settlement of the issue relies on the statistical test on the hypothesis that repurchasing firms are smaller than non-repurchasing firms.

5.5.4 OLS Regression of CAR(-1, 1) on Terms of Repurchase

Table 48 provides the estimates and test statistics for the ordinary-least-squares regression (OLS) coefficients with the abnormal return over the announcement period (-1, 1) as the dependent variable and the terms of the repurchase as the independent variables for each subsample of repurchases. The log of the market value of a firm's common stock measured ten days prior to the repurchase and the cumulative prediction error over the period (-50, -2) are also included in the independent variable set.

The striking differences of the coefficients' estimates demonstrates once more the underlying distinction between the two subsamples of open market repurchases. The abnormal return over the announcement period for an ordinary open market repurchase which occurred either before October 19 or after November 9, 1987 has a positive association with the fraction of shares sought but a negative association with the market value of the firm's common stock and the cumulative prediction error before the repurchase announcement, all significant at the 5 percent significance level. This would be consistent with the situation in which the market could correctly perceive the motivation of reducing free cash behind the open market repurchase, which was triggered in the first place by the substantial price decline due to the free cash flow problem, and react correspondingly. Recall that the fraction of shares sought for this subsample of open market repurchases was found to be negatively associated with the Tobin's Q.

In contrast, the abnormal returns over the announcement period experienced by those firms announcing open market repurchases from October 19 to November 9, 1987 is positively

associated with the price movement over the period (-50, -2) at the 1 percent significance level. Recalling the finding as shown in Table 44 that there was no significant price movement relative to the market prior to the announcement for these extraordinary open market repurchases, it seems to suggest that firms announcing open market repurchase programs in the 1987 crash period were performing quite well relative to the others in the market.. The lack of a significant association between the CAR(-1, 1) and the fraction of shares sought supports the argument that only the announcement itself mattered in those extraordinary days when the market was in turmoil.

As expected, no coefficient is significant for the sample of private repurchases.

Again, the results for the sample of self tender offers demonstrate the similarities between self tender offers and ordinary open market repurchases. The abnormal returns, CAR(-1, 1), are negatively associated with the market value of the firms' common stocks at a 1 percent significance level and the price movement over the period (-50, -2) at the 10 percent significance level. In addition, the CAR(-1, 1) is positively associated with the premium, defined as the percentage of the tendering price over the share price ten days prior to the announcement.

However, the fraction of shares sought does not seem to be perceived to be as important by the market as the premium. It may well be the case that the decision on the premium by the management already reflects the factor of the fraction of shares sought since it is likely that a decision to repurchase a higher faction of shares requires a higher premium offered to shareholders.

There does not seem to be a relationship between the CAR(-1, 1) and the variable of dilution costs defined in Section 3.2.2, which can be interpreted as the theoretical percentage price decline brought about by the tendering premium. One explanation could be due to the fact that this variable does not take into consideration the non-uniform distribution of the insider holdings across firms as discussed before.

To this point in this section, we have investigated market reaction to repurchase announcements and related issues. Notice that the three proxies for motivations for share repurchases are not used in these analyses, though the presentations are still centered on finding

the true motivations for each type of repurchase. In performing the statistical analysis involved with the motivational variables in order to find more direct evidence on the subject, the sample size decreases dramatically since a repurchase must have data available in all three databases of CRSP, COMPUSTAT, and I/B/E/S.

5.5.5 OLS Regressions of the Premium and Dilution Costs

Section 5.4 presents a discussion of the results (shown in Table 37 to Table 40) from the OLS regression of the fraction of shares sought in a repurchase against the proxies for the repurchase motivations for each subsample of repurchases. Table 49 presents the estimates and p-values of the tests on these estimates for the regression (2.4) as specified in Section 4.2.4. It is evident that there is no significant association between the premium or dilution costs and the motivational variables for either the private repurchase sample or the self tender offer sample. The intuitively conceived relationship between the premium and the fraction of shares sought in a self tender offer is not significant at the 10 percent of significance level for a two-tailed test, though the p-value of 0.106 is very close to 10 percent .

5.5.6 The Abnormal Rate of Return CAR(-1, 1) and the Motivational Proxies

Table 50 presents the results of the OLS regression of the abnormal returns, CAR(-1, 1), against the motivational proxies and the log of the market value of firms' common stocks measured ten days prior to the announcement. Market reactions are found to be negatively associated with the firm's market value for all subsamples except those open market repurchases

announced in the 1987 crash period.

For self tender offers, there is no significant association between CAR(-1, 1) and the proxies for repurchase motivations. This may be due to the small sample size of only 34 observations. Similarly, for the sample of private repurchases, there is also no significant association between the CAR(-1, 1) and the proxies.

The results for open market repurchase are unexpected. For the subsample of open market repurchases which occurred outside of the 1987 crash period, the abnormal returns over the announcement period are *negatively* associated with the long-term debt-equity ratio at the 1 percent significance level. On the other hand, for the subsample of open market repurchases which occurred from October 19 to November 9, 1987, the CAR(-1, 1) is *positively* and significantly associated with the Tobin's Q and the D/E ratio. It should be noted that what is being examined here is the market's reaction to the decision, rather than the motivation behind the decision.

Since OLS regressions are sensitive to the statistical behavior of the data, a logit regression is used to study the relationship between the abnormal return CAR(-1, 1) and the motivational variables. For a given cutoff point a (for example, 1%), if a firm's CAR(-1, 1) is greater than a, the repurchase is labeled 1, while if the CAR(-1, 1) is less than $-a$, then the observation is labeled 0. A logit regression using an artificial binomial choice can be employed to find the difference between the independent variables for those announcements receiving a favorable reaction in the market versus those receiving an unfavorable reaction.

Table 51 presents the estimates and tests for the logit regression coefficients for the two subsamples of open market repurchases. For those repurchases which occurred from October 19 to November 9, 1987, the coefficient of the *EFC* is significantly positive at the 10 percent significance level for the two-tailed test. If an one-tailed test is used, the coefficient is significantly positive at the 5 percent significance level. This is consistent with the signalling hypothesis associated with the open market repurchases which occurred over the 1987 crash period.

It is also evident from Table 51 that how the market reacts to an ordinary repurchase announcement is inversely dependent on its debt-equity ratio. The coefficient for the Tobin's Q is also negative but insignificant. The result provides evidence in support of the leverage hypothesis

for share repurchases.

Table 52 presents the results for private repurchases and self tender offers. Unfortunately, there are insufficient observations in the sample of self tender offer to produce meaningful conclusions. Interestingly, for the sample of private repurchases, the coefficient of the *EFC* is significantly positive, implying that some private repurchases may actually signal information about the firms' earnings future. Our sample of private repurchase may contain announcements with different motivations, cancelling out each other's market reaction.

Chapter Six   Summary and Conclusions

This study is an empirical investigation of the motivations behind equity repurchases in the open market, via private repurchases or through self tender offers. A series of statistical analyses and tests were conducted on a sample of repurchases which occurred from January, 1986 through April, 1989, and the following conclusions emerged regarding the three major hypotheses for share repurchases (signalling undervaluation, the free cash flow, and the leverage):

1. The signalling hypothesis is supported for open market repurchases which were announced over the 1987 crash period (from October 19 to November 9, 1987) by the findings of:

    A.   The repurchasing firms have significantly higher earnings forecast revisions in the first, second, and third months following the repurchase announcement than their matching non-repurchasing firms. The coefficient of the variable *EFC* in the logit regression is positive at the 1 percent significance level. The results are robust for different specifications of the variable *EFC*.

    B.   These open market repurchasing firms were associated with significantly higher earnings forecast revisions than the firms which made ordinary open market repurchases outside of the 1987 crash period in the logit regression in which the choice was the date of repurchase.

    C.   The R-Square in the market model over the period (51, 150) is significantly higher at the 1 percent significance level than the R-Square over the period (-150, -51). This

may imply a significant decrease in firm-specific risk for these repurchasing firms.

D. There is a significant difference between the earnings forecast revisions at the 10 percent level for the repurchasing firms with an abnormal return of more than 1 percent (or 2 percent) over the period (-1, 1) and the firms with an abnormal return of less than -1 percent (or -2 percent). It seems that the market could recognize the private information conveyed through the announcement of open market repurchases.

2. The free cash flow hypothesis is supported for open market repurchases which occurred outside of the 1987 crash period (either before October 19 or after November 9, 1987) by the findings of:

A. The repurchasing firms had significantly lower Tobin's Q prior to the repurchase announcement than their matching nonrepurchasing firms. The coefficient of the variable *Tobin's Q* in the logit regression is negative at the 1 percent significance level. The results are robust whether the variable *Tobin's Q* is the three-year average or for just one year prior to the repurchase. It was also found that the coefficient of the variable *AFCF*, which is the three-year average of a firm's post-tax net cash flow relative to its equity value prior to the repurchase, is also significantly positive in the logit regression at the 10 percent level for a two-tailed test.

B. These open market repurchasing firms had significantly lower Tobin's Q than the firms which announced open market repurchase programs over the 1987 crash period in the logit regression in which the choice was the date of repurchase.

C. The coefficient of the variable Tobin's Q was found to be significantly negative at the 5 percent level in the OLS regression of the fraction of shares sought against the motivational proxies, implying that firms with more free cash flow are likely to repurchase a larger percentage of shares.

D. The cumulative prediction error over the period (-150, -50) was significantly negative (-2.64 percent). The abnormal return over the announcement period (-1, 1) was found to be significantly associated with the fraction of shares sought in the OLS regression and inversely with the cumulative prediction error over the period (-150, -50). These results are consistent with the situation in which firms that experienced significant

price declines, which were the negative assessment of the firms' free cash free flow problem, initiate open market repurchases with the size dependent on the magnitude of the free cash flow, and the market in turn rewards the firms correspondingly.

3.   There seems to be weak evidence in support of the leverage hypothesis for open market repurchases which occurred outside of the 1987 crash period. However, the results appear more consistent with the hypothesis that a firm with the free cash flow problem is more likely to initiate an open market repurchase program to get rid of the free cash flow *if* its debt-equity ratio is low.

    A.   The coefficient of the variable *D/E Ratio* in the logit regression for the sample of open market repurchases and its control sample is significantly negative at the 5 percent level. The relationship is robust for the subsample of open market repurchases which occurred after November 9, 1987 under various specifications of the variable *D/E Ratio*. However, no significant difference between D/E ratios is found for open market repurchasers and their matching nonrepurchasing firms in the pairwise sample mean tests.

    B.   The abnormal return over the announcement period (-1, 1) is found to be inversely associated with the variable D/E Ratio in both the OLS regression and the artificial logit regression for these open market repurchases.

4.   For the sample of private repurchases, the results seem to support the hypothesis that typical private repurchases are not for any of the motivations investigated in this study. The findings appear consistent with the situation in which (1) the sample contains private repurchases with different motivations; (2) those small firms with low Tobin's Q and good earnings future may use private repurchases to maintain their corporate control when facing a takeover threat; and (3) while the repurchases may push up the bidding price from the current or potential corporate raiders, these small firms cannot defeat the takeover bid in the long run. However, larger firms may be more capable of defending their corporate control when facing the same takeover threats.

Chapter Six Summary and Conclusions   **111**

A. There is a positive difference between the earnings forecast revisions and a negative difference between the Tobin's Q for the sample of private repurchases and the control sample, all significant at the 6 percent level for one-tailed tests. However, none of the coefficients of the motivational variables in the logit regression is significant.

B. Compared with the sample of open market repurchases which occurred outside the 1987 crash period, the sample of private repurchases was found to contain smaller firms, have lower Tobin's Q and higher earnings forecast revisions.

C. The abnormal return over the announcement period (-1, 1) was found to be significantly positive (1.20 percent) for the private repurchasers listed in NASDAQ and significantly negative (−.79 percent) for those listed in the New York and American Stock Exchanges.

D. It was found that private repurchases were predominantly made by smaller firms compared with open market repurchases and self tender offers.

E. Whether the market reaction to a private repurchase announcement is favorable seems to be positively associated with the earnings forecast revisions in the artificial logit regression in which the binomial choice is the sign of the abnormal return over the period (-1, 1).

5. For the sample of self tender offers, the results do not yield conclusive evidence. This may be due to the small sample size after the construction of the control sample. However, there seems to be weak evidence in support of both the signalling hypothesis and the free cash flow hypothesis.

A. There is a positive difference between the earnings forecast revisions for the sample of self tender offers and the control sample, significant at the 5 percent level for a two-tailed non-parametric test. However, none of the coefficients of the motivational variables in the logit regression is significant.

B. The Tobin's Q was found to be the only significant variable in both the multinomial and the binomial logit regressions deciding the choice of self tender method versus open market repurchase method, with the self tender offers associated with lower

Tobin's Q.

C.   The coefficient of the Tobin's Q is significantly negative at the 10 percent level for a two-tailed test in the OLS regression with the fraction of shares sought in self tender offers as the dependent variable and the motivational proxies as the independent variables.

Table 1.   Summary Statistics of All Repurchase which Occurred From January, 1986 To April, 1989

		Open-Market	Private	Self-Tender
Sample Size		2,695	325	121
Companies		1,892	291	117
Fraction Sought	*Maximum*	66.70%	79.90%	67.90%
	Median	5.30%	7.90%	19.30%
	Minimum	0.20%	0.70%	3.70%
	Mean	**7.02%**	**10.61%**	**22.50%**
Shares Sought	*Maximum*	380,000,000	47,000,000	40,000,000
	Median	536,666	581,600	2,000,000
	Minimum	10,000	7,500	25,000
	Mean	**1,974,383**	**1,612,827**	**5,345,746**

Table 2. Occurrences of Repurchase For Each Year and During the 1987 Crash Period

		Open-Market	Private	Self-Tender
1986		441	99	28
1987		1,467	83	39
1988		588	104	41
1989 (up to April)		199	39	13
Total		2,695	325	121
1987 Crash Period	Oct 19 to Oct 26	441	3	1
	Oct 19 to Nov 2	735	7	2
	Oct 19 to Nov 9	813	8	3

Table 3.   Comparison of Open Market Repurchases During and Outside the 1987 Crash Period

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Sample Size		813	1,882	808	1,074
Fraction Sought	*Maximum*	55.20%	66.70%	66.70%	38.90%
	Median	5.40%	5.30%	5.20%	5.35%
	Minimum	0.20%	0.20%	0.20%	0.30%
	Mean	**7.02%**	**7.02%**	**7.07%**	**6.98%**
Shares Sought	*Maximum*	30,769,231	380,000,000	64,000,000	380,000,000
	Median	533,158	533,333	510,000	550,000
	Minimum	15,000	10,000	10,000	10,000
	Mean	**1,495,215**	**2,183,141**	**2,101,072**	**2,242,734**

Table 4.   Logit Regression of Repurchase .vs. Control (using *median* EFC in the *second* month, three-year average of Tobin's Qs, and three-year average of *market-value* based *long-term* debt-equity ratios)

		Open - Market	Private	Self - Tender
Intercept	*Estimate*	0.659	0.589	1.803
	p - value	*0.001*	0.311	*0.091*
EFC	*Estimate*	*0.476*	1.875	1.799
	p - value	*0.037*	0.193	0.164
Tobin's Q	*Estimate*	*-0.328*	-0.367	-0.988
	p - value	*0.002*	0.297	0.101
D/E Ratio	*Estimate*	*-0.393*	0.022	-0.676
	p - value	*0.015*	0.947	0.425
No. of Repurchases		413	45	20
No. of Control Firms		413	45	20
Chi-Square (DF = 3)		16.064	5.265	4.697
p-value of model fit		*0.001*	0.153	0.195

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Qs for the *three* fiscal years prior to repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 5. Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in *second* month, three-year average of Tobin's Qs, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.323	0.877	1.009	0.771
	p - value	0.354	*0.001*	*0.011*	*0.021*
EFC	*Estimate*	*1.792*	0.137	0.009	0.282
	p - value	*0.009*	0.586	0.979	0.435
Tobin's Q	*Estimate*	-0.081	*-0.465*	*-0.571*	*-0.383*
	p - value	0.659	*0.001*	*0.007*	*0.029*
D/E Ratio	*Estimate*	-0.241	*-0.561*	-0.590	*-0.535*
	p - value	0.311	*0.012*	0.110	*0.056*
No. of Repurchases		142	271	116	155
No. of Control Firms		142	271	116	155
Chi-Square (DF = 3)		12.109	14.222	8.064	7.002
p-value of model fit		*0.007*	*0.003*	*0.045*	*0.072*

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years before the repurchase.

Table 6. Pairwise Tests Between All Open Market Repurchases Sample and Control Sample

		Buying Firms	Control Firms	Buys - Controls	p-value of t-test	p-value of Wilcox Sign test
EFC	*Mean*	-6.20%	-11.50%	*5.29%*	*0.033*	0.102
	Minimum	-320.00%	-381.82%	-316.28%		
	Median	0.00%	0.00%	0.00%		
	Maximum	60.95%	100.00%	372.67%		
Tobin's Q	*Mean*	1.436	1.555	*-0.119*	*0.004*	*0.044*
	Minimum	0.490	0.370	-2.712		
	Median	1.258	1.341	-0.028		
	Maxixum	3.764	3.961	2.456		
D/E Ratio	*Mean*	0.311	0.351	-0.040	0.152	0.899
	Minimum	0.000	0.000	-3.197		
	Median	0.160	0.151	0.008		
	Maximum	3.236	4.006	2.962		
Sample Size		413	413			
Exchange Index		56.90%	61.50%		0.179	
Firm Size (in MM)	*Mean*	1,422	1,006		0.134	0.306
	Median	195	176			
Firm Size Difference	*Mean*		17.19%			
	Median		12.82%			
Fraction	*Mean*	7.39%				
	Minimum	0.40%				
	Median	5.60%				
	Maximum	36.50%				

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 7. Pairwise Tests Between Open Market Repurchases (Oct 19 to Nov 9, 1987) and Control Sample

		Buying Firms	Control Firms	Buys - Controls	p-value of t-test	p-value of Wilcox Sign test
EFC	*Mean*	-2.40%	-14.81%	*12.41%*	*0.003*	*0.002*
	Minimum	-100.00%	-381.82%	-99.00%		
	Median	0.00%	0.00%	0.93%		
	Maximum	38.46%	50.00%	351.82%		
Tobin's Q	*Mean*	1.483	1.506	-0.023	0.766	0.712
	Minimum	0.580	0.374	-2.712		
	Median	1.361	1.238	0.030		
	Maximum	3.309	3.893	2.168		
D/E Ratio	*Mean*	0.361	0.391	-0.030	0.591	0.962
	Minimum	0.000	0.000	-2.979		
	Median	0.164	0.165	-0.001		
	Maximum	3.236	4.006	2.962		
Sample Size		142	142			
Exchange Index		61.97%	66.90%		0.387	
Firm Size (in MM)	*Mean*	1,514	901		0.298	0.504
	Median	240	227			
Firm Size Difference	*Mean*		19.32%			
	Median		15.38%			
Fraction	*Mean*	7.26%				
	Minimum	0.60%				
	Median	5.50%				
	Maximum	29.90%				

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years before the repurchase.

Table 8.   Pairwise Tests Between Open Market Repurchases (before Oct 19, or after Nov 9, 1987) and Control Sample

		Buying Firms	Control Firms	Buys - Controls	p-value of t-test	p-value of Wilcox Sign test
EFC	*Mean*	-8.20%	-9.76%	1.56%	0.610	0.879
	Minimum	-320.00%	-375.00%	-316.28%		
	Median	0.00%	0.00%	0.00%		
	Maximum	60.95%	100.00%	372.67%		
Tobin's Q	*Mean*	1.411	1.581	*-0.170*	*0.001*	*0.005*
	Minimum	0.490	0.370	-2.612		
	Median	1.232	1.387	-0.070		
	Maximum	3.764	3.961	2.455		
D/E Ratio	*Mean*	0.284	0.330	-0.046	0.149	0.938
	Minimum	0.000	0.000	-3.197		
	Median	0.160	0.139	0.012		
	Maximum	2.390	3.368	2.066		
Sample Size		271	271			
Exchange Index		54.24%	58.67%		0.299	
Firm Size (in MM)	*Mean*	1,374	1,061		0.282	0.420
	Median	158	165			
Firm Size Difference	*Mean*		16.08%			
	Median		11.80%			
Fraction	*Mean*	7.45%				
	Minimum	0.40%				
	Median	5.60%				
	Maximum	36.50%				

EFC	the *median* earnings forecast revision in the *second* month after the repurchase.
Tobin's Q	the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.
D/E Ratio	the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 9.   Pairwise Tests Between Open Market Repurchases (before Oct 19, 1987) and Control Sample

		Buying Firms	Control Firms	Buys - Controls	p-value of t-test	p-value of Wilcox Sign test
EFC	*Mean*	-9.90%	-8.97%	-0.93%	0.851	0.176
	Minimum	-320.00%	-375.00%	-311.72%		
	Median	-1.41%	0.00%	0.00%		
	Maximum	18.75%	100.00%	372.67%		
Tobin's Q	*Mean*	1.367	1.591	*-0.224*	*0.002*	*0.006*
	Minimum	0.579	0.527	-2.405		
	Median	1.210	1.373	-0.093		
	Maximum	3.764	3.945	2.455		
D/E Ratio	*Mean*	0.275	0.300	-0.025	0.539	0.639
	Minimum	0.000	0.000	-1.580		
	Median	0.151	0.150	0.017		
	Maximum	2.356	1.814	2.063		
Sample Size		116	116			
Exchange Index		55.17%	62.07%		0.288	
Firm Size (in MM)	*Mean*	1,323	1,021		0.421	0.686
	Median	158	173			
Firm Size Difference	*Mean*		16.05%			
	Median		11.92%			
Fraction	*Mean*	7.19%				
	Minimum	0.70%				
	Median	5.10%				
	Maximum	32.80%				

EFC	the *median* earnings forecast revision in the *second* month after the repurchase.
Tobin's Q	the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.
D/E Ratio	the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years before the repurchase.

Table 10. Pairwise Tests Between Open Market Repurchases (after Nov 19, 1987) and Control Sample

		Buying Firms	Control Firms	Buys - Controls	p-value of t-test	p-value of Wilcox Sign test
EFC	*Mean*	-6.92%	-10.35%	3.43%	0.378	0.404
	Minimum	-300.00%	-240.00%	-316.28%		
	Median	0.00%	0.00%	0.00%		
	Maximum	60.95%	33.33%	240.00%		
Tobin's Q	*Mean*	1.444	1.573	***-0.129***	***0.056***	0.190
	Minimum	0.490	0.370	-2.612		
	Median	1.255	1.433	-0.028		
	Maximum	3.628	3.961	2.023		
D/E Ratio	*Mean*	0.291	0.353	-0.062	0.187	0.624
	Minimum	0.000	0.000	-3.197		
	Median	0.169	0.132	0.007		
	Maximum	2.390	3.368	2.066		
Sample Size		155	155			
Exchange Index		53.55%	56.13%			0.646
Firm Size (in MM)	*Mean*	1,412	1,092		0.451	0.497
	Median	163	157			
Firm Size Difference	*Mean*		16.10%			
	Median		11.80%			
Fraction	*Mean*	7.65%				
	Minimum	0.40%				
	Median	6.00%				
	Maximum	36.50%				

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 11.   Pairwise Tests Between Private Repurchase Sample and Control Sample

		Buying Firms	Contol Firms	Buys-Controls	p-value of t-test	p-value of Wilcox Sign test
EFC	Mean	-0.10%	-14.15%	*14.05%*	0.118	*0.048*
	Minimum	-75.70%	-366.67%	-77.87%		
	Median	0.00%	0.00%	1.68%		
	Maximum	44.78%	22.86%	366.70%		
Tobin's Q	Mean	1.343	1.580	*-0.237*	*0.071*	0.109
	Minimum	0.570	0.527	-2.452		
	Median	1.199	1.328	-0.283		
	Maximum	3.433	3.795	1.378		
D/E Ratio	Mean	0.429	0.378	0.051	0.654	0.208
	Minimum	0.000	0.000	-3.642		
	Median	0.228	0.155	0.084		
	Maximum	3.900	4.487	2.411		
Sample Size		45	45			
Exchange Index		42.22%	51.11%		0.404	
Firm Size (in MM)	Mean	715	571		0.725	0.775
	Median	111	112			
Firm Size Difference	Mean		18.34%			
	Median		15.32%			
Fraction	Mean	9.21%				
	Minimum	0.70%				
	Median	8.30%				
	Maximum	44.00%				

EFC the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 12.   Pairwise Tests Between Self-Tender Sample and Control Sample

		Buying Firms	Control Firms	Buys - Controls	p-value of t-test	p-value of Wilcox Sign test
EFC	*Mean*	-5.93%	-17.32%	*11.39%*	0.192	*0.048*
	Minimum	-100.00%	-110.53%	-67.00%		
	Median	-0.69%	-6.91%	10.06%		
	Maximum	13.58%	32.14%	101.44%		
Tobin's Q	*Mean*	1.210	1.476	-0.265	0.160	0.622
	Minimum	0.754	0.424	-1.851		
	Median	1.200	1.053	0.043		
	Maximum	2.055	3.170	0.851		
D/E Ratio	*Mean*	0.406	0.445	-0.038	0.762	0.985
	Minimum	0.000	0.006	-1.504		
	Median	0.300	0.233	0.033		
	Maximum	1.376	1.838	0.982		
Sample Size		20	20			
Exchange Index		60.00%	51.04%		0.355	
Firm Size (in MM)	*Mean*	319	291		0.828	0.946
	Median	158	143			
Firm Size Difference	*Mean*		17.04%			
	Median		12.35%			
Fraction	*Mean*	23.42%				
	Minimum	6.90%				
	Median	19.60%				
	Maximum	61.10%				

EFC the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 13.   Logit Regression of Repurchase .vs. Control (using *median* EFC in the *first* month, three-year average of Tobin's Qs, and three-year average of *market-value* based *long-term* debt-equity ratios)

		Open - Market	Private	Self - Tender
Intercept	*Estimate*	0.632	0.711	1.521
	p - value	*0.001*	0.182	0.151
EFC	*Estimate*	*0.804*	-0.851	6.158
	p - value	*0.013*	0.656	0.135
Tobin's Q	*Estimate*	*-0.306*	-0.467	-0.841
	p - value	*0.002*	0.133	0.157
D/E Ratio	*Estimate*	*-0.401*	-0.091	-0.565
	p - value	*0.011*	0.768	0.538
No. of Repurchases		466	52	21
No. of Control Firms		466	52	21
Chi-Square (DF = 3)		18.404	2.443	6.378
p-value of model fit		*0.0004*	0.486	*0.095*

EFC   the *median* earnings forecast revision in the *first* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 14.   Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in the *first* month, three-year average of Tobin's Qs, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.366	0.802	0.956	0.675
	p - value	0.267	*0.001*	*0.009*	*0.030*
EFC	*Estimate*	*1.889*	0.359	0.082	0.652
	p - value	*0.011*	0.315	0.870	0.205
Tobin's Q	*Estimate*	-0.117	*-0.407*	*-0.524*	*-0.315*
	p - value	0.499	*0.001*	*0.007*	*0.050*
D/E Ratio	*Estimate*	-0.246	*-0.567*	*-0.599*	*-0.533*
	p - value	0.283	*0.009*	0.100	*0.049*
No. of Repurchases		153	313	129	184
No. of Control Firms		153	313	129	184
Chi-Square (DF = 3)		10.876	14.093	8.066	7.509
p-value of model fit		*0.012*	*0.003*	*0.045*	*0.057*

EFC   the *median* earnings forecast revision in the *first* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 15. Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in the *third* month, three-year average of Tobin's Qs, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.256	0.850	0.719	0.951
	p - value	0.479	*0.003*	0.101	0.012
EFC	*Estimate*	*1.221*	-0.053	-0.380	0.110
	p - value	*0.032*	0.826	0.422	0.705
Tobin's Q	*Estimate*	-0.069	*-0.473*	*-0.498*	*-0.460*
	p - value	0.711	*0.002*	*0.041*	*0.018*
D/E Ratio	*Estimate*	-0.202	*-0.495*	-0.146	*-0.721*
	p - value	0.441	*0.046*	0.722	*0.027*
No. of Repurchases		134	230	97	133
No. of Control Firms		134	230	97	133
Chi-Square (DF = 3)		7.415	10.77	5.61	7.812
p-value of model fit		*0.060*	*0.013*	0.132	*0.050*

EFC   the *median* earnings forecast revision in the *third* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 16.   Logit Regression of Repurchase .vs. Control (using average of *median* EFC over the four months, three-year average of Tobin's Q, and three-year average of *market-value* based *long-term* debt-equity ratios)

		Open - Market	Private	Self - Tender
Intercept	*Estimate*	0.632	0.625	1.627
	p - value	*0.001*	0.251	0.122
EFC	*Estimate*	*1.513*	1.464	1.466
	p - value	*0.024*	0.238	0.344
Tobin's Q	*Estimate*	*-0.302*	-0.367	-0.913
	p - value	*0.002*	0.258	0.123
D/E Ratio	*Estimate*	*-0.414*	-0.089	-0.563
	p - value	*0.008*	0.769	0.498
No. of Repurchases		467	52	21
No. of Control Firms		467	52	21
Chi-Square (DF = 3)		16.999	4.283	3.394
p-value of model fit		*0.001*	0.232	0.335

EFC   the *average* of *median* earnings forecast revisions over the *four* months after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 17. Logit Regression of Open Market Repurchase .vs. Control (using average of *median* EFC over four months, three-year average of Tobin's Qs, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.345	0.802	0.964	0.676
	p - value	0.302	*0.001*	*0.009*	*0.029*
EFC	*Estimate*	*1.865*	0.178	0.086	0.291
	p - value	*0.004*	0.470	0.810	0.396
Tobin's Q	*Estimate*	-0.086	*-0.406*	*-0.526*	*-0.314*
	p - value	0.627	*0.001*	*0.007*	*0.051*
D/E Ratio	*Estimate*	-0.260	*-0.574*	-0.601	*-0.550*
	p - value	0.258	*0.008*	*0.100*	*0.041*
No. of Repurchases		154	313	129	184
No. of Control Firms		154	313	129	184
Chi-Square (DF = 3)		13.679	13.567	8.097	6.504
p-value of model fit		*0.003*	*0.004*	*0.044*	*0.090*

EFC the *average* of *median* earnings forecast revisions over the *four* months after the repurchase.

Tobin's Q the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 18. Logit Regression of Repurchase .vs. Control (using *mean* EFC in the *first* month, three-year average of Tobin's Qs, and three-year average of *market-value* based *long-term* debt-equity ratios)

		Open - Market	Private	Self - Tender
Intercept	*Estimate*	0.622	0.716	1.660
	p - value	0.001	0.182	0.121
EFC	*Estimate*	*0.836*	0.973	5.839
	p - value	*0.016*	0.693	0.180
Tobin's Q	*Estimate*	*-0.301*	-0.462	-0.908
	p - value	*0.003*	0.141	0.326
D/E Ratio	*Estimate*	*-0.400*	-0.081	-0.633
	p - value	*0.011*	0.792	0.471
No. of Repurchases		466	52	21
No. of Control Firms		466	52	21
Chi-Square (DF = 3)		18.229	2.398	5.109
p-value of model fit		*0.0004*	0.494	0.164

EFC   the *mean* earnings forecast revision in the *first* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 19. Logit Regression of Open Market Repurchase .vs. Control (using *mean* EFC in the *first* month, three-year average of Tobin's Qs, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.318	0.805	0.968	0.671
	p - value	0.333	*0.001*	*0.009*	*0.031*
EFC	*Estimate*	*2.015*	0.444	0.201	0.698
	p - value	*0.020*	0.253	0.720	0.197
Tobin's Q	*Estimate*	-0.094	*-0.407*	*-0.528*	*-0.311*
	p - value	0.592	*0.001*	*0.006*	*0.053*
D/E Ratio	*Estimate*	-0.220	*-0.570*	*-0.601*	*-0.541*
	p - value	0.334	*0.008*	*0.100*	*0.045*
No. of Repurchases		153	313	129	184
No. of Control Firms		153	313	129	184
Chi-Square (DF = 3)		9.761	14.403	8.169	7.549
p-value of model fit		*0.021*	*0.002*	*0.043*	*0.056*

EFC   the *mean* earnings forecast revision in the *first* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 20. Logit Regression of Open Market Repurchase .vs. Control (using *mean* EFC in the *second* month, three-year average of Tobin's Q, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.305	0.886	1.017	0.777
	p - value	0.380	*0.001*	*0.010*	*0.020*
EFC	*Estimate*	*1.654*	0.226	0.057	0.424
	p - value	*0.014*	0.397	0.880	0.276
Tobin's Q	*Estimate*	-0.076	*-0.466*	*-0.573*	*-0.380*
	p - value	0.681	*0.001*	*0.007*	*0.031*
D/E Ratio	*Estimate*	-0.231	*-0.563*	-0.591	*-0.538*
	p - value	0.331	*0.012*	0.109	*0.055*
No. of Repurchases		142	271	116	155
No. of Control Firms		142	271	116	155
Chi-Square (DF = 3)		10.327	14.655	8.087	7.627
p-value of model fit		*0.016*	*0.002*	*0.044*	*0.054*

EFC   the *mean* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 21. Logit Regression of Open Market Repurchase .vs. Control (using average of *mean* EFC over *four* months, three-year average of Tobin's Qs, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.361	0.806	0.980	0.672
	p - value	0.280	*0.001*	*0.008*	*0.030*
EFC	*Estimate*	*1.801*	0.242	0.172	0.348
	p - value	*0.004*	0.349	0.644	0.338
Tobin's Q	*Estimate*	-0.091	*-0.406*	*-0.532*	*-0.310*
	p - value	0.608	*0.001*	*0.006*	*0.054*
D/E Ratio	*Estimate*	-0.259	*-0.575*	-0.602	*-0.551*
	p - value	0.258	*0.008*	0.099	*0.041*
No. of Repurchases		154	313	129	184
No. of Control Firms		154	313	129	184
Chi-Square (DF = 3)		14.539	13.934	8.253	6.722
p-value of model fit		*0.002*	*0.003*	*0.041*	*0.081*

EFC   the *average* of *mean* earnings forecast revisions over the *four* months after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the *three* fiscal years prior to the repurchase.

Table 22. Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in *second* month, *yearly* Tobin's Q prior to repurchase, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.344	0.787	1.014	0.652
	p - value	0.349	0.001	*0.011*	*0.036*
EFC	*Estimate*	*1.821*	0.159	0.072	0.262
	p - value	*0.010*	0.541	0.842	0.488
Tobin's Q	*Estimate*	-0.103	*-0.428*	*-0.576*	*-0.335*
	p - value	0.607	*0.002*	*0.009*	*0.050*
D/E Ratio	*Estimate*	-0.229	*-0.519*	-0.582	*-0.486*
	p - value	0.329	*0.017*	0.108	*0.072*
No. of Repurchases		139	272	118	154
No. of Control Firms		139	272	118	154
Chi-Square (DF = 3)		10.379	12.332	7.638	5.669
p-value of model fit		*0.016*	*0.006*	*0.054*	0.129

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   Tobin's Q of the fiscal year immediately prior to the repurchase.

D/E Ratio the *average* of the yearly *market-value* based *long-term* debt-equity ratios over the

three fiscal years prior to the repurchase.

Table 23. Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in the *second* month, three-year average of Jensen's Measures, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.044	-0.085	-0.045	-0.098
	p - value	0.801	0.443	0.802	0.495
EFC	*Estimate*	*1.139*	0.087	-0.110	0.315
	p - value	*0.032*	0.730	0.763	0.383
AFCF	*Estimate*	-0.057	*1.382*	0.501	*1.905*
	p - value	0.968	*0.087*	0.716	*0.065*
D/E Ratio	*Estimate*	0.100	-0.072	-0.026	-0.102
	p - value	0.503	0.421	0.842	0.425
No. of Repurchases		152	301	127	174
No. of Control Firms		152	301	127	174
Chi-Square (DF = 3)		8.694	3.465	0.186	4.951
p-value of model fit		*0.034*	0.325	0.980	0.175

EFC the *median* earnings forecast revision in the *second* month after the repurchase.

AFCF the *average* of a firm's yearly post-tax net cash flows relative to the market value of its common stock over *three* years prior to the repurchase.

D/E Ratio the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 24.   Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in the *second* month, *yearly* Jensen's Measure prior to repurchase, and three-year average of *market-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	-0.047	-0.050	-0.056	-0.045
	p - value	0.758	0.640	0.735	0.749
EFC	*Estimate*	**0.989**	0.121	-0.139	0.397
	p - value	**0.047**	0.633	0.705	0.279
AFCF	*Estimate*	1.321	0.909	0.615	1.141
	p - value	0.257	0.172	0.580	0.172
D/E Ratio	*Estimate*	0.014	-0.040	-0.020	-0.051
	p - value	0.927	0.650	0.873	0.687
No. of Repurchases		152	296	125	171
No. of Control Firms		152	296	125	171
Chi-Square (DF = 3)		9.339	2.4	0.377	3.432
p-value of model fit		*0.025*	0.494	0.945	0.330

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

AFCF   a firm's post-tax net cash flow relative to the market-value of its common stock for the fiscal year immediately prior to the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 25. Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in the *second* month, three-year average of Tobin's Qs, and yearly *market-value* based *long-term* debt-equity ratio)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.188	0.770	0.903	0.669
	p - value	0.559	**0.002**	**0.017**	**0.033**
EFC	*Estimate*	*1.755*	0.132	-0.033	0.310
	p - value	*0.010*	0.600	0.927	0.391
Tobin's Q	*Estimate*	-0.030	*-0.423*	*-0.529*	*-0.342*
	p - value	0.867	*0.001*	*0.011*	*0.044*
D/E Ratio	*Estimate*	-0.085	*-0.390*	-0.413	*-0.377*
	p - value	0.621	*0.036*	0.199	*0.099*
No. of Repurchases		142	271	116	155
No. of Control Firms		142	271	116	155
Chi-Square (DF = 3)		11.306	12.243	7.11	6.159
p-value of model fit		*0.010*	*0.007*	*0.069*	0.104

EFC   the *mean* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio the *market-value* based *long-term* debt-equity ratio for the fiscal year

immediately prior to the repurchase.

Table 26. Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in the *second* month, three-year average of Tobin's Qs, and three-year average of *market-value* based *total* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.561	1.067	1.309	0.886
	p - value	0.1491	*0.0002*	*0.004*	*0.019*
EFC	*Estimate*	*1.799*	0.129	-0.002	0.281
	p - value	*0.009*	0.609	0.996	0.436
Tobin's Q	*Estimate*	-0.164	*-0.525*	*-0.671*	*-0.416*
	p - value	0.397	*0.0002*	*0.003*	*0.025*
D/E Ratio	*Estimate*	-0.277	*-0.408*	*-0.474*	*-0.358*
	p - value	0.101	*0.006*	*0.039*	*0.063*
No. of Repurchases		142	271	116	155
No. of Control Firms		142	271	116	155
Chi-Square (DF = 3)		13.905	15.655	10.000	6.758
p-value of model fit		*0.003*	*0.001*	*0.019*	*0.080*

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of yearly *market-value* based *total* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 27. Pairwise Tests Between Open Market Repurchases (before Oct 19, 1987) and Control Sample (using the *market-value* based *total* debt-equity ratios)

		Buying Firms	Control Firms	Buys - Controls	p-value of t-test	p-value of Wilcox Sign test
EFC	*Mean*	-9.90%	-8.97%	-0.93%	0.851	0.176
	Minimum	-320.00%	-375.00%	-311.72%		
	Median	-1.41%	0.00%	0.00%		
	Maximum	18.75%	100.00%	372.67%		
Tobin's Q	*Mean*	1.367	1.591	***-0.224***	***0.002***	***0.006***
	Minimum	0.579	0.527	-2.405		
	Median	1.210	1.373	-0.093		
	Maximum	3.764	3.945	2.455		
D/E Ratio	*Mean*	0.654	0.713	-0.059	0.390	0.695
	Minimum	0.020	0.024	-4.228		
	Median	0.482	0.460	0.035		
	Maximum	3.105	4.493	1.809		
Sample Size		116	116			
Exchange Index		55.17%	62.07%		0.288	
Firm Size (in MM)	*Mean*	1,323	1,021		0.421	0.689
	Median	158	173			
Firm Size Difference	*Mean*		16.05%			
	Median		11.92%			
Fraction	*Mean*	7.19%				
	Minimum	0.70%	.			
	Median	5.10%				
	Maximum	32.80%				

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *total* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 28. Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in the *second* month, three-year average of Tobin's Q, and three-year average of *book-value* based *long-term* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.358	0.895	1.067	0.763
	p - value	0.306	*0.0004*	*0.008*	*0.022*
EFC	*Estimate*	*1.803*	0.138	0.015	0.282
	p - value	*0.008*	0.583	0.966	0.435
Tobin's Q	*Estimate*	-0.095	*-0.472*	*-0.594*	*-0.380*
	p - value	0.606	*0.001*	*0.006*	*0.031*
D/E Ratio	*Estimate*	-0.263	*-0.564*	-0.629	*-0.517*
	p - value	0.247	*0.009*	0.076	0.060
No. of Repurchases		142	271	116	155
No. of Control Firms		142	271	116	155
Chi-Square (DF = 3)		12.444	14.621	8.699	6.844
p-value of model fit		*0.006*	*0.002*	*0.034*	*0.077*

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *book-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 29.   Logit Regression of Open Market Repurchase .vs. Control (using *median* EFC in the *second* month, three-year average of Tobin's Qs, and three-year average of *book-value* based *total* debt-equity ratios)

		From Oct 19 to Nov 9, 1987	Before Oct 19 or After Nov 9, 1987	Before Oct 19, 1987	After Nov 9, 1987
Intercept	*Estimate*	0.583	1.080	1.361	0.876
	p - value	0.1334	*0.0002*	*0.003*	*0.020*
EFC	*Estimate*	*1.803*	0.129	0.002	0.282
	p - value	*0.009*	0.607	0.996	0.436
Tobin's Q	*Estimate*	-0.173	*-0.531*	*-0.692*	*-0.413*
	p - value	0.372	*0.0002*	*0.003*	*0.026*
D/E Ratio	*Estimate*	-0.281	*-0.409*	*-0.493*	*-0.349*
	p - value	0.085	*0.005*	*0.030*	*0.067*
No. of Repurchases		142	271	116	155
No. of Control Firms		142	271	116	155
Chi-Square (DF = 3)		14.21	15.942	10.524	6.644
p-value of model fit		*0.003*	*0.001*	*0.015*	*0.084*

EFC　　　the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q　the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio　the *average* of the yearly *book-value* based *total* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 30. Statistics of Various Repurchasing Samples

		Open-Market (beofre Oct19, or after Nov 9, 1987)	Open-Market (between Oct 19 and Nov 9, 1987)	private	self tender
EFC	*Mean*	-6.58%	-3.69%	-1.75%	-3.40%
	Median	0.00%	0.00%	0.00%	0.00%
Tobin's Q	*Mean*	1.417	1.476	1.242	1.199
	Median	1.244	1.304	1.036	1.207
D/E Ratio	*Mean*	0.297	0.33	0.397	0.337
	Median	0.169	0.171	0.255	0.278
Sample Size		559	286	77	38
Exchange Index		66.01%	69.58%	57.14%	71.05%
Firm Size	*Mean*	2,381	1,419	846	1,104
	Median	272	247	223	224
Fraction	*Mean*	**7.33%**	**7.54%**	**9.21%**	**22.31%**
	Minimum	0.40%	0.40%	0.70%	6.90%
	Median	5.50%	5.80%	8.20%	19.10%
	Maximum	66.70%	55.20%	44.00%	61.10%

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 31.   Tests of Firm Size Difference Among Three Types of Repurchases

	Sample Size	Exchange Index	Firm Size	
			Mean	Median
Open-Market (before Oct 19, or after Nov 9, 1987)	559	66.01%	2,381	272
Open-Market (between Oct 19 and Nov 9, 1987)	286	69.58%	1,419	247
Private	77	57.14%	846	223
Self-Tender	38	71.05%	1,104	224
p-value of F-test			0.106	
p-value of Wilcoxon test		0.346	0.138	
p-value of median test				0.497

Exchange Index   percentage of firms listed in the New York Exchange or American Stock Exchange Stock Exchange in a sample.

Firm Size   the average of a firm's market value of common stock calculated at the closing price at fiscal year end over the 1983-1989 period.

Table 32. Multiple-Choice Logit Regression of All Repurchases

		Ln (Po/Ps)	Ln (Pp/Ps)
Sample Size		845/77/38	
Intercept	*Estimate*	1.419	0.768
	p - value	0.076	0.414
LnSize	*Estimate*	0.080	-0.085
	p - value	0.395	0.456
EFC	*Estimate*	-0.677	0.900
	p - value	0.504	0.485
Tobin's Q	*Estimate*	**0.859**	0.265
	p - value	**0.021**	0.543
D/E Ratio	*Estimate*	0.194	0.313
	p - value	0.641	0.498

LnSize   the log of the average of market value of a firm's common stocks over the 1983-1989 period.

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

P_o the probability that a repurchasing firm will use open-market method.

P_p the probability that a repurchasing firm will use private-repurchase method.

P_s the probability that a repurchasing firm will use self-tender method[6].

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[6]Notice that $P_o + P_p + P_s \equiv 1$.

Table 33. Binomial Logit Regressions of All Repurchases

		Ln (Po/Ps)	Ln (Pp/Ps)	Ln (Po/Pp)
Intercept	*Estimate*	1.371	0.893	0.654
	p - value	*0.089*	0.324	0.241
LnSize	*Estimate*	0.082	-0.112	***0.166***
	p - value	0.383	0.366	***0.018***
EFC	*Estimate*	-0.682	0.623	***-1.590***
	p - value	0.505	0.577	*0.066*
Tobin's Q	*Estimate*	***0.883***	0.244	***0.587***
	p - value	***0.019***	0.571	***0.016***
D/E Ratio	*Estimate*	0.214	0.431	-0.113
	p - value	0.603	0.450	0.623
Sample Size		845 / 38	77 / 38	845 / 77
p-value of model fit		0.106	0.771	***0.002***

LnSize   the log of the average of market value of a firm's common stocks over the 1983-1989 period.

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

P_o the probability that a repurchasing firm will use open-market method.

P_p the probability that a repurchasing firm will use private-repurchase method.

P_s the probability that a repurchasing firm will use self-tender method.

Table 34. Binomial Logit Regressions of Repurchases Which Occurred before Oct 19 or after Nov 9, 1987)

		Log (Po/Ps)	Log (Pp/Ps)	Log (Po/Pp)
Intercept	*Estimate*	1.018	1.009	0.145
	p - value	0.197	0.265	0.798
Lnsize	*Estimate*	0.095	-0.108	*0.179*
	p - value	0.304	0.378	*0.012*
EFC	*Estimate*	-0.941	0.611	*-1.767*
	p - value	0.359	0.584	*0.041*
Tobin's Q	*Estimate*	*0.801*	0.107	*0.650*
	p - value	*0.034*	0.810	*0.013*
D/E Ratio	*Estimate*	0.089	0.451	-0.216
	p - value	0.822	0.424	0.344
Sample Size		559 / 36	75/36	559 / 75
p-value of model fit		0.125	0.798	*0.001*

LnSize   the log of the average of market value of a firm's common stocks over the 1983-1989 period.

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

P_o the probability that a repurchasing firm will use open-market method.

P_p the probability that a repurchasing firm will use private-repurchase method.

P_s the probability that a repurchasing firm will use self-tender method.

Table 35. Binomial Logit Regressions of Repurchases (Excluding Open Market Repurchases Made Over the 1987 Crash Period)

		Log (Po/Ps)	Log (Po/Pp)
Intercept	*Estimate*	0.160	-0.451
	p - value	0.860	0.482
Lnsize	*Estimate*	0.045	***0.138***
	p - value	0.670	***0.090***
EFC	*Estimate*	0.002	-0.938
	p - value	0.998	0.335
Tobin's Q	*Estimate*	***1.093***	***0.708***
	p - value	***0.007***	***0.007***
D/E Ratio	*Estimate*	0.467	0.016
	p - value	0.327	0.954
Sample Size		286/ 77	286/38
p-value of model fit		***0.061***	***0.014***

LnSize   the log of the average of market value of a firm's common stocks over the 1983-1989 period.

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

P_o the probability that a repurchasing firm will use open-market method.

P_p the probability that a repurchasing firm will use private-repurchase method.

P_s the probability that a repurchasing firm will use self-tender method.

Table 36. Binomial Logit Regression of Open Market Repurchases (Crash Buys .vs. Non-Crash Buys)

		Ln (P1 / P0)
Intercept	*Estimate*	-1.025
	p - value	**0.0001**
EFC	*Estimate*	**0.789**
	p - value	**0.071**
Tobin's Q	*Estimate*	**0.217**
	p - value	**0.074**
D/E Ratio	*Estimate*	0.256
	p - value	0.123
Sample Size		559 / 286
p-value of model fit		**0.049**

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

P_0 the probability that an open market repurchase happened either before October 19, 1987 or after November 9, 1987.

P_1 the probability that an open market repurchase happened within the October 19, 1987 to November 9, 1987 period.[7]

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[7]Notice that $P_0 + P_1 \equiv 1$.

Table 37. OLS Regressions of The Fraction of Shares Sought for Open Market Repurchases Which Occurred before October 19 or after November 9, 1987

		Regression 1	Regression 2
Intercept	*Estimate*	10.785	8.575
	p - value	**0.0001**	**0.0001**
LnSize	*Estimate*	**-0.340**	
	p - value	**0.020**	
EFC	*Estimate*	-0.562	-1.054
	p - value	0.609	0.331
Tobin's Q	*Estimate*	**-1.161**	**-1.091**
	p - value	**0.013**	**0.020**
D/E Ratio	*Estimate*	0.621	0.780
	p - value	0.327	0.217
Sample Size		544	544
R-Square		0.029	0.019
Adjusted R-Square		0.022	0.014

LnSize the log of the average of market value of a firm's common stocks over the 1983-1989 period.

EFC the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 38. OLS Regressions of The Fraction of Shares Sought for Open Market Repurchases Which Occurred between October 19 and November 9, 1987

		Regression 1	Regression 2
Intercept	*Estimate*	11.830	7.370
	p - value	**0.0001**	**0.0001**
LnSize	*Estimate*	**-0.671**	
	p - value	**0.004**	
EFC	*Estimate*	0.075	-1.138
	p - value	0.977	0.664
Tobin's Q	*Estimate*	-0.358	-0.073
	p - value	0.574	0.909
D/E Ratio	*Estimate*	0.405	0.726
	p - value	0.640	0.404
Sample Size		274	274
R-Square		0.034	0.004
Adjusted R-Square		0.020	-0.007

LnSize   the log of the average of market value of a firm's common stocks over the 1983-1989 period.

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 39.   OLS Regressions of The Fraction of Shares Sought for Private Repurchases

		Regression 1	Regression 2
Intercept	*Estimate*	13.316	9.412
	p - value	**0.0002**	**0.0001**
LnSize	*Estimate*	-0.706	
	p - value	0.158	
EFC	*Estimate*	3.618	3.404
	p - value	0.463	0.493
Tobin's Q	*Estimate*	-0.223	-0.179
	p - value	0.875	0.900
D/E Ratio	*Estimate*	0.268	0.209
	p - value	0.178	0.891
Sample Size		77	77
R-Square		0.034	0.007
Adjusted R-Square		-0.020	-0.034

LnSize   the log of the average of market value of a firm's common stocks over the 1983-1989 period.

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 40. OLS Regressions of The Fraction of Shares Sought for Self Tender Offers

		Regression 1	Regression 2
Intercept	*Estimate*	46.264	42.393
	p - value	***0.0002***	***0.0001***
LnSize	*Estimate*	-0.980	
	p - value	0.473	
EFC	*Estimate*	12.819	11.513
	p - value	0.256	0.297
Tobin's Q	*Estimate*	***-13.375***	***-14.750***
	p - value	***0.078***	***0.044***
D/E Ratio	*Estimate*	-5.491	-5.931
	p - value	0.457	0.417
Sample Size		38	38
R-Square		0.147	0.134
Adjusted R-Square		0.044	0.057

LnSize   the log of the average of market value of a firm's common stocks over the 1983-1989 period.

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 41. The Cumulative Prediction Errors of Each Type of Repurchase

		Open Market	Private	Self Tender
Sample Size		2382	269	109
CAR (-50, -2)	Mean	*-1.59%*	1.48%	0.75%
	Z Statistic	*-4.95*	0.45	0.30
	Median	-1.83%	0.03%	0.76%
	Pcnt of >0	45.44%	50.19%	54.13%
CAR (-1, 1)	Mean	*3.39%*	0.06%	*7.95%*
	Z Statistic	*37.72*	-0.37	*25.03*
	Median	2.33%	0.08%	6.79%
	Pcnt of >0	68.73%	50.56%	84.40%
CAR (2, 10)	Mean	*0.95%*	-0.55%	-0.44%
	Z Statistic	*6.08*	-0.70	-1.05
	Median	0.18%	-0.66%	-0.11%
	Pcnt of >0	51.32%	44.98%	48.62%
Fraction	*Mean*	7.04%	10.12%	22.06%
	Minimum	0.20%	0.70%	3.70%
	Median	5.30%	7.70%	19.00%
	Maixmum	66.70%	79.90%	67.90%
Market Value (in MM)	Mean	1,364	526	1,124
	Median	154	77	220

$CARL(t_1, t_2)$ the cumulative prediction error over the event period (t_1, t_2).

Fraction   the fraction of shares sought in a repurchase.

Market Value   the market value of a firm's common stocks ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.

Table 42. The Cumulative Prediction Errors of Two Subsamples of Open Repurchases

		Open Market (before Oct 19 or after Nov 9, 1987)	Open Market (from Oct 19 to Nov 9, 1987)
Sample Size		1642	740
CAR (-50, -2)	Mean	*-2.64%*	0.76%
	Z Statistic	*-6.64*	1.00
	Median	-2.70%	1.04%
	Pcnt of >0	42.84%	51.22%
CAR (-1, 1)	Mean	*3.02%*	*4.21%*
	Z Statistic	*29.89*	*23.16*
	Median	2.18%	3.29%
	Pcnt of >0	71.48%	62.70%
CAR (2, 10)	Mean	*0.49%*	*1.98%*
	Z Statistic	*2.66*	*6.95*
	Median	-0.05%	1.00%
	Pcnt of >0	49.76%	54.86%
Fraction	*Mean*	7.03%	7.04%
	Minimum	0.20%	0.20%
	Median	5.02%	5.40%
	Maixmum	66.70%	55.20%
Market Value (in MM)	Mean	1,483	1,098
	Median	143	170

CARL(t_1, t_2)	the cumulative prediction error over the event period (t_1, t_2).
Fraction	the fraction of shares sought in a repurchase.
Market Value	the market value of a firm's common stocks ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.

Table 43. The Cumulative Prediction Errors of Repurchases by NYAM firms

		Open Market (NYAM)	Private (NYAM)	Self Tender (NYAM)
Sample Size		1375	154	74
CAR (-50, -2)	Mean	*-1.29%*	-0.21%	0.59%
	Z Statistic	*-2.18*	0.26	0.39
	Median	-1.41%	1.24%	0.69%
	Pcnt of >0	46.47%	51.30%	54.05%
CAR (-1, 1)	Mean	*2.33%*	*-0.79%*	*7.37%*
	Z Statistic	*25.96*	*-2.56*	*21.22*
	Median	1.78%	-0.76%	6.05%
	Pcnt of >0	65.89%	44.16%	82.43%
CAR (2, 10)	Mean	*0.50%*	-1.27%	-0.78%
	Z Statistic	*3.51*	-1.38	-1.48
	Median	0.07%	-0.69%	-0.26%
	Pcnt of >0	50.33%	43.14%	44.59%
Fraction	*Mean*	7.08%	8.74%	21.77%
	Minimum	0.20%	0.70%	3.70%
	Median	5.40%	6.90%	16.90%
	Maixmum	66.70%	48.20%	65.70%
Market Value (in MM)	Mean	2,244	789	1,599
	Median	478	179	698

$CARL(t_1, t_2)$ the cumulative prediction error over the event period (t_1, t_2).

Fraction   the fraction of shares sought in a repurchase.

Market Value   the market value of a firm's common stocks ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.

Table 44. The Cumulative Prediction Errors of Repurchases by NASDAQ firms (up to the end of 1988)

		Open Market (NASDAQ)	Private (NASDAQ)	Self Tender (NASDAQ)
Sample Size		1007	115	35
CAR (-50, -2)	*Mean*	***-2.00%***	3.73%	1.08%
	Z Statistic	***-5.08***	0.39	-0.03
	Median	-3.39%	-0.44%	1.90%
	Pcnt of >0	44.02%	48.70%	54.29%
CAR (-1, 1)	*Mean*	***4.85%***	***1.20%***	***9.16%***
	Z Statistic	***24.69***	***2.39***	***13.31***
	Median	3.75%	1.27%	8.91%
	Pcnt of >0	72.47%	59.13%	88.57%
CAR (2, 10)	*Mean*	***1.57%***	0.40%	0.28%
	Z Statistic	***5.25***	0.52	0.29
	Median	0.36%	-0.61%	0.30%
	Pcnt of >0	52.74%	47.83%	57.14%
Fraction	*Mean*	6.98%	11.97%	22.67%
	Minimum	0.20%	0.80%	5.10%
	Median	5.20%	9.85%	20.40%
	Maixmum	55.20%	79.90%	67.90%
Market Value (in MM)	*Mean*	160	173	121
	Median	58	41	46

CARL(t_1, t_2)   the cumulative prediction error over the event period *(t_1, t_2)*.

Fraction   the fraction of shares sought in a repurchase.

Market Value   the market value of a firm's common stocks ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.

Table 45. Tests of Market Model Parameter Changes

		Open Market (before Oct 19 or after Nov 9, 1987)	Open Market (from Oct 19 to Nov 9, 1987)	Private	Self Tender
Sample Size		1642	740	269	109
Beta (-150, -51)		1.167	1.305	1.037	1.015
Beta (51, 150)		1.104	1.171	1.054	0.853
Beta Change	*Mean*	*-0.063*	*-0.134*	0.017	*-0.162*
	T-Statistic	*-2.728*	*-4.428*	0.188	*-1.932*
	P - Value	*0.007*	*0.0001*	0.851	*0.056*
R-Square (-150, -51)		0.140	0.119	0.113	0.136
R-Square (51, 150)		0.143	0.168	0.107	0.130
R-Square Change	*Mean*	0.002	*0.050*	-0.007	-0.006
	T-Statistic	-0.546	*10.307*	-1.161	-0.650
	P - Value	0.585	*0.0001*	0.247	0.517

Beta (t$_1$, t$_2$)   the market model slope β in the estimation period *(t$_1$, t$_2$)*.

R-Square (t$_1$, t$_2$)   the R-Square of the market model in the estimation period *(t$_1$, t$_2$)*.

Table 46. Tests of Mean Difference in Market Value Between Repurchase Samples (all repurchases)

	1---Open Market vs. 2---Private			1---Open Market vs. 2---Self Tender		
	Sample Size	Mean	Median	Sample Size	Mean	Median
Sample1	2,382	1,364	154	2,382	1,364	154
Sample2	269	526	77	109	1,124	220
Sample2 - Sample1		*-838*	*-77*		-239	66
p-value of F-test		*0.005*			0.608	
p-value of Wilcoxon test		*0.0001*			0.209	
p-value of median test			*0.0001*			0.203

Market Value   the market value of a firm's common stock ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.

Table 47. Tests of Mean Difference in Market Value Between Samples of Repurchases Which Occurred either before Oct 19 or after Nov 9, 1987

	1---Open Market vs. 2---Private			1---Open Market vs. 2---Self Tender		
	Sample Size	Mean	Median	Sample Size	Mean	Median
Sample1	1640	1,483	143	1640	1,483	143
Sample2	262	535	77	106	1,154	220
Sample2 - Sample1		*-948*	*-66*		-329	77
p-value of F-test		*0.003*			0.513	
p-value of Wilcoxon test		*0.0001*			0.104	
p-value of median test		*0.001*	*0.0001*			*0.045*

Market Value the market value of a firm's common stock ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.

Table 48. OLS Regression of CAR(-1,1) Against the Terms of the Repurchase

		Open Market (before Oct 19 or after Nov 9, 1987)	Open Market (from Oct 19 to Nov 9, 1987)	Private	Self Tender
Intercept	*Estimate*	0.113	0.011	0.016	0.206
	p - value	*0.0001*	0.731	0.697	*0.0003*
Ln (market Value)	*Estimate*	*-0.008*	0.002	-0.002	*-0.012*
	p - value	*0.0001*	0.400	0.542	*0.001*
Fraction	*Estimate*	*0.001*	0.001	0.001	-0.000
	p - value	*0.0001*	0.487	0.452	0.585
Premium	*Estimate*			0.030	*0.194*
	p - value			0.210	*0.006*
Dilution Costs	*estimate*			-0.064	0.037
	p - value			0.196	0.737
CAR (-50,-2)	*estimate*	*-0.018*	*0.045*	0.005	*-0.070*
	p - value	*0.021*	*0.003*	0.838	*0.079*
Sample Size		1577	710	214	108
Adj R-Square		0.066	0.012	0.003	0.238

Ln(Market Value)   log of market value of a firm's common stocks ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.

Fraction   the fraction of shares sought in a repurchase.

Premium $(Pr - Pm)/Pm$, the premium of a self-tender or a privately negotiated repurchase where Pr is the tendering price or transaction price and Pm is the market share price ten days prior to the repurchase.

Dilution Costs   as defined in Section 3.2.2

Table 49. OLS Regressions of Premium and Dilution Costs for Private Repurchases and Self-Tender Offers

		Private		Self Tender	
		Premium	Dilution Costs	Premium	Dilution Costs
Intercept	Coefficient	-0.228	-0.065	0.280	0.231
	p - value	0.081	**0.006**	**0.025**	0.065
Ln (market value)	Coefficient	**0.038**	**0.008**	**-0.023**	-0.010
	p - value	**0.042**	**0.026**	**0.037**	0.438
EFC	Coefficient	0.008	-0.001	0.110	0.039
	p - value	0.958	0.974	0.277	0.754
Tobin's Q	Coefficient	-0.012	0.015	0.019	-0.051
	p - value	0.826	0.151	0.798	0.568
D/E Ratio	Coefficient	0.135	0.024	-0.060	-0.081
	p - value	0.139	0.155	0.352	0.315
Fraction	Coefficient	0.002		0.003	
	p - value	0.686		0.106	
Sample Size		55	55	35	35
R-Square		0.176	0.179	0.291	0.074
Adj R-Square		0.088	0.110	0.164	-0.054

Ln(Market Value)	log of market value of a firm's common stocks ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.
Fraction	the fraction of shares sought in a repurchase.
EFC	the *median* earnings forecast revision in the *second* month after the repurchase.
Tobin's Q	the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.
D/E Ratio	the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 50. OLS Regression of CAR(-1, 1) Against Motivational Proxies

		Open Market (before Oct 19 or after Nov 9, 1987)	Open Market (from Oct 19 to Nov 9, 1987)	Private	Self Tender
Intercept	*Estimate*	0.059	-0.038	0.054	0.278
	p - value	**0.0001**	0.270	0.189	**0.002**
Ln(market Value)	*Estimate*	**-0.005**	0.004	**-0.010**	**-0.023**
	p - value	**0.0001**	0.278	**0.072**	**0.006**
EFC	*Estimate*	-0.006	0.033	0.058	0.023
	p - value	0.621	0.493	0.307	0.754
Tobin's Q	*Estimate*	0.002	**0.029**	-0.000	-0.033
	p - value	0.545	**0.014**	0.984	0.534
D/E Ratio	*Estimate*	**-0.017**	**0.039**	0.010	0.023
	p - value	**0.003**	**0.013**	0.571	0.633
Sample Size		512	270	70	34
R-Square		0.054	0.036	0.064	0.279
Adj R-Square		0.046	0.022	0.006	0.180

Ln(Market Value)   log of market value of a firm's common stocks ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 51. Logit Regression of CAR(-1, 1) on Motivational Proxies for Two Subsamples of Open Market Repurchases

		Before Oct 19 or After Nov 9, 1987		From Oct 19 to Nov 9, 1987	
		a=1%	*a=2%*	*a=1%*	*a=2%*
Intercept	*Estimate*	1.758	2.462	-0.148	-0.073
	p - value	*0.001*	*0.0003*	0.825	0.918
Ln(market value)	*Estimate*	-0.034	-0.059	-0.002	0.018
	p - value	0.581	0.445	0.975	0.829
EFC	*Estimate*	-0.052	0.166	*1.677*	*1.838*
	p - value	0.944	0.850	*0.076*	*0.060*
Tobin's Q	*Estimate*	-0.102	-0.277	0.354	0.304
	p - value	0.620	0.269	0.123	0.206
D/E Ratio	*Estimate*	*-0.618*	*-0.653*	0.629	0.448
	p - value	*0.010*	*0.032*	0.082	0.216
No. of > a		313	255	154	146
No. of < -a		94	57	95	85
Chi-Square (DF = 4)		7.205	4.743	7.486	6.375
p-value of model fit		0.125	0.315	0.112	0.173

Ln(Market Value)   log of market value of a firm's common stocks ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.

EFC   the *median* earnings forecast revision in the *second* month after the repurchase.

Tobin's Q   the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.

D/E Ratio   the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

Table 52. Logit Regression of CAR(-1, 1) on Motivational Proxies for Private Repurchases and Self-Tender Offers

		Private	Self Tender
		a=0%	a=0%
Intercept	*Estimate*	0.593	1.078
	p - value	0.604	0.631
Ln(market value)	*Estimate*	*-0.295*	-0.190
	p - value	*0.072*	0.431
EFC	*Estimate*	*4.426*	1.182
	p - value	*0.033*	0.554
Tobin's Q	*Estimate*	0.462	0.513
	p - value	0.364	0.751
D/E Ratio	*Estimate*	1.277	3.113
	p - value	0.137	0.219
No. of > a		34	27
No. of < -a		36	7
Chi-Square (DF = 4)		11.264	2.971
p-value of model fit		*0.024*	0.563

Ln(Market Value)	log of market value of a firm's common stocks ten days prior to the repurchase (CRSP database is used in calculation), in unit of million.
EFC	the *median* earnings forecast revision in the *second* month after the repurchase.
Tobin's Q	the *average* of the yearly Tobin's Q for *three* fiscal years before the repurchase.
D/E Ratio	the *average* of the yearly *market-value* based *long-term* debt-equity ratios over *three* fiscal years prior to the repurchase.

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