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Source: *The Journal of Finance*, Oct., 2000, Vol. 55, No. 5 (Oct., 2000), pp. 2399-2424

Published by: Wiley for the American Finance Association

Stable URL: https://www.jstor.org/stable/222495

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Equity Undervaluation and Decisions Related to Repurchase Tender Offers: An Empirical Investigation

RANJAN D'MELLO and PERVIN K. SHROFF*

ABSTRACT

This paper tests whether managers repurchase stock when their assessment of the firm's economic value exceeds the market value. Using the forecasts managers would have if they had perfect foresight, we estimate economic value using an earnings-based valuation model. The major findings are as follows: (1) 74 percent of the firms that repurchase shares via fixed-price tender offers are undervalued relative to their preannouncement economic value; this percentage is significantly lower for a control sample, (2) the tender premium is highly correlated with the magnitude of undervaluation, and (3) the decision to satisfy oversubscription demand is influenced significantly by the magnitude of undervaluation.

A stock repurchase is often described as a device used by managers to reveal information about equity undervaluation. If managers believe that the firm is undervalued relative to their superior private information, they may attempt to disclose this potentially value-increasing information by repurchasing the firm's stock. The undervaluation hypothesis is supported by the significantly positive announcement-period abnormal returns documented by prior empirical studies.[1] The observed price reaction is attributed to investors revising their beliefs upward, upon perceiving favorable information about the firm's future prospects from the repurchase announcement.

This paper tests whether firms that repurchase stock via fixed-price tender offers are in fact undervalued relative to their "economic value" (EV). We estimate EV, which denotes the intrinsic value of a firm, using an earnings-based valuation model. The model expresses the value of a firm's equity as

[1] Dann (1981), Vermaelen (1981, 1984), Lakonishok and Vermaelen (1990), Comment and Jarrell (1991), among others. Alternative descriptions of this hypothesis in the literature are "signaling," "information-revealing," and "favorable prospects."

a combination of its book value and discounted future abnormal earnings. Our estimation procedure uses future realizations of earnings to calculate EV and thus uses the forecasts managers would have if they had perfect foresight. Unlike previous literature that relies on market reaction to *infer* the motivation behind a repurchase, we directly test the undervaluation hypothesis by comparing the perfect foresight EV of a firm with its prevailing market price.

Obtaining a numerical estimate of firm value from fundamental information has several advantages. First, it helps determine the magnitude of undervaluation that previously was inferred from announcement-period abnormal returns. However, in view of the delayed market reaction of approximately 23 percent that occurs over two years following the repurchase (Lakonishok and Vermaelen (1990)), announcement-period returns do not appear to fully capture the information conveyed by the tender offer. Thus, the magnitude of undervaluation implied by announcement-period returns may be biased downward. Second, although the calculation of EV is based on future earnings performance, it also takes into account the firm's expected cost of equity and the timing of future cash flows. Moreover, it avoids the need to assume an earnings expectation model for measuring the "surprise" in future earnings of repurchasing firms to draw inferences about their undervaluation. Prior studies following this methodology report either marginal or no significant improvement in post-repurchase earnings performance, depending on the time period examined and whether industry effects are controlled for.[2] The lack of strong support for the undervaluation hypothesis implied by these studies could be attributed to the following: (i) their failure to account for the discount rate and the timing of future cash flows, and/or (ii) the deviation of their estimate of expected earnings from market expectations. Finally, our approach enables us to address two related questions that have received little attention in the literature to date: Is the tender premium correlated with the magnitude of undervaluation as perceived by managers? Additionally, for oversubscribed offers, does the manager's decision to repurchase the excess shares tendered depend on whether the firm's EV exceeds the tender price?

The results indicate that, at the beginning of the fiscal year in which the tender offer is announced, the estimate of EV of 74 percent of the repurchasing firms is greater than the prevailing stock price. The median magnitude of undervaluation prior to the repurchase is substantial (30 percent)

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[2] Vermaelen (1981) and Dann, Masulis, and Mayers (1991), using a martingale plus drift model, document some improvement in mean unexpected earnings over five years subsequent to tender offers made in the 1960s and 1970s. The latter study finds significance only in years +2 and +3 and only when industry effects are *not* controlled for. More recently, Lie and McConnell (1998) find an insignificant *decline* in earnings (both raw and industry adjusted) over five years subsequent to tender offers made mainly in the 1980s. For our sample, the mean and median change in subsequent earnings (both raw and industry adjusted) is insignificant, and the frequency of firms with subsequent earnings increases is not significantly different from 50 percent.

when compared to the tender premium (21 percent) and the announcement-period market reaction (12 percent). Further, both the frequency of under-valued firms and the magnitude of undervaluation are significantly lower for a control sample of non-repurchasing firms.

Because our estimate of EV is based on future realizations, our results suggest that, on average repurchasing firms are undervalued relative to the managers' perceived value if they had perfect foresight. However, the question remains whether managers of repurchasing firms in fact possess perfect information about future earnings and book values and whether this information is private. We examine this assumption from several angles. First, we test whether managers possess *private* information about their firm's under- or overvaluation by analyzing the pattern of their personal trades made in the pre-repurchase year. We find that insiders of undervalued firms are net buyers, whereas insiders of overvalued firms are net sellers; this pattern is more pronounced in the six-month period immediately preceding the announcement date. Second, we find insignificant undervaluation of repurchasing firms when EV is measured with analysts' earnings forecasts (instead of future earnings realizations). This result, coupled with the finding that analysts revise their earnings forecasts upward following a repurchase announcement (Hertzel and Jain (1991)), is consistent with repurchases revealing managers' favorable *private* information. Third, we find that our results hold even when we assume that managers have imprecise knowledge of future earnings and can only predict true earnings plus a zero mean random error.

We find that small firms are significantly more undervalued than large firms, consistent with prior empirical evidence that suggests that small firms are more likely to repurchase shares to reveal information. The results also support the hypothesis that managers set the tender premium based on the degree of undervaluation as perceived by them; the tender premium is highly correlated with the magnitude of undervaluation. Further, for oversub-scribed offers, 72 percent (32 percent) of the firms repurchase more shares than originally sought, when the tender price is lower (greater) than the EV. Also, the ratio of EV to tender price is significantly positively related to the fraction of shares repurchased relative to shares tendered. This suggests that the decision to satisfy oversubscription demand or to pro-rate shares is influenced by the managers' perception of the magnitude of undervaluation.

Why firms that are identified as being *overvalued* repurchase shares remains an intriguing issue. We observe that their announcement-period abnormal return is significantly lower than that for firms identified as being undervalued, despite the substantial tender premium offered by these firms. An analysis of the overvalued firms provides some evidence of motivations behind their repurchases other than to reveal favorable managerial information. Significant among them are leverage- and takeover threat related motivations.

Overall, the paper suggests that managers' decisions to repurchase shares and related actions are consistent with their possessing favorable private information about their firm's future earnings prospects. The findings are

subject to the caveat that the empirical proxy used provides a good approximation of a firm's EV. Consequently, the analyses jointly test the undervaluation hypothesis and the empirical validity of the valuation model.

The rest of the paper is organized as follows. Section I states the hypotheses. Section II describes the valuation model and the estimation procedures. Section III discusses the data and the sample. Results are reported in Section IV, followed by concluding remarks in Section V.

I. Hypotheses Development

Prior studies of repurchase tender offers test several alternative explanations for the positive abnormal price reaction to announcements of repurchases. While there is weak support for the free cash flow hypothesis and some evidence confirming the management control hypothesis, the literature appears to be dominated by evidence consistent with the information-revealing hypothesis (Dann (1981), Vermaelen (1981, 1984), Lakonishok and Vermaelen (1990), Comment and Jarrell (1991), Dann, Masulis, and Mayers (1991), Hertzel and Jain (1991)).[3]

The information-revealing hypothesis predicts that managers repurchase stock to reveal their private information about the firm's favorable future prospects. Prior studies show that announcement-period abnormal returns are positively correlated with the tender premium, the fraction of shares sought, the fraction of insider holdings, future earnings performance, and decline in market risk. That managers reveal their favorable private information via repurchases is inferred from these correlations. Given the delayed market reaction (drift) observed by Lakonishok and Vermaelen (1990), the inference about the magnitude of undervaluation from announcement period returns may be biased. This paper avoids potential inferential problems associated with reliance on market reaction and directly tests whether repurchasing firms are undervalued.

Whereas open-market repurchases are the more common mode of share buybacks, this paper studies tender offer repurchases because the latter are considered to be more costly and hence more credible mechanisms to reveal information (see Comment and Jarrell (1991)). Also, in relation to tender offers, the tender premium and the fraction repurchased relative to the target fraction (for oversubscribed offers) are additional decision parameters that raise interesting questions that our methodology is able to address.

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[3] The free cash flow hypothesis suggests that the market reacts positively when a firm distributes excess cash via stock repurchases instead of overinvesting in negative net present value projects that reduce firm value (Howe, He, and Kao (1992), D'Mello (1995), Perfect, Peterson, and Peterson (1995), Nohel and Tarhan (1998)). The management control hypothesis suggests that managers use tender offers to increase the concentration of voting rights in their control and remain entrenched, for instance, in the face of a takeover threat (Vermaelen (1984), Denis (1990)).

A. Undervaluation Hypothesis

We hypothesize that firms that repurchase shares are in fact undervalued relative to their EV. Because EV is measured from subsequent earnings realizations, it is implicitly assumed that managers possess private information about future earnings that helps them estimate the firm's EV. This assumption is consistent with the findings of Lee, Mikkelson, and Partch (1992) that managers make personal open-market trades of their firm's shares prior to a repurchase as though they had private information about their firm's future prospects that is conveyed by the repurchase. We estimate the EV of a firm prior to the tender offer announcement and compare it with the prevailing stock price to determine the frequency and magnitude of undervaluation. Thus,

H1(a): A large percentage of repurchasing firms are undervalued relative to their EV, and this percentage is significantly larger relative to a matched sample of non-repurchasing firms.

H1(b): The average percentage difference between the EV and the stock price of repurchasing firms is positive and is significantly greater than that of a sample of non-repurchasing firms.

We acknowledge that results supporting our undervaluation prediction cannot rule out the free cash flow motivation for repurchases. Because EV is estimated using realizations of future earnings, the EV of firms that repurchase shares to distribute excess cash could be greater than the prevailing price. This is because their future performance is likely to improve if excess cash is distributed instead of being invested in negative net present value (NPV) projects.

B. Tender Premium Hypothesis

Prior studies have hypothesized that managers set the tender premium to reveal their superior information to investors. These studies document a positive relation between announcement-period abnormal returns and tender premium and thus infer that managers reveal information via the tender premium. This paper addresses the question: How do managers set the tender premium? We hypothesize that the greater the deviation of the stock price from the manager's perceived value, the higher is the tender premium. Hence, the hypothesis predicts a positive correlation between this deviation and the tender premium. Thus,

H2: Tender premium is positively correlated with the magnitude of undervaluation.

C. Oversubscription Demand Hypothesis

When a tender offer is oversubscribed, managers have the option to either buy back the shares sought (originally stated target) and allocate them pro rata or repurchase the excess shares tendered, wholly or in part. Lakonishok

and Vermaelen (1990) suggest that the manager's decision to satisfy over-subscription demand is influenced by the price behavior prior to the expiration date. They argue that, if the preexpiration price is substantially below the tender price, the market reaction to the signal provided by the repurchase announcement may be below the managers' expectation. Hence, managers may buy back the excess shares tendered to strengthen the original signal. In a regression of the ratio of shares repurchased to shares tendered on the relative discount from the tender price (ratio of preexpiration price to tender price), they show that the slope coefficient is negative (as predicted) but not significantly different from zero. We hypothesize that, in the case of oversubscribed offers, managers repurchase the excess shares tendered (wholly or in part) if the tender price is lower than the EV; otherwise only the shares sought are repurchased and allocated pro rata. Thus,

H3(a): For oversubscribed offers, a larger fraction of firms whose EV exceeds the tender price repurchase the excess shares tendered relative to firms whose EV is lower than the tender price.

H3(b): For oversubscribed offers, there is a significant positive relation between the ratio of EV to tender price and the ratio of shares repurchased to shares tendered.

II. Earnings-Based Valuation Model

A. The Theoretical Model

We use the residual income model (RIM) as the valuation method to estimate EV. A series of papers by Ohlson (notably, Ohlson (1995)) demonstrates that, assuming the clean surplus relation (i.e., the change in book value equals earnings minus dividends), firm value can be written as

$$EV_t = B_t + \sum_{i=1}^{\infty} (1+r)^{-i} E_t [X_{t+i} - r * B_{t+i-1}], \qquad (1)$$

where EV_t is the value of a firm's equity at date t, B_t is the book value at date t, X_t is the earnings for period t, and r is the cost of equity capital. Equation (1) expresses the value of the firm as its book value plus discounted expected future earnings in excess of a normal return on book value (termed residual income or abnormal earnings). Hence, value depends on the stock variable (book value) and the flow variable that relates to the firm's future wealth generation.[4]

Peasnell (1982), Ohlson (1995), and Feltham and Ohlson (1995) demonstrate that, given the clean surplus relation, RIM is theoretically equivalent to the dividend discounting model and the discounted cash flow model (DCF).

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[4] Earlier attempts at developing RIM are Preinreich (1938), and Edwards and Bell (1961). The model bears a strong resemblance to the concept of Economic Value Added popularized by Stewart (1991).

Bernard (1995) and Penman and Sougiannis (1998) maintain that RIM's merit lies in its finite horizon implementation. For most firms, the dividend discounting model involves forecasting a finite stream of future dividends (which are discretionary and whose relation to firm value is therefore tenuous) and a large and uncertain liquidating dividend. Substituting "free cash flows" for dividends involves the estimation of a liquidating cash flow or terminal value (the DCF model). Although a finite-period implementation of RIM also requires the calculation of terminal values, they carry less weight in the firm value calculation relative to the DCF analysis. This is because the terminal value calculation requires estimation of *abnormal* earnings after the finite horizon $t + T$—a number smaller than liquidating dividends or liquidating cash flow and hence less likely to have as great an impact on firm value.[5] Further, equation (1) is unaffected by biases arising from accounting conservatism and other manipulations because lower (higher) current book value resulting from conservatism (aggressiveness) is offset by higher (lower) future abnormal earnings, leaving value unaffected. In an empirical test, Bernard (1995) and Penman and Sougiannis (1998) find that earnings techniques dominate discounted cash flow techniques in terms of mean valuation error.

B. Model Estimation Procedures

Estimation of EV from equation (1) requires the expectations of future earnings (X_t), book values (B_t), and the cost of capital (r). Because managers' expectations are unobservable, we estimate EV by using ex post realizations as their proxies. We therefore use the forecasts managers would have if they had perfect foresight. Later, we allow for some degree of imprecision in managers' predictions, by adding a zero mean random error to the realizations of future earnings used in the estimation of EV. The perfect foresight EV is calculated using realized earnings and book values of five years subsequent to the tender offer announcement, where the tender offer year is included as the first of the five-year series.[6]

B.1. Terminal Value Calculation

Equation (1) expresses firm value in terms of an infinite series, but its implementation requires a finite period calculation with a terminal value (*TV*) at the horizon $t + T$. We calculate firm value by expanding the formula

[5] To provide an indication of differences across models, for the sample of repurchasing firms, the terminal value is 11 percent of total EV using the RIM, 33 percent using the DCF, and 58 percent using the dividend discounting models.

[6] The five-year period although arbitrary is, in our opinion, a reasonable forecasting horizon. Bernard (1995) provides some empirical evidence that value can be described well by earnings and book value forecasted over a horizon as short as four years.

to $t + T$ and treating the average of the terms for $t + T - 1$ and $t + T$ as a perpetuity—that is, the firm is assumed to earn that level of abnormal earnings in perpetuity. Hence, equation (1) is modified as

$$EV_t = B_t + \sum_{i=1}^{T} (1 + r)^{-i} E_t [X_{t+i} - r * B_{t+i-1}] + \frac{(1 + r)^{-T}}{r} TV. \qquad (2)$$

This approach is also adopted by Penman and Sougiannis (1998), Frankel and Lee (1998a, 1998b), and Lee, Myers, and Swaminathan (1999).[7] We calculate the terminal value (TV) as

$$TV = E_t [(X_{t+T-1} - r * B_{t+T-2}) + (X_{t+T} - r * B_{t+T-1})]/2. \qquad (3)$$

The average of the last two years of the finite series is used in our calculation of TV (instead of just the last year) to smooth cases of abnormally high or low earnings in the last year. TV is restricted to be nonnegative as in Bernard (1994) and Penman and Sougiannis (1998). The rationale behind this assumption is that, over a long horizon, managers are not expected ex ante to invest in negative NPV projects. For firms with positive TV, we assume zero growth in abnormal earnings after the horizon $t + T$. This assumption underestimates the EV and thus biases the results against detecting undervaluation.

B.2. Cost of Equity Capital

Three different measures of r are used to estimate EV: (1) a constant discount rate, (2) a firm-specific rate using the Capital Asset Pricing Model (CAPM), and (3) a firm-specific rate using the three-factor model proposed by Fama and French (1993). Assuming that the population of firms is, on average, correctly priced, we use a constant discount rate that divides the control sample of non-repurchasing firms equally into overvalued and undervalued firms. Because the same rate is applied to both the repurchase and the matched sample, the choice of r should not have a significant effect on the results.

The expected return implied by the CAPM is calculated as

$$E(r) = r_f + \hat{\beta}[E(r_m) - r_f], \qquad (4)$$

where r_f is the risk-free rate, $\hat{\beta}$ is the estimate of the firm's systematic risk, and $[E(r_m) - r_f]$ is the expected market risk premium. To estimate β, we use the aggregated coefficient method proposed by Dimson (1979) and modified by Fowler and Rorke (1983) to control for infrequent trading and bid-ask

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[7] Penman (1997) shows that equation (2) is equal to firm value expressed as the present value of expected future dividends to the horizon plus an abnormal earnings perpetuity as the terminal value.

bounce. The estimating regression is run with daily returns of the firm and returns on the S&P 500 over a period of 250 days ending on day -11 relative to the transaction date. To obtain a reasonably accurate estimate of β we require returns data for a minimum of 100 days. Expected market risk premium is measured as the arithmetic average of the spread between the return on the S&P 500 and the intermediate-term government bond rate (obtained from Ibbotson Associates (1995)) from 1926 until the month preceding the announcement month. The intermediate-term government bond yield is used as a proxy for the expected risk-free rate, supporting our implicit assumption of a fairly long investment horizon. We also test the sensitivity of our results with the one-month Treasury bill rate as the risk-free rate.

Firm-specific discount rates are also calculated using the Fama–French three-factor model where a security's expected return depends on the sensitivity of its return to the market return and the returns on size and book-to-market portfolios that mimic additional risk factors. We first estimate the firm's sensitivities to the three factors, γ, by running a time-series regression of monthly excess returns on the three Fama–French factors from months -60 to -1 relative to the tender offer month:

$$r_t - r_{ft} = \gamma_0 + \gamma_1[r_{mt} - r_{ft}] + \gamma_2(SMB_t) + \gamma_3(HML_t) + \epsilon_t, \tag{5}$$

where t is the month index, SMB is the difference between returns of a portfolio of small firms and a portfolio of big firms, and HML is the difference between returns of a portfolio of high book-to-market firms and a portfolio of low book-to-market firms. Consistent with Fama and French (1993), r_m is the value-weighted monthly return index for NYSE-AMEX-Nasdaq stocks, and r_f is the one-month Treasury bill rate. Monthly return data are required for a minimum of 24 months to obtain reasonable estimates of the coefficients.

The expected return, $E(r)$, is then calculated as

$$E(r) = r_f + \hat{\gamma}_1[E(r_m) - r_f] + \hat{\gamma}_2 E(SMB) + \hat{\gamma}_3 E(HML), \tag{6}$$

where the expectations of the three factors are based on arithmetic averages from July 1963 until the month before the transaction is announced.

III. Data and Sample Selection

The sample consists of 166 fixed-price self-tender offers announced and completed during the period from 1970 to 1989. This sample is compiled from a comprehensive set of tender offers by firms traded on the NYSE, AMEX, and Nasdaq used in earlier studies by Comment and Jarrell (1991), Dann et al. (1991), and D'Mello (1995). Tender offer announcement dates and descriptions of offers are also obtained from these sources. From the original sample of 291 repurchases, 38 repurchases made by firms that are missing from the COMPUSTAT Annual Industrial (PST and full coverage) or

Research files are excluded. We further exclude 21 firms that change their fiscal year-end during the test period, 10 firms with negative book values during the test period, and seven firms with missing price data at the beginning of the tender-offer year on files from the Center for Research in Security Prices (CRSP). The remaining firms are constrained to have earnings and book value data on COMPUSTAT for at least six consecutive years (including the year prior to, the year of, and four years following the repurchase announcement). The last filter eliminates 49 firms from the sample. Consistent with previous studies, the final sample of 166 firms is concentrated in the years 1973, 1974, and 1977 to 1979.

A control sample of firms is obtained by matching first on industry and then on firm size (market value of equity) at the beginning of the tender-offer year. Before applying the matching criteria, we exclude firms that repurchased one percent or more of their outstanding shares in the year corresponding to the tender offer announcement by the test firm. Repurchasing firms with data on the COMPUSTAT research file are matched with control firms with data also on the research file, so as to obtain substantially similar matches. Other sample selection criteria and data requirements imposed on the repurchasing sample are also applied to the control sample, which helps to minimize survivorship bias in our comparative analyses. Industry matches are based on the three-digit standard industrial classification (SIC) code on the COMPUSTAT tape. If no match is available at the three-digit level, the firm is matched at the two-digit level. Of the industry matches, the firm closest in size to the repurchasing firm is selected as the control firm.

We also test the sensitivity of our results to two alternative control samples. First, to reduce the effect of within-control-sample variation due to the small sample size, we select a control sample using the same matching criteria as described earlier (i.e., industry and size) but with three control firms matched with each repurchasing firm. Second, we select a sample with one control firm matched with each repurchasing firm on industry, size, and the book-to-price (B/P) ratio at the beginning of the tender-offer year. Because we observe that repurchasing firms have on average high B/P ratios, we include the B/P ratio as an additional matching criterion. Ikenberry, Lakonishok, and Vermaelen (1995) show that the delayed market reaction following open-market repurchases is significantly positive for firms with high B/P ratios. They attribute this finding to greater skepticism in the market's initial response to announcements made by high B/P firms. Alternatively, their finding may imply that the average undervaluation of repurchasing firms can be detected simply by observing their relative B/P ratios. Results showing undervaluation of repurchasing firms relative to the industry-size-B/P matched control sample would be inconsistent with the latter hypothesis. We select the firm with book-to-price (B/P) ratio closest to that of the repurchasing firm from a sample of firms that are in the same industry as the repurchasing firm and whose size is within ±20 percent of the size of the repurchasing firm.

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Table I

Descriptive Statistics of the Sample of Repurchasing Firms

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The table provides descriptive statistics for a sample of firms that made tender offer repurchases during 1970–1989. Tender premium (TPREM) is measured as tender price divided by the market price on day −10 relative to the tender offer announcement day. Cumulative abnormal returns are calculated relative to the CRSP value-weighted index for the respective exchange category. Announcement-period cumulative abnormal returns (CAR-3DAY) are calculated from day −1 to day +1 relative to the announcement day. Pre-announcement period cumulative abnormal returns (CAR-PRE) are calculated from day −261 to day −11 relative to the announcement day. Market value equals price times number of shares outstanding. PE ratio equals price divided by earnings per share after extraordinary items and discontinued operations. Market value and PE ratio are measured at the beginning of the tender offer year.

	Mean	Median
Tender offer and market measures		
Fraction of outstanding shares sought	17.3%	14.5%
Fraction of outstanding shares repurchased	16.8%	13.2%
Fraction of shares repurchased relative to shares tendered	83.6%	100.0%
Tender premium (TPREM)	22.9%	20.6%
Three-day-announcement-period cumulative abnormal returns (CAR-3DAY)**	14.1%	11.9%
Pre-announcement-period cumulative abnormal returns (CAR-PRE)*	5.5%	2.7%
Firm characteristics		
Market value (in millions of $)	675	49
PE ratio	9.81	7.62
Cost of capital: CAPM	13.9%	13.3%
Cost of capital: three factor model	14.6%	14.2%

** and * indicate significance at the 1 and 5 percent levels, respectively.

Table I reports descriptive statistics for the sample of repurchasing firms. On average, firms offer to buy back 17.3 percent of their outstanding common shares at a premium of 22.9 percent above the market price prevailing 10 days prior to the repurchase announcement. Firms repurchase 83.6 percent of the shares tendered, on average, which constitutes a total buyback of 16.8 percent of their outstanding common shares. Abnormal returns are calculated as security returns in excess of the CRSP value-weighted market index for the respective exchange category (NYSE-AMEX or Nasdaq). Consistent with previous studies, the average three-day announcement-period abnormal return (CAR-3DAY), calculated from −1 to +1 days relative to the announcement day, is 14.1 percent, which is significantly smaller than the average premium (of 22.9 percent) earned by the tendering shareholders. In contrast to the announcement period abnormal return, the average one-year pre-announcement-period abnormal return (CAR-PRE) is 5.5 percent. The repurchasing sample is comprised of small-sized firms (mean market value of $675 million) with an average price-to-earnings ratio of 9.8. The average cost of capital of the repurchasing sample is 13.9 percent using the CAPM and 14.6 percent using the Fama–French three-factor model.

IV. Empirical Results

A. *Undervaluation Hypothesis*

A.1. *Percentage of Firms Undervalued and Magnitude of Undervaluation*

Panel A of Table II presents results supporting the undervaluation hypothesis. We report three sets of results for the repurchasing and control samples with EV calculated using the following: (i) constant discount rate (12.5 percent), (ii) firm-specific-CAPM rate, and (iii) firm-specific rate from the three-factor model.[8] In the text, we discuss only the results based on the firm-specific-CAPM rate; using a constant or three-factor discount rate produces substantially similar results.[9] From Panel A, 74 percent of firms that repurchase shares are underpriced relative to their economic value at the beginning of the announcement year. In contrast, 51 percent of control firms are underpriced, which is significantly lower than the repurchasing sample. The *t*-statistic for the repurchasing sample is significant at the 1 percent level, using a normal approximation of the binomial probabilities and assuming that under the null hypothesis the probability of underpricing is 0.5. For the control sample, the test reveals that the split between under- and overpriced firms is not significantly different from 50 percent.

Panel A also shows that the magnitude of undervaluation is substantial for a large percentage of repurchasing firms—the magnitude exceeds 10 percent for 64 percent of the firms. The percentage of firms substantially undervalued is significantly lower for the control sample at 47 percent.[10] Further, for 41 percent of repurchasing firms the magnitude of undervaluation exceeds 40 percent, supporting the intuition that managers are more likely to repurchase shares at a considerable premium when the undervaluation is substantial (not tabulated). Moreover, the substantial magnitude of undervaluation suggests that our hypothesis is supported even allowing for some margin of error in our measure of the managers' perceived undervaluation.

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[8] 12.5 percent is the constant discount rate that divides the control sample approximately equally into under- and overvalued firms. The results are similar when the CAPM rate is calculated using the one-month Treasury bill rate instead of the intermediate-term government bond yield as the risk-free rate.

[9] When a common constant discount rate is used for the two samples, a higher EV relative to price may lead us to conclude that repurchasing firms are more undervalued than control firms, when in actuality the difference in relative EV may be due to a higher discount rate assigned by the market to repurchasing firms. Hence, we place more reliance on results based on firm-specific discount rates.

[10] We find 57 percent of the repurchasing sample to be undervalued by more than 20 percent; the corresponding percentage of the control sample is only 41 percent. The difference between the two samples continues to be significant even when our test focuses only on firms with undervaluation of such substantial magnitude.

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Table II

Percentage of Firms Undervalued and Magnitude of Undervaluation

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Economic value (EV) is estimated for a sample of firms making tender offer repurchases during 1970–1989 and an industry and size matched control sample of firms. Percentage undervaluation is calculated as EV minus the price at the beginning of the tender offer year (P) divided by P. The t-statistic tests the null hypothesis that the probability of underpricing is 0.5. The table also reports the chi-square test of the difference in percentage of repurchasing and control firms that are undervalued and the Kruskal–Wallis test of the difference in magnitude of undervaluation between repurchasing and control samples. Panel B reports percentage undervaluation with respect to the price on day -10 relative to the announcement day (PRTEN). Size quartiles are based on a ranking of market values at the beginning of the tender offer year. The Kruskal–Wallis statistic reported in Panel B tests the difference in magnitude of undervaluation between quartiles 1 and 4.

Panel A: Percentage of Firms Undervalued and Undervaluation Magnitude						
Discount Rate:	Constant 12.5%		Firm-Specific CAPM		Firm-Specific 3-Factor	
	Repurchase Firms	Control Firms	Repurchase Firms	Control Firms	Repurchase Firms	Control Firms
Under-/overvaluation						
% of firms with						
EV > P	74%	51%	74%	51%	69%	54%
EV ≤ P	26%	49%	26%	49%	31%	46%
t-statistic	(6.05)**	(0.31)	(6.21)**	(0.24)	(4.60)**	(0.87)
Chi-square	—	(17.45)**	—	(18.25)**	—	(5.75)**
Substantial under-/overvaluation						
% of firms with						
EV > 1.1P	64%	44%	64%	47%	64%	49%
EV ≤ 0.9P	21%	40%	23%	44%	27%	39%
t-statistic	(3.57)**	(−1.56)	(3.73)**	(−0.73)	(3.29)**	(−0.29)
Chi-square	—	(15.44)**	—	(14.58)**	—	(5.28)*
Magnitude						
% undervaluation						
Mean	73.8%	38.3%	67.6%	32.0%	73.9%	20.3%
Median	37.9%	2.6%	26.6%	4.3%	27.4%	5.6%
Kruskal–Wallis test	—	(12.96)**	—	(12.77)**	—	(10.43)**

Panel B: Firm Size and (Median) Magnitude of Undervaluation of Repurchasing Firms			
	% Undervaluation (EV-PRTEN)/PRTEN		Median
Size Quartile	Constant 12.5%	Firm-Specific CAPM	TPREM
1 (smallest)	64.4%	48.0%	32.6%
2	26.2%	43.9%	20.8%
3	46.7%	37.1%	17.8%
4 (largest)	24.2%	9.5%	11.5%
Overall sample	33.4%	30.2%	20.6%
Kruskal–Wallis test	(10.87)**	(9.28)**	(35.79)**

** and * indicate significance at the 1 and 5 percent levels, respectively.

From Panel A, the median undervaluation at the beginning of the announcement year is 26.6 percent for the repurchasing sample and is significantly higher than 4.3 percent for the control sample.[11] Overall, the results indicate that a significantly higher percentage of firms that repurchase stock are undervalued compared to a control sample and that their magnitude of undervaluation significantly exceeds that of the control sample. The observed undervaluation may reflect information about the firm's favorable future prospects that managers intend the repurchase to convey. Alternatively, it could result from future improvements due to elimination of negative NPV projects through the distribution of excess cash. Our methodology does not permit a differentiation between the two sources of undervaluation.

We test the robustness of our results with respect to two alternative control samples: (i) multiple firms—industry and size matched, and (ii) single firm—matched on industry, size, and B/P (not tabulated). We find that 53 percent (50 percent) of the multiple-firm (industry-size-B/P matched) control sample is undervalued, with median undervaluation of 7.4 percent (0.5 percent). The frequency and magnitude of undervaluation of both control samples are significantly lower than those of the repurchasing sample. The insignificant undervaluation of the industry-size-B/P control sample suggests that the undervaluation of repurchasing firms that we find cannot simply be inferred from their relatively high B/P ratios.

Analysis of subperiods 1970 to 1979 and 1980 to 1989 indicates that 79 percent (58 percent) of repurchasing (control) firms are undervalued in the 1970s and 65 percent (37 percent) in the 1980s (not tabulated). Thus, the percentage of repurchasing firms undervalued is significantly higher than the percentage of control firms undervalued in both subperiods. The lower undervaluation observed in the 1980s is consistent with conjectures made by prior studies that buybacks in this subperiod may be motivated by corporate restructuring activities (Lakonishok and Vermaelen (1990)) or as a defense against takeover threats (Denis (1990)).

As discussed earlier, 49 repurchasing firms are excluded from the sample due to lack of earnings and book value data for five consecutive years following the repurchase. Hence, the effect of survivorship bias on the results may be a concern. Data are available for 43 of these nonsurviving firms for horizons shorter than five years—four years for 12 firms, three years for 13 firms, and two years for 18 firms.[12] Using the available data to estimate EV,

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[11] We lose 77 (out of 332) observations due to missing monthly returns data required to calculate the firm-specific Fama–French discount rate. Hence, subsequent results based on this discount rate are not reported, although they are similar to those based on the firm-specific-CAPM and constant discount rates.

[12] EV at the beginning of the announcement year is calculated for each firm using equation (2) with T equal to four, three, and two, depending on data availability. For terminal value calculations, we assume the average abnormal earnings of the last two years of the available series to be earned in perpetuity—a reasonable assumption because over 95 percent of nonsurvivors were either taken over or taken private and hence continue to operate.

we find that 74 percent of nonsurvivors are undervalued relative to their EV, with median undervaluation of 40.2 percent (not tabulated). This finding suggests that the survivorship restriction very likely does not bias our results.

Because tender-offer-related decisions would be based on the pre-tender-offer price, we also calculate the magnitude of undervaluation based on the price 10 days prior to the announcement (*PRTEN*). From Table II, Panel B, the median magnitude of undervaluation measured relative to *PRTEN* is 30.2 percent for the overall sample. Further, the magnitude of undervaluation is inversely related to firm size. The median undervaluation is significantly higher for the smallest quartile (48 percent) compared to the largest quartile of firms (9.5 percent). This is consistent with prior empirical evidence (Lakonishok and Vermaelen (1990)) that suggests that small firms are more likely to repurchase shares to reveal information, whereas repurchases by large firms may be part of a corporate restructuring activity.

From the above results, the median undervaluation of 30.2 percent appears to be quite high when compared to the median tender premium of 20.6 percent; even more so when compared to the median announcement period abnormal return of 11.9 percent. This suggests that managers act conservatively in setting tender premia. Assuming that managers possess superior private information about their firm's EV, the relatively low market reaction to the repurchase announcement appears puzzling. Further analysis shows that the excess of EV over tender price (EVTP) exhibits explanatory power for announcement-period returns incremental to that of the tender premium (not tabulated). With the three-day announcement period CAR as the dependent variable, the coefficient on EVTP is significantly positive.[13] Hence, it appears that, at the repurchase announcement, the market partially accounts for managers' systematic conservatism in setting tender premia. However, this still does not explain the market underreaction to the good news inherent in the repurchase announcement.

A.2. Tests of the Assumption of Managers' Private Information

Results of the undervaluation hypothesis tests show that repurchasing firms are on average undervalued relative to the EV estimated from future information. This implicitly assumes that managers have superior information than that available to the public. The validity of this assumption is tested in two ways.[14] First, we test whether personal open market trades by managers prior to repurchases indicate that they have private information about their firm's EV. Second, we verify that repurchasing firms are not undervalued when EV is based on analysts' earnings expectations that are publicly available.

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[13] The results hold even after deleting 26 firms whose quarterly earnings are announced within a period of 10 days preceding the repurchase announcement and as such may have a confounding effect on CAR-3DAY.

[14] We thank the editor and two referees for suggesting this line of inquiry.

A.2.1. Insider Trades Prior to Repurchases

Lee et al. (1992) find that managers adjust their personal trading behavior prior to tender offer repurchases as though they had private information about their firm that is conveyed by the repurchase. We test whether the trading pattern of managers of repurchasing firms is consistent with their possessing private information about their firm's under- or overvaluation.[15] Open-market insider trading data are obtained from the *Ownership Reporting System Master File* compiled by the SEC. Following Lee et al. (1992), we include all trades of 100 shares or more by officers and directors, excluding persons legally defined as insiders but who are neither directors nor hold a management position. The reported results are based on both the average number of shares traded and the average dollar value of trades. Table III, Panel A, shows that, during a period of one year prior to the repurchase (Year -1), insiders of undervalued firms are net buyers (29,479 shares; $0.54 million), whereas insiders of overvalued firms are net sellers (19,430 shares; $0.49 million).[16] The pattern is more pronounced after adjusting for insider trades of industry and size matched firms—net purchases of 47,683 shares ($1.34 million) by undervalued firms and $-5,180$ shares ($0.11 million) by overvalued firms. This observed difference in trading pattern of undervalued versus overvalued firms occurs predominantly in the six-month period immediately preceding the repurchase (not tabulated). Overall, the pattern over time (comparing years -1 and -2) and relative to industry and size matches appears to be consistent with insiders having private information about their firm's under- or overvaluation prior to the repurchase.

A.2.2. Undervaluation Relative to Analysts' Forecast Information

We calculate the EV of 73 sample firms that have the most recent analysts' forecasts of earnings prior to the repurchase available on *Value Line Investment Survey*. We compare EV with the pre-repurchase market price to test whether the firm is undervalued relative to future information but is correctly priced relative to available public information. We follow the method employed by Frankel and Lee (1998a) and Lee et al. (1999) to estimate the EV using RIM. For the year following the repurchase, we use analysts' one-year-ahead earnings forecast, and for the subsequent four years, we derive earnings forecasts using the one-year-ahead forecast and the short-term (three to five years) earnings growth rate.

Panel B shows that 58 percent of repurchasing firms (insignificantly different from 50 percent) are undervalued relative to their EV based on publicly available analysts' forecast information. The percentage of firms

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[15] Insiders could also trade to rebalance their portfolios, for example, for liquidity reasons. However, numerous authors (see Seyhun (1986)) have documented that insiders earn significant profits on their trades, consistent with the notion that they have private information.

[16] Also, based on the number of shares traded, 47 percent (28 percent) of undervalued (overvalued) firms are net buyers.

Table III
Tests of the Assumption of Managers' Private Information

Panel A of the table reports means of number of shares traded and dollar value of trades by insiders of repurchasing firms classified as under- or overvalued. We present data on purchases, sales, net purchases (defined as purchases minus sales), and net purchases adjusted for insider trades of industry and size matched control firms made during Year -1 (a period of one year prior to the repurchase announcement date) and Year -2 (a period of one year preceding Year -1). Panel B reports the percentage of firms undervalued and magnitude of undervaluation based on EV calculated from analysts' earnings forecasts. The magnitude of undervaluation is measured as EV minus the price at the beginning of the announcement year (P) divided by P. The t-statistic tests the null hypothesis that the probability of underpricing is 0.5, and the chi-square tests the difference in the percentage of repurchasing firms undervalued based on analysts' forecasts versus (i) future information and (ii) control firms undervalued based on analysts' forecasts. The table also reports the Kruskal–Wallis test of difference in magnitude of undervaluation of repurchasing firms based on analysts' forecasts versus (i) future information and (ii) control firms' undervaluation based on analysts' forecasts.

Panel A: Insider Trading of Under-/Overvalued Firms Prior to Repurchase Announcement

	Purchases	Sales	Net Purchases	Net Purchases— Adjusted
Number of shares traded (means)				
Year -2: Undervalued firms	3,807	4,186	-379	3,376
Overvalued firms	5,387	21,628	$-16,266$	9,626
Year -1: Undervalued firms	39,926	10,447	29,479	47,683
Overvalued firms	2,555	21,985	$-19,430$	$-5,180$
Mean \$ value of trades (thousands)				
Year -2: Undervalued firms	56	318	-262	99
Overvalued firms	94	607	-512	597
Year -1: Undervalued firms	1,027	490	537	1,337
Overvalued firms	38	523	-485	106

Panel B: Percentage of Firms Undervalued and Undervaluation Magnitude Using EV Based on Analysts' Forecasts (calculations based on firm-specific CAPM discount rate)

	Repurchase Firms		Control Firms
	Analyst Information	Future Information	Analyst Information
Under-/Overvaluation: % of firms with			
EV $> P$	58%	73%	44%
EV $\leq P$	42%	27%	56%
t-statistic	(1.40)	(3.95)**	(-0.94)
Chi-square	—	(3.62)	(2.95)
Magnitude: % undervaluation			
Mean	23.3%	68.4%	28.1%
Median	14.9%	24.4%	-6.9%
Kruskal–Wallis test	—	(2.01)	(3.62)

**Significant at the 1 percent level.

undervalued relative to analysts' information is significantly lower than the percentage undervalued relative to future information. The mean (median) undervaluation is 23.3 percent (14.9 percent) based on analysts' information, relative to 68.4 percent (24.4 percent) based on future information. Further, both the frequency and the magnitude of undervaluation of repurchasing firms are insignificantly different from that of the control sample. That 58 percent of firms are undervalued relative to analysts' information suggests that the market ignores part of that information, perhaps to adjust for the well-documented positive bias in their forecasts. Given the limited degree of underpricing based on analyst information, if managers repurchase shares to reveal their private information to investors, they would be less likely to do so (paying considerable tender premium) if they had the same information as analysts. Thus, if repurchases convey managers' favorable information about firm value, the above finding implies that such information is not available to analysts. This is also consistent with the upward revision in analysts' forecasts following repurchase announcements observed by Hertzel and Jain (1991).

A.2.3. Undervaluation and Managers' Earnings Predictions

Although the above results suggest that managers may have information that is not available to the public, the question still remains: How critical is the assumption that managers can predict with perfect foresight earnings for the rest of the repurchase year and the subsequent four years? We relax this assumption by adding to each year's change in earnings a random error drawn from a uniform distribution ranging between ±25 percent. Thus we assume that managers expect earnings to be true earnings plus a zero mean random error. From 1,000 repetitions of this procedure, we find that 72.3 percent of repurchasing firms are undervalued with a mean magnitude of undervaluation of 68.2 percent (not tabulated). Further, we find that the frequency and magnitude of undervaluation are virtually unchanged when EV is calculated from realized earnings of the repurchase year and only one (instead of four) subsequent years. Thus, our results are robust with respect to the degree of precision of managers' earnings predictions and their forecast horizon.

B. Tender Premium Hypothesis

Table IV provides strong evidence in favor of hypothesis H2, which predicts a positive relation between tender premium and the deviation of the stock price from the manager's perceived firm value. We find that tender premium is positively correlated with the magnitude of undervaluation as indicated by the following: (i) the simple correlation coefficient of 0.39 and (ii) the significant regression slope coefficient. Using multivariate regression analysis, we also examine whether the size of the tender premium is affected by other factors, such as the target fraction, takeover threat,

Table IV

Relation between Tender Premium and Magnitude of Undervaluation

The table reports correlations and the results of regression of tender premium on magnitude of undervaluation and other explanatory variables. TPREM is the percentage tender premium measured as tender price divided by the market price on day −10 relative to the tender offer announcement day. UNDERVAL is percentage undervaluation measured as EV minus the price 10 days prior to the announcement day (PRTEN) divided by PRTEN. SS/SO is the number of shares sought (SS) divided by the number of shares outstanding (SO). TAKEOVER represents a (0, 1) dummy that takes on a value of one if the firm faces a takeover threat any time during a two-year period centered on the announcement date. CAR-PRE is the pre-announcement-period cumulative abnormal return calculated from day −261 to day −11 relative to the announcement day. Size is measured by the log of market value at the beginning of the tender offer year.

	Discount Rate	
	12.5%	Firm-Specific CAPM
Corr (TPREM,UNDERVAL)	0.44	0.39
Spearman Corr (TPREM,UNDERVAL)	0.41	0.37

	Dependent Variable (TPREM) Discount Rate:			
Independent Variable	12.5%		Firm-Specific CAPM	
Intercept	0.186	0.246	0.197	0.268
	(13.26)**	(6.30)**	(14.20)**	(6.82)**
UNDERVAL	0.057	0.051	0.049	0.043
	(6.20)**	(6.15)**	(5.42)**	(5.31)**
SS/SO		0.378		0.360
		(3.46)**		(3.22)**
TAKEOVER		0.090		0.087
		(1.94)		(1.82)
CAR-PRE		−0.094		−0.100
		(−2.97)**		(−3.05)**
Size		−0.028		−0.030
		(−4.69)**		(−4.90)**
Adjusted R^2	19%	41%	15%	37%
N	163	154	163	154

**Significant at the 1 percent level.

preannouncement abnormal returns, and firm size. One, because the price pressure hypothesis predicts a higher premium when a greater fraction of shares outstanding is sought, we expect the target fraction to have a positive effect on the size of the tender premium. Two, repurchases have been employed defensively in hostile takeovers by increasing leverage and reducing liquidity and the number of shares available to the bidding firm. The tender premium is likely to be higher for such repurchases, because

the target firm has to compete with the bidder for these shares.[17] Three, if the firm's stock has underperformed the market prior to the repurchase announcement, we expect a higher tender premium if the manager's intention is to provide a stronger signal of improved future performance. Four, because firm size affects the magnitude of tender premium (from Panel B of Table II), we use the log of market value (at the beginning of the tender offer year) as a control variable in the multivariate regression.

The results indicate that the magnitude of undervaluation, the target fraction, preannouncement abnormal returns, and firm size have significant explanatory power for tender premium. The signs of all coefficients are in the predicted directions. The coefficient on the takeover threat variable is positive as expected but insignificant. Thus, consistent with our hypothesis, the magnitude of undervaluation exhibits significant explanatory power even after controlling for other determinants of tender premium.[18]

C. Oversubscription Demand Hypothesis

This subsection tests hypothesis H3, which predicts that, for oversubscribed offers, managers would be more likely to repurchase excess shares tendered (wholly or in part) if the tender price is below the EV; otherwise they would be more likely to repurchase only the shares sought and allocate them pro rata. Table V presents results providing strong support for H3. Panel A shows that 72 percent of oversubscribed firms whose EV exceeds the tender price repurchase excess shares tendered (wholly or in part). In contrast, 32 percent of oversubscribed firms whose EV is less than or equal to the tender price repurchase more shares than originally sought. The difference in percentage of firms purchasing excess shares when EV exceeds versus when EV is below the tender price is significant. The above finding is consistent with Masulis (1980), who finds that, in oversubscribed offers, the expiration-period abnormal returns are positive and significant when managers repurchase excess shares and negative and significant when the offer is prorated. Panel B further supports the hypothesis that, in the case of oversubscription, the number of shares repurchased relative to shares tendered (SR/ST) depends on the excess of EV over tender price (EVTP). The Pearson (Spearman) correlation coefficient is 0.31 (0.39), and the slope coefficient from the regression of *SR*/ST on EVTP is positive and significant.

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[17] Only 14 firms (nine percent) are categorized as facing a takeover threat. The firms are thus identified by searching the *Wall Street Journal Index* for news of either a takeover bid or a rumor during a two-year period centered on the announcement date.

[18] We also introduce the B/P ratio (or log(B/P)) as an additional explanatory variable. If the B/P ratio is a reasonable indicator of undervaluation (rather than our measure based on EV) we expect to find a significant positive coefficient on B/P (or log(B/P)). The coefficient is positive as predicted but insignificant.

Table V

Repurchase of Excess Shares in Oversubscribed Offers

The table reports the number of firms that repurchased excess shares tendered in oversubscribed offers. EV denotes the economic value of the firm calculated using the RIM. TPRICE is the tender price. SR denotes number of shares repurchased. SS denotes number of shares originally sought. The Chi-square statistic tests the difference between the percentage of firms repurchasing excess shares when EV is greater than the tender price versus when EV is less than or equal to the tender price. Panel B reports correlations and results of the regression of the ratio of shares repurchased to shares tendered (SR/ST) on EV relative to tender price (EVTP).

Panel A: Number of Firms Repurchasing Excess Shares Tendered				
	Discount Rate			
	12.5% (N = 95)		Firm-Specific CAPM (N = 95)	
	No. of Firms	%	No. of Firms	%
EV > TPRICE	61		61	
SR > SS	46	75%	44	72%
SR ≤ SS	15	25%	17	28%
EV ≤ TPRICE	34		34	
SR > SS	9	26%	11	32%
SR ≤ SS	25	74%	23	68%
Chi-square	(21.45)**		(14.17)**	

Panel B: Results of Correlation and Regression of Shares Repurchased Relative to Shares Tendered (SR/ST) on EV Relative to Tender Price (EVTP)		
	Discount Rate	
	12.5%	Firm-Specific CAPM
Corr (SR/ST, EVTP)	0.33	0.31
Spearman Corr (SR/ST, EVTP)	0.36	0.39

	Dependent Variable (SR/ST) Discount Rate	
Independent Variable	12.5%	Firm-Specific CAPM
Intercept	0.618 (13.50)**	0.635 (14.63)**
EVTP	0.084 (3.31)**	0.075 (3.10)**
Adjusted R^2	10%	9%

** Significant at the 1 percent level.

D. Motivations behind Repurchases by Firms Identified as Overvalued

Whereas the results confirm the undervaluation hypothesis on average, we identify 50 firms as being overvalued prior to the tender offer. Table VI, Panel A, shows that, although both groups offer substantial tender premia,

Table VI

Firm Characteristics of Undervalued versus Overvalued Firms

The table provides median characteristics of undervalued versus overvalued firms that repurchased shares during 1970–1989. Under- or overvaluation is measured by economic value (EV) minus price on day −10 relative to the announcement day (PRTEN). Calculations of EV are based on firm-specific CAPM discount rate. The third column reports statistics testing the difference between under- and overvalued firms–the chi-square test for the difference in percentage of under- versus overvalued firms facing a takeover threat and making tender offers in the year after the October 1987 crash and the Kruskal–Wallis test for all other firm characteristics. % Undervaluation is calculated as EV minus PRTEN divided by PRTEN. TPREM is the tender premium measured relative to PRTEN. SS/SO is the number of shares sought (SS) divided by the number of shares outstanding (SO). Cumulative abnormal returns are calculated relative to the CRSP value-weighted index for the respective exchange category. CAR-3DAY is the cumulative abnormal return calculated from day −1 to day +1 relative to the announcement day. CAR-PRE is the cumulative abnormal return from day −261 to day −11 relative to the announcement day. Firm characteristics in Panels B and C are measured at the beginning of the repurchase year. Market value equals price times number of shares outstanding. PE ratio equals price divided by earnings per share after extraordinary items and discontinued operations. Leverage ratio is calculated as long-term debt divided by the sum of market value of equity and long-term debt. Free cash flow is measured by operating income minus change in net operating assets. A firm is categorized as facing a takeover threat if a relevant news item is reported during a two-year period centered on the repurchase announcement date.

	Undervalued (N=116)	Overvalued (N=50)	Test Statistic
Panel A: Tender Offer and Market Measures			
% undervaluation	56.0%	−17.9%	(104.19)**
TPREM	23.4%	13.1%	(10.96)**
SS/SO	15.0%	13.6%	(0.31)
CAR-3DAY	14.3%	6.4%	(23.68)**
CAR-PRE	2.4%	5.4%	(0.26)
Panel B: Firm Characteristics			
Market value	41	115	(6.62)**
PE ratio	6.67	10.39	(11.59)**
Cost of capital:CAPM	12.5%	15.2%	(7.04)**
Panel C: Indicators of Other Motivations			
Leverage ratio	0.33	0.23	(6.18)**
Current ratio	2.36	2.18	(0.83)
Free cash flow	0.09	0.09	(0.01)
Insider holdings	15.00%	3.55%	(4.43)*
% Facing takeover threat	3%	18%	(12.38)**
% Tender offers during 10/19/1987 +12 months	5%	16%	(5.30)*

** and * indicate significance at the 1 and 5 percent levels, respectively.

CAR-3DAY is significantly lower for overvalued firms compared to undervalued firms. Surprisingly, despite significant overvaluation and low announcement-period abnormal returns relative to the tender premium, 50 per-

cent of these offers are undersubscribed. Also, we find that the magnitude of undervaluation is uncorrelated with the tender premium offered (not tabulated). These results suggest that managers of overvalued firms repurchase shares and offer substantial tender premia for motivations other than to reveal favorable information to investors. With a view to understanding these motivations, we compare firms identified as under- or overvalued on several dimensions.

From Table VI, Panel B, overvalued firms are significantly larger in size, with a higher cost of capital and a higher P/E ratio compared to undervalued firms. The high P/E appears to be consistent with the stock being overpriced (relative to the firm's earnings performance). From Panel C, the pre-tender offer leverage ratio of overvalued firms is significantly lower at 0.23 versus 0.33 for undervalued firms. Further, for firms that are substantially overvalued (>10 percent), the leverage ratio increases from 0.15 to 0.27 at the tender offer year-end whereas that for undervalued firms remains almost constant (not reported in table). This result coupled with the large size composition of the overvalued firms is consistent with the suggestion by Lakonishok and Vermaelen (1990) that repurchases by large firms may be part of a corporate restructuring activity rather than an attempt to signal undervaluation of the firm. We also examine whether firms identified as overvalued repurchase shares to distribute excess cash. We find that the pre-tender offer current ratios and free cash flows of the over- and undervalued firms are not significantly different.

Panel C shows that 18 percent of overvalued firms (relative to three percent of undervalued firms) face a takeover threat during a two-year period surrounding the repurchase. Panel C also shows that 16 percent of overvalued firms (relative to five percent of undervalued firms) repurchase shares in the year following the October 1987 crash, a period with respect to which prior studies have raised questions regarding motivations behind repurchases (e.g., Denis (1990) and Comment and Jarrell (1991)). Further, a comparison of median percentage insider holding shows that insider holdings of overvalued firms are significantly smaller than those of undervalued firms.[19] This suggests that overvalued firms may be mimicking other firms by repurchasing shares to provide a signal of undervaluation, because they have lower exposure to costs associated with "false signaling."

The above analysis indicates that takeover threat and leverage related motivations and possibly low-cost false signaling may explain why some of the overvalued firms repurchase stock. We refrain from examining the likely motivation for each individual firm identified as overvalued, as we consider

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[19] Percentage insider holding is measured by the total of all stockholdings of insiders, officers, and directors divided by the total number of shares outstanding as reported in the *Value Line Investment Survey*. Insider holdings data are available for 59 and 28 firms classified as under- and overvalued, respectively.

it to be beyond the scope or purpose of this paper. Besides, given the joint hypothesis of the valuation model's empirical validity underlying our tests, a firm-by-firm analysis would amount to attaching a level of precision to our results that is not intended.

V. Concluding Remarks

This paper provides a direct test of whether firms that repurchase shares are undervalued relative to their "economic value" (EV). We estimate EV from an earnings-based valuation model using the earnings forecasts managers would have if they had perfect foresight. We hypothesize that managers repurchase shares if their assessment of the firm's EV is greater than the prevailing stock price. We find that 74 percent of the repurchasing firms are undervalued (prior to the tender offer) compared to only 51 percent of a control sample of non-repurchasing firms. The magnitude of undervaluation is significantly higher for the repurchasing firms relative to the control firms. A significant fraction of repurchasing firms is substantially undervalued, which supports the intuition that managers would be likely to make a costly repurchase (paying a large tender premium) only when considerable mispricing exists. Our results hold even when we assume that managers lack perfect foresight and can predict true earnings with error. Further, the pattern of insider trading prior to the repurchase and insignificant mispricing when economic value is based on analysts' forecasts of future earnings together suggest that managers have private information about their firm's favorable future prospects.

We also find a strong positive correlation between the undervaluation measure and the tender premium. Further, the magnitude of undervaluation is considerably greater than the tender premium, indicating that managers are conservative in setting tender premia. For oversubscribed offers, the managers' decision to repurchase excess shares tendered or to prorate shares is influenced by the magnitude of undervaluation. Overall, the results suggest that decisions to repurchase shares and actions in connection therewith are consistent with managers possessing superior information about their firm's economic value.

Whereas the undervaluation hypothesis is supported on average, we identify several firms in the repurchasing sample as being overvalued. The abnormal returns for these firms are significantly low relative to that of undervalued firms, suggesting other motivations behind their repurchases unrelated to revealing favorable information. Significant among these are leverage or takeover threat related motivations.

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