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A Discrete Choice Model of Dividend Reinvestment Plans: Classification and Prediction

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Abstract: We study 852 companies with dividend reinvestment plans in 1999 matched by total assets to 852 companies without such plans. We use discrete choice methods to predict the classification of these companies. We interpret the misclassified companies as being likely to switch their plan status. That is, if a firm's financial data suggest that a company should have had a dividend reinvestment plan in 1999 but did not, then we expect that it would be more likely to institute a plan than the other companies in the sample. Conversely, if it did have a plan but the financial data suggest that it should not, then we expect that the company would be more likely to drop the plan. We use data from 2004 to explore this conjecture and find evidence supporting it. Our model is an economically and statistically reliable predictor of changes in plan status. We also identify which variables have the most influence on a company's decision whether or not to offer a plan.

JEL classification: G20, G29, G35

Key words: dividend reinvestment, discrete choice, clustering

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Please address questions regarding content to Ramon P. DeGennaro, Visiting Scholar, Federal Reserve Bank of Atlanta, and SunTrust Professor of Finance, Finance Department, University of Tennessee, 423 Stokely Management Center, Knoxville, TN 37996, 865-974-1726, rdegenna@utk.edu, or Thomas P. Boehm, AmSouth Scholar and Professor of Finance, Finance Department, University of Tennessee, 430 Stokely Management Center, Knoxville, TN 37996-0540, 865-974-1723, tboehm@utk.edu.

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A Discrete Choice Model of Dividend Reinvestment Plans: Classification and Prediction

1. Introduction

Dividend reinvestment plans (DRIPs) allow investors to reinvest their dividends in additional shares of the same stock that paid the dividend.[1] Previous research suggests that firms that offer such plans differ from those that do not in systematic ways (DeGennaro, 2003). Is it possible to use financial data to determine whether a firm will or will not offer a plan? And is it possible to take the next step and predict which firms will or will not offer plans in later years? The answer to both is yes. The financial characteristics of companies that offer DRIPs do differ from those that do not, and financial traits respond quicker than management can decide to add or drop a DRIP and implement that decision. This has immediate managerial implications as well as potential wealth effects for investors. We also find evidence suggesting that firms institute DRIPs to insulate management from control challenges.

Our paper is therefore different in substance and in spirit from previous research on DRIPs. For example, some researchers have studied the value of specific plan terms to investors. Two important examples are Dammon and Spatt (1992), who calculate the value of an option implicit in the share-purchase terms of certain DRIPs, and Scholes and Wolfson (1989), who analyze and report the success of their efforts to exploit a price discount provision incorporated in other plans. Another strand of research studies the stock price of companies that announce plans (e.g. Dubofsky and Bierman (1988), Perumpral, Keown and Pinkerton (1991) and Dhillon, Lasser and Ramirez (1992)). Still others have explored the interaction of DRIPs and the tax code. Chang and Nichols (1992), for example, investigate whether Internal Revenue Code

[1] For a thorough description of these plans and a discussion of why firms offer them, see DeGennaro (2003) and the references therein.

Section 305(e) affects qualifying utilities. They study the cost of equity capital, leverage ratios, stock price reactions and participation rates for DRIPs around the time of the changes in the tax code. Todd and Domian (1997) conduct a survey to relate plan characteristics to shareholder participation rates. To our knowledge, though, no research has attempted to predict whether or not a company will have a DRIP.

DRIPs and a more general class of investments, Direct Investment Plans, allow investors to avoid investment channels typically used in the past, such as securities brokers. A DRIP is a mechanism that permits shareholders to reinvest their dividends in additional shares automatically. Brokers are not involved unless they are agents of the plan administrator. If the firm does not restrict its plan to current shareholders, then the plan is also what is called a Direct Investment Plan, sometimes known as a Super DRIP. Transactions costs are typically much lower than when using traditional brokerage accounts. For example, share purchases are often executed free of charge and sales usually cost just a few cents per share.

DRIPs are not a different class of security, such as swaps or options. They are simply a new way of selling traditional equity securities. The privileges and obligations of equity ownership are unchanged. For example, DRIP investors receive the usual mailings and retain all voting rights. Tax implications of share ownership are unaffected, and stock splits are handled exactly as if the investor were using a traditional brokerage account.

Our analysis uses a sample of 852 matched pairs of firms. The firms are matched on total asset size in the base year of observation, 1999. Each pair of firms contains one company that had a DRIP in 1999 and one that did not. We fit a logistic probability model to the 1999 data to determine empirically which specific firm characteristics have an impact on whether or not firms have a DRIP. Based on this model we predict whether or not a firm will change its DRIP status

by 2004. In general, we find that the dividend yield and several variables capturing a firm's ability to pay dividends, the extent of managerial entrenchment, and industry differentials are significant predictors of whether or not a firm has a DRIP. We are able to predict successfully which firms change their DRIP status based on these parameter estimates and firm information on the significant factors.

From the perspective of the financial economist, these data provide information that may let us determine the likelihood that companies without plans will adopt one. Given the results of Dubofsky and Bierman (1988), Perumpral, Keown and Pinkerton (1991) and Dhillon, Lasser and Ramirez (1992), the ability to predict such an adoption before the marginal investor can do so represents a potentially profitable trading opportunity. The managerial implications are even more important: companies that administer direct investment plans that seek new customers can identify firms most likely to be interested in purchasing their services. The reverse is also possible: they can identify which companies are likely to abandon their plans, helping plan administrators concentrate resources on customers that are at greatest risk to become former customers. Predicting changes in plan terms may also be possible.

The paper proceeds as follows. Section 2 describes our data and outlines our method. Section 3 reports summary statistics and univariate results. Section 4 contains the logistic results and Section 5 provides a summary.

2. Data and Methodology

Data are from *The Guide to Dividend Reinvestment Plans* (1999, 2004) and the Compustat and CRSP databases. We begin with 852 firms with available data in 1999 that offered DRIPs. Because DRIP firms tend to be much larger in terms of total assets than companies without such plans (DeGennaro, 2003), we match these 852 DRIP companies to a

sample of firms without such plans, for a total of 1704 companies. We use total assets in 1999 as our matching variable.

Since the dependent variable in our analysis is discrete (1 = company had a DRIP at a particular time, 0 otherwise) Ordinary Least Squares regression is inappropriate for two reasons. First, because the regression analysis is linear, it is quite possible to estimate probabilities in the sample that are outside the (0,1) interval. In addition, the error terms in such a regression would be heteroskedastic. To avoid these problems we use a maximum likelihood logit model. This is the standard way to handle these problems. The logit model has the following form:

$$P_{DRIP} = 1/ (1 + e^{-Xi'\beta i}), \qquad (1)$$

where: P_{DRIP} = the probability the firm has a DRIP,

X_i = a set of variables hypothesized to influence P_{DRIP},

β_i = a set of coefficients which represent the estimated impact of X_i on P_{DRIP},

$X_i'\beta_i = \beta_0 + X_1\beta_1 + X_2\beta_2 + \ldots + X_n\beta_n$.

Classification methods have a long history of productive uses in business and finance. These methods include both models that use continuous variables and those that use discrete choice variables. Discrete choice models are probably more common. One form of discrete choice model is cluster analysis. Shaffer (1991), for example, studies federal deposit insurance funding and considers its influence on taxpayers.

Multinomial logit, another discrete choice approach, has been used at least as far back as Holman and Marley (in Luce and Suppes, 1965). More recent variations include the nested logit model of Ben-Akiva (1973), which is designed to handle correlations among alternatives. Calhoun and Deng (2000) use multinomial logit models to study loan terminations.

3. Sample statistics and Univariate Results

Table 1 presents the number of firms in each category partitioned by year and by plan status. In 1999 we have a size-matched sample of 852 companies, one of each pair offering a DRIP and one not offering a DRIP, for a total of 1704 companies. By 2004 the sample has shrunk considerably. Only 916 remain in the sample.[2] Of these, 465 have a plan and 451 do not. Of course, this masks movement across groups. Table 2 shows that most companies maintained their plan status, either retaining a plan five years later (387 of 916) or not offering a plan in either year (394 of 916). A moderate number do change their plan status, though. A total of 71 companies, or about 7.75%, added a plan within the five years and 64 of the 916, or 6.99%, dropped their plans.

Factors Affecting the Likelihood of Having a DRIP

Table 3 lists the independent variables included in the analysis. It also shows whether we expect companies that offer DRIPs to have higher or lower values in univariate tests. Excluding total assets (the matching variable) and the categorical industry variables that we include as controls, our variables fall into four categories. These rely on DeGennaro (2003). We call variables in the first category *fundamental variables*, not in the sense of fundamental economic value, but rather because their economic meanings are fundamentally changed by a reinvestment plan. These are the payout ratio and the dividend yield. Consider two companies which are identical except that one has a plan and one does not. Suppose that the optimal dividend yield is 4% for both. The company without a DRIP simply pays a 4% yield. The DRIP company, though, cannot expect plan participants to retain all of their dividends. The DRIP company must offer a higher explicit yield to have an effective yield of 4%. The same reasoning applies to the

[2] Firms leave the sample for the usual reasons: Merger or other corporate combinations along with delisting due to financial distress head the list.

payout ratio. All else equal, we expect DRIP companies to have higher explicit payout ratios and dividend yields.

We call variables in the second category *maturity variables* because they distinguish mature companies from growth companies. In our sample these include net sales, net profit margin, the debt ratio, the market-to-book ratio, and the price/earnings ratio (measured at fiscal year-end). Mature companies tend to pay higher dividends (Smith and Watts 1992 and Barclay, Smith and Watts 1995). Although higher dividends are not directly linked to the probability of having a DRIP, to the extent that the dividend yield and payout ratio fail to proxy completely for maturity, these variables could have predictive power. In univariate tests the first three of these variables should be marginally higher for DRIP companies and the last two, marginally negative (DeGennaro 2003).[3]

We call variables in the third group *ability variables* because they control for the ability to pay dividends – all else equal, firms that earn more can pay more. These variables are after-tax return on assets (ROA), after-tax return on common equity (ROE) and earnings per share (EPS). Although the ability to pay dividends is not directly related to the probability of having a DRIP, the dividend yield itself is a strong predictor of having a plan. What do these ability variables offer that the yield itself does not? To the extent that the ability to pay dividends affects the dividend yield in the future, these variables contain information about future dividends that is not captured by the current yield. Therefore, the ability variables could provide indirect information about the likelihood of having a DRIP in the future.

The fourth group controls for *managerial entrenchment*. DeGennaro (2003) speculates that one reason for the existence of DRIPs is that they can insulate management from threats to

[3] Research and development expense is another obvious choice. We do not use it because it has the most missing values by far. In almost all cases, including it reduces the sample size by more than half.

their control. Four variables fit this category: The number of common shareholders, the number of common shares outstanding, the number of common shares traded, and the number of employees. First, if management worries about retaining its control, then it prefers a diffuse shareholder base with many small shareholders. If they bother to vote their shares at all, these investors are likely to vote with management. Second, as long as small shareholders do not get a large enough position to become activist shareholders, management wants them to have more voting shares. Third, these small shareholders tend to trade less frequently. Finally, because employees' jobs are often at risk during corporate reorganizations, employees have incentives to support current management in takeover battles. This means that management wants employees to be shareholders, too, so companies with many employees are more likely to institute a DRIP (sometimes plans have features that are quite favorable to employees and are sometimes even restricted to employees). DRIP companies, therefore, should tend to have higher values for all of these variables except for the number of shares traded, which should be lower for DRIP firms.

Table 4 presents sample statistics for all 1704 companies. As is to be expected, all observations have missing observations for certain variables. Still, for the sample of 1704 companies in 1999, we have upwards of 1300 observations for all variables. Most have more than 1550 observations. Almost all observations on all variables lie within a reasonable range. Exceptions occur for certain ratios with denominators near zero. For example, Compustat defines the Payout Ratio as essentially the dollar amount of dividends paid to common shareholders divided by earnings. Because earnings can be near zero, ratios can be large in absolute value. Even these cases, though, are relatively rare.

Results by DRIP Status

Because we have two time periods and two classes of DRIP status (plan or no plan), we have four possible pairs to signify plan status through time. A company can have a plan in both periods, drop a plan, add a plan, or have no plan in either period. Table 5 reports *t*-tests of differences across these four groups using 1999 data. We report the results of six combinations of plan status. The first column contains the results of *t*-tests comparing companies that did not have a plan in either year to companies that did have a plan in both years. We would expect these companies to be different, and they are. Six *t*-tests are significant, and the signs of all six are consistent with our predictions. In addition, all eight of the insignificant tests have the correct sign. These strong results make sense, because companies that had a plan in both years and those that had no plan in either year are the most distinct groups in Table 5.

The second column contains the results of companies that did not have a plan in either year versus companies that added a plan by 2004. To the extent that the financial data from 1999 foreshadow this change in plan status, we would expect these classes of companies to differ, and they do. Setting aside the matching variable, Total Assets, seven of the 14 *t*-tests are statistically significant. Six of these are correctly signed: The dividend yield, net sales, the debt ratio, the number of common shareholders, the number of common shares outstanding, and the number of employees are significantly negative, meaning that companies which added plans have higher means, which is consistent with Table 3. The number of common shares traded, though, has a negative sign, meaning that companies that institute DRIPs have more shares traded. All other signs are as predicted except for Market-To-Book, P/E at Fiscal Year End, and EPS, and it is hard to worry about *t*-ratios that are under 0.3 in absolute value.

The third column of Table 5 contains the results of t-tests comparing companies that did not have a plan in either year to companies that had a plan in 1999 and dropped it by 2004. To

the extent that the financial data from 1999 completely foreshadow this change in plan status, we would expect these classes of companies to be somewhat similar even as early as 1999. They are. Only two *t*-tests are statistically significant and both have the expected signs: The dividend yield and the number of common shareholders. Consistent with having a plan in 1999, firms that would later drop their plans have higher dividend yields and more common shareholders than companies that had no plan in either year. Of the 12 insignificant estimates, 10 have the predicted sign.

The fourth column compares companies that dropped a plan to those that added a plan. It is hard to make predictions about these tests, because all of the companies switched plan status. To the extent that these companies' financial statements reflect either their 1999 status or foreshadow their future status, then we might expect significant differences. However, the expected signs of the tests depend on which of those two cases – dropping or adding a plan -- dominates. The only two tests that are significant are the debt ratio and the number of common shares traded.

The fifth column of Table 5 contains the results of *t*-tests comparing companies that did not have a plan in 1999 but added one by 2004 to companies that had a plan in both years. To the extent that financial data from 1999 foreshadow this change to having the same plan status, we would expect these classes of companies to be similar. In contrast, if they have not fully adjusted, then they will differ. In fact, five *t*-tests (not counting total assets) are significant. Two of these five (ROA and common shares traded) have signs that are consistent with the 1999 plan status and the other three (net sales, debt ratio and common shares outstanding) are not. To the extent that the nine insignificant coefficients convey useful information, they support the economic reasoning underpinning Table 3 for the 1999 data: seven have the expected signs.

The sixth column of Table 5 contains the results of *t*-tests comparing companies that had a plan in 1999 and dropped it by 2004 to companies that had a plan in both years. If financial statements anticipate this change, then we would expect to find differences, and in three cases, we do. All three (net profit margin, debt ratio, and ROA) are consistent with the predictions in Table 3. These results are also consistent with the interpretation that some of these companies dropped their plans because they could no longer afford to pay dividends.

Clearly, the financial statements of companies that have DRIPs differ from those that do not. For our purposes, the point is that these differences hold promise for partitioning the data using logit regressions and for predicting DRIP status in the future.

4. Logit Results

Table 3 and Table 5 show that certain firm-specific variables systematically differ between DRIP firms and no-DRIP firms. DeGennaro (2003) shows that DRIP firms cluster by industry. Based on this information we estimate this logit regression:

$$DRIP_i = \beta_0 + \beta_1 TA_i + \beta_2 PR_i + \beta_3 DY_i + \beta_4 NS_i + \beta_5 PM_i + \beta_6 DR_i + \beta_7 MB_i + \beta_8 PE_i + \beta_9 ROA_i + \beta_{10} ROE_i + \beta_{11} EPS_i + \beta_{12} CS_i + \beta_{13} CSout_i + \beta_{14} CST_i + \beta_{15} Emp_i + \sum_{16}^{22} \beta_j Industry + \varepsilon_i$$

Where the subscript *i* signifies the company and:

$DRIP_i$ = 1 if company *i* has a DRIP; else 0
TA_i = total assets ($MM)
PR_i = payout ratio
DY_i = dividend yield
NS_i = net sales ($MM)
PM_i = net profit margin
DR_i = debt ratio
MB_i = market-to-book ratio
PE_i = price/earnings ratio
ROA_i = after-tax return on assets
ROE_i = after-tax return on common equity
EPS_i = earnings per share
CS_i = number of common shareholders
$CSout_i$ = number of common shares outstanding
CST_i = number of common shares traded
Emp_i = number of employees
$\sum_{16}^{22} \beta_j Industry$ = seven one-digit SIC codes
ε_i = logistically distributed *i.i.d.* error term.

The SIC categories included are: (1) Mining oil production and consumption, (2) Materials and food processing, (3) Manufacturing, (4) Transportation utilities and waste disposal,

(5) Wholesale and retail activity, (6) Financial services, (7) Other services, and (8) Other miscellaneous. It is important to note that the dummy variable that we exclude from the regression, "Other services," includes "medical legal, social and accounting services".[4]

The first column of Table 6 (Model 1) contains the results using 1999 data. The top number in each cell is the logit coefficient estimate and asymptotic *p*-values are in parenthesis below. Model 1's performance is reasonable but less than stellar. Total assets – the matching variable – is insignificant as expected and five of the seven industry effects are significant. Of the other 14 variables, three are significant at the 5% level or better and two just miss, with *p*-values under 0.06. All of these five significant coefficients have the expected signs. Of the remaining nine variables, six have the expected signs. How can we best interpret these results? Analyzing each group of variables is a good starting point. Three of the variable groups conform quite well to our predictions in Table 3. For example, the two fundamental variables work well. The dividend yield is correctly signed and very significant, and the payout ratio is correctly signed though insignificant. Two of the three ability variables are also correctly signed and significant, and the incorrectly signed coefficient (ROE) is zero to three decimal places. The likely explanation is that ROE is highly correlated with another variable or combination of variables, making it difficult to separate their contributions to explaining variation. Two of the management entrenchment variables, common shares outstanding and common shares traded, are correctly signed and significant and the other two are at least correctly signed.

None of the maturity variables is significant, though. In univariate analysis, we have followed DeGennaro (2003) and argued that DRIP companies are more mature, leading to higher sales and margins, and lower research and development expenses. Mature companies also tend to carry more debt, and because they have relatively few growth opportunities they tend to have

[4] There are so few in this category that they would not have provided meaningful results.

lower market-to-book and price/earnings ratios. These arguments lose force in a multivariate analysis that includes dividend yields and payout ratios. Dividend yields and payout ratios should be higher for more mature companies. But these reported values do not included reinvestments – after reinvestments, the effective values are lower. If we matched companies by reported dividend yields and payout ratios, then DRIP companies would very likely be *less* mature, because their effective values are lower.

This suggests that although dividend yields and payout ratios are positively correlated with DRIP status, there is no obvious reason to predict that other traits of mature companies are correlated with status once we control for dividend yields and payout ratios. To the extent that dividend yields and payout ratios fail to proxy completely for maturity, then the other maturity variables may be marginally positive, but Model 1 shows that these variables can safely be eliminated.

If we drop the maturity variables from the multivariate analysis, along with ROE, then we obtain Model 2. The results are in the second column of Table 6. Model 2 gives away virtually nothing compared to Model 1. The pseudo R^2 of 0.3511 is the same to the second decimal place, we actually gain two observations, and the coefficient estimates are remarkably similar. These estimates are much more precise in Model 2, though. First, purists will note that the coefficients on EPS and the number of common shares outstanding are now significant at well below the 5% level. In addition, the *p*-value for the estimate on the number of employees drops from above 15% to a statistically significant 2.8%. A likelihood-ratio test formally rejects Model 1 in favor of Model 2. In short, the data support Model 2 much better than Model 1.

Model 2 correctly classifies companies with DRIPs slightly better than companies without them. For DRIP firms the correct classification rate is 79.33% and for no-DRIP firms the rate is 73.54%. Overall, the rate of correct classifications is 76.73%.

The Impact of Independent Variable Groups on the Likelihood of Having a DRIP

Table 7 presents two other ways to gain insight about the implications of Model 2. Panel A reports results for companies with no DRIP in 1999 and Panel B reports results for companies with a DRIP in 1999. The top part of each panel reports the mean predicted probability of having a DRIP for companies that had no plans in 2004 (second column) and for companies that did have them in 2004 (third column). The second part of each panel reports the contribution of each of the four variable subgroups (fundamental, ability, managerial entrenchment, and industry effects) to the difference in the those mean predicted probabilities. Panel A shows that for firms with no DRIP in 1999 the predicted probability of having a DRIP is substantially different depending on plan status in 2004. The 464 companies that did not have a drip in 2004 had a predicted mean probability of having a DRIP of 34.73%; whereas the 50 companies that did have a DRIP in 2004 had a mean likelihood of having a DRIP of 64.26%. This difference is not only statistically significant (*t*-statistic of 7.43) but also represents a 29.53 percentage point difference. We interpret this is evidence that the model is picking up factors in the financial statements that foreshadow the change in DRIP status.

This difference in these predicted likelihoods of having a DRIP derives from the differences in mean values for the independent variables rather than the estimated coefficients in the model. For example, given the positive coefficient on the payout ratio, a higher payout ratio implies that there is a higher probability of having a DRIP. Thus it is easy to calculate the impact of each variable group on this difference between the 34.73% average likelihood and the

64.26% average likelihood of having a DRIP. In the second part of Panel A in Table 7 we see that differences in fundamental variables (16.40 percentage points) are the largest component of this differential. If the mean values for the fundamental variables (payout ratio and dividend yield) for no DRIP firms in 2004 are increased to the level of firms that have a DRIP in 2004, their predicted likelihood of having a DRIP increases 16.40 percentage points. This would increase the predicted probability of having a DRIP for this group by almost half (a 47.23% increase over the 34.73% probability for firms adding a DRIP by 2004). Of the remaining variable groups, managerial entrenchment variables clearly have the largest impact, 6.44 percentage points (which is 18.54% of the 34.73% probability of firms adding a DRIP by 2004). The changes associated with ability and industrial effects variables are relatively small (3.56 and 3.08 percentage points respectively).

The importance of managerial entrenchment variables in the decision to add a DRIP merits mention because entrenched management has been linked to lower firm value. Bebchuk and Cohen (2005), for example, show that staggered boards (probably the most important governance arrangement that insulates managers from dismissal) are associated with lower corporate value. Ryngaert (1988) finds similar (though weaker) results for poison pills. Future research would do well to explore whether companies that institute a DRIP to entrench management suffer stock price declines while those that do so for other reasons do not. This might explain the conflicting evidence researchers have found concerning the stock price reaction around the announcement that a company will institute a DRIP. For example, Dubofsky and Bierman (1988) and Perumpral, Keown and Pinkerton (1991) find evidence of positive abnormal returns when companies announce that they will institute a DRIP while Dhillon, Lasser and Ramirez (1992) find evidence of losses. Peterson, Peterson and Moore (1987) find mixed

results. Perhaps these latter studies had higher proportions of firms that instituted plans for reasons of corporate control. Estimating abnormal returns after controlling for the reason for instituting the DRIP is likely to be fruitful.

The results for firms that did have a DRIP in 1999 are in Panel B of Table 7. Again, the mean predicted probability of having a DRIP is significantly higher for those firms that retain a DRIP in 2004 (third column) compared to those that dropped their DRIP (second column). The difference is 74.64% versus 70.54%, with a *t*-statistic of 2.68. Unlike the companies that have a DRIP in 1999, though, the variables controlling for the ability to pay dividends drive the difference. The 2.01 percentage point influence is almost double that of any other category of variables. This suggests that firms choose to add or drop DRIPS for substantially different reasons. Companies that add DRIPs tend to have higher payout ratios and dividend yields, and higher levels of variables related to managerial entrenchment. In contrast, companies that drop DRIPS do not earn as much and may even need to tap capital markets to raise funds. If a firm does want to reduce dividend payments, then a DRIP works against this. To see this, suppose that a firm has a dividend yield of 5% but because of its DRIP, its effective yield is 1%. In the face of the dividend cut to say, 2% and poor financial performance, some investors will probably stop reinvesting. Other investors who were reinvesting 4% to achieve an effective yield of 1% might reinvest only half of the reduced dividend in order to retain their 1% effective yield. From the firm's perspective these investor responses reduce the effect of the dividend cut. Because operating a plan entails costs, companies may find it simpler just to eliminate the DRIP entirely.

How Well Can We Predict Changes in Plan Status?

Consider companies that the logistic model misclassifies; either the model says that they should have a plan and they do not, or it says that they should not have a plan and they do. How

do we interpret this? One way is to conclude that the model simply fails in such cases. An alternative interpretation is that financial statements contain information about *future* plan status as well as current plan status. Under this interpretation, misclassified companies are more likely to switch their plan status. That is, if the firm's financial data suggest that a company should have had a dividend reinvestment plan in 1999 but it did not, then we expect that it would be more likely to institute a plan than the other companies in the sample. Conversely, if it did have a plan but the financial data suggest that it should not, then we expect that the company would be more likely to drop the plan. Put differently, misclassifications in 1999 include both predictions of changes in plan status as well as classification errors.

Do the data support this interpretation? The short answer is yes. We conduct a two-pronged experiment. In the first part, we consider companies that have a DRIP in 1999 and explore whether or not they drop it by 2004. In the second part, we consider the companies that do not have a DRIP in 1999 and explore whether they add one by 2004. These two groups of firms should have different financial characteristics. To perform the first part of this experiment we partition the 629 companies that had a DRIP in 1999 into those that the logit model correctly classifies and those that it misclassifies. We then compute the proportion of each group that dropped their plans by 2004 and test the difference between them. If the 1999 financial statements contain information about future plan status, then the companies that the model misclassifies as not having a plan in 1999 should drop their plans significantly more often. In the second part of this experiment we partition the 514 companies that had a DRIP in 1999 into those that the logit model correctly classifies and those that it misclassifies. We compute the proportion of each group that added a plan by 2004 and test the difference between them. If the

1999 financial statements contain information about future plan status, then the companies that the model misclassifies as having a plan in 1999 should add plans significantly more often.

Table 8 reports the results of this experiment. The top part of Table 8 contains a transition matrix that partitions the 629 companies that had DRIPs in 1999 into two groups: 130 companies that are predicted not to have a DRIP, and 499 companies that are predicted to have a DRIP. Considering actual changes in DRIP status across these two groups between 1999 and 2004, a significantly higher proportion of those companies predicted not to have a DRIP (*t*-statistic of 3.513), in fact do not have a DRIP in 2004 (33.85% versus 21.84%) as compared to those firms predicted to have a DRIP. Thus the predicted probabilities generated from this model do allow us to distinguish between those firms that would be more likely to actually terminate their program over the next five years and those that would not.

In the bottom section of Table 8 a similar experiment is conducted for those firms that did not have a DRIP in 1999. The results of this experiment are even more impressive than those for firms that initially had a DRIP. Specifically, of the 514 companies that did not have a DRIP in 1999, 378 firms were predicted not to have a DRIP. Of this group only 17 (4.5%) added a DRIP by 2004. This is a significantly lower proportion (*t*-statistic of -8.95) than that of the 136 firms that the model predicted would have a DRIP. For these companies 24.26% actually added a DRIP by 2004. Once again, the probabilities calculated based on our logit model allow us to distinguish between firms that might be expected to adopt a DRIP over a five year observation window and those that would not.

5. Summary

Most research on dividend reinvestment plans has focused on stock-price responses to the announcements of such plans or attempted to value certain plan features. To date, little research

has attempted to determine which type of firm adopts a plan, and none has attempted to predict whether companies will have a plan in the future. This paper fills that void. We use discrete choice methods to predict the classification of 1704 companies: A sample of 852 companies with dividend reinvestment plans in 1999 matched by total assets to a sample of 852 companies without such plans. We develop a logit model that successfully classifies almost 77% of companies yet uses only readily available contemporaneous financial data. Our analysis demonstrates that in addition to the dividend yield, variables measuring ability to pay dividends, managerial entrenchment, and industry differentials all have a significant influence on the likelihood that a firm has a DRIP. In addition, by interpreting the misclassified companies as those being likely to switch their plan status, we can then test whether the model can predict changes in plan status. The underlying premise is that a company's current financial data contain information not only about whether a company currently has a dividend reinvestment plan, but also that they contain information about future plan status. We use data from 1999 and 2004 to explore this conjecture. We find that our model can predict changes in plan status even as much as five years in the future.

Our results are important for at least three reasons. First, the ability to predict changes in plan status before the marginal investor can do so represents a potentially profitable trading opportunity (Dubofsky and Bierman, 1988 and Perumpral, Keown and Pinkerton, 1991). Second, companies that administer direct investment plans that seek new customers can produce a list of firms most likely to be interested in purchasing their services, thus saving time and resources. The reverse is also possible: we can improve our predictions of which companies are likely to abandon their plans, and plan administrators can improve their predictions about which customers are at greatest risk to become former customers. Finally, we find that variables

controlling for managerial entrenchment are highly correlated with the decision to institute a dividend reinvestment plan. This is the first empirical evidence that dividend reinvestment plans might serve to insulate management from outside control.

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Table 1

Number of firms by year and plan status

Number of Companies			
Year	**with Dividend Reinvestment Plans**	**without Dividend Reinvestment Plans**	**Total**
1999	852	852	1704
2004	465	451	916

Table 2

Plan status of the 916 surviving firms in 1999 and 2004

Plan Status in Years 1999 and 2004	Number of companies	Percent of total
Neither 1999 nor 2004	387	42.25%
Not 1999 but 2004	71	7.75%
1999 but not 2004	64	6.99%
Both 1999 and 2004	394	43.01%
Total Surviving Companies	916	100%

Table 3
Expected relation between financial statement data for companies with DRIPs compared to companies without DRIPs (univariate tests)

Variable	Companies with DRIPs tend to have higher or lower values?
Total Assets	N/A (matching variable)
Fundamental Variables	
Payout Ratio	Higher
Dividend Yield	Higher
Maturity Variables	
Net Sales	Higher
Net Profit Margin	Higher
Debt Ratio	Higher
Market-To-Book Ratio	Lower
P/E at Fiscal Year End	Lower
Ability Variables	
After Tax Return on Total Assets	Higher
After Tax Return on Common Equity	Higher
Earnings Per Share	Higher
Managerial Entrenchment Variables	
Number of Common Shareholders	Higher
Number of Common Shares Outstanding	Higher
Number of Common Shares Traded	Lower
Number of Employees	Higher

Table 4
Sample Statistics, 1999 Data, 1704 Firms in Operation in 1999

Variable	N	Mean	Std Dev	Min.	Max.
Total Assets ($MM)	1703	14,648	47,081	9.06	575,167
Fundamental Variables					
Payout Ratio (%)	1649	35.02	168.52	-3626.04	3192.31
Dividend Yield (%)	1576	2.55	3.36	0	48.32
Maturity Variables					
Net Sales ($MM)	1700	5444.4	13,451	0	173,215
Net Profit Margin (%)	1700	4.21	45.19	-1324.84	371.10
Debt Ratio	1703	0.69	0.230	0.0032	2.741
Market To Book	1565	2.97	9.06	-238.17	121.53
P/E at Fiscal Year End	1578	18.21	104.0	-1693.80	1437.50
Ability Variables					
After Tax Return on Total Assets (%)	1704	2.65	8.87	-117.33	48.15
After Tax Return on Common Equity (%)	1694	4.79	184.73	-6812.12	565.89
Earnings Per Share ($)	1621	1.69	9.38	-51.66	276.02
Managerial Entrenchment Variables					
Common Shareholders (M)	1303	38.14	161.69	0	4206.32
Common Shares Outstanding (MM)	1657	198.80	468.90	0	6133.40
Common Shares Traded (MM/yr.)	1574	168.98	525.61	0	8129.69
Employees (M)	1526	21.91	55.61	0	1140.0
Industry Effects Variables					
Mining, Oil, and Construction	1704	0.03	0.18	0	1
Materials Processing	1704	0.15	0.36	0	1
Manufacturing	1704	0.17	0.37	0	1
Transportation, Utilities, and Waste Disposal	1704	0.17	0.38	0	1
Wholesale and Retail	1704	0.07	0.25	0	1
Financial Services	1704	0.31	0.46	0	1
Other Services	1704	0.06	0.24	0	1
Medical, Legal, Management Accounting Services	1704	0.01	0.12	0	1
Other Miscellaneous	1704	0.01	0.08	0	1

Table 5
***T*-tests: Surviving Firms, 1999 Data**

Variable	NN v YY	NN v NY	NN v YN	NY v YN	NY v YY	YN v YY
Total Assets ($MM)	-0.17	-2.03*	-0.84	0.67	2.35*	0.89
Fundamental Variables						
Payout Ratio (%)	-2.45*	-1.48	-1.18	0.36	0.60	0.19
Dividend Yield (%)	-10.1**	-3.30**	-4.68**	-0.88	-1.94	-0.40
Maturity Variables						
Net Sales ($MM)	-2.09*	-4.51**	-1.55	1.59	2.35*	0.01
Net Profit Margin (%)	-2.81**	-0.93	-0.41	1.16	-0.97	-2.66**
Debt Ratio	-1.06	-2.40*	1.33	3.26**	2.32*	-2.27*
Market To Book	0.07	-0.30	0.14	1.29	1.55	-0.59
P/E at Fiscal Year End	0.83	-0.07	0.99	0.94	0.63	-0.77
Ability Variables						
After Tax Return On Total Assets (%)	-4.67**	-0.60	-0.79	-0.26	-2.42*	-1.99*
After Tax Return on Common Equity (%)	-1.20	-0.51	-0.39	0.26	-0.18	-0.28
Earnings Per Share ($)	-0.22	0.04	0.19	0.74	-0.61	-1.33
Managerial Entrenchment Variables						
Common Shareholders (M)	-2.70**	-3.32**	-3.17**	0.12	-0.09	-0.16
Common Shares Outstanding (MM)	-1.45	-3.58**	-1.80	0.74	2.18*	0.80
Common Shares Traded (MM/yr.)	0.38	-2.32*	1.59	2.21*	2.60**	-1.44
Employees (M)	-1.64	-3.37**	-1.02	1.39	1.40	0.14
Degrees of freedom for the *t*-tests range between these numbers:	662, 779	402, 456	323, 449	88, 132	387, 463	373, 456

t-test code: NN = No DRIP in either 1999 or 2004
NY = No DRIP in 1999 but DRIP in 2004
YN = DRIP in 1999 but no DRIP in 2004
YY = DRIP in both 1999 and 2004

The two pairs of letters represent the groups in a *t*-test for equal means. For example, the statistics in the column headed NN v NY report the results of *t*-tests for the sample of firms that had no DRIP in either 1999 or 2004 versus the sample that did not have a DRIP in 1999 but did have a DRIP in 2004. A positive test statistic means that the first-named class has the higher mean.

* indicates significance at the 5% level.
** indicates significance at the 1% level.

Table 6
Logit Results, 1999 Data

$$DRIP_i = \beta_0 + \beta_1 TA_i + \beta_2 PR_i + \beta_3 DY_i + \beta_4 NS_i + \beta_5 PM_i + \beta_6 DR_i + \beta_7 MB_i + \beta_8 PE_i + \beta_9 ROA_i + \beta_{10} ROE_i + \beta_{11} EPS_i + \beta_{12} CS_i + \beta_{13} CSout_i + \beta_{14} CST_i + \beta_{15} Emp_i + \sum_{16}^{22} \beta_j Industry + \varepsilon_i$$

Variable	Model 1	Model 2
Intercept	-2.4807** (<.0001)	-2.034** (<.0001)
Total Assets (MM$)	-0.0000 (0.321)	
Fundamental Variables		
Payout Ratio	0.0006 (0.221)	0.0007 (0.179)
Dividend Yield	0.4355** (<.0001)	0.4278** (<.0001)
Maturity Variables		
Net Sales ($MM)	0.0000 (0.867)	
Net Profit Margin (%)	-0.0014 (0.658)	
Debt Ratio	0.6276 (0.124)	
Market To Book	0.0105 (0.412)	
P/E at Fiscal Year End	0.0000 (0.954)	
Ability Variables		
After Tax Return On Total Assets (%)	0.0437* (0.016)	0.031* (0.024)
After Tax Return on Common Equity (%)	-0.0001 (0.960)	
Earnings Per Share ($)	0.0657 (0.058)	0.0819* (0.019)
Managerial Entrenchment Variables		
Common Shareholders (M)	0.00004 (0.948)	0.0001 (0.926)
Common Shares Outstanding (MM)	0.0008 (0.0535	0.0010* (0.016)
Common Shares Traded (MM/yr.)	-0.0006* (0.025)	-0.0007* (0.015)
Employees (M)	0.0041 (0.156)	0.0051* (0.028)
Industry Effects Variables		
Mining, Oil, and Construction	0.9866* (0.023)	0.9312* (0.029)

Materials Processing	1.5200** (<.0001)	1.5504** (<.0001)
Manufacturing	1.3228** (<.0001)	1.3124** (<.0001)
Transportation, Utilities, and Waste Disposal	0.9631** (0.005)	0.9779** (0.004)
Wholesale and Retail	0.8799* (0.016)	0.8605* (0.016)
Financial Services	0.3523 (0.302)	0.5027 (0.126)
Other Miscellaneous	1.2142 (0.271)	1.1627 (0.280)
Pseudo R^2	0.3549	0.3511
Number of observations	1141	1143

Asymptotic *p*-values in parentheses. The dependent variable is unity if a firm had a DRIP in 1999 and zero if it did not.

* indicates significance at the 5% level.
** indicates significance at the 1% level.
Proportion of firms correctly classified: 76.73%.

Table 7		
Mean Probabilities of Drip and Impact of Variable Group Changes		
1999 Data		
Panel A: Companies with No Drip in 1999		
	No Drip in 2004	**Drip in 2004**
Predicted Probability of having a DRIP	34.73%	64.26%
Number of Observations	464	50
t-statistic for Difference in Means	7.43**	
	Change in No Drip versus Drip in 2004 Pr(Drip in '04 | No Drip in '99)	
	Percentage Point†	% of Total
Fundamental Variables	16.40	47.23%
Ability Variables	3.56	10.25%
Managerial Entrenchment Variables	6.44	18.54%
Industrial Effects Variables	3.08	8.08%
Panel B: Companies with Drip in 1999		
	No Drip in 2004	**Drip in 2004**
Predicted Probability of having a DRIP	70.54%	74.64%
Number of Observations	150	479
t-statistic for Difference in Means	2.68**	
	Change in No Drip versus Drip in 2004 Pr(Drip in '04 | Drip in '99)	
	Percentage Point†	% of Total
Fundamental Variables	1.09	1.55%
Ability Variables	2.01	2.84%
Managerial Entrenchment Variables	0.57	0.81%
Industrial Effects Variables	0.82	1.16%
† the individual percentage point changes do not sum exactly to the total probability differential because of the non-linear (logit) form of the probability calculations. ** indicates significance at the 1% level.		

Panel A reports results for companies with no DRIP in 1999 and Panel B reports results for companies with a DRIP in 1999. The top part of each panel reports the mean predicted probability of having a DRIP for companies that had no plans in 2004 (second column) and for companies that did have them in 2004 (third column). The second part of each panel reports the contribution of each of the four variable subgroups (fundamental, ability, managerial entrenchment, and industry effects) to the difference in the those mean predicted probabilities.

Table 8
Transition Matrix using 1999 data to predict DRIP status in 2004

Companies That Had a DRIP in 1999			
	Predicted not to have DRIP in 1999	Predicted to have DRIP in 1999	Total
Number of Observations	130	499	629
Number that had DRIP in 2004	86	393	479
Proportion that still had DRIP in 2004	66.15%	78.76%	
Number that no longer had DRIP in 2004	44 (i.e. transition correctly predicted)	106 (i.e. transition not predicted)	150
Proportion that no longer had DRIP in 2004	33.85%	21.84%	*t*–statistic for Difference in Proportions: 3.513**

Companies That Did Not Have a DRIP in 1999			
	Predicted not to have DRIP in 1999	Predicted to have DRIP in 1999	Total
Number of Observations	378	136	514
Number that Did Not Have DRIP in 2004	361	103	464
Proportion that did not have DRIP in 2004	95.50%	75.74%	
Number that had DRIP in 2004	17 (i.e. transition not predicted)	33 (i.e. transition correctly predicted)	50
Proportion that added DRIP by 2004	4.50%	24.26 %	*t*–statistic for Difference in Proportions: -8.965**
** indicates significance at the 1% level.			

The top section of the table reports the transition data for the 629 companies that had a DRIP in 1999. The logit model predicts that 130 of these companies should not have a DRIP. Alternatively, the model predicts that 499 firms should have a DRIP. Considering actual changes in DRIP status by 2004, a significantly higher (*t*-statistic of 3.513) portion of firms predicted not to have a DRIP in fact do not have one in 2004 (33.85% versus 21.84%) as compared to firms predicted to have one.

The bottom section of the table conducts a comparable experiment for companies that did not have a DRIP in 1999. Of the 514 companies that did not have a DRIP in 1999, 378 were predicted by the logit model not to have a DRIP, while 136 were predicted to have a DRIP. Again, considering actual changes in DRIP status by 2004, a significantly lower proportion (*t*-statistic of -8.965) of firms predicted not to have a DRIP added a DRIP in 2004 (4.50% versus 24.26%) as compared to firms predicted to have one.