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ON THE TIMING OF INITIAL STOCK REPURCHASES

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ABSTRACT

In this paper, we study the timing of initial stock repurchases for a sample of firms from their IPO onwards, using panel adjusted logistic regressions and hazard models to examine which variables may predict and theoretical hypotheses may explain these transactions. First, we find that initial repurchases (in comparison with non-repurchase firms) seem to have similar financial characteristics of dividend initiators (relative to matched dividend postpone firms), as reported by Kale *et al*., (2006) and Bulan *et al*., (2006). Second, our empirical findings in the two multivariate empirical approaches used are particularly consistent with the timing and undervaluation signaling hypotheses in explaining the timing of stock repurchases, consistent with the results of Jagannathan and Stephens (2003) for the likelihood of less frequent stock repurchases. We also offer some support for the risk reduction signaling, free cash flow and maturity hypotheses for initial repurchase firms which are also dividend payers.

JEL classification: G32; G35.

Key words: Stock Repurchases, Initial Stock Repurchases; Timing of Initial Repurchases; Payout Policy.

ON THE TIMING OF INITIAL STOCK REPURCHASES

1. Introduction

Studying stock repurchases is an interesting and important research activity. Stock repurchases are an important financial policy instrument that may affect the future of a firm and its strategy. In fact, stock repurchases are increasingly important transactions in most developed stock markets (Stephens and Weisbach, 1998; Ikenberry *et al*., 2000; Lafer, 2002; Grullon and Michaely, 2002), where they seem to have strong value relevance. Several empirical studies show their significant influence on the market valuation of a firm (e.g., Grullon and Michaely, 2004) and on managerial decision making (Baker *et al*., 1981; Baker *et al*., 2003; Brav *et al*., 2005). Further, in recent years stock repurchases have become an increasingly important instrument for distributing cash flows to stockholders, as (factual and) scientific evidence clearly shows (Stephens and Weisbach, 1998; Fama and French, 2001; Weston and Siu, 2002; Grulon and Michaely, 2002 and 2004, among many others). However, compared to the subject of stock repurchases as a whole or to the dividend initiation decision, we know almost nothing about the timing, motivations and determinant factors for firms to repurchase their stock for the first time (henceforth, initial repurchases). However, we argue that the timing of stock repurchases in general and the first stock repurchase in particular is an important issue for both researchers and decision makers.

The purpose of this paper is to study the timing determinants of initial repurchase transactions and to examine the validity of the several stock repurchases' theoretical hypotheses that attempt to explain and predict the timing of stock repurchases. We examine the factors that drive the timing of initial repurchases in the context of panel data by using several empirical approaches, including logistic regressions (to understand the repurchase-or-postpone decision) and hazard models (to study the duration of the non-repurchase decision). We focus on actual stock repurchases made by US firms that went public in the 1980-2004 period to analyze the behavior of those firms along their life cycle until their repurchase initiation. We believe that the methodology used facilitates a good understanding of the firms' decision to repurchase their stock for the first time.

The papers most similar to our empirical analysis are Bulan *et al*., (2006) and Kale *et al*., (2006). In these papers, the authors analyze the timing of dividend initiations, using similar methodologies. Both papers claim that dividend initiation is a unique event in the life cycle of a firm that represents a significant change in a firm's financial policy. We agree and think the same is true for the initial repurchase decision, although the literature shows that, contrary to cash dividends, stock repurchase transactions tend to be non-recurrent and their magnitude is far more volatile than period-to-period cash dividends (Stephens and Weisbach, 1998; Grullon and Michaely, 2002). In this context, we argue that initial repurchases might be motivated by a different rationale from dividend initiations and they may appear at a point in time for some different economic reasons. In particular, dividend initiation studies show that life cycle factors are fundamental to the initiation decision and occur when firms have reached the mature stage of their life cycles. We expect different results for initial stock repurchase firms. In other words, we anticipate that initial repurchase firms are different from dividend initiators: growth firms which present higher volatility in their operating cash flows and fewer cash reserves than the typical firms that pay dividends for the first time.

First, we find that in relation to non-repurchase firms, initial repurchase firms have significantly higher operating cash flows, market-to-book ratios and profitability, both prior to and after the initial repurchase transaction. Initial repurchases are also made by firms with lower leverage and operating risk, on average, before and after the initial repurchase event. Further, initial repurchase firms present ex-ante higher cash balances, options and stock returns and ex-post higher non-operating income and retained earnings. We show that there is almost no difference in terms of the dividend behavior of initial repurchase firms relative to non-repurchase firms. Our results also suggest that initial repurchase firms (in comparison with non-repurchase firms) seem to have financial characteristics similar to those of dividend initiators (relative to matched dividend postpone firms), as reported by Kale *et al*., (2006) and Bulan *et al*., (2006). This is an unexpected result for us, because most empirical literature find that dividends tend to be "sticky", whereas the same is not valid for stock repurchases. Further, our empirical findings in the two multivariate empirical approaches used are particularly consistent with the equity timing and undervaluation signaling hypotheses in explaining the timing of stock repurchases (consistent with the results of Jagannathan and Stephens (2003) for the likelihood of less frequent stock repurchases). We also offer some support for the risk reduction signaling, free cash flow and maturity hypotheses for initial repurchase firms which are also dividend payers. For all other theoretical hypotheses, the results are somewhat different for the two approaches used. The logistic regression supports

the free cash flow, the timing, the (leverage) tax rate differential and the maturity (only for dividend payers) hypotheses. Among those, the duration analysis offers evidence consistent only with the free cash flow and the maturity hypotheses for dividend payers. Both approaches do not show any evidence in support of the dividend substitution and options and dilution hypotheses. We note that all hazard models employed have consistent results and the same occurs for the logistic regressions using panel and non-panel regression techniques.

This study makes a number of contributions relative to previous empirical studies. First, this is the first study we are aware of that attempts to explain the timing of the initial repurchase decision. While considerable attention has been devoted in the financial literature to related subjects, such as dividend initiations or stock repurchases in general, surprisingly little consideration has been given to a firm's decision to repurchase its own stock for the first time. Second, it uses panel data techniques in the logistic regressions, which is not usual in most published papers so far.

The remainder of this paper is organized as follows. The next section contains a brief review of the related literature. Section 3 present our hypotheses and empirical predictions. Section 4 provides information about data, sample selection and the methodology used. Section 5 presents and discusses the empirical results and section 6 provides the conclusions.

2. Review of Related Literature

2.1. Introduction

The absence of any theoretical and empirical literature on firms' decision to first repurchase their stock stands in sharp contrast to the strong flow of empirical literature on stock repurchases, especially since Dann (1981) and Vermaelen (1981). But even in the context of dozens or hundreds of papers and working papers on stock repurchases, we were not able to find any references to the decision of (re)purchasing stock for the first time. The only empirical work we know about initial stock repurchases is an unpublished event study from Gesser *et al*., (2005), with clearly different objectives from this work. They want to test the wealth effects related to unanticipated stock repurchases. Hence, they define a stock repurchase as an initial repurchase when a firm initiates stock repurchases after four consecutive years with no repurchase transactions, arguing that in these cases the announcement of the stock repurchase should be unanticipated by the market.

There has also been a good deal of interest in the literature on the timing of dividend initiations (Healy and Palepu, 1988; Michaely *et al*., 1995; Benartzi *et al*., 1997; Kale *et al*., 2006; Bulan *et al*., 2006), in contrast to the little, if any, attention that has been devoted to firms' decision to initiate stock repurchases. To our knowledge, the analysis of the timing of initial stock repurchases is also absent from the empirical literature on firms' applications of cash, despite the attention this literature has devoted to acquisitions (e.g. Harford, 1999) or payments of special dividends (e.g., Howe *et al*., 1992; Lie, 2000). The perceived flexibility of stock repurchases commonly found in management surveys (e.g., Campbell and Graham, 2001; Brav *et al*., 2005) is, perhaps, the best explanation for this absence in the financial literature: while the perceived inflexibility of dividend initiations makes managers particularly averse to initiating dividends, the same would not occur for stock repurchases, in view of their (timing and magnitude) flexibility. This might influence management's perception that the initial stock repurchase would be a "not-so-important transaction" for the firms' future.

Whatever the reasons may be, so far, there is no integrated theory which provides clear insights into the reasons why a particular firm initiates a stock repurchase at a particular point in time. For example, it is difficult to predict whether a firm with high information asymmetry or with a strong incentive to avoid free cash flow problems may initiate a stock repurchase in the current year, the next year or even the year after. Consequently, this study attempts to fill this gap in the literature by investigating the economic motivations and theories that may explain the timing of initial stock repurchases. In the next section, we briefly describe the literature about stock repurchases in general and about dividend initiations.

2.2. (Brief) Review of the Literature on Stock Repurchases in General

Presumably, the most cited theories of stock repurchases as a whole are the performance signaling (Bhattacharya, 1979; Miller and Rock, 1985, among others) and free cash flow agency costs theories (e.g., Easterbrook, 1984; Jensen, 1986) according to the Stephens and Weisbach (1998) and Dittmar (2000) surveys. These theories have been analyzed extensively in the empirical literature on financial decisions, including stock repurchases, because they tend to be consistent with the most pervasive empirical findings. However, other theories have been labeled as truly important in explaining stock repurchases,

such as the undervaluation (e.g., Asquith and Mullins, 1986; Ikenberry *et al*., 1995), the maturity theory (e.g., Grullon *et al*., 2002), the risk signaling theory (e.g., Grullon and Michaely, 2004; Lie, 2005), the dividend substitution hypothesis theory (e.g., Fama and French, 2001; Grullon and Michaely, 2002) and the equity timing theory (e.g., Baker and Wurgler, 2002). Several empirical studies test the differential tax theory, related to both leverage and payout dimensions of stock repurchases (e.g., Barclay and Smith, 1988; Dittmar, 2000). Finally, the options and earnings dilution hypothesis may be put forth here as an explanation for stock repurchases (e.g., Jolls, 1998; Fenn and Liang, 2001; Kahle, 2002).

These theoretical explanations are consistent with several economic motivations (not mutually exclusive) that are usually found in the financial literature, including the existence of lower than target debt ratios (e.g., Bagwel and Shoven, 1988; Opler and Titman, 1996; Dittmar, 2000), the distribution of excess cash balances (e.g., Guay and Harford, 2000; Jaganathan *et al*., 2000), the flexibility in distributing payouts (e.g., Jagannathan *et al*., 2000; Grullon and Michaely, 2002), a mechanism for takeover defense (e.g., Denis, 1990; Bagwell, 1991) and for inside trading (e.g., Fried, 2001), several market microstructure effects (e.g., Brockman and Chung, 2001; Cook *et al*., 2003) and managing earnings per share objectives (e.g., Badrinath and Varaya, 2000; Bens *et al*., 2002), among other plausible motivations. In fact, it is quite likely that multiple objectives are contemporaneously driving managers' decisions for repurchasing their own stock, resulting from the fact that stock repurchases simultaneously influence the capital and ownership structures, and financial policies related to incentive compensation, investment, financing and stockholder remuneration. Dittmar (2000) provides a detailed empirical test of these competing explanations and finds support for some of these explanations at different points in time. More recently, Dittmar and Dittmar (2007) argue that the main force that drives the timing of the aggregate value of stock repurchases is the business cycle.

2.3. Review of the Literature on Dividend Initiations

Studies of dividend initiations are relatively few compared to those on the broader category of dividend increases. In the 19-eighties, Asquith and Mullins (1983), Healy and Palepu (1988), Venkatesh (1989), among others, studied the signaling role of dividend initiations. The most common result of these studies was evidence in support of the signaling effects on both future operating performance improvements and higher future stock returns.

These empirical results were grounded in theoretical models of Bhattachayra (1979) and John and Williams (1985). Later, studies by Lang and Lintzenberger (1989) and Smith and Watts (1992) found evidence consistent with the free cash flow theory of Easterbrook (1984) and Jensen (1986), but the signaling role was still the most important explanation for dividend initiations (John and Lang, 1991; Michaely *et al*., 1995; Lipson *et al*., 1998). However, Grullon *et al*., (2002) challenged the crucial importance of operating performance signaling in explaining dividend initiations, when they proposed the maturity or life cycle hypothesis, which predicts that firms will pay dividends upon reaching the mature stage of their life cycle (although they did not separate the impact of dividend initiations in their empirical study). Baker and Wurgler (2004 and 2004a) also show the importance of the *catering theory* (a different explanation but very close to the dividend clientele effect of Bajaj and Vijh, 1990), which predicts that firms will change their payouts in response to investors' preferences for dividend paying stocks and the correspondent market dividend premium (i.e., the difference in market price that investors are willing to pay for firms that distribute cash dividends). In this context, Bulan *et al*., (2006) find empirical support for the latter two theoretical hypotheses, while they find no evidence for the signaling role of dividend initiations. On the contrary, while also using the most recent and robust empirical methodologies, Kale *et al*., (2006) find support for the most common theoretical explanations of dividend initiations but they argue that the most pervasive findings are in support of the dividend signaling models of John and Williams (1985) and Allen *et al*., (2000).

3. Hypotheses Development and Empirical Predictions

3.1. Introduction

The purpose of this section is to determine what the existing theories of stock repurchases imply specifically for the timing of the initial repurchases decision. Our primary research question is about providing insights into why firms first repurchase their own stock at a particular point in time. We start by examining several alternative theoretical hypotheses and economic motivations that the financial literature has found to be able to explain the stock repurchase decision as an alternative mechanism for distributing cash flow. We must do this, because the literature so far provides no specific theory to indicate when a firm will initiate stock repurchase transactions for the first time. In this study, we try to fill this gap in the

literature by focusing on explaining the timing of initial repurchases. Since most of the theoretical models of stock repurchases have very little to say about the timing of the initial stock repurchase decision, with the exceptions noted in the discussion below, the predicted relation between these variables and the timing of an initial stock repurchases is the same as the likelihood of an initial stock repurchase.

3.2. Hypothesis About Determinants of the Timing of Initial Repurchases

The several theoretical hypotheses briefly presented in the last section make a number of testable empirical predictions regarding the likelihood of stock repurchases in general and, although they have no such predictions for initial repurchases, we are going to apply them here to the timing of initial stock repurchases. Since most of the theoretical models of stock repurchases have very little to say about the timing of the initial stock repurchase decision, the predicted relation between these variables and the timing of initial stock repurchases are mostly the same as for the likelihood of initial stock repurchases (see chapter 2). The duration analysis should confirm the main hypothesis mentioned above and, by including the time dimension in the context of a firm's life cycle, should present new evidence supporting the potential uniqueness of initial repurchases. In particular, the maturity hypothesis posits that we should observe large cash accumulations, declines in growth, capital expenditures and risk for firms that have transitioned from the growth phase to the low growth phase. It is in this low growth phase of a firm's life cycle that it should decide to repurchase, whereas we expect that won't be true for initial repurchases. Therefore, initial repurchase firms might be at a lifecycle stage at which they grow at high rates and still rely on external capital and are not yet self-financing (as other repurchase firms plausibly are).

3.2.1. Performance Signaling Hypothesis

The performance signaling theory assigns an information role to stock repurchases and posits that firms will repurchase their stock when they have good prospects of future operating performance (e.g., Bhattacharya, 1979; Miller and Rock, 1985). This theory suggests that firms which expect performance improvements in the future, would initiate stock repurchases earlier than firms without these characteristics. Also, according to the performance signaling hypothesis, as stock repurchases convey information to the market,

initial repurchase firms are expected to have relatively higher levels of asymmetric information. Consequently, we should expect that smaller size firms that present higher growth and operating volatility may repurchase earlier.

In addition to performance improvements related to the magnitude of operating profits or cash flows, performance signaling may also be linked to the information content of decreases in operating risk (Grullon and Michaely, 2004; Lie, 2005). With regard to this hypothesis, we should expect that firms with higher operating risk would initiate stock repurchases earlier.

3.2.2.Undervaluation Signaling Hypothesis

It is very well documented in the literature that the amount of information available and the degree of accuracy of the market valuation of a firm may affect its stock repurchase decisions (see stock repurchase surveys such as Dittmar, 2000; Weston and Siu, 2002). One potential indication of undervaluation is a history of low returns. If the undervaluation signaling hypothesis drives the timing of initial stock repurchases, then we expect to find that firms initiate stock repurchases after periods of low returns and that these transactions should be followed by high future returns. The assumption here is that low past returns indicate relatively low past valuations and that high future returns represent a market correction of past undervaluation (as the market investors realize that managers are seeking to repurchase stock to take advantage of this potential undervaluation in the stock price). Dittmar (2000) argues that since historical returns are a backward-looking measure of valuation, they may not detect current undervaluation. Also, Ikenberry *et al*., (1995) show that firms with low market-to-book ratios earn abnormal returns in subsequent periods, meaning that market-to-book ratios may indicate undervaluation. Therefore, we also posit that firms with lower market-to-book ratios should also have a higher likelihood of earlier initial stock repurchases. Finally, as stock repurchases convey information to the market, firms with relatively higher levels of asymmetric information and, hence, lower size, should also have a higher likelihood to initiate stock repurchases earlier.

3.2.3. Free Cash Flow Hypothesis

The free cash flow theory states that low growth firms with limited investment opportunities are more likely to have higher free cash flows and, therefore, incur higher

equity agency costs because managers of those firms have the incentive to invest in value-destroying assets and activities (Easterbrook, 1984; Jensen, 1986). This agency theoretic framework predicts that managers can commit themselves to minimizing those wasteful expenditures by adopting a policy of distributing excess free cash flows, for instance through stock repurchases. Apparently, the free cash flow theory makes similar predictions for initial and other stock repurchase transactions. In fact, the predictions for the likelihood of stock repurchase decisions are that they are negatively related to the firms' future growth options and discretionary expenditures and positively related to the existing amount of cash (and negatively related to leverage), cash flows and profitability. We argue, however, that this may well be the case for stock repurchase transactions in general but not necessarily for initial repurchases. Thus, firms with lower growth options and discretionary expenditures should not necessarily be more likely to initiate repurchases earlier. On the contrary, we should expect that initial repurchase firms may be high growth firms which are more likely to suffer from information asymmetry due to uncertainty about future growth, rather than from free cash flow problems.

3.2.4. Dividend Substitution Hypothesis

Some literature documents that dividends are used to distribute permanent cash flows while stock repurchases are used to distribute transitory cash flows, as is the case of non-operating cash flows (Guay and Harford, 2000; Jagannathan *et al*., 2000). Stock repurchases should play an important restructuring role by enabling management to distribute cash in a timely manner. Therefore, we should expect a negative relation between non-operating income and the duration of initial stock repurchases.

The financial flexibility question that drives most of the dividends-repurchases substitution debate is not only related to the degree of predictability of cash flow but also with the number of future investment opportunities and the magnitude of operating and financial risk. Firms with higher growth options face not only more profitable investment opportunities, but also greater uncertainty about the level of profitable investment opportunities, and hence they should rely more on stock repurchases rather than dividends to distribute cash to stockholders, if they do so, because in this case firms may require a more flexible payout policy. Also, higher volatility of operating income should reduce dividends and significantly increase the mix of cash flow distributions made through stock repurchases. We hypothesize that these relations will hold for initial repurchases. This prediction means

that higher growth and operating risk attributes will increase the likelihood of initial stock repurchases, in particular for the sample of non-dividend payers. This prediction supports the Fama and French (2001) view that the lower propensity to pay dividends is a characteristic of younger, smaller firms, with higher rates of capital and R&D expenditures, that do not pay dividends but which may repurchase their stock. Hence, this will be consistent with a lower substitution effect between dividends and stock repurchases for initial repurchase firms.

3.2.5. Differential Tax Rates Hypothesis

Stock repurchases may also be preferred over dividends as a mechanism of cash flow distribution due to the personal tax rate advantage of capital gains (Copeland and Weston, 1988). If initiating stock repurchases is an alternative to cash dividends distribution, we should expect that stock repurchases should be negatively related to dividend payout ratios. Also, stock repurchases reduce equity and increase debt ratios or reduce cash levels. These two latter effects reduce the tax burden of repurchase firms. Therefore, we expect that firms with lower debt ratios and lower payout ratios may repurchase earlier.

3.2.6. Maturity Hypothesis

The maturity hypothesis predicts that firms will repurchase their stock upon reaching the mature stage of their life cycle, when they are faced with high cash flows and low investment opportunities (Grullon *et al*., 2002). This hypothesis implies that stock repurchases are associated with subsequent declines in growth and operating risk and increases in profitability, operating cash flow and cash balances. In this context, our hypothesis about the potential uniqueness of initial stock repurchases may have a special opportunity to be tested. Indeed, we anticipate that the maturity characteristic associated with stock repurchases is not valid for initial repurchases but only applies to subsequent repurchase transactions. We believe stock repurchases only become a regular event when firms reach maturity (Jagannathan and Stephens, 2003). We will also test the lifecycle theory by using the variable used by DeAngelo *et al*., (2005) in analyzing the maturity hypothesis for dividends payers (the mix of earned-contributed capital) to assess whether firms with relatively higher retained earnings as a proportion of total assets are more likely to repurchase stock for the first time earlier. Finally, we test whether age impacts the duration of initial repurchases.

3.2.7. Timing Hypothesis

According to this hypothesis managers attempt to time the market when making financial decisions, such as to issue securities and distribute cash flows (Baker and Wurgler, 2002). Therefore, firms will tend to repurchase stock (increase leverage) when market valuations are at low levels (and to raise equity capital when market valuations are at high levels). In reality, if this market timing theory holds, we should expect that low prior stock returns, market-to-book ratios and debt ratios may reduce the time to initial repurchases.

3.2.8. Options and Dilution Hypothesis

Financial literature observes that managers have incentives to avoid earnings dilution and to report earnings disappointments and hence they make decisions to preserve their firms' reported earnings per share and stock prices (Jolls, 1998, Kahle, 2002). These decisions may explain stock repurchase decisions, especially when these managers hold stock options. In this context, we should expect that firms with a larger proportion of stock options may repurchase more often. However, since we hypothesize that initial repurchases are generally implemented by growth firms with high operating risk, it is likely that these firms may have a significant number of long term options. These are not likely to be exercised in the short term and stock repurchases may not be necessary to remove the dilution effects of the exercise of these options. Thus, although we expect that initial repurchases may be associated with the use of stock options for incentive compensation, using stock repurchases to avoid dilution is less likely to occur for firms with high growth in earnings per share, as may be the case of initial repurchase firms. In other words, if we are right, we anticipate that the magnitude of options will not impact the timing of initial repurchases.

3.2.9. Summary

To summarize, we expect that initial repurchases are more likely to be undertaken by firms that have a potentially high degree of asymmetric information and are willing to signal to the market their potential undervaluation or operating performance improvements. Therefore, we shouldn't find empirical support for some of the plausible explanations for the timing of non-initial repurchase transactions, such as the free cash flow hypothesis, maturity hypothesis, dividends substitution and options and dilution hypothesis. We anticipate that

other than the signaling hypothesis, the differential tax rates and timing, to be more likely determinants for the timing of initial stock repurchases. Table 1 summarizes this section' hypothesis in terms of expected relations between the timing of initial repurchases (in the sense of hazard rates, inverse of duration or likelihood of repurchasing earlier) and explanatory variables, which will be described in the next chapter.

4. Data and Methodology

4. 1. Sample Selection and Data Collection

The data for this study comes from the Compustat database for the period 1975 through 2004, inclusive (henceforth data item shown in parentheses). We used this dataset to collect all firms' financial statement data, stock returns and industry, as defined by their 4-digit SIC code, and to determine the firms' age at time of their initial repurchase.

In this study, we analyze the timing of initial stock repurchases and empirically examine the extent to which firms formulate their initial repurchase decisions according to the most frequently mentioned theoretical models of financial policies and decisions. We focus on actual stock repurchases by tracking a sample of 1,379 firms which went public after 1975 and that initiated stock repurchases in the period of 1980-2004. Allen and Michaely (2002) and Banyi *et al*., (2005) evaluate various methods for estimating actual stock repurchases figures and recommend a measure based on the cash flow statement that they name as Compustat purchases of common and preferred stock adjusted for the change in preferred stock, and which they consider as the most accurate (or least biased) measure of the actual dollar amount spent on repurchases, particularly for firms with high stock options.[1] We follow this approach. Therefore, we identify stock repurchases as the amount of purchase of common and preferred stock (Compustat data item #115) minus any reduction in the value (retirement, conversion, and/or redemption of preferred stock, Compustat items #56 and #130) of the net amount of preferred stock outstanding.[2]

[1] Also, Grullon-Michaely (2002) compared that measure to the amount of repurchase activity reported by SDC (amount of repurchases announced) and found that the correlation coefficient between these two measures is 0.97 and that the dollar amounts were similar.

[2] The Compustat data item overstates open market repurchases of common stock for a number of reasons (Stephens-Weisbach, 1998; Jagannathan et al., 2000). First, it includes repurchases of preferred stock. Second, it includes a variety of other transactions such as the conversion of other classes of stock into common stock. In

Our analysis of initial repurchases is conducted only on firms listed on NYSE, AMEX and NASDAQ that also conducted an IPO during the period of our investigation. We argue that using only observations of initial repurchasers with an IPO date after 1975 as the basis for this study allows us a better understanding of the motives and timing for initial repurchase decisions. Baker and Wurgler (2002) define the IPO year as the first year in which Compustat provides data to the market. We begin by identifying firms on Compustat that repurchased their stock for the first time during the period 1980-2004 (henceforth, initial repurchase firms are "initial repurchasers"). An initial repurchase is defined as the first repurchase that a firm makes since its IPO. We will assume that the IPO year is the year that the firm had a positive stock price on Compustat (as Baker and Wurgler, 2002; Lemmon and Zender, 2003 and Bulan *et al*., 2006). We follow previous literature when we further restrict the sample to initial repurchases that represent more than one million US dollars. Also, in line with previous studies, we truncate all variables at the top and bottom one percentiles and we exclude those firms for which several relevant variables from our analysis were missing. We further excluded financial companies and utilities (SIC codes 4813, 4900-4999 and 6000-6999) from our sample. These criteria identify our sample of 1,379 observations of initial repurchases collected for the period 1980-2004 from the Compustat database. We obtain the annual financial information from Compustat to construct our variables as described in the next section.

4.2. Variables

To study the determinants of initial stock repurchases, we will perform univariate and multivariate empirical analysis of the timing of initial repurchases using a set of variables that the literature has identified as important in explaining any stock repurchase decisions. These variables are proxies for several firm characteristics that have been shown to be correlated with stock repurchases. Dittmar (2000), Grullon and Michaely, 2002), Jagannathan and Stephens (2003), among others, document that firms' size, payout, industry, operating risk, leverage, cash balances, cash flow, growth options, earnings and sales growth, profitability, non-operating income, underpricing, stock returns, total retained earnings, amount of stock options and ownership structure, all help explain the probability of a certain firm repurchasing

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some cases Compustat data item #115 corresponds to repurchases net of equity issuance, which *Compustat* indicates with a combined figure code. We treat such observations as missing values.

its own stock. We use these same variables, with the exception of ownership structure variables because the databases that include those variables were unavailable to us. In the univariate analysis, we use three-year averages for all variables (unless otherwise noted) as in Jagannathan *et al*., (2000), either because it is possible that firms would initiate stock repurchases in response to cumulative performance, liquidity and risk from the previous years and also in order to reduce noise induced by year-to-year variations in many of the variables. That is, average values for years –3 through –1 relative to the initial repurchase year are used for variables prior to the initial repurchase year and average values for years 0 through +2 relative to the initial repurchase year are used for the variables subsequent to the repurchase initiation. In this context, the sample for our univariate analysis is limited to the period between 1980 to 2002 to allow for measurement of prior and subsequent variables. In contrast, when used in the multivariate analysis, all independent variables are lagged by one year, to mitigate any potential endogeneity problems (e.g., leverage, cash, total assets, equity). All variables' absolute values are scaled by total assets (#6), unless otherwise stated, to control for scale effects and mitigate heteroskedasticity. Table 2 presents a synthesis of the definition and measure of all variables used (for more details, see appendix 1).

4.3. Methodology

The main goal of this study is to explain the timing of initial repurchases, by investigating the economic characteristics of firms that influence this decision and their evolution over time, using a panel analysis framework. In addition to univariate analysis, we perform multivariate logit regressions (see Hosmer and Lemeshow, 2000; for a more detailed discussion on applying logistic regressions) and duration-type regressions (in this case, we apply a proportional hazard model) on the panel data to estimate the probability (hazard rate) that a firm will repurchase its stock for the first time as a function of several firm attributes relative to other firms that are in the same stage of their life cycle (see Alison, 2000; Wooldridge, 2002; for a more detailed discussion on applying duration and hazard models).[3] The hazard model allows us to introduce the time dimension in the context of a firm's life cycle, providing us with the possibility of being able to track the non-repurchases over their life cycle until the moment they first repurchase their stock. To complement this analysis in

[3] In all cases, we used robust variance-covariance matrix estimators to account for possible heteroskedasticity and serial correlation in the panel data.

the panel data, we also conduct a logit analysis of the repurchase-or-postpone decision, using panel data techniques that allow to control for unobserved firm heterogeneity, in order to find more insights about the initial repurchase decision. We believe that those two quantitative approaches should give us a better understanding of the timing of the initial repurchase decision.

First, we use a fixed-effects logit model (with panel adjustments to neutralize the unobserved firm heterogeneity) to determine whether it is possible to establish some observable criteria for the decision to "repurchase or to postpone", considering that, in each year since the IPO, firms made the decision as to whether to repurchase in that year or not.[4] As in Kale *et al*., (2006), the dependent variable is constructed as follows. Those firms that initiated repurchases in the year after the IPO (year 1) have one as a dependent variable and the others have a value of 0. Of the firms with 0 in the previous year, those that are initial repurchase firms in the following year are assigned with a value of 1 and the remaining with 0. The former ones leave the sample for all subsequent periods. This process is conducted for all the years under investigation until the year 2004 is reached. If a firm is not an initial repurchase firm until 2004, we classify it as non-repurchaser in each year after its IPO and as an initial repurchaser in 2004. Each firm has a value of one in the year it repurchases its stock for the first time and is a non-repurchase firm in all preceding years. Finally, an initial repurchase firm does not reappear in the sample after the year of initiation. This specification allows us to investigate the decision to initiate a repurchase transaction or to postpone it.

To study the timing of initial repurchases and, in particular, to investigate the impact of several explanatory variables on this decision, the natural method to use is duration analysis. This empirical methodology will shed some light on the timing of initial repurchases, since it provides a way of introducing the time dimension into the analysis by comparing firms of the same age (since their IPO). Following Hale and Santos (2004), Bulan *et al*., (2006), among others, we estimate the following Cox-proportional hazard model:

$$\Pr(IR_{it} = 1 / IR_{ix} = 0, \forall x < t) = \exp(X_{it} b) h_0(t)$$

This time, the dependent variable equals one when the firm is an initial repurchaser at period *t* (number of years after its IPO or "survival time", not calendar time) and zero

[4] We repeated our calculations using a random-effects logit and probit models but we did not reach convergence in both cases. Therefore, we were unable to perform Hausman tests to analyze which model would provide the best fit.

otherwise, X is a vector of time varying firm characteristics, b is a vector of coefficients, and h_0 is the baseline hazard function to be estimated. That is, each firm is assumed to be "born" at time 0 and ages by one year for every subsequent calendar year. In our case, the "failure" event is the initial repurchase by a firm and the "exposure time" is the age of the firm on that date, the final period of our analysis if the firm is a non-repurchaser or on the date the firm ceased to exist if this occurred prior to the date of its first repurchase. The hazard rate $h(t)$ is, therefore, a firm's probability of repurchasing its stock in a given year t, conditional on the fact that it did not repurchase its stock in the previous year $t-1$. Once the firm has repurchased its stock, it exits the sample. We examine whether there are any significant changes that occur along the life cycle of the firm that culminate in the first repurchase. We thus estimate the propensity of firms to first repurchase their stock as a function of a set X of time-varying explanatory and control variables for firms that are in the same stage in their life cycle. We consider the values of these variables for each year and firm from its first appearance in Compustat until the year prior to the initial repurchase.

5. Results

5.1. Univariate Analysis

We begin our empirical analysis by analyzing the differences between initial repurchase firms and those firms similar in industry and size that never engaged in any stock repurchase transactions (non-repurchase firms) that went public between 1975 and 2002. We use only a sub-sample of initial repurchase firms, which we consider representative of the full sample of 1,379 initial repurchase firms that we will use in the multivariate analysis, that have a matched-sample of non-repurchase firms (see chapter 2). The final sample consists of 1,204 industrial companies (i.e., excluding utilities and financial firms) listed on the NASDAQ, NYSE and AMEX. Of those, 630 initial repurchase firms were matched with 630 non-repurchase firms similar in size (differences lower than 25% of total assets) and industry (four-to-two digits of SIC Codes).

As presented in tables 3A and 3B, firms that repurchase their stock for the first time do so on average 5.5 to 5.6 years after the IPO (median of 4 years), without any noticeable differences across the two samples. The non-repurchase firms are older, on average, but have the same median age. Finally, we document that 83.5% of those transactions occurred within

10 years following the IPO. We begin our matched sample analysis by comparing some descriptive statistics of the explanatory variables across the three sub-samples (a sample of event firms relative to their matched control firms), reported in Tables 3C to 3F. These tables show that there are significant differences between the sample of initial repurchase firms and both control samples. In table 3C we compare ex-ante descriptive statistics. In order to reduce noise induced by year-to-year variations in many of the variables, these statistics are calculations based on three year averages preceding the initial repurchase event (years -3 to -1). In Table 3D we repeat the same analysis using ex-post values, meaning that calculations are based on three year averages subsequent to the initial repurchase event (years 0 to +2). These time windows follow the work of Jagannathan *et al*., (2000) and Jagannathan and Stephens (2003). In table 3E, we compare ex-post values with ex-ante values to preview some evolutionary trends with economic meaning. Finally, in table 3F we analyze the differences in dividend characteristics between the two matched samples.

First, in relation to non-repurchase firms, initial repurchase firms have significantly higher operating cash flows, market-to-book ratios and profitability, both prior to and after the initial repurchase transaction. Initial repurchases are also made by firms with lower leverage and operating risk, on average, before and after the initial repurchase event. There are no major differences in terms of capital and other discretionary expenses, retained earnings (those variables have lower average values but higher or similar median values), and earnings per share and sales growth in relation to their non-repurchase peers.[5] Further, initial repurchase firms present ex-ante higher cash balances, options and stock returns and ex-post higher non-operating income and retained earnings.

The ex-post versus ex-ante differences between the two control groups follow a similar trend. In particular, both samples present increases in leverage and decreases in cash flow, market-to-book ratios, capital and other discretionary expenses, sales growth and profitability. In addition, we notice that the non-repurchase firms median values remain lower than their initial repurchase counterparts but in almost all variables the net effects indicate a trend towards convergence. The only exceptions are leverage and operating risk. In both cases, the difference increases for non-repurchase firms. In fact, the stock returns for initial repurchase firms actually decreases, while the opposite occurs for non-repurchase firms.

Finally, in table 3F we see that there is almost no difference in terms of dividend characteristics of initial repurchase firms relative to non-repurchase firms.

[5] As expected, the matched-pairs analysis tends to neutralize the growth options impact on stock repurchases but the same is not achieved for the operating risk variable.

Our results suggest that initial repurchasers (in comparison with non-repurchase firms) seem to have similar financial characteristics to dividend initiators (relative to matched dividend postpone firms), as reported by Kale *et al*., (2006) and Bulan *et al*., (2006), which is an unanticipated result. In particular, Kale *et al*., (2006) and Bulan *et al*., (2006) report that dividend initiators tend to have higher operating returns and cash reserves and lower leverage and operating risk. Bulan *et al*., (2006) also document no significant improvements in profitability and growth. However, the only "different" result found is also important: they both find that dividend initiators have lower growth, whereas we find no significant changes in growth. Of course these are only a few attributes, but this evidence is worthwhile to mention.

Overall, these results seem to support the free cash flow, the maturity, the risk reduction signaling, and the (leverage induced) differential tax rates theoretical hypotheses and both the leverage and cash flow distribution economic motivations in explaining initial stock repurchases. We note, however, that the age and retained earnings variables present evidence that contradict the maturity hypothesis, which is meaningful because these are variables that are included specifically to measure the impact of life cycle effects. Also, we find only slight support for the options hypothesis. The data does not confirm the dividend substitution hypothesis in relation to the role of non-operating cash flows. Also, the performance signaling hypothesis is mostly unsupported by the data, as occurs with Bulan *et al*., (2006) and Kale *et al*., (2006) for dividend initiators and with Grullon and Michaely (2002), Jagannathan and Stephens (2003), among others, for stock repurchases. Finally, the consistently higher market-to-book ratios of initial repurchase firms (and the similar values for previous stock returns) do not provide support for the undervaluation-signaling and the timing theoretical explanations of stock repurchases. Thus, they neither confirm Stephens and Weisbach (1998), Jagannathan *et al*., (2000), among others, nor the main motivations for repurchases by infrequent repurchasers, as documented by Jagannathan and Stephens (2003).

5.2. Multivariate Analysis

5.2.1. Introduction

Next, we examine the timing of initial repurchases along a firm's life cycle by using logistic and duration models in a comprehensive panel of 1,379 initial repurchases made

between 1980 and 2004. In the last chapter, we focused on cross-sectional logistic regressions for multivariate comparisons between initial repurchase firms and two matched samples of non-repurchase firms and secondary repurchase firms.[6] Although the technique of comparing initial repurchase firms with matched samples may allow investigation of whether initial repurchase firms have systematic differences from other firms with similar attributes in terms of size and industry, other interesting findings may arise when analyzing changes in the propensity for firms to start repurchasing stock as they go public and continue through their life cycle and become more mature.

5.2.2. The Decision to Repurchase or to Postpone

5.2.2.1. Introduction

First, we examine the decision to repurchase or to postpone in order to obtain insights into our research question: to better understand the timing of the initial repurchase decision. In this analysis, we focus only on the sample of initial repurchase firms that went public over the 1980-2004 period and attempt to determine whether it is possible to establish some observable criteria for the "repurchase or postpone" decision, considering that, in each year since the IPO, firms made the decision as to whether to repurchase in that year or not. As in Kale *et al*., (2006), the dependent variable, PROBINREP, for the logistic regression used to investigate this subject is constructed as follows. Those firms that initiated repurchases in the year after the IPO (year 1) have one as a dependent variable and the others have a value of 0. Of these firms with 0 in the previous year, those that are initial repurchase firms in the following year are assigned a value of 1 and the remaining with 0. The former ones leave the sample for all subsequent periods. Then, this process is conducted for all the years under investigation until the year 2004 is reached. If a firm is not an initial repurchase firm until 2004, we classify it as non-repurchaser in each year after its IPO and as an initial repurchaser in 2004. Each firm has a value of one in the year it repurchases its stock for the first time and is a non-repurchase firm in all preceding years. Finally, an initial repurchase firm does not reappear in the sample after the year of initiation. This specification allows us to investigate the decision to initiate a repurchase transaction or to postpone it. The sample for the logistic

[6] This timing analysis extends the cross-sectional regressions in a natural way and has two advantages. First, it introduces the time dimension into the analysis by comparing firms of the same age (since their IPO). Hence we include all of a firm's observations from its IPO until the initial repurchase year. Second, it allows us to test the impact of industry and size that have not yet been analyzed in the matched sample approach.

regression consists of 8,778 observations, in which 1,379 are initial repurchases and 7,399 are "postponer observations". A positive coefficient in the estimated logistic regressions implies that a higher value for the explanatory variable increases the likelihood that the firm will initiate repurchases this year, i.e., makes it more likely that the firm will repurchase this year, and vice-versa. Thus, our "repurchase or postpone" analysis investigates whether this particular year is the right time to repurchase stock for the first time. The results from estimating the logistic regressions are presented in panels 1 (all observations, dividend payers and non-dividend payers), 2 (market-to-book quartiles), 3 (size quartiles) and 4 (four time period windows) of Table 4A.

Overall, our results show that higher values for size and cash flow generally increase the probability that the firm will initiate stock repurchases rather than postpone them in the current year. In contrast, the postpone decision is more likely for firms with higher leverage, cash, current growth, retained earnings and stock returns and more options. We get mixed evidence related to payout and dividend yield, underpricing, future growth, profit, operating risk, non-operating income and earnings per share growth. Next, we present tables with the logistic regression results, we discuss them and present a comparison with current literature on stock repurchases.

5.2.2.2. Performance Signaling Hypothesis

Our results do not support the operating profitability improvements hypothesis of initial stock repurchases (as in Grullon *et al*., 2002). We find that firms with larger size and operating cash flows and lower sales growth are significantly more likely to repurchase than to postpone, which does not support this hypothesis, in particular if we consider size as a proxy for asymmetric information. One piece of supportive evidence, although non-significant, is the negative sign of underpricing (also significant for non-dividend payers) and profitability and the positive sign of earnings per share growth. To the contrary, we document a negative relation between future growth and the decision to initiate stock repurchases, but only for dividend payers. Furthermore, we find very weak support for risk reduction signaling, because the operating risk variable is predominantly positive (the same result appears in Jagannathan *et al*., 2000), although never significantly. Finally, we do not find any important difference in results for the samples of different market-to-book and size quartiles and for the different time periods in relation to performance signaling.

5.2.2.3. Undervaluation Signaling Hypothesis

Our evidence for variables related to the undervaluation signaling hypothesis offer some support for this theoretical explanation of initial repurchase timing. We find that the likelihood of initial repurchases increases with lower stock returns and market-to-book ratios (although not statistically significant for the latter), in particular for the sub-sample of non-dividend payers. This result is consistent with several studies which document that stock repurchases follow periods of low returns and are associated with highly positive average (abnormal) returns (Lie, 2000; Jagannathan *et al*., 2000; Grullon and Michaely, 2002). However, this result is also at odds with the conclusion of the matched-pairs approach in chapter 2, perhaps indicating that industry effects related to the matching approach drive those results (because we can not find any size effect in the size quartiles analysis). Also, again if we consider size as a proxy for asymmetric information, the evidence shows a significant positive relation between size and initial repurchase likelihood, which goes against any signaling hypothesis.

5.2.2.4. Free Cash Flow Hypothesis

Our evidence confirms the hypothesis that firms repurchase their stock for the first time in response to potential agency costs induced by free cash flow problems, as the crucial variables related to this hypothesis (lower leverage, current and future growth, and higher cash flows) have statistical significance with the proper signs. These results are common in the literature (e.g., Nohel and Tarhan, 1998; Kahle, 2002; Grullon and Michaely, 2004). We note that this is true for both dividend and non-dividend payers, suggesting that the latter firms may wish to avoid equity agency costs by repurchasing instead of paying dividends, while the former ones do both to mitigate free cash flow problems. There is one exception to the overall support of this hypothesis, however: the sign of the cash variable is always negative and significant, which is not a usual attribute of firms that suffer from free cash flow problems.

5.2.2.5. Dividends Substitution Hypothesis

Our evidence allows us to conclude that the dividends substitution hypothesis related to the use of non-operating income is not confirmed. The coefficient is negative most of the

time and without overall statistical significance, although it is negatively and statistically significant for dividend payers, in two out of four market-to-book and size quartiles. Therefore, the motivation for distributing transitory cash flows, such as non-operating income, does not increase the likelihood of initial repurchases. This contradicts the matched-pairs results and other results of some empirical studies, such as Guay and Harford (2000) and Jagannathan *et al*., (2000) and even reduce the likelihood in the case of dividend payers. The other two dimensions in which the substitution effect between dividends and stock repurchases may occur (high growth and operating risk) also do not increase the initial repurchase likelihood. However, the samples of dividend payers and non-dividend payers have some different attributes. In particular, the sample of dividend payers presents lower future growth. Table 3D shows that only about 15% of these firms decrease their dividends (against 26,3% of dividend increases), which suggests that most dividend payers that start to repurchase stock do not substitute cash dividends with stock repurchases. Overall, it seems that initial repurchases do not substitute for but rather complement dividends for the distribution of surplus operating cash flows.

5.2.2.6. Differential Tax Rates Hypothesis

The differential tax rates hypothesis is only partially supported by our findings, in particular the leverage motivation for tax reasons. On the contrary, the payout variable is never statistically significant with the proper signs. These results are similar to those of the matched-pairs analysis and from other empirical studies for stock repurchases, such as those of Jagannathan *et al*., (2000) and Dittmar (2000), which almost always conclude that leverage is an important motivation for stock repurchases and that dividend differential tax rates are, at most, weak determinants of the stock repurchase behavior of firms.

5.2.2.7. Maturity Hypothesis

The evidence for the maturity hypothesis is, once again, mixed. First, our logistic regressions support the maturity hypothesis by documenting significant positive coefficients on cash flow and negative coefficients on current growth. Those results are very common in the literature on stock repurchases (Jagannathan *et al*., 2000; Grullon and Michaely, 2002, etc). On the other hand, we find a negative relation between retained earnings and cash with initial repurchasing activity. The particular result for retained earnings casts doubt on the

maturity hypothesis, as did the variable "age" in the matched-pairs analysis, because it is the only variable that is there precisely to measure life cycle effects. We document, however, a positive relation between retained earnings and the decision to repurchase, and a negative relation between future growth and the decision to repurchase for dividend payers. Therefore, the maturity hypothesis is mostly supported only for initial repurchase firms which are also dividend payers.

5.2.2.8. Timing Hypothesis

Our results clearly support the contention that firms attempt to time the market when they repurchase their stock for the first time because all coefficients have the proper signs predicted by the timing hypothesis (although the negative sign of the underpricing variable is not statistically significant). These results are specially significant for non-dividend payers, suggesting that those firms choose to distribute cash flow by repurchasing stock in order to take advantage of previous low stock returns and market-to-book ratios. Similar results are common in the literature on stock repurchases, in particular prior market underperformance (e.g., Stephens-Weisbach, 1998, Jagannathan *et al*, 2000) and lower market-to-book ratios (e.g., Dittmar, 2000) but they contradict our matched-pairs findings. Once again, industry effects related to the matching approach may have driven these results, since we do not find any size effect.

5.2.2.9. Options and Dilution Hypothesis

Our evidence clearly does not support the options and dilution hypothesis. Although both operating risk and earnings per share growth have some (non-significant) coefficients with the same signs predicted by this theory, the options variable coefficients are always significant and negative (the opposite sign predicted by the options and dilution hypothesis). This evidence is similar to that observed in the matched-pairs approach for initial repurchase firms that pay dividends.

5.2.2.10. Summary

The analysis in this section yields several interesting results. First, the free cash flow theory, the undervaluation signaling, the timing hypothesis, the maturity hypothesis for

dividend payers and the differential tax rates hypothesis related to debt, are the five confirmed hypothesized explanations. These results are common in the literature, although not consensual. For example, our results are consistent with some of the findings of Stephens and Weisbach (1998), Dittmar (2000), Kahle (2002), Jagannathan and Stephens (2003), Grullon and Michaely (2004), among others, but they seem at odds to other studies, such as Fama and French (2001) and Lie (2005). In comparison with the previous univariate results and our matched-pairs results in chapter 2, we note that risk reduction signaling is no longer supported, while the undervaluation signaling and the timing hypothesis now have empirical support. The explanation for these results is twofold. On one hand, the matched-pairs approach used is based on firms with similar size and industry attributes. However, our evidence shows that size is always significant and may have a role in explaining initial repurchases, especially in explaining the evidence related to prior negative stock returns and higher underpricing. Because of this, we add a size quartile analysis in both the matched-pairs and repurchase-or-postpone analyses, by also splitting the samples by size quartiles in order to check for differences across quartiles. However, we are unable to find strong differences across quartiles. On the other hand, in the repurchase-or-postpone analysis, the operating risk is measured by the change in return on assets instead of standard deviation of return on assets used in the matched-pairs. This change may have driven the difference in results. To check this possibility, as the calculation of (the moving average of) the standard deviation of return on assets is no longer possible without the loss of thousands of observations (and hundreds of firms), we recalculate the matched-pairs regressions with the new proxy for operating risk. Again, the results are essentially the same.

Second, there is no supporting evidence for the role of initial repurchases as a financial instrument for operating performance signaling and substituting cash dividends These are common results, however, in the empirical literature (e.g., Lie and McConnell, 1998; Grullon *et al*., 2002). The same conclusions seem to apply to the maturity hypothesis for initial repurchase firms which are not dividend payers, because these firms have some attributes of mature firms, such as lower current growth and higher operating cash flows, but lower values for cash and retained earnings (the latter variable is included to measure firms' maturity according to DeAngelo *et al*., 2005). In addition, the option and dilution hypothesis is strongly rejected, which is not consistent with common findings for stock repurchases in general (e.g., Jolls, 1998; Kahle, 2002). All these results confirm the matched-pairs' findings of chapter 2.

Third, the strong and significant positive impact of size in the timing of initial repurchases is very interesting. If one considers size as a proxy for asymmetric information, we could argue that this generic result provides some additional support for the rejection of the three signaling related hypotheses and could partially explain the above mentioned differences between the matched-pairs and repurchase-or-postpone analyses. However, the additional tests referred below did not confirm this.

Finally, the variables' significance (or absence there of) is almost never valid for all market-to-book quartiles (only cash flow and size) and for the four time periods (only size), but we can not find a pattern which could suggest that a particular theory is (or is not) valid for any time periods or market-to-book and size quartiles.

5.2.3. Hazard Models Analysis

5.2.3.1. Introduction

In this section we present the results of our duration analysis of the age at which the firms in our sample choose to repurchase their own stock for the first time. We used several parametric models that assume known distributions for survival rates and hazard functions: Cox-Proportional Hazards, Exponential, Weibull and Gompertz distributions. Surprisingly (or perhaps not), we found that the results are essentially the same, although the exponential hazard models display some differences and present higher (Wald) Chi-Square for all regressions. Therefore, we choose to use the Cox-proportional hazards model as the base-case model because it gives higher values for the Chi-Square statistic (in relation to the other two models with absolutely the same results) and it has the advantage of being semi-parametric with weaker assumptions (it assumes a parametric form for the effects of the explanatory variables but it allows an unspecified form for the underlying hazard function).[78]

[7] The fact that the Cox Proportional Hazard Model does not assume any particular functional form is important but the main problem of Cox's partial likelihood method for the proportional hazard model is that, with time-varying covariates, it requires the covariates to be strictly exogeneous. Further, there are a number of ways of extending duration models to account for unobservable heterogeneity. The non-parametric approach of the Kaplan-Meyer estimator is largely immune to the problem, but is also limited in how much information can be provided.

[8] Intuition may suggest that the longer a postpone decision persists, the more likely it is that it will end within the next year (positive duration dependence). Or it may be the opposite. It seems equally plausible that the longer a postpone decision has lasted, the more unlikely it will be for a firm to initiate stock repurchases and, therefore, the less likely it is that it will occur in the next year. But as we are unsure whether the data can be characterized by positive or negative duration dependence, it is counterproductive to assume a distribution that shows one

Simultaneously, to ensure robustness, we will also discuss the exponential model, whenever it presents (somewhat) different results.[9]

According to the Cox-proportional hazards model, different firms have hazard functions proportional to one another and the ratio of hazard functions with the covariates does not vary over time:

$$h_i(t) = h(t;x_i) = h_0(t)\times\exp(x_i'\beta)$$

Where $h_i(t)$ is the hazard function for the firm i and $h_0(t)$ is the baseline hazard rate when all explanatory variables are ignored.[10]

Therefore, we estimate a Cox Proportional Hazard Model to understand the determinants of the timing of initial repurchases using a sample of all firms that had an IPO in 1975 or later and that subsequently repurchase their own stock for the first time. In the same spirit as the repurchase-or-postpone decision analysis, the Cox proportional hazard model that we estimate includes all firm observations until and including the initial repurchase. At any given time, the set of firms that have not yet repurchased their stock comprise the hazard set over which the likelihood of repurchase initiation is calculated. In order to compare firms at the same stage in their life cycle, the model converts calendar time to the time since birth (*survival time*), as in the previous section. This enables us to examine whether there are any significant changes that occur along the life cycle of the firm that culminate in initial repurchase. The main benefit of hazard models over logistic regression models is that they can predict whether an event will occur and, at the same time, explicitly model the time it takes to reach that outcome (Kale *et al*., 2006).

For reading convenience, in all the tables that follow we report coefficients, rather than hazard ratios (multiplicative or exponential coefficients), because, as our main interest is in the direction of the effects rather than their magnitude, both present the same information. In the hazard model, a positive coefficient indicates that an increase in the independent variable associated with this coefficient will lead, *ceteris paribus*, to a higher hazard, i.e. to an increase in the probability of a firm's decision to repurchase its stock for the first time (which

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characteristic or the other over the entire range of time. The hazard function for the exponential distribution is constant, those of the Weibull and Gompertz distributions are monotonically increasing or decreasing depending on the sign of the coefficient of duration dependence and the hazards. Which among these is likely to be the best in any application is uncertain.

[9] In this model, the hazard rate does not vary over time. This is a characteristic of a process that has no memory. The conditional probability of a failure event in a given period of time is the same, regardless of when the observation is made.

[10] This model does not have a constant term because the baseline hazard is a firm-specific constant.

also means it speeds up initial repurchases). In other words, a positive increase in the independent variable shortens the time until the initial repurchase. The reverse holds true for a negative coefficient. Thus, we investigate the impact of the factors identified by the existing literature that help explain a firm' choice of repurchasing, on the hazard of the initial repurchase transaction. The results from this analysis are reported in five panels of table 4B. The estimated coefficients are reported in the first column and the resulting economic significance of each dependent variable in the second column.

The results from the hazard model are similar to those obtained from the repurchase-or-postpone decision results. However, we find some differences, especially for leverage, cash and sales growth (opposite signs with large statistical significance), but also for market-to-book ratios, which are significant with a negative sign. Therefore, we find similar results for most variables. In other words, we find that higher values for factors that imply a higher probability of initial repurchase transactions in our earlier logistic regression analysis also lead necessarily to a shorter time to repurchase initiation, with the exceptions referred to below (four out of fifteen variables). [11]

Overall, our results show that the initial repurchase hazard rates tends to be higher for larger firms, with higher debt ratios, cash balances, and sales growth, and with lower market-to-book ratios, options usage, retained earnings and stock returns. Hence, firms with these attributes have a higher probability of initiating later. However, the results for the exponential hazard model show that some other variables may impact the timing of initial repurchases: firms with higher earnings per share growth of sales and lower non-operating income seem to initiate stock repurchases sooner, while leverage is no longer statistically significant.

Next, we present our evidence, discuss the results and compare them with the previous results of our repurchase-or-postpone decision analysis.[12]

5.2.3.2. Performance Signaling Hypothesis

Our results do not fully support the operating profitability improvements hypothesis as a theoretical explanation of the timing of initial stock repurchases. We find that larger size

[11] Of course, when interpreting the results we present in this section, it is important to keep in mind that firm' characteristics evolve over time. For example, when our findings show that size of the firm positively affects the hazard rate, it does not only mean that larger firms repurchase their stock earlier. This could also be interpreted in dynamic terms, meaning that small firms repurchase stock unfrequently, but as they grow larger, the probability that they will repurchase their stock increases, conditional to the fact that these firms have not repurchased their own stock before.

[12] Note that there is no current literature about the timing of stock repurchases.

(eventually firms with lower asymmetric information costs) speed up firms' initial repurchases, which does not support this hypothesis. Some supportive evidence comes from the significantly positive coefficient of current growth and, most particularly, from the negative coefficient related to market-to-book ratio, which suggests that firms may wish to convey information to the market with the initial stock repurchase. However, we have no evidence that this potential signal is related to improvements in cash flows or profitability. Further, we document some support for risk reduction signaling in explaining the timing of initial repurchases for dividend payers only, which is unexpected, since the "stickiness" of cash dividends should be sufficient for this signaling. Therefore, we conclude that a firm's management may be signaling their stock mispricing.

Summarizing, the results from duration analysis are slightly more supportive of the performance signaling hypothesis than with those of previous analysis, particularly in view of the significant negative sign of the market-to-book ratio. But in our opinion we have, at most, only weak supporting evidence for the performance signaling hypothesis. This overall result is similar to Bernatzi *et al*., 1997, Grullon *et al*., (2002), among others, for stock repurchases in general.

5.2.3.3. Undervaluation Signaling Hypothesis

Our evidence on variables related with the undervaluation signaling hypothesis are highly supportive of this initial repurchase timing explanation. We find that the time to initial repurchases decreases with lower market-to-book ratios and stock returns and higher size. Of those results, only the last result is not consistent with any signaling hypothesis, as long as we consider size as a proxy for asymmetric information. The other results are strongly consistent with several studies which document that stock repurchases follow periods of low returns and that they are associated with highly positive average (abnormal) returns (Lie, 2000; Jagannathan *et al*., 2000; Kahle, 2002; Grullon and Michaely, 2002).

5.2.3.4.Free Cash Flow Hypothesis

Our evidence does not confirm the hypothesis that firms choose the timing to repurchase their stock for the first time in response to potential free cash flow problems, since the crucial relationship between explanatory variables related to this hypothesis and the dependent variable (especially, lower leverage, future growth and higher cash balances) is

mixed. On one side, the positive and significant signs for leverage (with the exception of the exponential model) and sales growth do not support the free cash flow hypothesis. Furthermore, operating cash flows, future growth and earnings per share growth do not have any significant effect on the timing of initial stock repurchases. In sum, only the positive sign for cash balances favors the free cash flow hypothesis.

However, this weak and mixed support does not apply directly to the two sub-samples of firms that differ in terms of dividend payments. The evidence is somewhat supportive of the free cash flow hypothesis for the sub-sample of dividend payers (as it presents lower future growth and higher operating cash flows) but the opposite is true for the sub-sample of non-dividend payers. This last result suggests that non-dividend payers either do not have strong equity agency costs, or that they do not try to mitigate them by repurchasing stock or paying dividends.

Finally, we note that this empirical evidence contradicts our previous results in both the matched-pairs analysis (in chapter 2) and the repurchase-or-postpone decision analyses, both of which support the free cash flow theory.

5.2.3.5.Dividends Substitution Hypothesis

Our evidence allow us to conclude that the dividends substitution hypothesis related to the use of non-operating income is not confirmed because the coefficient is only significantly positive for firms in the first size quartile. In addition, this coefficient is actually significant and negative in some regressions using the exponential distribution. Therefore, distributing transitory cash flows speeds the initial repurchase transaction only for smaller firms, which obviously does not agree with the results for the initial repurchase likelihood of the matched-pairs analysis and the findings of other empirical studies, such as Guay and Harford (2000) and Jagannathan *et al*., (2000) and Grullon and Michaely (2002) for stock repurchases in general. The other two dimensions in which the substitution effect between dividends and stock repurchases may occur, high growth and operating risk, do not have an impact on the timing of initial repurchase occurrence. Finally, we do not confirm the Fama and French (2001) findings that stock repurchase firms tend to be smaller in size, since the coefficient of size is always significantly positive.[13] Hence, the results do not confirm the flexibility motivation for initial repurchases and they also do not help us to conclude whether initial

[13] Note that this result do not contradict them, either.

repurchases either substitute or complement cash dividends for the distribution of surplus operating cash flows (as in Dittmar and Dittmar, 2002).

5.2.3.6.Differential Tax Rates Hypothesis

The differential tax rates hypothesis is clearly not supported by our findings. The payout variable is either not statistically significant or does not have the proper signs. On the other hand, leverage coefficients have positive statistical significance, which contradicts the leverage differential tax hypothesis and the leverage motivation. This latter result is different from those of the matched-pairs analysis and from other empirical studies of the likelihood of stock repurchases, such as Jagannathan *et al*., (2000) and Dittmar (2000), which almost always conclude that leverage is an important motivation for stock repurchases. The former results support the claim that dividend differential tax rates are, at best, weak determinants of the stock repurchase behavior of firms.

5.2.3.7.Maturity Hypothesis

The evidence for the maturity hypothesis is, once again, mixed. First, our hazard regressions support the maturity hypothesis by documenting significant positive coefficients for cash and operating cash flows for all observations and negative coefficients on future growth for dividend payers. However, we find a negative coefficient for retained earnings and a positive coefficient for current growth for all observations. These results cast doubt on the validity of the maturity hypothesis, especially the results related to retained earnings, which is the only variable in the analysis used specifically to measure life cycle effects. However, there is some support for the maturity hypothesis for the sub-samples of dividend payers and firms in the larger size quartiles, which is an expected result if we believe that dividend payers and larger firms tend to be more mature. It also partially confirms the findings of our logistic regressions on the repurchase-or-postpone decision for dividend payers.

5.2.3.8.Timing Hypothesis

Our results show some evidence to support the idea that firms attempt to time the market when they choose the timing of initial repurchasing activity because most coefficients are statistically significant, with the proper signs predicted by the timing hypothesis (stock

returns and underpricing). Only leverage (in fact the weaker predicted relation of the timing theory) presents the opposite sign.

5.2.3.9.Options and Dilution Hypothesis

Again, we find evidence that contradicts the options and dilution hypothesis. Although operating risk and earnings per share growth are not significant coefficients, the options variable coefficients are always significant and negative, which is the inverse of the result predicted by the options and dilution hypothesis. This evidence supports our previous empirical results with other models and the results of Jagannathan and Stephens (2003) for the less frequent repurchases.

5.2.3.10. Summary

The results in this section are very similar to those found in the repurchase-or-postpone logit analysis. This fact is usual on the literature of dividend initiations (Kale *et al*., 2006; Bulan *et al*., 2006). However, although the results of both approaches are similar, some differences exist.

First, of the theories supported by the repurchase-or-postpone analysis, only the undervaluation signaling and the timing hypothesis are fully supported. In contrast, the free cash flow theory (especially for non-dividend payers), the maturity hypothesis (again in particular for non-dividend payers) and the differential tax rates hypothesis related to debt are not confirmed by the hazard models. On the other hand, the negative significance of market-to-book ratios in the hazard models analysis slightly increased the support to the signaling hypothesis as a whole. Furthermore, we find results consistent with the risk reduction signaling hypothesis for the dividend-payers sub-sample.

Second, the dividends substitution hypothesis is again not supported. However, this analysis does not enable us to reject this theoretical hypothesis, since we do not find growth and risk attributes that are necessary to provide us with clearer results. In this context, we should stress that the flexibility motivation for stock repurchases is also not supported, nor do we find support for the leverage increasing motivation of stock repurchases.

Third, the options and dilution hypothesis is again rejected as an explanation for the timing of initial stock repurchases. This confirms the matched-pairs analysis (in chapter 2)

and our previous repurchase-or-postpone logit analysis, but contradicts common findings for stock repurchases in general (e.g., Jolls, 1998; Kahle, 2002).

Finally, we still have only mixed evidence in favor of the maturity hypothesis, because the timing of initial repurchase firms is not determined by some maturity attributes, such as lower growth and operating risk, and higher values for retained earnings (a special variable included to measure firms' maturity according to DeAngelo *et al*., 2005). However, the positive and significant coefficients for the cash variable (for all observations) and growth variable (for dividend payers) provides some support for this hypothesis.

5.3. Robustness Checks

To assess the robustness of our results and to analyze the contradictory results of the two approaches used, we repeated calculations using different explanatory variables and model specifications. However, our conclusions are mostly unaffected. In particular, we used the same specification for the duration analysis as Bulan *et al*., (2006), in which we used the matched-pairs data for initial and non-repurchase firms (only 1980-to-2002 observations, explanatory variables measured by three year averages and including ex-post changes in variables) but, once again, the results were almost the same as the conventional duration analysis. The new empirical evidence came from ex-post changes in variables, which presented evidence in support of the performance signaling hypothesis and the excess cash distribution motivation, and against the free cash flow and maturity hypotheses (in particular the significant negative changes in cash and positive changes in profitability, growth and operating risk). In this context, the conclusions related to the exponential hazard model were more limited, since it only supported the excess cash distribution motivation.

6. Conclusions

In this paper, we investigate the timing of initial stock repurchase transactions by studying the validity of the motivations and theoretical explanations commonly used in the literature to explain stock repurchases. We used two distinct approaches. First, we employed a panel adjusted logistic approach to analyze the postpone-or-repurchase decision. Second, we used the natural approach to study the timing of decisions: the duration or hazard models

approach. In our study, both approaches present similar evidence, although we find some differences. In studying a research question similar to ours, Kale *et al*., (2006) and Bulan *et al*., (2006) apply a similar empirical methodology to analyze dividend initiations, but the results of both approaches are almost the same. In our paper, the undervaluation signaling and the timing hypotheses are the only two fully supported by both empirical approaches, thus confirming the results of Jagannathan and Stephens (2003) for less frequent repurchasing firms and Stephens and Weisbach (1998), Jagannathan *et al*., (2000) and Kahle (2002) for stock repurchase firms. Also, the dividends substitution and options and dilution hypotheses are not supported by both approaches. The latter result is not common in the literature on stock repurchases in general (e.g., Jolls, 1998; Kahle, 2002). There is also some consistency, as both approaches give slight support for the risk reduction signaling, free cash flow and maturity hypotheses for dividend payers. But for the performance signaling and leverage tax rate differential hypotheses the two approaches give different results. We note that all hazard models employed have consistent results and the same occurs for the logistic regressions using panel and non-panel regression techniques. In relation to our univariate results, we find that in relation to non-repurchase firms, initial repurchase firms have significantly higher operating cash flows, market-to-book ratios and profitability, both prior to and after the initial repurchase transaction. Initial repurchases are also made by firms with lower leverage and operating risk, on average, before and after the initial repurchase event. Further, initial repurchase firms present ex-ante higher cash balances, options and stock returns and ex-post higher non-operating income and retained earnings. We confirm that there is almost no differences between the dividend behavior of initial repurchase firms relative to non-repurchase firms. Our results also suggest that initial repurchase firms (in comparison with non-repurchase firms) seem to have financial characteristics similar to those of dividend initiators (relative to matched dividend postpone firms), as reported by Kale *et al*., (2006) and Bulan *et al*., (2006), which is an unexpected result, because most empirical literature find that dividends tend to be “sticky”, whereas the same is not true for stock repurchases.

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Table 1: Predicted Relations of Independent Variables with the Timing of Initial Stock Repurchases (Hazard rates or increase likelihood of conducting an initial repurchase earlier)

Variables	Perfor -mance Signaling	Under- valuation Signaling	Free Cash Flow	Dividends Substitution	Differential Tax Rates	Maturity	Timing	Options and Dilution
SIZE	–	–		–				
PAYOUT				–	–			
LEVERAGE			+		–		–	
CASH			–			– =		
CASHFLOW	–		–			– =		
UNDERP	–	–					–	
GROWTH	+		+	+		+ =		
PROFIT	–					– =		
OPRISK	+		+	+		+ =		+
OPTIONS								+ =
NONOPINC				+				
EPSGRW								+
SALESGRW	+		+			+ =		
RETEARN						– =		
STOCKRET		–					–	

Signs: Positive relation (+); Negative relation (–); no positive relation (– =); no negative relation (+ =).
R0: sample of non-repurchase firms; R2: sample of secondary-repurchase firms.
Note: Predicted relations take into consideration the hypothesis development in section 3.1. and have signs consistent with the differential strength expected for initial repurchase firms and their matched counterparts. Therefore, they may include different signs from conventionally predicted relations in order to account for the overall research question related to the uniqueness of initial repurchases. For example, the prediction for the free cash flow theory and maturity hypothesis is that they may apply to stock repurchases as a whole but not to initial repurchases. Thus the signs are the opposite from the conventional application of this theory.

Table 2: Definition and Measurement of Variables

List of variables used with definition and Compustat code. Data for firms' characteristics are obtained from the Compustat database.

Variables	Definition	Compustat #
PROBINREP	1 if the observation is an initial repurchase firm and 0 otherwise	Dummy variable
AGE	Years since first stock market price	
SIZE	Natural log of the book value of assets	ln(#6)
PAYOUT	Dividend payout ratio	#21/#18
LEVERAGE	Book value of total debt	(#9+#44)/#6
CASH	Cash balances	#1/(#6-#1)
CASHFLOW	Operating cash flow	(#110+#308)/#6
UNDERP	Equity market-to-book ratio	(#24*#25)/#60
GROWTH	Capex advertising and R&D	(#128+#45+#46)/#6
PROFIT	Return on assets	#18/#6
OPRISK	Operating risk	(#18t-#18t-1/#18t-1)
OPTIONS	Stock reserved for stock options	#215/#6
NONOPINC	Non operating income	#61/#6
EPSGRW	Earnings per share growth	#58(t/t-1)-1
SALESGRW	Sales growth	#12(t/t-1)-1
RETEARN	Total retained earnings	#36/#6
STOCKRET	Stock return	(#24*#25)(t/t-1)-1

Table 3A: Length of Time Between IPO and Initial Repurchases (in years)

Matched Pairs Analysis	Mean	Median	Standard deviation
Sub-sample of 630 Initial Repurchase Firms	5.6	4.0	4.4
Total ample of 1,379 Initial Repurchase Firms	5.5	4.0	4.3

Table 3B: Age of Sample Firms (in years)

Matched Pairs Analysis	Mean	Median	Standard deviation
Initial Repurchase Firms	5.5	4.0	4.3
Non-Repurchase Firms	7.1	4.0	8.3

Table 3C: Ex-Ante Descriptive Statistics for Event Firms and Non-Repurchase Firms

Summary descriptive statistics for event firms (R1) and for non-repurchase matched-pairs control firms (R0). Ex-ante means that calculations are based on three-year averages preceding the initial repurchase event (years -3 to -1). A t-test on differences in means is performed for PAYOUT and OPTIONS. A non-parametric Mann/Whitney ranksum test on differences in medians between these two samples of firms is conducted for all other variables. The sign *** denotes significance at 1%-level, ** indicates significance at 5%-level and * denotes significance at 10%-level. See Table 2 for variable definitions and appendix 1 for details.

Variables	Event Firms (R1)			No Repurchases Firms (R0)			Difference
	Mean	St. Dev.	Median	Mean	St. Dev.	Median	
SIZE	5.230	1.184	4.941	5.150	1.258	4.944	
PAYOUT	0.121	0.648	0.000	0.069	1.387	0.000	
LEVERAGE	0.172	0.179	0.124	0.222	0.238	0.148	***
CASH	0.417	0.677	0.167	0.482	1.174	0.124	*
CASH FLOW	0.097	0.102	0.100	0.054	0.158	0.071	***
UNDERP	3.502	4.421	2.498	3.413	6.268	2.054	***
GROWTH	0.133	0.096	0.115	0.154	0.146	0.120	
PROFIT	0.052	0.137	0.064	0.000	0.222	0.040	***
OPRISK	0.066	0.108	0.035	0.101	0.220	0.039	**
OPTIONS	0.042	0.069	0.007	0.041	0.077	0.000	***
NONOPINC	0.012	0.028	0.009	0.011	0.019	0.008	
EPSGRW	-0.125	7.426	0.010	0.183	9.160	0.023	
SALESGRW	0.663	7.338	0.251	0.964	3.787	0.264	
RETEARN	0.317	2.348	0.338	0.831	1.536	0.292	
STOCKRET	0.681	4.284	0.182	0.426	1.470	0.043	***

Table 3D: Ex-Post Descriptive Statistics for Event Firms and Non-Repurchase Firms

Summary descriptive statistics for event firms (R1) and for no-repurchases matched-pairs control firms (R0). Ex-post means that calculations are based on three-year averages subsequent to the initial repurchase event (years 0 to +2). A t-test on differences in means is performed for PAYOUT and OPTIONS A non-parametric Mann/Whitney ranksum test on differences in medians between these two samples of firms is conducted for all other variables. The sign *** denotes significance at 1%-level, ** indicates significance at 5%-level and * denotes significance at 10%-level. See Table 2 for variable definitions and appendix 1 for details.

Variables	Event Firms (R1)			No Repurchases Firms (R0)			Difference
	Mean	St. Dev.	Median	Mean	St. Dev.	Median	
SIZE	5.866	1.057	5.617	5.830	1.080	5.622	
PAYOUT	0.127	0.672	0.000	0.067	1.420	0.000	
LEVERAGE	0.181	0.172	0.144	0.248	0.270	0.177	***
CASH	0.330	0.522	0.121	0.380	0.938	0.106	
CASH FLOW	0.096	0.074	0.092	0.061	0.148	0.070	***
UNDERP	2.749	2.358	2.137	2.750	3.639	1.890	***
GROWTH	0.122	0.086	0.108	0.129	0.109	0.102	
PROFIT	0.033	0.109	0.047	-0.034	0.269	0.028	***
OPRISK	0.066	0.113	0.035	0.122	0.284	0.046	***
OPTIONS	0.022	0.044	0.000	0.021	0.051	0.000	
NONOPINC	0.011	0.015	0.008	0.008	0.033	0.006	***
EPSGRW	-0.231	1.273	-0.007	-1.034	12.89	0.000	
SALESGRW	0.137	0.841	0.080	0.123	0.312	0.075	
RETEARN	0.449	5.351	0.397	0.552	2.390	0.303	***
STOCKRET	0.203	0.561	0.101	0.240	0.738	0.091	

Table 3E: Ex-Post Versus Ex-Ante Medians for Event Firms and Non-Repurchase Firms
In this table, we calculate medians for event firms (R1) and for non-repurchase matched-pairs control firms (R0) for all variables except for PAYOUT and OPTIONS, to which we calculate means. Ex-ante means that variable calculations are based on three-year averages preceding the initial repurchase event (years -3 to -1). Ex-post means that calculations are based on three-year averages subsequent to the initial repurchase event (years 0 to +2). A t-test on differences in means is performed for PAYOUT and OPTIONS. A non-parametric Mann/Whitney ranksum test on differences in medians between these two samples of firms is conducted for all other variables. The sign *** denotes significance at 1%-level, ** indicates significance at 5%-level and * denotes significance at 10%-level. See Table 2 for variable definitions and appendix 1 for details.

Variables	Event Firms (R1)			No Repurchases Firms (R0)		
	Ex-Ante	Ex-Post	Difference	Ex-Ante	Ex-Post	Difference
SIZE	4.941	5.617	0.676***	4.944	5.622	0.678***
PAYOUT	0.121	0.127	0.006	0.069	0.067	-0.002
LEVERAGE	0.124	0.144	0.020	0.148	0.177	0.029
CASH	0.167	0.121	-0.056**	0.124	0.106	-0.018
CASH FLOW	0.100	0.092	-0.008	0.071	0.070	-0.001
UNDERP	2.498	2.137	-0.361***	2.054	1.890	-0.164
GROWTH	0.115	0.108	-0.007*	0.120	0.102	-0.018***
PROFIT	0.064	0.047	-0.017***	0.040	0.028	-0.012***
OPRISK	0.035	0.035	0.000	0.039	0.046	0.007*
OPTIONS	0.042	0.022	-0.020***	0.041	0.021	-0.020***
NONOPINC	0.009	0.008	-0.001	0.008	0.006	-0.002***
EPSGRW	0.010	-0.007	-0.017	0.023	0.000	-0.023***
SALESGRW	0.251	0.080	-0.171***	0.264	0.075	-0.179***
RETEARN	0.338	0.397	0.059	0.292	0.303	0.011
STOCKRET	0.182	0.101	-0.081***	0.043	0.091	0.048

Table 3F: Dividend Characteristics of Event Firms and Non-Repurchase Firms
Summary dividend characteristics for event firms (R1) and matched-pairs control firms (R0). See text for details.

Panel 1: Ex-Ante Cash and Ex-post Dividends Characteristics

	Initial Repurchase Firms (R1)			Non-Repurchase Firms (R0)		
	Ex-ante	**Ex-post**	**Change**	**Ex-ante**	**Ex-post**	**Change**
No Cash Dividends	463 (73.5%)	472 (74.9%)	9 (1.4%)	443 (70.3%)	471 (74.8%)	28 (4.5%)
Positive Cash Dividends	167 (26.5%)	158 (25.1%)	-9 (-1.4%)	187 (29.7%)	159 (25.2%)	-28 (-4.5%)

Panel 2: Changes in Cash Dividends

	Initial Repurchase Firms (R1)		Non-Repurchase Firms (R0)	
	n = 1,247	**n = 630**	**n = 782**	**n = 630**
Increases	328 (26.3%)	144 (22.9%)	181 (23.1%)	139 (22.1%)
No Changes	728 (58.4%)	392 (62.2%)	483 (61.8%)	399 (63.3%)
Decreases	191 (15.3%)	94 (14.9%)	118 (15.1%)	92 (14.6%)

Table 4A: Logistic Regressions – Panel 1: All Observations and Dividend Payers and Non-Payers
This table presents coefficient estimates from logistic regressions explaining the decision to repurchase or to postpone using a sample of initial repurchase firms. Definitions of the variables employed here are provided in table 2 and in appendix 1 with details.

Variables	All Observations		Dividend Samples			
			Payers		Non-Payers	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
SIZE	7.275	0.000***	12.06	0.000***	6.611	0.000***
PAYOUT	0.175	0.701	0.012	0.803		
LEVERAGE	-4.950	0.000***	-5.454	0.022**	-4.757	0.000***
CASH	-0.788	0.004***	-4.3941	0.000***	-0.555	0.034**
CASH FLOW	3.943	0.000***	8.889	0.002***	3.361	0.000***
UNDERP	-0.006	0.272	0.018	0.584	-0.059	0.000***
GROWTH	-1.2543	0.233	-5.598	0.061*	-0.193	0.868
PROFIT	-1.072	0.166	-4.120	0.246	-0.495	0.555
OPRISK	0.007	0.853	0.015	0.265	-0.008	0.838
OPTIONS	-11.39	0.000***	-10.24	0.050**	-11.54	0.000***
NONOPINC	-3.907	0.331	-9.900	0.031**	2.929	0.637
EPSGRW	0.004	0.188	0.004	0.674	0.002	0.542
SALESGRW	-0.111	0.000***	-2.068	0.001***	-0.122	0.000***
RETEARN	-0.120	0.005***	0.517	0.023**	-0.202	0.001***
STOCKRET	-0.277	0.000***	-0.506	0.048***	-0.188	0.001***
McFadden R2		**57.67%**		**60.64%**		**58.06%**

Table 4A: Logistic Regressions – Panel 2: Market-to-Book Quartiles
This table presents coefficient estimates from logistic regressions explaining the decision to repurchase or to postpone using a sample of initial repurchase firms. Definitions of the variables employed here are provided in table 2 and in appendix 1 with details.

Variables	M-B Quartile 1		M-B Quartile 2		M-B Quartile 3		M-B Quartile 4	
	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value
SIZE	6.064	0.000***	9.919	0.000***	12.22	0.000***	7.714	0.000***
PAYOUT	0.018	0.744	0.089	0.628	-0.297	0.374	-0.854	0.448
LEVERAGE	-4.643	0.001***	-10.51	0.000***	-12.06	0.000***	-2.828	0.160
CASH	-0.735	0.296	-2.493	0.001***	-1.807	0.022**	-0.435	0.239
CASH FLOW	5.580	0.002***	6.048	0.004***	6.326	0.007***	3.665	0.038**
UNDERP	-0.076	0.143	0.066	0.164	-0.235	0.068*	-0.004	0.537
GROWTH	0.892	0.638	3.031	0.213	1.588	0.628	-5.093	0.047**
PROFIT	3.966	0.049**	-1.944	0.046**	-8.644	0.000***	-1.007	0.518
OPRISK	0.005	0.373	0.027	0.047**	0.023	0.610	-0.010	0.566
OPTIONS	-11.30	0.001***	-10.13	0.024**	-11.40	0.030**	-13.92	0.055*
NONOPINC	-20.79	0.005***	-32.97	0.021**	-2.924	0.802	15.68	0.168
EPSGRW	0.001	0.705	-0.033	0.023**	-0.016	0.645	-0.007	0.623
SALESGRW	-0.989	0.004***	-3.674	0.000***	-1.032	0.000***	-0.123	0.001***
RETEARN	-0.474	0.084	-0.009	0.616	-1.434	0.016**	-0.152	0.025**
STOCKRET	-0.310	0.021**	-0.271	0.095*	-0.013	0.931	-0.238	0.043**
McFadden R2		**44.68%**		**69.78%**		**74.28%**		**67.22%**

Table 4A: Logistic Regressions – Panel 3: Size Quartiles
This table presents coefficient estimates from logistic regressions explaining the decision to repurchase or to postpone using a sample of initial repurchase firms. Definitions of the variables employed here are provided in table 2 and in appendix 1 with details.

Variables	SIZE Quartile 1		SIZE Quartile 2		SIZE Quartile 3		SIZE Quartile 4	
	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value
SIZE	20.61	0.000***	9.919	0.000***	6.828	0.000***	5.834	0.000***
PAYOUT	1.586	0.020**	0.089	0.628	0.380	0.481	0.014	0.761
LEVERAGE	-4.595	0.181	-10.51	0.000***	-10.01	0.000***	-1.225	0.433
CASH	-2.171	0.013**	-2.493	0.001***	-0.248	0.449	-2.020	0.019**
CASH FLOW	5.389	0.065*	6.048	0.004***	0.691	0.637	9.357	0.000***
UNDERP	-0.244	0.000***	0.066	0.164	-0.253	0.000***	0.004	0.979
GROWTH	-1.669	0.691	3.031	0.213	-0.914	0.730	-2.116	0.402
PROFIT	-9.248	0.001***	-1.944	0.046**	1.849	0.311	3.077	0.119
OPRISK	-0.056	0.113	0.027	0.047**	-0.004	0.831	0.007	0.351
OPTIONS	-13.21	0.042**	-10.13	0.024**	-16.61	0.002***	-18.07	0.002***
NONOPINC	42.87	0.071*	-32.97	0.021**	-13.91	0.057*	-4.706	0.255
EPSGRW	0.006	0.759	-0.033	0.023**	0.034	0.155	0.002	0.702
SALESGRW	-0.270	0.000***	-3.674	0.000***	-3.433	0.000***	-1.157	0.001***
RETEARN	-1.385	0.000***	-0.009	0.616	-0.173	0.033**	-0.257	0.152
STOCKRET	0.056	0.756	-0.271	0.095*	-0.167	0.362	-0.219	0.091*
McFadden R2		**87.19%**		**69.78%**		**62.06%**		**46.43%**

Table 4A: Logistic Regressions – Panel 4: Four Time Period Windows
This table presents coefficient estimates from logistic regressions explaining the decision to repurchase or to postpone using a sample of initial repurchase firms. Definitions of the variables employed here are provided in table 2 and in appendix 1 with details.

Variables	1982-87		1988-92		1993-97		1998-04	
	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value
SIZE	6.143	0.077*	11.40	0.000***	10.55	0.000***	5.860	0.000***
PAYOUT	-2.927	0.126	0.746	0.315	0.007	0.851	0.068	0.625
LEVERAGE	-7.273	0.116	-6.192	0.098*	-6.700	0.001***	-4.463	0.000***
CASH	-2.405	0.180	-1.839	0.177	-3.836	0.000***	-0.493	0.075*
CASH FLOW	11.02	0.077*	4.517	0.230	7.900	0.001***	3.100	0.000***
UNDERP	-0.213	0.470	0.039	0.589	0.019	0.770	-0.005	0.338
GROWTH	-1.461	0.602	2.136	0.659	-0.021	0.993	-2.113	0.146
PROFIT	-17.09	0.065	-4.400	0.381	2.647	0.377	0.135	0.885
OPRISK	0.115	0.217	0.033	0.193	-0.011	0.257	0.008	0.234
OPTIONS	15.88	0.078*	14.18	0.169	-15.70	0.000***	-10.27	0.989
NONOPINC	2.957	0.779	2.715	0.886	-1.275	0.926	-3.112	0.458
EPSGRW	0.406	0.088*	-0.206	0.377	-0.004	0.762	0.008	0.074*
SALESGRW	0.745	0.485	-3.393	0.000***	-2.003	0.001***	-0.106	0.000***
RETEARN	4.977	0.123	-0.559	0.424	-0.779	0.873	-0.115	0.010**
STOCKRET	-0.729	0.228	-0.343	0.338	-0.256	0.217	-0.238	0.000***
McFadden R2		**92.71%**		**66.66%**		**72.19%**		**54.77%**

Table 4B: Several Probability Distribution Hazard Models – Panel 1: All Observations

This table presents the signs of the coefficient estimates from several parametric Hazard Models and the semi-parametric Cox-Proportional Hazard Models explaining the timing dimension of the initial repurchase decision, using a sample of initial repurchase firms. Definitions of the variables employed here are provided in table 2 and in appendix 1 with details.

Variables	Cox Proportional		Exponential		Gompertz		Weibull	
SIZE	+	***	+	***	+	***	+	***
PAYOUT	-		-		-		-	
LEVERAGE	+	*	+		+	**	+	**
CASH	+	***	+	***	+	***	+	***
CASH FLOW	+	**	+	***	+	**	+	**
UNDERP	-	***	-	***	-	***	-	***
GROWTH	-		-		-		-	
PROFIT	+		+		+		+	
OPRISK	+		+		+		+	
OPTIONS	-	***	-	***	-	***	-	***
NONOPINC	-		-	**	-		-	
EPSGRW	+		+	*	+		+	
SALESGRW	+	***	+	**	+	***	+	***
RETEARN	-	***	-	***	-	***	-	***
STOCKRET	-	***	-	***	-	***	-	***
Wald Chi2		**268,6**		**365,7**		**228,6**		**242,2**

Table 4B: Hazard Models – Panel 2: All Observations and Dividend Payers and Non-Payers

The following tables present the coefficient estimates and p-values from the semi-parametric Cox-Proportional Hazard Model explaining the timing dimension of the initial repurchase decision, using a sample of initial repurchase firms. Definitions of the variables employed here are provided in table 2 and in appendix 1 with details.

Variables	All Observations		Dividend Samples			
			Payers		Non-Payers	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
SIZE	0.092	0.000***	0.061	0.028**	0.191	0.000***
PAYOUT	-0.005	0.616	0.012	0.414	0.136	0.396
LEVERAGE	0.268	0.066*	0.360	0.376	0.134	0.000***
CASH	0.154	0.000***	-0.425	0.201	0.449	0.172
CASH FLOW	0.625	0.038	1.947	0.028**	0.625	0.038
UNDERP	-0.006	0.001***	-0.005	0.094*	-0.008	0.001***
GROWTH	-0.231	0.435	-1.807	0.030**	-0.166	0.596
PROFIT	0.417	0.148	0.957	0.360	0.618	0.052*
OPRISK	0.002	0.468	0.008	0.000***	-0.008	0.848
OPTIONS	-6.023	0.000***	-2.413	0.076*	-6.348	0.000***
NONOPINC	-2.199	0.102	-1.564	0.558	-1.072	0.494
EPSGRW	0.003	0.387	0.000	0.994	0.000	0.966
SALESGRW	0.007	0.001***	-0.026	0.890	0.007	0.001***
RETEARN	-0.047	0.000***	-0.174	0.032**	-0.046	0.001***
STOCKRET	-0.165	0.008***	-0.017	0.940	-0.201	0.000***
Wald Chi2		**268.6**		**90.3**		**311.6**

Table 4B: Hazard Models – Panel 3: Market-to-Book Quartiles

The following tables present the coefficient estimates and p-values from the semi-parametric Cox-Proportional Hazard Model explaining the timing dimension of the initial repurchase decision, using a sample of initial repurchase firms. Definitions of the variables employed here are provided in table 2 and in appendix 1 with details.

Variables	M-B Quartile 1		M-B Quartile 2		M-B Quartile 3		M-B Quartile 4	
	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value
SIZE	0.141	0.000***	0.077	0.006***	0.143	0.000***	0.035	0.249
PAYOUT	0.000	0.975	0.033	0.685	-0.041	0.437	-0.143	0.207
LEVERAGE	0.311	0.171	0.719	0.028**	-0.238	0.578	-0.663	0.073*
CASH	-0.238	0.492	0.042	0.531	0.201	0.022**	0.202	0.001***
CASH FLOW	0.353	0.677	0.309	0.583	0.567	0.379	1.071	0.043**
UNDERP	-0.035	0.000***	-0.229	0.002***	-0.066	0.139	-0.002	0.186
GROWTH	0.242	0.659	-0.013	0.984	-1.023	0.080	-0.982	0.104
PROFIT	2.391	0.001***	0.345	0.577	0.223	0.744	-0.480	0.192
OPRISK	0.002	0.692	-0.001	0.786	0.020	0.070*	-0.012	0.367
OPTIONS	-2.737	0.026**	-5.802	0.000***	-5.530	0.000***	-10.45	0.000***
NONOPINC	-1.523	0.599	1.308	0.603	-6.527	0.000***	-0.967	0.741
EPSGRW	0.000	0.385	0.014	0.080*	-0.020	0.800	0.004	0.668
SALESGRW	0.001	0.940	0.003	0.311	0.088	0.012**	0.021	0.000***
RETEARN	-0.186	0.000***	-0.129	0.073*	0.011	0.884	-0.011	0.059*
STOCKRET	-0.348	0.001***	-0.013	0.896	-0.238	0.065*	-0.187	0.011**
Wald Chi2		**81.18**		**112.46**		**113.90**		**344.54**

Table 4B: Hazard Models – Panel 4: Size Quartiles

The following tables present the coefficient estimates and p-values from the semi-parametric Cox-Proportional Hazard Model explaining the timing dimension of the initial repurchase decision, using a sample of initial repurchase firms. Definitions of the variables employed here are provided in table 2 and in appendix 1 with details.

Variables	Size Quartile 1		Size Quartile 2		Size Quartile 3		Size Quartile 4	
	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value
SIZE	1.506	0.000***	1.593	0.000***	1.178	0.000***	0.059	0.120
PAYOUT	-0.367	0.064*	-0.117	0.165	0.271	0.168	0.037	0.332
LEVERAGE	-1.057	0.012**	-0.426	0.200	0.276	0.361	0.487	0.053*
CASH	0.081	0.230	-0.142	0.297	0.047	0.511	-0.342	0.174
CASH FLOW	1.361	0.068*	0.830	0.278	0.559	0.359	3.044	0.002***
UNDERP	0.029	0.001***	0.014	0.357	-0.084	0.000***	-0.005	0.033**
GROWTH	0.751	0.167	0.249	0.645	-0.89	0.135	-2.426	0.035**
PROFIT	-1.069	0.042**	-0.043	0.929	-0.234	0.609	0.978	0.175
OPRISK	-0.002	0.629	0.007	0004***	-0.000	0.987	0.005	0.316
OPTIONS	-1.568	0.065*	-2.385	0015**	-3.706	0.002***	-6.877	0.000***
NONOPINC	8.154	0.018**	2.176	0.636	0.435	0.860	-4.157	0.012**
EPSGRW	0.008	0.813	-0.009	0.066*	0.031	0.008***	-0.000	0.586
SALESGRW	0.012	0.000***	-0.164	0.288	-0.275	0.148	-0.017	0.893
RETEARN	-0.017	0.555	-0.014	0.568	-0.098	0.000***	-0.061	0.060*
STOCKRET	-0.085	0.015**	-0.296	0.007***	-0.386	0.000***	-0.025	0.716
Wald Chi2		**229.83**		**370.93**		**398.74**		**89.24**

Table 4B: Hazard Models – Panel 5: Four Time Period Windows

The following tables present the coefficient estimates and p-values from the semi-parametric Cox-Proportional Hazard Model explaining the timing dimension of the initial repurchase decision, using a sample of initial repurchase firms. Definitions of the variables employed here are provided in table 2 and in appendix 1 with details.

Variables	**1980-87**		**1988-92**		**1993-97**		**1998-2004**	
	Coeff	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
SIZE	0.209	0.083*	0.328	0.000***	0.206	0.000***	0.045	0.020**
PAYOUT	0.056	0.730	0.242	0.153	-0.003	0.812	-0.094	0.075*
LEVERAGE	1.003	0.077*	1.315	0.002***	0.550	0.172	-0.106	0.610
CASH	-0.542	0.062*	0.056	0.837	0.294	0.000***	0.159	0.000***
CASH FLOW	5.748	0.009***	-2.211	0.129	1.843	0.007***	0.372	0.352
UNDERP	-0.066	0.318	-0.104	0.620	0.009	0.027**	-0.006	0.002***
GROWTH	-2.046	0.037**	1.541	0.155	-0.899	0.094*	-0.363	0.419
PROFIT	-5.923	0.033**	4.288	0.025**	0.258	0.761	0.036	0.904
OPRISK	0.041	0.658	-0.007	0.470	0.004	0.032**	0.001	0.765
OPTIONS	3.009	0.151	1.280	0.476	-9.793	0.000***	-3.655	0.000***
NONOPINC	-0.988	0.877	-13.33	0.084*	-16.66	0.000***	-2.227	0.206
EPSGRW	-0.023	0.383	-0.029	0.055*	0.001	0.832	0.001	0.011**
SALESGRW	0.055	0.126	-0.431	0.151	0.070	0.001***	0.011	0.005***
RETEARN	-0.055	0.681	-0.311	0.037**	-0.168	0.013**	-0.050	0.001***
STOCKRET	0.039	0.016**	-0.044	0.652	-0.124	0.089*	-0.245	0.000***
Wald Chi2		**70.04**		**77.19**		**216.00**		**159.34**

Appendix 1

In this study, we use the following variables:

- SIZE (measured as in Dittmar, 2000);

In the matched-pairs approach, we control for size and industry but in the other empirical tests we use size as a proxy for information asymmetry (Vermaelen, 1981; Dittmar, 2000), because large firms are believed to have less uncertainty regarding future cash flows and, therefore, to have a lower level of information asymmetry.

- PAYOUT (measured as in Dittmar, 2000; Grullon and Michaely, 2002);

We include PAYOUT variable in the analysis because another common explanation for stock repurchases is that firms repurchase stock as a substitute for cash dividends because stock repurchases are associated with a lower tax burden for stockholders (capital gains versus ordinary income) and increased financial flexibility.

- LEVERAGE (as measured in Bagwell and Shoven, 1989; Grullon and Michaely, 2002);

We use LEVERAGE to account for the effect of current financial risk and flexibility in explaining stock repurchases. Presumably, if stock repurchasing firms are below their optimal capital structure, then the increase in leverage associated with stock repurchases should increase firm value for reasons related to tax, agency and signaling considerations.

- CASH (as measured in Opler et al., 1999; Dittmar, 2000; Grullon and Michaely, 2002);

We include CASH to test whether firms engage in initial stock repurchases to distribute excess cash in response to agency, signaling or maturity considerations. In addition, CASH is used to check the possibility of dividend substitution by initial stock repurchases.

- CASHFLOW (as measured in Jagannathan et al., 2000);

CASHFLOW is included to account for agency, signaling or maturity considerations, which all suggest that firms with high level of cash flow would benefit more by repurchasing stock. Hence, we test the hypothesis that this may not be the case for initial repurchases.

- UNDERP (underpricing as measured in Jagannathan et al., 2000);

Ikenberry et al (1995) show that firms with low market-to-book ratios earn abnormal performance in subsequent years. Thus, as this variable may indicate a firm's potential for undervaluation and future abnormal returns, we include the variable UNDERP to capture the potential undervaluation effect driving initial repurchase decisions. We estimate the association between market-to-book ratios and initial repurchase decisions incremental to proxies for actual and future growth, enabling us to interpret the coefficient on market-to-book ratios as relating to undervaluation and predict a positive relation. Also, controlling for size, we decrease the possibility for market-to-book ratios to proxy for information asymmetry.

- GROWTH (growth options);

The amount of capital., advertising and R&D expenditures is used to measure a firm's reliance on future growth opportunities and, hence, to help testing agency, signaling or maturity hypotheses for initial stock repurchases. In particular, we predict a different relation between growth and initial repurchases vis-à-vis secondary repurchases.

- PROFIT (profitability as measured in Dittmar, 2000);

We also use PROFIT to account for the effect of agency, signaling or maturity hypotheses in explaining initial stock repurchases.

- OPRISK (operating risk as measured in Jagannathan et al., 2000; Jagannathan and Stephens, 2003);

In the matched-pairs approach, we control for size and industry in order to hold constant (at least partially) some economic attributes as is the case of operating risk. In the other tests, we use operating risk to present evidence supporting some of the most common explanations of

stock repurchases, specially, maturity and free cash flow theories.

- OPTIONS (stock options as measured in Dittmar, 2000; Kahle, 2002);

The variable OPTIONS is included to test the management incentive to distribute cash by repurchasing stock in order to avoid earnings per share dilution and reporting earnings disappointments.

- NONOPINC (Non operating income as measured in Guay and Harford, 2000; Jagannathan et al., 2000);

We also use NONOPINC as a proxy for temporary cash flow to emphasize the potential role of initial stock repurchases flexibility as a mechanism to distributing temporary cash flows and, hence, to test the substitution effect between initial repurchases and dividends.

- EPSGW (actual growth rate of earnings per share) and SALESGW (actual growth rate of sales)

Sales and EPS growth are used as proxies for current growth that may be positively related to potential agency costs of free cash flows. EPS growth is also included following evidence reported by Brav et al (2005) that managers posit the desire to increase earnings per share among their list of repurchase reasons.

- RETEARN (retained earnings as measured in DeAngelo et al., 2005);

We proxy the firms' stage in their financial lifecycle by using the earned-contributed capital mix variable of DeAngelo et al., (2005), that measures the extent to which the firm is self-financing or reliant on external capital. The variable RETEARN is, therefore, included to capture this potential life cycle effect, that allows us to test maturity and signaling considerations. In effect, firms in the early stages of their lifecycle have large and valuable investment opportunities and limited retained earnings, so they retain all internal cash flow available, specially when external financing is very costly due to larger asymmetric information costs.

- STRET (stock returns) and STRET1 (dummy variable for the stock returns at initial repurchase year)

These variables measure the managerial incentive to time the market with stock repurchase transactions and the degree of stocks' potential undervaluation. In particular, STRET1 is a dummy variable that is equal to one when the return on the stock in the initial repurchase year is higher than the average return in the three-year period preceding the initial repurchase.

- STREP (stock repurchase amount as suggested by Grullon and Michaely, 2002 and Banyi et al., 2005) and PROBINREP (stock initial repurchases);

PROBINREP and STREP are the independent variables. PROBINREP is a dummy variable which equals one if the observation is an initial stock repurchase transaction, and zero otherwise and STREP is the amount of stock repurchased (in millions of US dollars).

- INDUSTRY (industry dummies based on two digit SIC codes);

Prior research has identified a firm's industry as a potentially important determinant of financial decisions, specially high growth and competitive industries characterized by strong operating and technological risks and cyclical businesses . This is clearly also true for stock repurchases. Therefore, we capture any industry fixed effects by including dummy variables corresponding to 2 to 4-digit SIC codes.

- AGE (as measured in Lemmon-Zender, 2003 and Bulan et al., 2003);

We define age as the amount of time (in years) since the firms' first positive stock price on Compustat-CRSP until the date of its initial repurchase. Knowing the IPO date allows us to study the evolution of financial decisions, including repurchases, as firms mature. We follow firms from the year of their IPO (between 1975 and 2002) until their first stock repurchase.