Share Repurchases, the Clustering Problem, and the Free Cash Flow Hypothesis

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We examine the market reaction to announcements of actual share repurchases, events that cluster both within and across firms. Using a multivariate regression model, we find that the market reacts positively to the events, indicating that these announcements provide additional information to that contained in the initial repurchase intention announcements. Further, the market response is especially favorable for firms with overinvestment problems as measured by Tobin's *q*, and is not related to signaling costs as measured by the size of the repurchase. Our findings generally support the hypothesis that share repurchases reduce the agency costs of excessive free cash flow.

I. Introduction

Announcements of open market repurchase programs in the United States are popular and attract positive market reactions (Asquith and Mullins, 1986; Netter and Mitchell, 1989; Comment and Jarrell, 1991; Singh, Zaman, and Krishnamurti, 1994; Ikenberry, Lakonishok, and Vermaelen, 1995; McNally, 1999; Kahle, 2002). However, the reason that the market reacts favorably to these announcements remains in dispute because they do not represent firm commitments to buy back shares in the future. Bartov (1991), Comment and Jarrell (1991), and Lie (2005) argue that share repurchases increase firm value since potential cash payouts signal managerial confidence about future financial performance and cash flow.[1] This is consistent with the information-signaling (or undervaluation) hypothesis of Bhattacharya (1979) and Miller and Rock (1985). In contrast, Jagannathan and Stephens (2003), Grullon and Michaely (2004), and Li and McNally (2007) favor the free cash flow hypothesis, which states that share repurchases create firm value as potential repurchases reduce resources wasted on negative net present value (NPV) projects (Jensen, 1986). Both hypotheses predict a positive market reaction to repurchase intention announcements. Previous studies have used various data, methodologies, and proxies to shed light on these two hypotheses. However, these investigations have generally yielded mixed results.

Lie (2005), investigating U.S. firms, argues that these conflicting results probably occur because the announced repurchase programs reflect managerial intentions rather than legal obligations to actually repurchase shares from the market. He finds that both operating performance improvements and positive earnings announcement returns are limited to firms that actually repurchase shares during the same fiscal quarter. His findings suggest that the announcement of repurchase intention alone may not be a good indicator of superior future financial performance and cash flow. Similarly, Mitchell and Dharmawan (2007) find that

[1] Using Canadian data, Ikenberry, Lakonishok, and Vermaelen (2000) demonstrate that firms experience large price increases at the time of repurchase intention announcements even when the shares are not subsequently repurchased.

Australian firms, which are required to disclose daily buy back transactions, have greater incentives to signal stock under valuations or to return excess cash than do firms in countries like the U.S. that lack formal procedures for disclosing relevant information regarding repurchases.[2]

Previous studies in the United Kingdom by Rees (1996) and in Hong Kong by Zhang (2005) find that the market reacts positively to actual share repurchases, even after it has shown a positive response to initial announcements of intent to repurchase. These actual share repurchases appear to provide value relevant information in addition to that conveyed by the initial repurchase program announcements. We examine this issue further by investigating how the market interprets the reasons for actual share repurchases after the initial repurchase intention announcements.

We use UK data for this study for the following reasons. Although U.S. firms have been disclosing cash spending on capital transactions in their cash flow statements since 1984, Stephens and Weisbach (1998) and Jagannathan, Stephens, and Weisbach (2000) point out that this cash spending may include other capital transactions such as the conversion of other classes of stock into common stock, the retirement of common or preferred stock, or the redemption of redeemable preferred stock. These researchers note that this expenditure is, therefore, not a good measure of actual share repurchases. Firms in the UK, however, must announce their repurchase transactions before 7:30 a.m. on the following trading day. These compulsory announcements provide a precise description of every repurchase transaction, including its timing and payout size.

With a sample of 5,500 announcements of UK share repurchases identified from September 1997-July 2003, we are able to examine two empirical issues. First, we test the statistical significance of abnormal returns around the announcements of actual repurchases

[2] In addition to the uncommitted nature and non-standard structure of U.S. repurchase intention announcements, the mixed results regarding share repurchases may also be attributable to the tendency of firms to mimic the repurchase intention announcements of their competitors (see Massa, Rehman, and Vermaelen 2007).

using Zellner's (1962) seemingly unrelated regression (SUR). The SUR generates more efficient estimates than does a traditional multivariate regression model when actual repurchase announcements cluster both within and across firms. This is an important research design issue as failing to account for cross-sectional correlations and heteroskedasticity in estimating abnormal returns and associated standard errors can invalidate evidence of the market's reaction to actual repurchases. Second, we investigate whether the market's interpretation of actual share repurchases is consistent with the free cash flow hypothesis or information-signaling hypothesis using proxies for firm investment strategy and actual repurchase size. Previous studies have investigated how the market interprets the purpose of initial repurchase program announcements, but have largely ignored actual share repurchases. Lie (2005) points out that the actual share repurchases play an important role in explaining the abnormal returns around the initial repurchase intention and earnings announcements. However, it is still unclear as to why firms actually purchase their shares even after the initial repurchase announcements have increased share prices, except in an inefficient market as shown theoretically by Isagawa (2002).

Consistent with previous studies, we find that the announcements of actual repurchases convey favorable information to the market. This finding indicates that actual share repurchases contain value relevant information beyond that contained in the initial announcements of intent to repurchase. In studying how investors interpret the reasons for the actual share repurchases, we follow Lang and Litzenberger (1989), who use Tobin's q to identify overinvesting firms. In this way, we test the free cash flow hypothesis. Our results generally support this hypothesis in that we find that the market reacts more positively to repurchase announcements by firms with overinvestment problems. This suggests that share repurchases shift financial resources away from unnecessary costly projects, thereby increasing shareholder confidence in overinvesting firms. To test the information-signaling

hypothesis, we apply the argument of Bhattacharya (1979) and Miller and Rock (1985) and use the size of individual buyback transactions as a proxy for signaling costs. We find that higher payouts do not result in higher abnormal returns around the announcements of actual share repurchases. This suggests that the market does not consider the magnitude of actual share repurchase to be significant when signaling future cash flow performance.

This paper contributes to the literature in several ways. First, instead of discarding clustered announcements of actual repurchases, we apply Zellner's (1962) SUR model to identify the significance of the market reaction to clustered events (i.e., the announcements of actual share repurchases). Second, our data regarding actual repurchases are accurate because UK firms, unlike U.S. firms, must report the details of these transactions. Third, our sample size is large enough to investigate how investors interpret the purpose of share repurchases. Fourth, we provide further evidence as to how the market interprets the underlying reasons for firms actually repurchasing their own shares even after their repurchase intention announcements have resulted in increased share prices.

This paper continues as follows. Section II discusses the regulations governing the reporting of share repurchases in the UK and summarizes previous studies. Section III describes the selection criteria of our sample. Research methodology and hypothesis development are discussed in Section IV, and our empirical findings are presented in Section V. Section VI offers our conclusion.

II. UK Repurchase Regulations and Prior Studies

We focus on open-market equity share repurchases, which are the most common type of buyback engaged in by listed UK companies (Rau and Vermaelen, 2002; Oswald and Young, 2004a, 2004b). UK firms were first allowed to repurchase their own shares under the Companies Act of 1981. The provisions are now part of the Companies Act of 1985. Listed

firms must also comply with the Listing Rules of the London Stock Exchange when conducting open-market share repurchases.

According to the Companies Act of 1985 and the Listing Rules, UK listed firms must have articles of association permitting share repurchase and buyback authority conferred by shareholders at a general meeting. For repurchase authority, the board of directors must submit to shareholders a resolution authorizing their firm to buy back shares. In this context, UK repurchase intention announcements can refer to: 1) a board's decision to seek repurchase authority from shareholders, 2) a resolution passed by shareholders at a general meeting, or 3) a declared share repurchase plan. UK repurchase intention announcements, like their U.S. counterparts, are uncommitted; many firms announce buyback intentions, but do not subsequently repurchase their stock (Netter and Mitchell, 1989; Singh et al., 1994; Stephens and Weisbach, 1998; Garella, 1999). There is also no evidence that at the time of a repurchase intention announcement, investors can predict which firms will actually follow through and repurchase their shares (Lie, 2005).

UK repurchase announcement data provide a unique opportunity for testing the information content of actual share repurchases as a result of three distinctive regulations. First, after executing a share repurchase, the firm is required, according to the Listing Rules, to report details of the transaction no later than 7:30 a.m. on the first business day following the repurchase execution. Investors are aware of the timing and size of the share repurchases immediately because the announcement is disseminated electronically and includes: 1) the repurchase date, 2) the number of shares repurchased, and 3) the price paid or the highest and lowest prices paid. Second, an open-market repurchase price cannot exceed 5% of the average price of the stock for five business days prior to the repurchase day. This price restriction limits the ability of UK firms to manipulate prices upward by repurchasing shares (Kim, Schremper, and Varaiya, 2005). Third, shares repurchased before December 1, 2003

have to be cancelled and cannot be used to fund employee share schemes or trusts. This restriction limits other potential explanations for abnormal returns on repurchase announcement days (Oswald and Young, 2004a). Finally, the Listing Rules prohibit a firm from repurchasing shares during the one- or two-month 'close periods' before preliminary announcements of interim (and final) operating results. These close periods may help deter UK firms from exploiting information asymmetry between insiders and investors (Rau and Vermaelen, 2002).

Several studies demonstrate that repurchase intention announcements attract positive abnormal returns (Netter and Mitchell, 1989; Comment and Jarrell, 1991; Singh et al., 1994; Ikenberry et al., 1995; McNally, 1999; Kahle, 2002; Rau and Vermaelen, 2002; Oswald and Young, 2004b), but provide no consensus as to what information the announcements actually contain. For example, Netter and Mitchell (1989), Bartov (1991), Comment and Jarrell (1991), McNally (1999), and Lie (2005) favor the information-signaling hypothesis, whereas Jagannathan and Stephens (2003), Grullon and Michaely (2004), and Li and McNally (2007) favor the free cash flow hypothesis. This disagreement may be due to the uncommitted nature of repurchase intention announcements (Lie, 2005), or may be due to difficulties in forecasting the number or value of shares actually to be repurchased following each announced intention (Stephens and Weisbach, 1998; Jagannathan et al., 2000). Moreover, firms may simply announce repurchase intentions to mimic competitors that have previously made such announcements (Massa et al., 2007). Consequently, it is the actual repurchase announcements and not the repurchase intention announcements that are correlated with changes in systematic risk and operating performance (Wang and Johnson, 2005; Lie, 2005). Thus, although repurchase intention announcements deliver favorable information to the market, it is the announcements of actual share repurchases that provide additional and more reliable information for investigating the reasons for share repurchases as they are perceived

by market participants. Despite this, the market reactions to actual repurchases have been examined only by Rees (1996) for UK firms and by Zhang (2005) for Hong Kong firms.

It is difficult to test abnormal returns around actual share repurchase announcements because they tend to repeat, with small, irregular intervals between consecutive announcements. In addition, announcements by different firms occur on the same day, causing the traditional event clustering problem. Rees (1996) pools return data for 105 firms from 1983-1990, regressing abnormal returns on 11 dummy variables covering an 11-day period centering on the announcement day. His results demonstrate that for unadjusted and market adjusted returns, there is a small, but significant announcement day abnormal return of 0.236% and 0.260%, respectively.[3] To control for event clustering, Rees (1996) uses an approximate randomization technique to confirm his tests of significance. However, Rees' (1996) explanation of this procedure is brief, and he does not explain the announcement day abnormal returns.

Zhang (2005) finds that the market reacts more favorably to repurchase execution announcements by small and value (high book-to-market) firms. He interprets that this finding is due to the fact that these firms are more likely to be subject to market mispricing. Zhang (2005) collects 3,628 announcements released by 135 Hong Kong firms from September 1993-August 1997, but considers only the first announcement of each firm in any given month. That is, he tests only 22.05% of all possible announcements (800 of 3,628) because the remaining 77.95% occur later in the month and are excluded from his sample. In addition, Zhang (2005) barely mentions the clustering issue; therefore event clustering problems may be affecting Zhang's tests of significance.

[3] Rau and Vermaelen (2002) argue that Rees' (1996) results are not comparable to the 3.5% positive abnormal return around repurchase intention announcements found for U.S. firms because UK firms implement repurchase programs through actual repurchases spread over several weeks or months.

III. Sample Selection

We collect actual share repurchases announced by all UK listed firms from September 1997-July 2003 quoted on the database Company REFS, published by HS Financial Publishing Ltd (formerly Hemmington Scott Ltd). Each listing contains an announcement date, a repurchase price, and the number of shares repurchased. We verify more than 3% of the 9,020 buyback announcements by checking the original disclosures of the firms. The data documented in Company REFS are found to accurately reflect the original announcements.

Table I summarizes our five sample selection criteria. First, we examine only the announcements of ordinary share repurchases. Second, announcements must contain the announcement date, the repurchase price, and the number of shares repurchased. Third, we exclude firms without Datastream codes. Fourth, following Lie (2005) and Hribar, Jenkins, and Johnson (2006), we exclude closed end investment trusts. Finally, similar to Rees (1996) and Cook, Krigman, and Leach (2004), we exclude announcements with a ratio of actual repurchase price to unadjusted closing price outside the range of 0.8772-1.0874 on the announcement day in order to reduce potential errors in reported repurchase prices. In addition to these five criteria, we delete 337 announcements that are subsequent announcements by the same firms on the same day. As a result, our final sample includes 5,500 repurchase execution announcements released by 316 UK listed firms.

Insert Table I about here.

Because the 5,500 announcements of actual share repurchases of our sample were released by UK firms over a period of 1,494 trading days (from September 1, 1997-July 31, 2003), it is obvious that announcements by different firms occurred on the same day. This introduces the possibility of cross-correlation of abnormal returns (Collins and Dent, 1984;

Sefcik and Thompson, 1986; Bernard, 1987), and incorrect inferences can occur if this issue is not accounted for.

This is highlighted in Table II which illustrates the clustering problem within and across firms with the reporting of the distribution of the 5,500 announcements. Only 61 firms (19.3%) release a single announcement over the sample period, whereas 120 firms (37.9%) released at least 10 announcements over the same period. In terms of the time lag between consecutive announcements, 2,469 (44.8%) announcements were released on the trading day following a prior announcement, and 4,175 (75.9%) announcements were released within five trading days of a prior announcement. This finding is generally consistent with that of Rees (1996). In his sample of 882 repurchase execution announcements, 359 (604) announcements, or 40.7% (68.5%) of his sample, were released within 5 (30) days of a previous announcement. The above findings confirm that within firms, there is a clustering of repurchase execution announcements and this must be addressed in the statistical design of the study.

Table II also indicates that announcements of repurchase executions cluster across firms. Of the 1,494 trading days in the sample period, 155 days (10.3%) have no announcements at all, 1,079 days (72.2%) have between two and ten repurchase announcements released by different firms, and 81 days (5.4%) have at least ten firms announcing their actual share repurchases on the same day. At the extreme, 19 different firms made repurchase announcements on April 1, 2003. These findings demonstrate that actual share repurchase announcements by different firms overlap (cluster) to various degrees.

Insert Table II about here.

IV. Research Methodology and Hypothesis Development

We find that the announcements of actual share repurchases in the UK cluster both within and across firms. To mitigate the clustering problem and to extend the studies of Rees (1996) and Zhang (2005), we apply a modified version of Gibbons' (1982) multivariate regression model (MVRM) to estimate abnormal returns and their standard errors. Several studies advocate the MVRM (e.g., Schipper and Thompson, 1983; Binder, 1985a, 1985b; Salinger, 1992; Acharya, 1993) or apply the MVRM (Schipper and Thompson, 1983; Hughes and Ricks, 1984; Malatesta and Thompson, 1985; Sefcik and Thompson, 1986) to incorporate cross-sectional correlations into hypothesis testing.

In our study, each firm has a unique set of repurchase execution announcements. When compared with the traditional MVRM, in which all firms subject to a common external event have the same regressors, Zellner's (1962) seemingly unrelated regression (SUR) generates the same slope coefficients of abnormal returns as ordinary least squares (OLS). Thus, there is no improvement in efficiency by using the traditional MVRM when the explanatory variables are the same for different regression equations (Binder, 1985b). However, by using a modified MVRM, we are able to efficiently estimate both the coefficients of abnormal returns and their standard errors as each firm has a unique set of dummy variables indicating the firm-specific repurchase execution announcements of the firm. We specify the modified MVRM as:

$$\begin{aligned} R_{1t} &= \alpha_1 + \beta_1 R_{mt} + \sum_{n=0}^{S} b_{1n} D_{1,n,t} + \varepsilon_{1t} \\ &\vdots \qquad\qquad \vdots \qquad\qquad \vdots \\ R_{it} &= \alpha_i + \beta_i R_{mt} + \sum_{n=0}^{S} b_{in} D_{i,n,t} + \varepsilon_{it} \\ &\vdots \qquad\qquad \vdots \qquad\qquad \vdots \\ R_{Mt} &= \alpha_M + \beta_M R_{mt} + \sum_{n=0}^{S} b_{Mn} D_{M,n,t} + \varepsilon_{Mt} \end{aligned} \tag{1}$$

where R_{it} is firm *i*'s return on day *t*; R_{mt} is the FTSE All-Share Index return on day *t*; $t = 1, 2, \ldots, T$ is each distinct trading day in the data period; $D_{i,n,t}$ is a dummy variable equal to one if day *t* is *n* days from a repurchase execution announcement of firm *i*, and 0 otherwise; and *S* is the number of trading days after an announcement.[4] *M* is the number of firms; α_i and β_i are market model parameters; $b_{in}, i = 1, \ldots, M; n = 0, \ldots, S$ are an estimate of average abnormal returns; and ε_{it} is an error term.[5]

We use two proxies, Tobin's *q* and the size of share repurchases, to distinguish between the free cash flow and the information-signaling hypotheses. Lang and Litzenberger (1989) illustrate how Tobin's *q* can be used as a proxy for a firm's investment strategy. They argue that because conflicts of interest over payout policies are more severe for firms with overinvestment problems, cash payouts made by these firms should attract more favorable abnormal returns. When the firms distribute excess cash to shareholders, the likelihood that the firms will invest in negative NPV projects is reduced (Jensen, 1986) and/or managers are more likely to succumb to the monitoring discipline of the market (Easterbrook, 1984). Thus, we accept the free cash flow hypothesis if the market reacts asymmetrically to share repurchases by firms with and without overinvestment problems.[6]

Many studies have applied the methodology of Lang and Litzenberger (1989) to the analysis of tender offer share repurchases (Howe, He, and Kao, 1992; Perfect, Peterson, and

[4] When measuring distinct abnormal returns on each announcement day, we let *n* equal 1, 2, …, S_i, which is the number of announcements by firm *i* during the data period, and $D_{i,n,t}$ equal 0 if day *t* is the *n*th announcement of firm *i*. However, we cannot apply this method to find distinct abnormal returns on the announcement day and on the following day for each announcement because a firm may make repurchase execution announcements on consecutive trading days. The dummy variable identifying the second announcement is identical to the dummy variable identifying the day following the first announcement. We measure average abnormal returns over a two-day event period (the announcement day and the following day) for each announcement to confirm the robustness of our results.

[5] It is, here, an average abnormal return as a firm may have made more than one repurchase execution announcement during the data period.

[6] This argument does not exclude the possibility that firms that do not have overinvestment problems still make actual share repurchases. However, the free cash flow hypothesis predicts that the market reacts negatively (positively) to repurchase announcements by firms without (with) overinvestment problems.

Peterson, 1995; Nohel and Tarhan, 1998). However, to our knowledge, no studies have used Tobin's *q* to test how investors interpret the reasons for open-market repurchase execution announcements. We measure Tobin's *q* for each repurchase execution announcement as

$$\text{Tobin's } q_i = \frac{MV_i + DEBT_i}{ASSETS_i} \tag{2}$$

where MV_i is firm *i*'s equity market value (Datastream Item MV) one day before the repurchase execution announcement; $DEBT_i$ is firm *i*'s book value of debt calculated as the book value of total assets (Datastream Item 392) minus the book value of equity (Datastream Item 305) at year-end before the announcement; and $ASSETS_i$ is the book value of total assets of firm *i* at year-end before the announcement.[7] Our proxy for investment opportunities is similar to that used by Chung and Pruitt (1994), Chen and Ho (1997), Carroll, Griffith, and Rudolph (1998), Friday, Howton, and Howton (2000), Kohers and Kohers (2001), and Broussard, Buchenroth, and Pilotte (2004).

When there is more than one share repurchase during a year, we deduct the cumulative value of the share repurchases made in the previous announcements from both MV_i and $ASSETS_i$ for each subsequent share repurchase. The deduction of the cumulative value of shares repurchased and the use of MV_i one day before the announcement are intended to mitigate the concern that Tobin's *q* is stable for a firm's several repurchase execution announcements in the same year.

Information-signaling models hypothesize that payout increases (decreases) convey favorable (unfavorable) information about future cash flow as higher cash payouts indicate

[7] We also calculate two adjusted forms of Tobin's *q*: an industry and a market adjusted Tobin's *q*. The industry adjusted Tobin's *q* is the ratio of the unadjusted Tobin's *q* to the industry median of the non-repurchasers' Tobin's *q* in the announcement year. Industry groups correspond to Datastream's Level 4 industrial classification. Similarly, the market adjusted Tobin's *q* is the ratio of the unadjusted Tobin's *q* to the market median of non-repurchasers' Tobin's *q*. We do not present the robustness checks, but the results are consistent and available upon request.

the confidence of managers in the future and increase signaling costs, thereby discouraging financially troubled firms from making similar cash disbursements. Consequently, if the information-signaling hypothesis best explains the abnormal returns around actual share repurchases, there should be a positive relation between abnormal returns and repurchase size. We compare the percentage of shares repurchased with the overall median percentage over the previous 12 months to avoid hindsight bias, and divide the 4,968 announcements into those with a repurchase size greater than or smaller than the median size over the previous 12 months.[8]

Although actual share repurchases confirm the timing and size of actual cash payouts, these repurchase announcements are released in a repeated and irregular fashion. To test the information-signaling and free cash flow hypotheses, it is necessary to control for this unusual pattern. We predict that if the announcement of actual share repurchases contains new information, then the longer the time elapsed since a previous announcement of actual share repurchase, the greater the information content of this actual repurchase announcement (Rees, 1996). Time lag, therefore, is the control variable, and a positive association between abnormal returns and the time lag (measured in days) is consistent with both the free cash flow hypothesis and information-signaling hypothesis.

V. Empirical Results

Table III demonstrates that the average abnormal returns on the day following the actual repurchases range from 0.032% (0.092%)-1.33% (0.507%) over the sample period.[9]

[8] We lose 532 announcements occurring in the first 12 months (September 1997-August 1998) of the sample period because they have no comparison benchmark. We use two other measures of unexpected cash payout. First, we use the total percentage of shares repurchased as the unexpected change in cash payout. Second, we measure the difference in percentage of outstanding shares repurchased between one announcement and the previous announcement for the same firm. The results from these different payout measures are similar and available on request.

[9] We separate the sample period into seven calendar years, 1997-2003, to avoid missing observations. In SUR, each regression equation in a system needs to have the same number of observations. If one of the regression

These are much smaller than the average market reaction to the initial repurchase intention announcements. All of these abnormal returns are statistically significant except for announcements in 2003. The results are robust as the *t*-statistics of Zellner's (1962) SUR account for the effect of heteroskedasticity across equations and contemporaneous dependence in the disturbances.

Insert Table III about here.

The abnormal returns are predominantly positive and the positive returns outnumber the negative abnormal returns in all years except 2003.[10] This finding remains unchanged when we extend the test period to an 11-day window centered on repurchase execution announcements following Rees (1996).[11] The above results indicate that the actual share repurchase announcements convey favorable information to the market beyond that which is available in the initial repurchase intention announcements.

To further test the observed significant abnormal returns around actual share repurchases, Table IV reports the results partitioned by Tobin's *q*, the size of the share repurchase, and the time lag since a previous repurchase.[12] We divide the 4,968 announcements into three groups and report their results separately in three panels and for two subsamples based on whether the time lag equals one or is greater than one. We further divide each panel into two subgroups according to whether the percentage of shares actually

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equations has a missing value, SUR takes the corresponding observations of the other regression equations as missing. We exclude 224 announcements by 17 firms because of insufficient return data.

[10] Many factors may contribute to the exceptional results in 2003. First, the time lag between consecutive announcements is shorter in 2003 than in other years, and it has been found that the information content increases as the time lag between consecutive announcements increases (Rees, 1996). Second, firms may have had more investment opportunities in 2003 than in other years. The average daily return of the FTSE All-Share Index is positive in 2003, but is negative in the previous three years. Third, repurchase behavior in 2003 may be different from that in the other years due to the expectation that shares repurchased after December 1, 2003 could be held as treasury shares for resale.

[11] We do not report these robustness checks here, but they are available upon request.

[12] Note that 532 announcements occur in the first 12 months (September 1997-August 1998) of the sample period, and are excluded as there is no comparison benchmark.

repurchased is greater or less than the median of the previous 12 months. Finally, we divide firms into two groups based on the results of Tobin's *q*: 1) those with high Tobin's *q* in one group and 2) those with low Tobin's *q* in the other. For each group of announcements partitioned by Tobin's *q*, repurchase size, and time lag, we test whether the average abnormal return is significantly different from zero. We test the free cash flow hypothesis by examining the difference in abnormal returns between announcements for firms with high and low Tobin's *q*, and test the information-signaling hypothesis by examining the difference in abnormal returns between announcements for large and small payouts.

Insert Table IV about here.

Table IV demonstrates that consistent with the free cash flow hypothesis, the average abnormal returns on the day following share repurchases are higher for firms with lower Tobin's *q* in every panel and every group.[13] Differences in the average abnormal returns between firms with and without overinvestment problems are significant at the 1% level, except for the subsample in which the repurchase announcements occur on the day following a previous announcement (i.e., when the time lag is one) and the repurchase size is smaller than the median. These findings suggest that the market welcomes cash payouts in the form of share repurchases by firms with overinvestment problems. Our results, however, do not support the information-signaling hypothesis, as larger repurchases do not appear to attract higher abnormal returns than do smaller ones. Interestingly, the market punishes share repurchases made by firms with high Tobin's *q*, both for larger repurchases on consecutive

[13] Table IV also indicates a large percentage (75.87%) of actual share repurchases made by firms with good investment opportunities (i.e., Tobin's $q > 1$). With profitable investment opportunities, these firms do not appear to have excess cash flow to return to shareholders via share repurchases. However, firms may repurchase shares for many reasons (see Dittmar, 2000). That high *q* firms buy back their own shares does not contradict the free cash flow hypothesis, which predicts a positive (negative) market reaction to cash payouts of overinvesting (underinvesting) firms.

days and for smaller nonconsecutive repurchases. This negative relation between market reaction and Tobin's *q* is consistent with the argument that some firms forgo value creating investment opportunities in order to repurchase shares (Marsh, 1990; Chung, Wright, and Charoenwong, 1998; Bens, Nagar, and Wong, 2002). Future study is needed to determine whether managers tend to invest excess free cash flow in share buybacks instead of in profitable investment projects.

Table IV provides further evidence that supports the free cash flow hypothesis. First, firms with low (high) Tobin's *q* tend to announce repurchase sizes greater (smaller) than the median repurchases for the previous 12 months. The correlation between indicators of Tobin's *q* smaller than one and repurchase size greater than the median for the previous 12 months is 0.296, which is significant at the 1% level. Second, there is a longer time lag between announcements by firms with low Tobin's *q*, whereas announcements by firms with high Tobin's *q* tend to occur on the trading day following prior announcements. The correlation between indicators of Tobin's *q* smaller than one and a time lag equal to one is −0.238, which is significant at the 1% level.

The use of Tobin's *q* as the proxy for over and under investment may suffer from the problem that most firms under invest because the Tobin's *q* is close to the market-to-book ratio and tends to be greater than one. Although our measurement of Tobin's *q* is 96.6% consistent with Tobin's *q* estimated by the more theoretically correct model of Lindenberg and Ross (1981) (see Chung and Pruitt, 1994), Table V reports the robustness of Table IV by separating the sample into three groups and testing the difference in abnormal returns between the highest and lowest *q* groups.

Insert Table V about here.

The results in Table V are somewhat weaker than those in Table IV, but still support the free cash flow hypothesis in two different ways. First, a greater payout size seems to attract higher abnormal returns for the lowest *q* group. Second, the market welcomes (punishes) increases (decreases) in payout size for the low *q* group, when the time lag between consecutive announcements is fixed (i.e., a time lag equal to one). These findings indicate that the market reacts more favorably to greater cash payouts via repurchases made by firms with overinvestment problems.

Table VI reports the descriptive statistics and results for the cross-sectional OLS regression:

$$AR_i = \beta_0 + \beta_1 QDUM_i + \beta_2\ PSIZE_i + \beta_3\ Q_i \cdot PSIZE_i + \beta_4 TLAG_i + \varepsilon_i \qquad (3)$$

where AR_i is firm *i*'s abnormal return on the day of the actual share repurchase, estimated from Gibbons' (1982) MVRM; $QDUM_i$ is a dummy variable equal to one if Tobin's *q* is smaller than one, and 0 otherwise; $PSIZE_i$ is a dummy variable equal to one if the repurchase size is greater than the median over the past 12 months, and 0 otherwise; $Q_i \cdot PSIZE_i$ is the interaction of $QDUM_i$ and $PSIZE_i$; and $TLAG_i$ is the log of the number of trading days since a prior announcement.

Table VI demonstrates that $Q_i \cdot PSIZE_i$ is highly correlated with $QDUM_i$, and the Pearson correlation between the two variables is 0.808, which is significant at the 1% level. The correlation between $Q_i \cdot PSIZE_i$ and $PSIZE_i$ is also high and significant. A high correlation between regressors inflates standard errors, reducing the significance levels of the three variables $Q_i \cdot PSIZE_i$, $QDUM_i$, and $PSIZE_i$. To mitigate collinearity problems, we drop $Q_i \cdot PSIZE_i$ from one of the five regressions in Table VI and report this result under

Model (1).

To avoid possible missing variables, we add three groups of control variables in the regression. First, Model (3) includes 471 dummy variables to identify 472 firm-years with share repurchases. Because a firm tends to make more than one share repurchase in a year, unknown firm characteristics are likely to affect the market reactions in that year. In addition to the firm-year dummy, five dummies are included in Model (4) to identify six calendar years in the sample period. Finally, if previous repurchases contain more information than do subsequent repurchases, then the sequence of announcements is important. Therefore, in Model (5), we assign a sequence of dummy variables to every announcement subsequent to the first announcement in a firm-year. A maximum of 133 announcements by the same firm occurs in a firm-year. With more control variables, the adjusted R^2 increases considerably from 0.01 in Models (1) and (2) to 0.04 or 0.05 in Models (3) to (5).

Insert Table VI about here.

The cross-sectional OLS regression reported in Table VI shows that $TLAG_i$ is positive and significant, suggesting that the market responds more favorably the longer the time is that has elapsed since a previous buyback. This positive coefficient also implies that the actual share repurchase announcements can convey new information to the market in addition to that contained in repurchase intention announcements. However, nearly half (48.19%) of the 4,968 announcements occur one trading day following a previous announcement (i.e., there are 2,394 $TLAG_i$ s equal to 0; the average time lag in trading days is 18.3). Because observations in the regression are individual announcements, the overall results suggest that when firms make consecutive buybacks, there is less information content.

Table VI also provides clear evidence to support the free cash flow hypothesis through

the proxy for investment problems. $QDUM_i$, the proxy for firms with overinvestment problems, is equal to one when Tobin's $q < 1$, and is positive and highly significant in all the five models. This implies that cash payouts by overinvesting firms are viewed positively by shareholders as the actual share repurchases curb value destroying investment activities. Moreover, the coefficient for $Q_i \cdot PSIZE_i$ is positive, indicating that the market reacts more favorably to announcements with greater repurchase size only when firms have overinvestment problems.[14]

Overall, our empirical evidence suggests that actual share repurchases provide information beyond that which is available in the initial repurchase intention announcements and that they increase firm value by reducing the agency costs of excessive free cash flow. We do not find evidence supporting the information-signaling hypothesis because $PSIZE_i$ appears to be negatively associated with abnormal returns on the day following the announcement day.

VI. Conclusion

We examine the market reaction to announcements of actual share repurchases in order to investigate how market participants respond to the actual share repurchases after the initial repurchase intention announcements. To extend previous studies, we use a modified multivariate regression model to address issues of repurchase announcement clustering. We use actual share repurchases disclosed by UK firms from September 1997-July 2003 to obtain accurate details of cash payouts, repurchase timing, and size. Our empirical results support the free cash flow hypothesis. We find that the average market reaction to actual share

[14] The sum of the coefficients for *PSIZE* and *Q·PSIZE* is insignificant ($t = 0.480$). This, together with the significantly positive coefficient for *QDUM*, suggests that a cash payout per se creates value, but the size of payout does not matter for overinvesting firms. A possible explanation is that a cash payout per se represents the concession of managers to overinvestment problems. However, the size of the payout is less important for low *q* firms since firms can repurchase more shares on the open market any time.

repurchase announcements is positive and significant for firms with overinvestment problems, as indicated by their low Tobin's *q*'s.

Our results do not support the information-signaling hypothesis, because larger payouts for actual share repurchases do not convey more favorable information to the market. Further, we find that the market actually penalizes firms with high Tobin's *q*s when they make consecutive repurchases and that the penalty increases with the size of the repurchases. The penalty for the greater payouts of high Tobin's *q* firms suggests that the market perceives managers as being financially negligent because they are shifting resources that could be used for profitable investments into share repurchases.

This study demonstrates a new way to test the market reaction to events clustering both within and across firms. In addition, this study raises several questions for future research. First, it is unclear why UK firms execute repurchases consecutively when the market reacts more favorably to isolated announcements. Second, it is unclear why UK firms with high Tobin's *q*'s continue to buy back their own shares when this action appears to be economically detrimental. Finally, share repurchases, under some circumstances, trigger negative abnormal returns. This is a phenomenon that neither the information-signaling nor the free cash flow hypotheses can explain.

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Table I. Summary of Sample-Selection Screening Results

This table summarizes the sample selection criteria and associated sample size. The sample period is September 1, 1997-July 31, 2003.

	Number of Announcements	Number of Firms
Original data from Company REFS	9,020	494
Less:		
Not ordinary share repurchases	183	26
No announcement date	1	1[a]
No repurchase price or volume data	17	11[b]
No Datastream code	274	2
Investment trusts	634	62
Implausible reported trading prices	1,836	67[c]
Subtotal	6,075	335
Less:		
Combined multiple announcements	337	112[d]
Less:		
No return and/or accounting data	238	19
Final sample	5,500	316

[a] This firm makes an announcement to correct a previous announcement.
[b] Nine of these firms make 14 announcements to correct or supplement their previous announcements.
[c] The ratio of the repurchase price per share to the unadjusted closing price on the announcement day is outside the range of 0.8772 to 1.0874.
[d] Different announcements released by the same firms on the same days.

Table II. Distributions of Sample Firms, Trading Days, and Announcements

This table reports the distribution of 5,500 repurchase execution announcements (events) released by 316 firms over the period from September 1, 1997-July 31, 2003 (1,494 trading days). Column 1 indicates the number of events or time lag in the days referred to in Columns 2–4. Column 2 reports the distribution of 316 firms based on number of announcements over the sample period. Column 3 reports the distribution of 5,500 announcements based on the time lag, which is the number of trading days since a prior announcement. Column 4 reports the distribution of trading days during the sample period based on the number of announcements on the same day.

Number	Firms with Different Numbers of Events	Events with Time Lags of Different Numbers of Days	Days with Different Numbers of Events
0	-	316 (5.74%)	155 (10.3%)
1	61 (19.3%)	2,469 (44.8%)	260 (17.4%)
2	30 (9.49%)	708 (12.8%)	228 (15.2%)
3	29 (9.17%)	335 (6.09%)	211 (14.1%)
4	16 (5.06%)	213 (3.87%)	166 (11.1%)
5	17 (5.37%)	134 (2.43%)	118 (7.89%)
6	11 (3.48%)	116 (2.10%)	111 (7.42%)
7	14 (4.43%)	75 (1.36%)	74 (4.95%)
8	11 (3.48%)	73 (1.32%)	48 (3.21%)
9	7 (2.21%)	63 (1.14%)	42 (2.81%)
$\geq$ 10	120 (37.9%)	998 (18.1%)	81 (5.42%)
Total	316	5,500	1,494

Table III. Average Abnormal Returns on the Day Following the Actual Share Repurchases

This table reports the results of seemingly unrelated regressions for a system of *M* equations (the number of firms) for each year from 1997-2003. Each of the *M* equations is $R_{it} = \alpha_i + \beta_i R_{mt} + b_{i0} D_{i,0,t} + b_{i1} D_{i,1,t} + \varepsilon_{it}$, where R_{it} and R_{mt} are the daily returns on firm *i* and on the FTSE All-Share Index, and $D_{i,0,t}$ ($D_{i,1,t}$) is a dummy variable equal to one if day *t* is a repurchase execution announcement day (the following day) of firm *i*, and 0 otherwise. The average coefficients are in percentages. The numbers in parentheses are the *t*-statistics from seemingly unrelated regressions that incorporate heteroskedasticity across equations and contemporaneous dependence in the disturbances.

Year	No. of Firms	No. of Events	No. of Days	Estimates of b_0				Estimates of b_1				$b_0 + b_1$
				Average Estimate	Percent Positive	Percent Significant at 5%		Average Estimate	Percent Positive	Percent Significant at 5%		Average Estimate
						Positive	Negative			Positive	Negative	
1997	25	87	86	1.334***	73.08	30.77	3.85	0.507**	57.69	11.54	0.00	1.842***
				(5.41)				(2.26)				(5.83)
1998	95	430	252	0.349***	51.58	18.95	11.58	0.442***	57.89	12.63	8.42	0.790***
				(2.70)				(3.42)				(4.43)
1999	91	766	252	0.288**	59.34	17.58	8.79	0.387***	59.34	15.38	9.89	0.675***
				(2.16)				(2.92)				(3.72)
2000	133	1,167	252	0.170**	53.38	22.56	11.28	0.315***	61.65	15.79	8.27	0.485***
				(2.05)				(3.82)				(4.39)
2001	81	806	253	0.421***	49.38	18.52	12.35	0.127	56.79	19.75	11.11	0.548***
				(3.24)				(0.98)				(3.08)
2002	100	1,347	252	0.218**	55.00	30.00	15.00	0.395***	69.00	26.00	13.00	0.613***
				(2.27)				(4.09)				(4.63)
2003	88	911	147	0.032	39.77	20.45	23.86	0.092	47.73	10.23	11.36	0.124
Total		5,514	1,494	(0.35)				(0.97)				(0.95)

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

Table IV. One-day Abnormal Returns for Groups Partitioned by Tobin's *q* (2-Group), Repurchase Size, and Time Lag

This table reports the results of 4,968 abnormal returns partitioned by Tobin's *q*, repurchase size, and time lag. The abnormal returns are relative to a set of market models with the dummy variables identifying announcement days in the period from September 1, 1997-July 31, 2003. Tobin's *q* is the ratio of the market value of equity one day before the announcement plus the book value of other securities to the book value of total assets at the year-end before the announcement. Repurchase size is the ratio of shares repurchased to outstanding shares one day before the announcement relative to the median over the previous 12 months. Time lag is the number of trading days since a prior repurchase execution announcement. This table reports the average percentage abnormal returns with the number of observations in parentheses. The test of significance is based on a two-tailed *t*-test.

		Repurchase Size Relative to 12-Month Median		Difference
	All Observations	> Median	< Median	Large – Small
	Panel A: All Announcements			
$q < 1.0$	0.342***	0.352***	0.317***	0.036
	(1,199)	(855)	(344)	
$q > 1.0$	–0.123***	–0.238***	–0.057	–0.181**
	(3,769)	(1,389)	(2,380)	
Difference (low q – high q)	0.465***	0.590***	0.373***	
	Panel B: Time Lag = 1			
$q < 1.0$	0.438***	0.488***	0.350	0.137
	(325)	(208)	(117)	
$q > 1.0$	–0.138***	–0.506***	0.016	–0.522***
	(2,069)	(608)	(1,461)	
Difference (low q – high q)	0.576***	0.994***	0.335	
	Panel C: Time Lag > 1			
$q < 1.0$	0.306***	0.309***	0.299**	0.010
	(874)	(647)	(227)	
$q > 1.0$	–0.106*	–0.029	–0.171**	0.142
	(1,700)	(781)	(919)	
Difference (low q – high q)	0.412***	0.338***	0.470***	

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

Table V. One-Day Abnormal Returns for Groups Partitioned by Tobin's *q* (3-Group), Repurchase Size, and Time Lag

This table reports the results of 4,968 abnormal returns partitioned by Tobin's *q*, repurchase size, and time lag. The abnormal returns are relative to a set of market models with the dummy variables identifying the announcement days in the period from September 1, 1997-July 31, 2003. Tobin's *q* is the ratio of the market value of equity one day before the announcement plus the book value of other securities to the book value of total assets at year-end before the announcement. Repurchase size is the ratio of shares repurchased to outstanding shares one day before the announcement relative to the median over the previous 12 months. Time lag is the number of trading days since a prior repurchase execution announcement. The table reports the average percentage abnormal returns with the number of observations in parentheses. The test of significance is based on a two-tailed *t*-test.

		Repurchase Size Relative to 12-Month Median		Difference
	All Observations	> Median	< Median	Large – small
	Panel A: All Announcements			
lowest q	0.134**	0.210***	0.012	0.198*
	(1656)	(1017)	(639)	
median q	–0.112*	–0.207***	–0.023	–0.184
	(1656)	(803)	(853)	
highest q	–0.055	–0.182	–0.012	–0.171
	(1656)	(424)	(1232)	
Difference (lowest *q* – highest *q*)	0.189**	0.393***	0.024	
	Panel B: Time Lag = 1			
lowest q	0.022	0.225	–0.145	0.370*
	(573)	(258)	(315)	
median q	–0.225***	–0.622***	0.049	–0.670***
	(806)	(329)	(477)	
highest q	0.026	–0.261*	0.110	–0.370**
	(1015)	(229)	(786)	
Difference (lowest *q* – highest *q*)	–0.004	0.486**	–0.255*	
	Panel C: Time Lag > 1			
lowest q	0.193***	0.205**	0.165	0.040
	(1083)	(759)	(324)	
median q	–0.005	0.082	–0.113	0.195
	(850)	(474)	(376)	
highest q	–0.184**	–0.090	–0.225**	0.135
	(641)	(195)	(446)	
Difference (lowest *q* – highest *q*)	0.378***	0.296	0.390***	

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

Table VI. Descriptive Statistics and Regression Analysis of Abnormal Returns

Panel A reports the Pearson correlation coefficients, means, medians, and standard deviations (SD) of explanatory variables and Panel B reports the results of the regression:

$$AR_i = \beta_0 + \beta_1 QDUM_i + \beta_2 PSIZE_i + \beta_3\, Q \cdot PSIZE_i + \beta_4 TLAG_i + \varepsilon_i$$

where AR_i is the abnormal return on the announcement day of an actual share repurchase estimated from Gibbons' (1982) MVRM. $QDUM_i$ is a dummy variable equal to 1 if Tobin's *q* is smaller than 1, and 0 otherwise. $PSIZE_i$ is a dummy variable equal to one if the percentage of outstanding shares repurchased in an announcement is greater than the median over the previous 12 months, and 0 otherwise. $Q_i \cdot PSIZE_i$ is the product of $QDUM_i$ and $PSIZE_i$. $TLAG_i$ is the log of the number of trading days since a prior announcement. The firm-year (calendar-year) dummy identifies the announcement(s) in different firm-years (calendar year). The sequence dummy identifies the order of a firm's several announcements in a firm-year. The regression has 4,968 observations. Numbers in parentheses are the *t*-statistics.

Panel A: Descriptive Statistics

	PSIZE	***Q PSIZE***	***TLAG***	**Mean**	**Median**	**SD**
QDUM	0.296***	0.808***	0.271***	0.241***	0.000***	0.428
PSIZE	1	0.502***	0.283***	0.452***	0.000***	0.498
Q PSIZE		1	0.281***	0.172***	0.000***	0.378
TLAG			1	1.103***	0.693***	1.498

Panel B: Regression Analysis of Announcement Day Abnormal Returns

Regressor	**Predicted Sign**	**Model**				
		(1)	(2)	(3)	(4)	(5)
Intercept		–0.126***	–0.108**	–1.907*	–1.854	–1.843
		(–2.68)	(–2.23)	(–1.66)	(–1.37)	(–1.59)
QDUM	+/–	0.452***	0.317**	1.086***	1.100***	1.055***
		(5.61)	(2.40)	(3.75)	(3.79)	(3.63)
PSIZE	+/–	–0.189***	–0.236***	–0.346***	–0.351***	–0.357***
		(–2.72)	(–3.02)	(–3.43)	(–3.45)	(–3.49)
Q PSIZE	+/–		0.213	0.183	0.177	0.225
			(1.30)	(0.89)	(0.86)	(1.09)
TLAG	+	0.083***	0.082***	0.072**	0.071**	0.057*
		(3.61)	(3.60)	(2.51)	(2.50)	(1.81)
471 Firm-Year Dummies				Yes	Yes	Yes
5 Calendar-Year Dummies					Yes	
132 Sequence-Order Dummies						Yes
R^2		0.011	0.011	0.140	0.140	0.167
Adjusted R^2		0.010	0.011	0.049	0.048	0.051
F Stat.		18.39***	14.21***	1.53***	1.52***	1.44***

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.