



Mimicking repurchases[☆]

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Received 22 March 2005; received in revised form 17 January 2006; accepted 24 February 2006

Available online 9 February 2007

Abstract

We study the tendency of firms to mimic the repurchase announcements of their industry counterparts. We argue that a firm, by repurchasing its shares, sends a positive signal about itself and a negative one about its competitors. This induces the competing firms to mimic the behavior of the repurchasing firm by repurchasing themselves. Using a broad sample of US firms from the period 1984–2002, we show that, in concentrated industries, a repurchase announcement lowers the stock price of the other firms in the same industry. The other firms react by repurchasing themselves to undo these negative effects. Repurchases are chosen as a strategic reaction to other firms' repurchase decisions and are not motivated by the desire to time the market, i.e., to take advantage of a significantly undervalued stock price. Therefore, repurchasing firms in more concentrated industries experience a lower increase in value in comparison with their counterparts in less concentrated industries in the post-announcement era. Alternative methodologies used to estimate long-term performance confirm that it is only the repurchasing firms in low concentration industries that outperform the market, their non-repurchasing peers, and their counterparts in more concentrated industries by amounts that are economically and statistically significant.

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JEL Classification: G35; G32

Keywords: Payout policy; Repurchases; Product market competition; Signaling

[☆]We are grateful to Amy Dittmar, Roman Inderst, Evgeny Lyandres, Bill Schwert (the editor), an anonymous referee, and seminar participants at 2005 European Finance Association meetings, the 2005 European Financial Management Association meetings, and the 2006 Western Finance Association meetings for helpful comments and suggestions. Zahid Rehman gratefully acknowledges the financial support of the Institute of International Finance. All remaining errors are our own.

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1. Introduction

Repurchases have been an intensely studied topic in finance. On average, the prices of firms that announce a stock repurchase program increase significantly in the short run (e.g., Dann, 1981; Vermaelen, 1981) and in the long run (e.g., Ikenberry, Lakonishok, and Vermaelen, 1995). The most common explanation for the short-term abnormal returns is that the repurchase announcement is a positive information signal or that it reflects the benefits from a reduction in the agency costs of free cash flow. The long-run excess returns are consistent with the market timing hypothesis, i.e., the idea that managers can benefit long-term shareholders (including themselves) by buying back stocks when these are undervalued. This paper differs from the existing literature as it shows that an open-market share repurchase announcement provides information not only about the repurchasing firm but also about its competitors. These competitors are aware of the information externality of their rival's repurchase decision and react by repurchasing themselves. We provide evidence on this dimension of repurchases and analyze its implications for the stock price drift of the firm in the post-announcement period.

Previous research has shown the ability of the market to infer something about the firm's rivals based on various firm actions such as mergers, dividend payments, earnings announcements, initial public offerings (IPOs) and announcements of financial distress.¹ In this paper we focus on share repurchases. Past research on the impact of share repurchases on rival firms is inconclusive. While Akhigbe and Madura (1999) report a positive reaction of a repurchase announcement on the share price of non-repurchasing product market rivals, a negative reaction is reported by Erwin and Miller (1998) and Hertzell (1991) finds no effect at all. We show a negative impact of a share repurchase on the price of other firms in the same industry and go a step further by showing how firms react to repurchases of their industry counterparts thereby relating to the literature on strategic reaction (Rajan, 1994; Acharya and Yorulmazer, 2004; Servaes and Tamayo, 2004).

We argue that a stock repurchase affects positively the stock price of the repurchasing firm and negatively the price of the other competing firms in the same industry. As a firm repurchases, it generates expectations that the other firms within the same industry will also repurchase. If they do not, the market interprets it negatively and attributes the lack of the repurchase announcement to worse economic prospects and a weaker competitive position with respect to the repurchasing firm. This induces the other firms in the industry to repurchase, not to take advantage of a significantly undervalued stock price (as predicted by the market timing hypothesis), but simply to correct the negative market perception by mimicking the behavior of their competitors. As a result, repurchases acquire a hitherto unexplored mimicking dimension. This mimicking dimension is related to the degree of strategic interaction within the industry: The higher the interaction, the greater the perceived deterioration in the competitive positions of rival firms and the stronger the effect. If we proxy for the degree of strategic interaction with the degree of concentration in the product market, we expect firms to be more likely to initiate

¹See, for example, Eckbo (1983), Rajan (1994), Lang and Stulz (1992), Acharya and Yorulmazer (2004), Servaes and Tamayo (2004), Hoberg and Qiu (2005), and Laux, Starks, and Yoon (1998).

repurchases as a reaction to the repurchases of the other firms in the same industry, the more concentrated the industry is.²

If repurchases are chosen mostly as a reaction to other firms' repurchase decisions, firms that repurchase shares for mimicking reasons will experience, on average, lower increases in value in the post-repurchase announcement period. Indeed, in a concentrated industry, a repurchase initiated as a reaction to the repurchases of other firms might have no direct link with the degree of undervaluation of the firm, other than the undervaluation resulting from the repurchase announcement by a competitor. In a competitive industry, instead, a repurchase is more likely to be initiated if the firm sees a large gap between its current stock price and its perceived true value. Therefore, repurchasing firms in more concentrated industries should, in the long run, experience a lower increase in value than those in less concentrated industries.

This mimicking hypothesis (MH) is tested against an alternative "similarity" hypothesis (SH). The similarity hypothesis posits that repurchases are made by mature firms for which the stock market has already partially anticipated a decline in investment opportunities. Repurchases confirm the declining growth prospects of these firms but, at the same time, signal low agency problems for the repurchasing firm. Given that the decline in growth had already been partially priced, the positive signal regarding low agency problems prevails and determines an appreciation in the stock price of the repurchasing firms. For similar mature non-repurchasing firms located in the same industry, however, only the confirmatory signal about the decline in investment opportunities occurs, which leads to a depreciation in their stock price. These firms announce their own repurchase programs in the near future not because they are mimicking their rivals' behavior but because they face prospects similar to those of the firms that made earlier repurchase announcements.

Under this hypothesis, the post-announcement price drift of repurchasing firms is caused by the decrease in the systematic risk that occurs for mature firms resulting from declining growth opportunities. However, given that the earlier repurchases within the same industry by mature firms signal changes in the systematic risk for all the other similar firms in the industry, when these other firms repurchase at a later date, they do not experience a post-announcement drift because changes in their underlying characteristics have already been anticipated and priced. If concentrated industries contain repurchasing firms that are more mature than their counterparts in unconcentrated industries, repurchase announcements in concentrated industries should be accompanied by negative reactions on the share prices of non-repurchasing rival firms and should be more correlated. Moreover, within the set of concentrated industries, post-announcement drift should be smaller in those industries in which information flows within the industry at a faster speed because the market is quicker to impound the decline in the cost of capital for all the firms in that industry.

The underlying intuition of this alternative hypothesis is that mature firms within the same industry tend to act in similar ways because they share similar economic prospects. The mimicking hypothesis, instead, argues that there exists strategic interaction between

²In a recent survey on financial executives, [Brav, Graham, Harvey, and Michaely \(2005\)](#) provide some support for the hypothesis that the share repurchase policies of industry competitors could have a significant influence on the firm's own repurchase decision. In their Table 10, they report that 31% of firms that did not repurchase shares during the previous three years believe that the share repurchase policies of competitors are an important consideration when deciding to repurchase shares in the future. Although the survey does not condition on the level of competition in the industry, it nonetheless provides some anecdotal evidence for our findings.

firms operating in concentrated industries because of which firms get influenced by the actions of their competitors.

We carry out tests of the MH against the SH by using a broad sample of US firms for the period 1984–2002. As our measure of concentration, we use the Herfindahl Index constructed at the three-digit SIC classification level. We start by showing that there is no difference between the maturity of repurchasing firms located in either the concentrated or the unconcentrated industries. We then show the negative impact that the repurchase announcement of a firm has on the share price of other firms operating in the same industry. While, in the unconcentrated industries, the repurchase of a firm does not significantly affect the other firms, in the concentrated ones, the impact is significant and negative. For the non-repurchasing firms located in concentrated industries, in the three days surrounding the announcement, this externality amounts to approximately -0.4% . After a month, the effect can be as big as -2.04% , which is both economically and statistically significant. Because this result is robust to the control for maturity of the non-repurchasing firms, it provides evidence in favor of the MH and against the SH. On the whole, we employ ten different proxies to capture firm maturity, and in each case we fail to find any evidence relating the negative impact on the firm's share price caused by repurchase announcements of competitors to the firm's maturity.

We next test whether the repurchase of a firm is driven by the repurchase decisions of other firms in the same industry. We find that the decision to repurchase is directly affected by the repurchases of other firms in the same industry if the industry is concentrated. As the concentration of the industry increases, it becomes more likely that a firm repurchases shares if other firms are repurchasing shares. In particular, a one standard deviation increase in the interaction between the concentration of the industry and the number of repurchase announcements that took place in the industry over the previous six months increases the likelihood of another firm repurchasing by around 15%. Maturity of the firms does not play a role. Using a comprehensive set of proxies for maturity, we show that the correlation in repurchase activity tends to increase within both mature and non-mature firms in the industry as the industry becomes more concentrated.

The absence of the link between repurchases and the degree of undervaluation implies that repurchases in concentrated industries should generate less long-run value. We test this by conditioning on the degree of market competition and focusing on the long-term abnormal return. We use alternative methodologies: market-adjusted returns, returns across time and securities (RATS), and the calendar-time portfolio regressions (CTPR) using both value- and equal-weighted portfolios to capture the long-run performance of repurchasing firms. In the process, we control for the market, the three and four Fama and French (1993) factors (augmented with the Carhart, 1997, momentum factor in case of the four factor model) and comparable firms. The results are consistent across all the methodologies and robust to the alternative controls. Stocks of repurchasing firms in high concentration industries do not experience any significant long-run abnormal returns (over the 36 months following the announcements). This contrasts with repurchases in competitive industries that deliver an average long-run abnormal return of 25% over the 36 months following the announcement. Furthermore, no evidence linking the long-term drift to the speed of information flow within the industry or firm maturity is found.

In summary, all the findings support the mimicking hypothesis. Long-run abnormal returns emerge only in those cases in which repurchases are not chosen as a reaction to other firms' repurchases, i.e., in low concentration industries. These findings are robust to

controls for the quality of corporate governance, the extent of institutional ownership, and the level of information asymmetry.

We relate to previous literature showing how the behavior of a firm affects the other firms belonging to the same industry. For example, [Lang and Stulz \(1992\)](#) investigate the effect of bankruptcy announcements on the equity value of the bankrupt firm's competitors and show that the effect is significantly positive for highly concentrated industries with low leverage as competitors in such industries benefit from the difficulties of bankrupt firms. [Brewer and Jackson \(2000\)](#) report the inter-industry signaling effect of financial distress announcements by commercial banks on stock returns of life insurance companies and vice versa, while [Acharya and Yorulmazer \(2004\)](#) theoretically model these inter-bank effects. [Ecbko \(1983\)](#) and [Servaes and Tamayo \(2004\)](#) analyze effects of mergers and control threats, respectively, on other firms in the industry. [Foster \(1981\)](#) and [Baginski \(1987\)](#) provide evidence of inter-industry signaling effects for earnings announcements, while [Firth \(1996\)](#), [Howe and Shen \(1998\)](#), and [Laux, Starks, and Yoon \(1998\)](#) describe inter-industry signaling effects around dividend announcements. More recently, [DaDalt and Margetis \(2004\)](#) show inter-industry effects for earning restatements, which induce a significant decrease in market values of both the restating firms and their competitors. [Wasley \(2001\)](#) shows the impact of earnings pre-announcements on the competitors: The more positive (negative) the pre-announced earnings of announcing firms, the more positive (negative) the size-adjusted returns of non-announcing firms. [Hertzel, Li, Officer, and Rodgers \(2006\)](#) document wealth effects of financial distress for firms along the same supply chain, while [Hoberg and Qiu \(2005\)](#) show that IPOs within concentrated industries signal increasing competition and declining profitability for all firms in the industry.

The paper closest to ours is that by [Erwin and Miller \(1998\)](#). They show that rival firms experience significant negative stock price reactions on the day of a firm's repurchase announcements if the industry is concentrated. [Hertzel \(1991\)](#) looks at the impact of stock repurchase tender offers on rival firms and shows an insignificant return for rival firms. [Akhigbe and Madura \(1999\)](#), focusing on the banking industry, find a positive reaction on the share prices of non-repurchasing banks. They attribute this to the unique characteristics of the banking industry resulting from capital requirements and regulatory constraints.

Our results are relevant along many dimensions. First, they provide an initial bridge between the corporate finance of payout policies and the industrial organization structure in which the firm operates. We provide a first evidence of the circumstances in which firms choose their payout policy as a reaction to the policy of their competitors.

Second, our results shed some light on the reason why firms tend to cluster their repurchases and why we observe repurchases happening in waves. In concentrated industries, waves are the results of a signal mimicking strategy in which repurchasing is the optimal strategy if other firms in the same industry repurchase. In the less concentrated industries, instead, waves are the result of firms optimally choosing to repurchase because (financial) market conditions induce them to exploit the window of opportunity. The post-announcements drifts in the two groups show the economic implications of such behavior.

Third, our results help us to further understand the factors that could be responsible for the post-announcement drift of the repurchasing stocks. According to [Ikenberry, Lakonishok, and Vermaelen \(1995\)](#), this drift is pronounced only for low market-to-book (or value) stocks. We show a highly significant post-announcement drift for repurchasing stocks located in unconcentrated industries even when these stocks have been matched

with repurchasing stocks in concentrated industries on market-to-book value and size. Moreover, we find that the magnitude of this effect dwarfs the existing results based on just market-to-book value or other explanatory variables. Hence, the degree of strategic interaction plays a key role in determining as well as explaining the post-announcement drift, something which had been overlooked until now.

Finally, our results suggest an explanation for the strong cyclicality of repurchases. We know that changes in the firms' strategic interaction depend on the overall economic conditions. For example, Rotemberg and Saloner (1986) and Chevalier and Scharfstein (1996) argue that collusion is more difficult in booms when the incentive to cheat is greatest and that collusion is easier in recessions. In contrast, Bagwell and Staiger (1997) argue that collusion is easier in booms than during a recession. To the extent that the negative externalities created by repurchase announcements in high concentration industries are interpreted by rivals as aggressive behavior on the part of the repurchasing firms, these announcements would be seen as detrimental to the possibility of collusion. Given that the firms' ability to collude varies over the business cycle, the use of repurchases by firms in this mimicking manner would also vary over the business cycle.

The remainder of the paper is structured as follows. In Section 2, we consider our hypotheses and lay out the testable restrictions. In Section 3, we describe the data. In Section 4, we analyze the maturity of repurchasing firms, and in Section 5, we examine whether the market reacts differently to the repurchase announcements of firms depending on the degree of concentration of their industries. Section 6 provides evidence of the impact of a repurchase announcement on the share price of other non-repurchasing firms in the same industry. In Section 7, we study how the decision to repurchase is affected by the repurchases of other competing firms, while in Section 8, we analyze how the degree of concentration affects the long-run performance of repurchasing firms. A brief conclusion follows.

2. Hypotheses

In this section we lay out our working hypothesis, contrast it to the main alternative, and outline the empirical tests to distinguish between them. Both the MH and the SH start from the premise that the repurchase of a firm provides a signal about other firms in the same industry. The MH posits that the quality of the signal and the market reaction to it are a function of the degree of strategic interaction between the firms operating in the same industry. The higher the strategic interaction—i.e., the more concentrated the industry is—the stronger is the market reaction on the share price of non-repurchasing firms in the same industry. This is because, as a firm repurchases, it generates expectations that other firms within the same industry will also repurchase. If rival firms do not repurchase, the market interprets it negatively and attributes the lack of the repurchase announcement to worse economic prospects and a weaker competitive position with respect to the repurchasing firm. This leads to a negative stock price reaction for non-repurchasing firms in the industry and induces them to repurchase, thereby mimicking the behavior of their competitors to correct this negative market perception.

Under the MH, therefore, firms are more likely to initiate repurchases as a reaction to the repurchases of the other firms in the same industry, the more concentrated the industry is. This implies that, in a concentrated industry, a firm's repurchase might have no direct link with the degree of undervaluation of the firm. Therefore, repurchasing firms in more

concentrated industries should, in the long run, experience a lower increase in value in comparison with that experienced by repurchasing firms in less concentrated industries.

The alternative SH is based on the recent findings of Grullon and Michaely (2004). They provide evidence that repurchases tend to be made by maturing firms. For these firms, the market has already priced the slower expected future growth but is unsure about agency conflicts. The reaction to the repurchase announcement is positive because the agency conflict is reduced as a result of the payout. The long-run drift is explained by the fact that the market updates its beliefs slowly about the decline in the systematic risk of the firm.

Based on these findings, the SH posits that repurchases are made by mature firms. The stock market partially anticipates the decline in investment opportunities for these firms. As firms announce repurchases, they signal both that the market was right—the firms no longer require as much cash to fuel their growth prospects—and that the repurchasing firm will distribute that cash rather than waste it. Because the market has already partially anticipated the decline in growth, the confirming (negative) effect of the first part of the signal is swamped by the positive effect of the second aspect of the signal. For similar mature non-repurchasing firms located in the same industry, only the first part of the signal remains. This induces a positive stock price reaction for the repurchasing firm and a negative stock price reaction for similar non-repurchasing firms in the industry. Hence, we observe a more pronounced negative share price reaction for mature non-repurchasing rivals than for their non-mature rivals in the industry.

Given that mature firms share similar economic prospects of declining profitability and growth opportunities, the SH posits that their repurchasing activity is correlated. Finally, as more firms in the industry repurchase, the changes in these firms' systematic risk would get priced into all firms in the industry. This would be true especially for those industries within the set of concentrated industries in which information within the industry flows faster. Thus, when other firms in the same industry repurchase at a later date, they do not experience a drift as the changes in their underlying characteristics have already been anticipated and priced.

If concentrated industries contain firms that are more mature, then both the MH and SH would share some empirical predictions but the underlying rationale would still be very different. The SH argues that mature firms within the same industry share similar economic prospects while the MH argues that the existence of a limited number of firms in concentrated industries makes strategic interaction more likely because the decision to repurchase acquires a strategic dimension. Moreover, the interpretation of the firm's reaction is very different. The SH posits that similar firms in the same industry repurchase at the same time because their similar economic conditions induce them to act in this way. The MH, instead, posits that firms repurchase as a strategic reaction to the prior repurchases of other firms in the same industry. The MH considers a world in which the decision to repurchase is influenced or driven by the decision of a firm's product market rivals. The SH, instead, considers a world in which the repurchasing firms could be completely ignorant of the decisions of their rivals but could still end up making the same decisions.

Because the SH and MH yield similar predictions when concentrated industries are characterized by repurchasing firms that are more mature than the ones in unconcentrated industries, one way to distinguish the two theories is to compare the maturity of repurchasing firms located in concentrated and unconcentrated industries. If repurchasing firms located in concentrated industries are not more mature than their counterparts in

unconcentrated industries, the SH would not be able to predict either a negative reaction on the prices of non-repurchasing rivals or a higher correlation of repurchase activity in these industries.

Another way to distinguish the MH from the SH is to systematically consider and test all the different restrictions resulting from these hypotheses. We start with the effect of the repurchase announcement on the stock price of the repurchasing firm. The SH implies that a repurchase announcement conveys two opposing signals to the market. The first signal is negative as it confirms the lack of the firm's growth opportunities. The second one is positive as it signals the reduction in the firm's agency costs. For the repurchasing firm, the positive signal outweighs the negative one resulting in a net positive effect on the share price because of a repurchase announcement. However, given the similarity of the firms in the industry, the market impounds the negative signal of the decline in profitability into the prices of other non-repurchasing firms in the same industry. Hence, these firms experience a more positive share price reaction when they repurchase later because a part of the negative signal reflecting the decline in profitability has already been anticipated and priced by the market. In the unconcentrated industries, because firms are less similar, this anticipation by the market does not occur and, therefore, the strength of the negative signal is stronger for repurchasing firms. Hence, according to the SH, we would expect the share price reaction to repurchase announcements to be more positive, on average, for firms located in concentrated industries.

The MH, on the other hand, does not posit any difference in reaction between repurchasing firms in concentrated and unconcentrated industries because the repurchase announcement never conveys a signal of permanent decline in future growth opportunities for the repurchasing firms. These considerations allow us to formulate a first testable restriction.

(SH1a): *The market's reaction to a repurchase announcement is more positive for a firm located in a concentrated industry.*

(MH1a): *The strength of the share price reaction to the repurchase announcement does not depend on the concentration of the industry in which the firm is located.*

Furthermore, regardless of the maturity or similarity of firms, we expect that the effect of the repurchase on the firm's stock price should vary with the quality of governance of the firm in the case of the SH. Indeed, according to Grullon and Michaely (2004), even though a repurchase announcement sends a negative signal about the firm's profitability, it also signals, at the same time, a reduction in agency costs. Given that the impact of the signal depends on the market perception of the quality of governance of the firm, the SH posits the strength of the positive signal to be greater if the repurchasing firms have poor governance. No analogous effect is predicted by the MH. Therefore, a second way of distinguishing the SH and the MH that does not rely on firm maturity is to analyze the differences in the way the market reacts to repurchases depending on the quality of governance:

(SH1b): *The strength of the share price reaction to the repurchase announcement should be more positive for firms with poor governance than for firms with better governance.*

(MH1b): *The strength of the share price reaction to the repurchase announcement should not depend on the quality of governance of the firm.*

Let us now consider the impact on other firms in the same industry. The SH posits that maturing firms experience a change in investment opportunities and the repurchase provides a confirmatory signal about this perception. This signal should have a negative

impact on the value of mature non-repurchasing firms in the same industry at the time of the repurchase announcement. The MH, instead, posits that the ability of the market to use the repurchase as a useful signal to draw inferences about other non-repurchasing firms depends on the degree of strategic interaction within the industry. The higher the degree of strategic interaction within the industry, the greater would be the perceived deterioration in the competitive position of non-repurchasing rival firms, leading to a drop in their stock prices. If we proxy for strategic interaction by the degree of concentration in the product market, we expect the drop to be stronger the more concentrated the industry is.

The two hypotheses make similar predictions only if concentrated industries are made up of firms that are more mature than the ones located in unconcentrated industries. By identifying a few firms in each type of industry that are most like the repurchasing firm, we can determine whether the reaction on their price is driven by declining profitability or whether it is a phenomenon related to industry concentration. This allows us to formulate:

(SH2): *The negative reaction on share prices of non-repurchasing rival firms should be significant only for mature firms and should be insignificant for non-mature firms, regardless of the concentration of the industries in which these firms are located.*

(MH2): *The negative reaction on share prices of non-repurchasing rival firms should be significant only for firms located in concentrated industries, regardless of their maturity.*

We now consider the decision to repurchase. The SH posits that repurchase activity should be correlated among mature firms in the same industry because they share similar economic prospects. According to the MH, however, we should only observe correlated repurchasing activity in concentrated industries because it is precisely in these industries that the degree of strategic interaction between the firms is the highest and firms have a greater incentive to mimic each other. Therefore, according to the SH, we would observe more correlation in repurchase activity not in concentrated industries, but among more mature firms. Even within concentrated industries, non-mature firms should not repurchase because their economic prospects would be brighter. Hence, according to the SH, it is not the concentration of the industry that drives the correlation but the maturity of the firms located within these industries. The MH, however, contends that it is only the concentration of the industry that matters. These considerations allow us to formulate:

(SH3a): *Repurchase activity should be correlated only among the mature firms in the industry, regardless of the industry's concentration.*

(MH3a): *Repurchase activity should be correlated only in concentrated industries, regardless of the maturity of firms located in these industries.*

As before, we can also distinguish the two hypotheses using a test that does not rely on assessing whether concentrated industries are more mature. According to the SH, firms with declining profitability and availability of free cash flows repurchase to give these cash flows back to the shareholders. The incentive in doing this will be a function of the quality of governance of the firm. Well-governed firms will distribute more, while less well governed firms will distribute less, if anything at all. Therefore, the quality of governance should make a difference in the incentive to repurchase. If, as the SH posits, firms cluster their repurchases because they react to a common factor and if the repurchase wave of other firms in the same industry proxies for this factor, then the sensitivity to the repurchase wave should be stronger in the case in which firms have good governance. In case of the MH, instead, the decision to repurchase is affected by the repurchases of other firms in the industry per se and the repurchase wave is not a proxy for a common factor related to profitability changes. Hence, governance quality should not make any difference

in the case of the MH. This implies that we can use governance quality to distinguish the SH from the MH:

(SH3b): *Repurchase activity should be more correlated among well-governed firms in the industry than among poorly governed firms.*

(MH3b): *The correlation of repurchase activity within the industry should not depend on the quality of governance of the firms.*

Lastly, we consider the long-term price implications. According to Grullon and Michaely (2004), long-run drift results as the market slowly impounds the decrease in the cost of capital of the repurchasing firm into its share price. In the case of the SH, the information regarding the declining cost of capital is impounded into the share price of similar firms in the industry as more firms in the industry repurchase. Therefore, when later firms announce repurchases there might be no drift. This implies that, on average, repurchasing firms located in concentrated industries might not show any share price drift. This is less so, however, for repurchasing firms in unconcentrated industries as these firms are less similar. Hence, these firms exhibit significant post-announcement share price drift.

The MH also makes a similar prediction but for different underlying reasons. According to the MH, repurchases by firms in concentrated industries need not be followed by a share price drift because the repurchase decision is not motivated by market timing but is a response to the repurchase decisions of other firms in the industry. In contrast, since firms in unconcentrated industries only repurchase if their stocks are genuinely undervalued, these firms are more likely to experience a price increase in the post-announcement period.

These considerations suggest that we can use the speed of information flow within the industry to distinguish the two hypotheses. In case of the SH, we expect to observe, within the set of repurchasing firms located in concentrated industries, a more significant share price drift for firms located in industries in which the flow of information is slower. This is because in these cases the market will not be very quick in pricing the decline in cost of capital for other firms in the industry. The speed of information flow should not matter for the MH, however, as repurchases in concentrated industries are not motivated by market timing. This implies (see Fig. 1):

(SH4): *The size of the post-announcement drift for repurchasing firms in concentrated industries should be negatively related to the speed with which information flows within the industry.*

(MH4): *No share price drift should occur for repurchasing firms located in concentrated industries.*

3. Data

In this section we describe our sample selection procedure as well as the construction of our main variables.

3.1. The sample

The data for this study comes from three sources: the Center for Research in Securities Prices (CRSP)-Compustat Merged Industrial Database for the accounting variables and the total payout dollar amounts by year for each firm, the Securities Data Corporation (SDC) Database for open-market repurchase program announcements and CRSP

Concentrated	MH: no drift SH: drift is negatively related to the speed of information flow within the industry
Unconcentrated	MH: positive drift SH: positive drift

Fig. 1. Predictions of the mimicking hypothesis (MH) and the similarity hypothesis (SH) regarding the post-announcement drift of repurchasing stocks located in concentrated or unconcentrated industries.

Monthly Stocks for dividend announcements.³ The time period of our study ranges from 1984 to 2002. The choice of this period is motivated by the fact that open-market stock repurchases increased dramatically in the US after 1982 following the adoption by the SEC of Rule 10b–18, which greatly reduced the ambiguity associated with this activity. Furthermore, since 1984, firms have been required to report the value of their repurchases in their cash flow statements and this item can be found in the CRSP-Compustat Merged database as data item number 115.

Following Grinstein and Michaely (2005), we use data item 115 from the CRSP Compustat Merged database as our measure of repurchase activity for our tobit regressions. Although this measure includes preferred stocks in addition to common stocks, this repurchase activity represents only a minute fraction of the firm's overall repurchases.⁴ For tests of market reaction to repurchase announcements as well as the analysis of post-announcement performance of firms, we use repurchase announcements from SDC.⁵

The CRSP-Compustat Merged Industrial Database is the source for all the accounting variables that have been used as controls. We give a detailed description of the construction of all variables used in this study in the Appendix (Table A.1). In addition we use CRSP Monthly Stocks to calculate the stock's liquidity and CRSP Daily Stocks to calculate its standard deviation of returns. Institutional holdings for each firm are derived from the data on CDA/Spectrum. Following Fenn and Liang (2001) and Kahle (2002), we also control for managerial compensation derived from the Standard & Poor's Executive Compensation database. We construct a measure of managerial holdings (*Managerial Holdings*) defined as the percentage of shares held by the top five executive officers of the firm in the previous year. We also construct a variable that proxies for the more high-powered incentives provided by the holdings of stock options (Datta, Iskandar-Datta, and Raman, 2001). This variable (*Equity Based Compensation*) is calculated as the percentage of new stock options awarded in the year in terms of total compensation.

Following Ikenberry, Lakonishok, and Vermaelen (1995), Grullon and Michaely (2002), and others, we exclude the year 1987 for firm-year observations and the last quarter of 1987 for announcement data, because of the October 1987 crash. Also, we exclude financial firms and regulated utilities and focus exclusively on US listed common stocks

³We focus on open market repurchases (Jagannathan, Stephens, and Weisbach, 2000; Guay and Harford, 2000).

⁴See also Stephens and Weisbach (1998) and Grullon and Michaely (2002).

⁵Following Guay and Harford (2000), if a firm makes more than one open-market repurchase announcement within any given year, we only consider the first one.

(CRSP share codes 10 and 11) thereby excluding American Depositary Receipts (ADRs), closed-end funds, etc. We consider firms with positive payouts only. Finally, we require that, for each firm-year, data be available and non-missing for all the main explanatory variables. The resulting sample contains 28,636 firm-years. We report descriptive statistics of our sample in Table 1, and these are comparable to the summary statistics reported in Jagannathan, Stephens, and Weisbach (2000).

3.2. Measures of product market concentration, strategic interaction and corporate governance

As mentioned before, the mimicking dimension of a repurchase is related to the degree of strategic interaction within the industry: The higher the interaction, the stronger the effect. We proxy for the degree of strategic interaction with the degree of concentration in the product market. Our measure of product market concentration (*Concentration*) is based on the Herfindahl Index of concentration. It is measured as the sum of the squares of market shares of all the firms in a particular industry for a particular year. The higher the degree of monopoly power in the industry, the closer this index tends to the value of one, which is its maximum value, and the higher the degree of competition, the closer the value of this index to zero. We choose the Herfindahl Index as our measure of concentration because this index has the advantage of taking into account all the firms in a particular industry while computing the degree of competition and monopoly power, unlike the other popular measures of concentration such as the C4 Index or the Lerner Index. Following Hou and Robinson (2006), we define the industry by using the three-digit SIC classification. The SIC codes themselves have been obtained from CRSP Monthly Stocks.

Repurchasing stocks in high (low) concentration industries are identified by sorting all the repurchasing stocks within each year on *Concentration* and selecting those which fall in the top (bottom) quintile. The reaction of the repurchase announcements on the stock prices of repurchasing firms and their rival firms is then carried out for these stocks. This procedure yields 1,404 repurchasing stocks for high concentration industries and 1,383 repurchasing stocks for low concentration industries. To control for spurious correlation and other confounding effects, repurchasing firms in the high and low concentration industries are then matched on the basis of time of announcement, market-to-book, and size (*matched firms*).⁶ Applying these criteria, we are left with 679 repurchase announcements for each of the concentrated and unconcentrated industries.⁷

We capture the mimicking aspect of the repurchase activity through an interaction term denoted by *Conc/RW Interaction*. This term is the product of *Concentration* and *Repurchase Wave*. The *Repurchase Wave* term is computed from SDC data, and it is the total number of repurchase announcements, excluding those of the firm in question, that take place in the same industry over the past six-months. This variable quantifies the intensity of repurchase activity in the same industry considering all the other firms in the industry apart from the firm in question. The *Conc/RW Interaction*, therefore, measures

⁶Matching repurchasing firms on the basis of market to book and size allows us to control for the effects uncovered by Ikenberry, Lakonishok, and Vermaelen (1995) who show that value stocks (i.e., low market-to-book stocks) exhibit high post-announcement drift while glamour stocks do not.

⁷We find that there is no significant difference between the size, market-to-book ratio, or the pre-announcement price decline (Ikenberry, Lakonishok, and Vermaelen, 1995; Peyer and Vermaelen, 2005) for repurchasing stocks in high and low concentration groups after this matching procedure has been performed.

Table 1
Summary statistics

The summary statistics have been computed for a time period ranging from 1984 to 2002. The number of observations for each variable is given under the condition that the data on all our main control variables, given in Column 1 of Table 5, Panel A, below, should be non-missing. Detailed variable definitions are provided in the Appendix.

Variable type	Variable	Database	Number of Observations	Mean	Median	Standard Deviation	
Payout variables	Dollar Amount of Repurchase	Industrial CRSP/Compustat	20,361	56.50	2.28	284.62	
	Dollar Amount of Dividends	Industrial CRSP/Compustat	17,713	57.84	5.54	253.70	
	Total Payout	Industrial CRSP/Compustat	28,636	75.95	4.10	379.97	
	Share of Repurchase in Total Payout	Industrial CRSP/Compustat	28,636	0.53	0.59	0.44	
Accounting variables and other controls	Size	Industrial CRSP/Compustat	28,636	1,394.44	160.03	5,891.77	
	M/B Ratio	Industrial CRSP/Compustat	28,636	2.62	1.86	4.21	
	D/E Ratio	Industrial CRSP/Compustat	28,636	0.54	0.28	2.22	
	Operating Income	Industrial CRSP/Compustat	28,636	0.14	0.15	0.14	
	Non-Operating Income	Industrial CRSP/Compustat	28,636	0.01	0.01	0.03	
	Std. of Operating Income	Industrial CRSP/Compustat	28,636	0.06	0.04	0.13	
	Lag Dividend Payout Ratio	Industrial CRSP/Compustat	28,636	0.43	0.08	9.27	
	Liquid Assets	Industrial CRSP/Compustat	28,636	0.28	0.29	0.22	
	Price Earnings Ratio	Industrial CRSP/Compustat	28,636	18.49	14.43	68.16	
	Capital Expenditures	Industrial CRSP/Compustat	28,636	0.07	0.06	0.06	
	Prior Year Stock Return	CRSP Monthly Stocks	28,636	0.23	0.11	0.73	
	Stock Liquidity	CRSP Monthly Stocks	28,616	0.95	0.62	1.21	
	Equity Based Compensation	Compustat Executive Compensation	8,506	0.32	0.30	0.25	
		Managerial Holdings	Compustat Executive Compensation	8,471	0.05	0.01	0.10
		Institutional Holdings	CDA/Spectrum 13f	28,636	0.40	0.38	1.11
	Variables depicting	Concentration	Calculated from Industrial CRSP/Compustat	28,636	0.24	0.19	0.18
Product market competition and strategic interaction	Repurchase Wave	Calculated from SDC	28,636	0.56	0	2.79	
Additional controls	Stock Return Volatility	CRSP Daily Stocks	28,613	0.03	0.03	0.02	
	Governance Index	IRRC	9,549	9.29	9.00	2.83	

the effect on the probability of a repurchase announcement resulting from an increase in both the concentration of the industry and the intensity of repurchase activity in the industry.

We also control for the quality of corporate governance, which is generally seen to improve with competition.⁸ This is important as firms in less concentrated industries could over-perform those in more concentrated industries simply because of differences in the quality of governance. Better governance in less concentrated industries would imply that repurchases in these industries are not value-destroying and are more likely to increase long-run performance. We use the governance index of Gompers, Ishii, and Metrick (2003) to control for governance quality (*Governance Index*). The higher the index, the weaker the shareholder rights and the poorer the governance quality. Moreover, we capture the interaction between the level of industry competition and the governance quality, by *Conc/Gov Interaction* constructed as a product of *Concentration* and a dummy variable that takes the value of one if *Governance Index* is greater than nine (i.e., the median) and zero otherwise.

4. Analyzing the maturity of repurchasing firms in concentrated and unconcentrated industries

We start by conducting univariate tests to confirm whether repurchasing firms located in concentrated and unconcentrated industries differ in terms of maturity. Instead of considering matched repurchasing firms, we focus on the full set of repurchasing firms in each concentration quintile as matched firms might not have much chance of showing a difference in maturity.

Following Grullon and Michaely (2004), we first test whether there exists any difference between changes in operating performance of concentrated and unconcentrated repurchasing firms from one year to the next in the post-repurchase period. According to Grullon and Michaely, mature firms should exhibit declining operating performance in the post-repurchase period. Therefore, if the SH is true and if repurchasing firms in concentrated industries are more mature than their counterparts in unconcentrated industries, then the decline in the operating performance of repurchasing firms in concentrated industries should be significantly higher than the decline in the operating performance of their counterparts in the unconcentrated industries. In line with Barber and Lyon (1996), Lie (2001), and Grullon and Michaely (2004), we use return on assets (ROA) as our primary measure of operating performance.

To check the robustness of our results, we also employ other measures of operating performance: return on cash-adjusted assets (ROCAA), return on sales (ROS), return on equity (ROE), and cash-flow return on assets (CFROA). ROCAA, ROS, and CFROA are defined as in Grullon and Michaely (2004).⁹ We compute yearly changes in each of these

⁸See, for example, Hart (1983), Shleifer and Vishny (1986), Grosfeld and Tressel (2002), and Jagannathan and Srinivasan (1999).

⁹ROA is operating income before taxes and depreciation (Compustat item 13) scaled by the average book value of assets (item 6) measured at the beginning and end of the period. ROCAA equals operating income before depreciation scaled by average of beginning- and ending-period book value of cash-adjusted assets [given by the book value of total assets minus cash and marketable securities (item 1)]. ROS is operating income before depreciation scaled by the average of beginning- and ending-period sales (item 12). CFROA is operating cash flow scaled by the average of beginning- and ending-period book value of total assets. Operating cash flow is equal to

measures for both concentration groups over a window of (–2 to +5) years relative to the date of the repurchase announcement and then conduct univariate tests on the means and medians.

The results are reported in Table 2. They show that there is no difference in the post-announcement operating performance between the two groups of firms. Before the announcement, the changes in operating performance are significantly more positive for repurchasing firms in concentrated industries. However, after the announcement, we observe a similar decline in operating performance in both groups, which supports the Grullon and Michaely findings but does not support SH.¹⁰

As a way of ensuring that our results are not driven by the choice of our proxies, we also employ a host of other proxies for firm maturity. Grullon and Michaely (2004) show that that mature firms reduce their capital and R&D expenditures in the post-repurchase period because of declining growth opportunities. We analyze the changes in capital and R&D expenditures of repurchasing stocks in concentrated and unconcentrated industries over a window of (–2 to +3) years relative to the date of the repurchase announcement and conduct univariate tests to check whether there is a bigger decline in these expenditures in one group with respect to the other. The results show that there is no difference in the decline of these expenditures across the repurchasing stocks in the two concentration groups.¹¹

Our next proxy is based on the changes in risk of repurchasing stocks around the repurchase announcement. According to Grullon and Michaely (2004), a contraction in the investment opportunity set must be accompanied by a decline in the firm's risk. Therefore, if repurchasing firms in concentrated industries are more mature in comparison with their counterparts in unconcentrated industries, then the decline in their risk should be more significant in the post-announcement period. We employ two different methods for analyzing the changes in risk of repurchasing stocks around the repurchase announcement.

In our first test we measure the change in the firms' risk by focusing on the change in the standard deviation of their stock returns around the repurchase announcement. *Stock Return Volatility* is computed as the standard deviation of daily stock returns. We calculate the average *Stock Return Volatility* for repurchasing stocks for years (+1, +2) and subtract from this the average volatility for years (–1, –2). As in the previous case, there is no difference in the changes in the risk characteristics between the two groups of stocks.

In our second test, following Grullon and Michaely (2004), we measure changes in the systematic risk of equity using the Fama and French (1993) three-factor

(footnote continued)

the operating income before depreciation (item 13) plus the decrease in receivables (item 2), the decrease in inventory (item 3), the increase in accounts payable (item 70), the increase in other current liabilities (item 72), and the decrease in other current assets (item 68). ROE is operating income before depreciation scaled by the average beginning- and ending-period book value of equity (item 60).

¹⁰In only one measure, ROS, out of the five employed, do we see that firms in unconcentrated industries do better than their counterparts in concentrated industries and that, too, is present only in the medians for years (+2 to +5). For all the other measures reported and for all the time periods, there is no case in which the change in operating performance for repurchasing firms in unconcentrated industries is better than that of repurchasing firms in concentrated industries.

¹¹The median decline for repurchasing stocks in concentrated industries is 0.13%, while for their counterparts located in unconcentrated industries, it is 0.15%. Results are available upon request.

Table 2

Univariate tests for analysing the maturity of repurchasing stocks in high and low concentration industries using changes in operating performance measures.

This table provides summary statistics of changes in firm operating performance measures as well as univariate tests for differences in means and medians between repurchasing stocks located in concentrated and unconcentrated industries. All the repurchasing stocks are ranked in terms of concentration, and the top and bottom quintile are chosen as the concentrated and unconcentrated repurchasing stocks. The table displays the results for five different measures of firm operating performance: return on assets (ROA), return on cash-adjusted assets (ROCAA), return on sales (ROS), return on equity (ROE), and cash flow return on assets (CFROA). We define ROA, ROCAA, ROS, and CFROA following Grullon and Michaely (2004). ROA is defined as operating income before depreciation (Compustat item 13) scaled by the average of beginning- and ending-period book value of total assets (item 6). ROCAA is equal to operating income before depreciation scaled by average of beginning- and ending-period book value of cash-adjusted assets. The cash-adjusted assets are equal to the book value of total assets minus cash and marketable securities (item 1). ROS is equal to the operating income before depreciation scaled by the average of beginning- and ending-period sales (item 12). CFROA is equal to the operating cash flow scaled by the average of beginning- and ending-period book value of total assets. The operating cash flow is equal to the operating income before depreciation (item 13) plus the decrease in receivables (item 2), the decrease in inventory (item 3), the increase in accounts payable (item 70), the increase in other current liabilities (item 72), and the decrease in other current assets (item 68). ROE is defined as operating income before depreciation scaled by the average of beginning- and ending-period book value of equity (item 60). Year 0 represents the year of the repurchase announcement. In each case the table displays the mean and median changes in operating performance measures for a particular time window (relative to the repurchase year) along with a test statistic. This test statistic represents the two-tailed *t*-test (in case of means) and a two-tailed Wilcoxon test (in the case of medians). The change over (+2 to +5) is calculated as the average change over years (+2 to +3), (+3 to +4), and (+4 to +5). We calculate mean and median changes after winsorizing the extreme 1% of observations on each side of the distribution. ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively. ‘Obs.’ refers to the number of observations.

	–2 to –1			–1 to 0			0 to +1			+1 to +2			+2 to +5		
	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median	Obs.
Return on assets															
Concentrated	0.0042	0.0055	1,154	–0.0058	–0.0021	1,249	–0.0103	–0.0046	1,270	–0.0081	–0.0014	1,183	–0.0030	–0.0003	2,923
Unconcentrated	–0.0036	0.0020	1,115	–0.0142	–0.0028	1,223	–0.0117	–0.0016	1,250	–0.0060	–0.0007	1,160	–0.0049	–0.0001	2,781
Test statistic	2.63***	2.19**		2.69***	1.60		0.42	–1.37		–0.66	–1.03		0.96	–0.46	

Table 2 (continued)

	–2 to –1			–1 to 0			0 to +1			+1 to +2			+2 to +5		
	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median	Obs.
Return on cash adjusted assets															
Concentrated	0.0053	0.0059	1,155	–0.0071	–0.0031	1,246	–0.0130	–0.0065	1,269	–0.0108	–0.0024	1,182	–0.0026	–0.0002	2,918
Unconcentrated	–0.0085	0.0011	1,110	–0.0294	–0.0059	1,216	–0.0135	–0.0036	1,234	–0.0060	–0.0007	1,152	–0.0049	0.0002	2,770
Test statistic	2.85***	2.35**		4.18***	3.10***		0.10	0.88		–0.92	1.24		0.70	0.80	
Return on sales															
Concentrated	0.0026	0.0033	1,153	–0.0054	–0.0012	1,246	–0.0046	–0.0016	1,266	–0.0012	0.0005	1,182	–0.0009	0.0012	2,917
Unconcentrated	0.0082	0.0023	1,114	–0.0064	–0.0020	1,219	–0.0084	–0.0009	1,237	–0.0104	0.0013	1,150	0.0010	0.0037	2,765
Test statistic	–0.93	0.72		0.16	1.52		0.62	–0.54		1.42	–0.62		–1.26	–2.46**	
Return on equity															
Concentrated	0.0045	0.0062	1,138	–0.0124	–0.0020	1,233	–0.0109	–0.0011	1,244	–0.0021	0.0033	1,150	–0.0069	–0.0002	2,794
Unconcentrated	–0.0099	–0.0025	1,111	–0.0182	–0.0060	1,223	–0.0180	–0.0001	1,237	–0.0090	–0.0008	1,138	–0.0075	–0.0006	2,696
Test statistic	1.94*	1.89*		0.75	1.52		0.87	–0.02		0.81	0.81		0.11	–0.35	
Cash flow return on assets															
Concentrated	0.0090	0.0051	1,083	–0.0003	0.0005	1,169	–0.0035	–0.0045	1,198	–0.0059	–0.0025	1,121	–0.0003	–0.0017	2,728
Unconcentrated	0.0026	0.0014	1,061	–0.0014	–0.0011	1,167	–0.0120	–0.0044	1,189	–0.0080	–0.0037	1,100	–0.0013	–0.0021	2,598
Test statistic	1.15	1.26		0.21	0.84		1.52	0.46		0.36	–0.20		0.23	–0.55	

model:

$$r_{it} - r_{ft} = \alpha_{-i} + \alpha_{\Delta i} D_i + b_{-i}(r_{mt} - r_{ft}) + b_{\Delta i} D_i (r_{mt} - r_{ft}) + s_{-i} SMB_t + s_{\Delta i} D_i SMB_t + h_{-i} HML_t + h_{\Delta i} D_i HML_t + e_t, \quad (1)$$

where r_{it} is the monthly return on stock i , r_{ft} is the monthly return on the one-month US Treasury bills, and $(r_{mt} - r_{ft})$, SMB_t , and HML_t are the three Fama and French (1993) factors. D_i is a dummy variable that is equal to one in the months following the repurchase announcement. A 73-month window (-36 to $+36$) is used to estimate the parameters of the regression model. b_{-i} , s_{-i} , and h_{-i} are the factor loadings of firm i during the three years prior to the repurchase announcement. $b_{\Delta i}$, $s_{\Delta i}$, and $h_{\Delta i}$ are the changes in the factor loadings after the repurchase announcement. α_{-i} and $\alpha_{\Delta i}$ are the abnormal return before the repurchase announcement and the change in announcement return after the repurchase announcement, respectively. According to the SH, $b_{\Delta i}$, $s_{\Delta i}$, and $h_{\Delta i}$ should be more significantly negative for repurchasing stocks in concentrated industries because these firms are more mature. Also in this case, we find no difference between the changes in the risk characteristics of the two groups of stocks in any of the risk factors. Hence, we find a similar decline in systematic risk for stocks located in concentrated and unconcentrated industries.

Then, we conduct two further tests using the permanence of the cash flow shock measure of Guay and Harford (2000) and the dispersion of analyst forecasts. Following Guay and Harford (2000), we define the permanence of cash flow shock as:

$$\begin{aligned} & [\text{Average (CFO/Total Assets) in years } +1 \text{ to } +3] \\ & - [\text{Average (CFO/Total Assets) in years } -4 \text{ to } -2], \end{aligned} \quad (2)$$

where *Cash Flow from Operations* (CFO) is defined as

$$\begin{aligned} \text{Cash Flow from Operations} = & \text{Operating Income Before Depreciation}_t - \text{Interest}_t - \text{Taxes}_t \\ & - \Delta \text{ Working Capital}_t. \end{aligned} \quad (3)$$

This measure is designed to capture the degree to which the future cash flows settle above or below their pre-shock value. Because the overall risk of the firm declines as the firm matures, we believe that the cash flow shocks for mature firms should be more permanent and, therefore, less risky. As above, we find no difference in the permanence of cash flow shocks across the two groups in either the means or the medians.

Finally, we consider the dispersion in analyst forecasts. We define *Adjusted Standard Deviation* of analyst forecasts as the dispersion of estimates standardized by the mean estimate for a one-year fiscal period. Data for this measure has been obtained from Institutional Brokers Estimate System (I/B/E/S). Because mature firms are less risky than their non-mature counterparts, the dispersion in analyst forecasts for these firms should also be smaller. We compute the average *Adjusted Standard Deviation* for year $(-1, -2)$ as well as for years $(+1, +2)$ for repurchasing stocks located in concentrated and unconcentrated industries. The results show no difference between the dispersion of analyst forecasts between the two groups.

To summarize, our univariate tests do not reveal any difference between the maturity of repurchasing firms located in concentrated and unconcentrated industries. As a result, one of the fundamental conditions that was required for the SH and the MH to yield similar predictions is violated. Although we distinguish the SH from the MH in each of the

following tests, the evidence here suggests the MH to be the most likely explanation for our findings.

5. Market reaction to the repurchase announcement

According to SH1, the market reaction to the repurchase announcement should be larger for firms located in concentrated industries. MH1, on the other hand, does not make such a claim. We test this prediction by conducting univariate and multivariate tests on announcement returns for repurchasing firms located in both concentrated and unconcentrated industries.¹²

The results for the test are reported in Table 3. Panel A displays the results for the univariate tests. The table reports both the mean and the median cumulative abnormal returns (CAR) resulting from a repurchase announcement for matched and unmatched repurchasing firms located in concentrated and unconcentrated industries using event windows of $(-1, +1)$ and $(0, +1)$ relative to the announcement date.¹³ The findings do not show any statistical difference in market's reaction across the two groups.

Table 3, Panel B, reports results for multivariate tests when we control for other firm characteristics such as *Institutional Ownership*, *Analyst Following*, *Stock Liquidity*, and *Payout Size*, as well as for differences in governance. We first focus on the *Concentration Dummy*. This takes a value of one for firms located in concentrated industries and a value of zero for firms located in unconcentrated industries. The results show that *Concentration Dummy* is insignificant in all the four specifications and suggest that there exists no difference between the two groups of stocks in terms of the market reaction to the repurchase announcement. This rejects SH1a.¹⁴

We then focus on the *Governance Index*. According to Hypothesis SH1b, we expect the sign on the *Governance Index* variable to be positive.¹⁵ Moreover, as explained in Section 2, in concentrated industries, this effect should be amplified by the degree of market concentration. Hence, we expect the sign of the *Conc. Dummy*Gov. Index* interaction to be positive. The results show that the announcement reaction does not vary either with the quality of governance or with the degree of concentration of the industry in any of the four specifications. Furthermore, *Conc. Dummy*Gov. Index* is also insignificant. This rejects the predictions of the SH.

6. The effect of a repurchase on other non-repurchasing firms within the same industry

We estimate how a firm's share price reacts to the repurchase announcement of its rivals. We identify rivals of matched repurchasing firms as those firms that belong to the same industry as the repurchasing firms and that have not made a repurchase announcement in

¹²The value-weighted market index is the market benchmark. The estimation period ends 90 days prior to the announcement with a maximum of 255 days and minimum of 100 days required.

¹³The matching of repurchasing firms is based on size, book to market and the time of announcement.

¹⁴In unreported tests we split the sample of repurchasing firms in concentrated and unconcentrated industries into mature and non-mature firms using the proxies of maturity described above and compare the market reaction for firms in concentrated and unconcentrated industries with similar maturity. In each case, we find that there is no significant difference in the market reaction depending on the concentration of the industry to which the firm belongs. These results are available upon request.

¹⁵This is because the quality of the governance deteriorates as the *Governance Index* increases.

Table 3

Testing for differences in market reaction to share repurchase announcements.

This table presents the results for the market reaction to the repurchase announcement for stocks located in concentrated and unconcentrated industries. All the repurchasing stocks are ranked in terms of concentration and the top and bottom quintile are chosen as the concentrated and unconcentrated repurchasing stocks. Cumulative abnormal returns (CAR) are computed using two different event windows of $(-1, +1)$ and $(0, +1)$ days relative to the date of the repurchase announcement (0). The value-weighted market index is used as the market benchmark. The estimation period ends 90 days prior to the announcement with a maximum of 255 days and minimum of 100 days required for the estimation. Results are presented for both matched and unmatched quintiles of repurchasing stocks. In case of matched quintiles, the repurchasing stocks have been matched with each other on size, book to market, and time of announcement.

Panel A presents the results of univariate tests conducted to check the significance of the difference in the market reaction to the repurchase announcement for stocks located in concentrated and unconcentrated industries. Test statistic refers to the t -test in case of the means and to the two-sample Wilcoxon test in case of the medians. ***, **, and * denote significance levels of 1%, 5%, and 10% respectively. 'Obs.' refers to the number of observations.

Panel B presents the results of multivariate tests conducted to check the significance of the difference in the market reaction to the repurchase announcement for stocks located in concentrated and unconcentrated industries. *Concentration Dummy* takes a value of one for firms located in concentrated industries and it takes a value of zero for firms located in unconcentrated industries. *Governance Index* is obtained from the Investor Responsibility Research Center (IRRC) database and is constructed following Gompers, Ishii, and Metrick (2003). *Conc. Dummy * Gov. Index* represents the interaction of *Concentration Dummy* and *Governance Index*. The *Payout Size* variable is taken from the SDC and it is the percentage of outstanding shares sought in the repurchase announcement. *Analyst Following* comes from I/B/E/S and represents the total number of analysts (NUMEST) following a particular stock over the one-year fiscal period. All the other variables are defined in the Appendix. ***, **, and * denote significance levels of 1%, 5%, and 10% respectively using heteroskedasticity robust standard errors with t -statistics given in parentheses.

Panel A. Univariate tests for market reaction

	Event window $(-1, +1)$			Event window $(0, +1)$		
	Mean	Median	Obs.	Mean	Median	(Obs.)
Matching firms						
Concentrated	2.5313%	1.6270%	674	2.8748%	1.8364%	674
Unconcentrated	2.5862%	1.8761%	674	2.7375%	2.0056%	674
Test statistic	-0.10	-0.81		0.31	-0.66	
Non-matching firms						
Concentrated	2.6072%	1.6733%	1,392	2.8391%	1.7656%	1,392
Unconcentrated	2.9834%	2.0089%	1,369	3.3147%	1.9713%	1,369
Test statistic	-1.06	-1.47		-1.53	-1.30	

Panel B: Multivariate tests for market reaction

Variables	Matching firms				Non-matching firms			
	$(-1, +1)$		$(0, +1)$		$(-1, +1)$		$(0, +1)$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Concentration Dummy	0.0739 (0.11)	-3.1223 (-1.19)	0.3381 (0.59)	-1.8571 (-0.77)	0.2406 (0.51)	-0.1924 (-0.11)	0.3117 (0.77)	0.8216 (0.52)
Control variables								
Governance Index		0.0075 (0.04)		-0.0173 (-0.09)		0.0910 (0.69)		0.0877 (0.70)

Table 3 (continued)

Panel B: Multivariate tests for market reaction								
Variables	Matching firms				Non-matching firms			
	(-1, +1)		(0, +1)		(-1, +1)		(0, +1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conc. Dummy * Gov. Index		0.2190 (0.84)		0.1395 (0.58)		-0.0051 (-0.03)		-0.0784 (-0.49)
Size	-0.5116 (-1.79)	-0.3047 (-0.71)	-0.7190*** (-2.92)	-0.6033 (-1.51)	-0.4407** (-2.41)	-0.2219 (-0.82)	-0.5648*** (-3.48)	-0.3904 (-1.52)
Market to Book	0.0081 (0.07)	0.0768 (0.55)	-0.0482 (-0.63)	0.0277 (0.26)	-0.0402 (-0.57)	0.0190 (0.16)	-0.0138 (-0.27)	-0.0004 (-0.01)
Debt to Equity	-0.0395 (-0.34)	-0.0564 (-0.54)	0.0536 (0.65)	0.0290 (0.40)	-0.0066 (-0.08)	-0.0112 (-0.13)	0.0849 (1.39)	0.0496 (0.84)
Analyst Following	0.0123 (0.24)	-0.0500 (-0.72)	0.0580 (1.44)	0.0082 (0.16)	0.0133 (0.41)	-0.0268 (-0.60)	0.0206 (0.78)	0.0007 (0.02)
Institutional Holdings	-4.6220*** (-2.80)	-2.0845 (-0.91)	-2.6299* (-1.76)	-2.7886 (-1.32)	-5.1724*** (-4.20)	-2.6406* (-1.72)	-3.9722*** (-3.31)	-2.2534 (-1.60)
Stock Liquidity	-0.0918 (-0.15)	-0.3902 (-0.51)	0.3671 (0.82)	0.0710 (0.10)	0.1617 (0.41)	0.1946 (0.40)	0.5957* (1.92)	0.5955 (1.34)
Payout Size	0.0184 (0.71)	-0.0067 (-0.30)	0.0215 (0.95)	0.0215 (0.86)	0.0606** (2.42)	0.0112 (0.53)	0.0622*** (2.66)	0.0435* (1.70)
Intercept	7.0151*** (5.22)	5.3039 (1.63)	7.0170*** (5.97)	7.3118** (2.42)	6.7646*** (7.06)	3.8396* (1.68)	6.9183*** (8.24)	4.4279** (2.10)
Number of Observations	834	382	834	382	1,625	722	1,625	722
R-squared	0.0308	0.0167	0.0323	0.0218	0.0383	0.0106	0.0499	0.0204

the three years prior to the announcement or in the month following the announcement. These rival firms are then matched with the repurchasing firms on the basis of market-to-book ratio and size and the closest ten, five or three firms are selected. By picking the closest rivals, we maximize our chances of finding a reaction on the rivals' price in either type of industry. We then calculate the CAR for rival firms resulting from the repurchase announcements of their competitors over (-1 to +30) days relative to the announcement date.¹⁶

The results are reported in Table 4, Panel A. They show a significant negative abnormal return for the non-repurchasing firms in concentrated industries. The CAR is approximately equal to -0.40% in the three-day window surrounding the repurchase announcement that grows up to -2.04% within 30 days. These abnormal returns are

¹⁶The value-weighted market index is used as the market benchmark. The estimation period of the market model ends 90 days prior to the announcement with a maximum of 255 days and minimum of 100 days required for the estimation. We consider the following periods: (-1, +1), (-1, +9), (-1, +15), (-1, +21), and (-1, +30) days, with zero representing the announcement date.

Table 4

Return reaction of repurchase announcements on non-repurchasing rival firms.

This table shows the reaction caused by the repurchase announcements of firms on the stock prices of their non-repurchasing rivals in both high and low concentration industries. High and low concentration repurchasing firms are identified as the top and bottom quintiles of repurchasing firms sorted on the concentration variable. These repurchasing firms have been matched with each other on the basis of size, market to book, and time of announcement. The rival firms are identified as those firms that belong to the same industry as the high and low concentration repurchasing firms and that have not made a repurchase announcement in the three years prior to the announcement or in the month following the repurchase announcement. These rival firms are then matched with the repurchasing firm on the basis of market-to-book ratio and size and the closest ten, five or three firms are selected. The value-weighted market index is used as the market benchmark. The estimation period ends 90 days prior to the announcement with a maximum of 255 days and minimum of 100 days required for the estimation.

Panel A reports the average cumulative abnormal returns (CAR) for rival firms following the announcement for the time period specified. $(-1, +1)$, $(-1, +9)$, $(-1, +15)$, $(-1, +21)$, and $(-1, +30)$ represent the windows (in days) relative to the announcement event for which the abnormal return is being measured (0 representing the actual announcement day). ***, **, *, and \$ represent significance levels of 0.1%, 1%, 5%, and 10%, respectively, using two-tailed tests. The CAR is measured over the relevant window and control group (given at the top of the table).

Panel B reports results of cross-sectional regressions of CAR computed over a period following the announcement on payout size, concentration, and other controls. $(-1, +9)$ and $(-1, +30)$ day windows around the repurchasing announcement are used for computing CAR and up to ten rival firms for each repurchasing firm are selected. The *Payout Size* variable is taken from the actual repurchasing firm (it is the percentage of outstanding shares sought in the repurchase announcement, the data coming from SDC) while all the other variables used in the regression are for the rival firms being analysed. *Concentration Dummy* takes a value of one for the high concentration group and a value of zero for the low concentration group. *Maturity Dummy* controls for the maturity of rival firms. It takes a value of one for mature firms and a value of zero for non-mature firms. Mature and non-mature firms are identified using change in return on assets (ROA), change in capital and R&D expenditures (Capexp. & R&D), change in volatility (Volatility), change in market beta (Change in Mkt. Beta), permanency of cash flow shocks (Permanency) and dispersion of analyst forecasts (Analyst Dispersion). Each of these measures is defined in Section 4. For ROA and capital and R&D expenditure, we calculate the average change for the years $(-2$ to $-1)$ and $(-1$ to $0)$. If this average change is negative (positive), the firm is classified as mature (non-mature). In case of *Stock Return Volatility*, the average *Stock Return Volatility* for stocks for years $(-1, -2)$ is subtracted from the average volatility for years $(+1, +2)$. If the change is negative (positive), the firm is classified as mature (non-mature). For change in market beta, if the change is negative (positive), the firm is classified as mature (non-mature). For permanency of cash flow shocks, the measure for each rival firm is compared with the median measure for all the rivals in that concentration category. If the measure is greater (smaller) than the sample median, the firm is classified as mature (non-mature). For analyst dispersion, the lagged *Adjusted Standard Deviation* of each firm is compared with the lagged annual median *Adjusted Standard Deviation* of all firms. If the value for the firm is greater (smaller) than the median, the firm is classified as non-mature (mature). *PS * Concentration Dummy* and *PS * Maturity Dummy* represent the interaction of *Payout Size* with the *Concentration Dummy* and *Maturity Dummy*, respectively. *Previous Month CAR* is the cumulative abnormal return in the month preceding the announcement measured over $(-30, -2)$ days interval using the same market model and estimation periods as mentioned above. Size, market-to-book and debt-to-equity are defined in the Appendix. The dependent variable, *Payout Size*, and *Previous Month CAR* are represented in percentages. ***, **, and * represent significance levels of 1%, 5%, and 10%, respectively, using heteroskedasticity robust standard errors with *t*-statistics given in parentheses.

Panel A. Average cumulative abnormal returns

Concentration	Observations	Controls	(-1, +1)	(-1, +9)	(-1, +15)	(-1, +21)	(-1, +30)
High concentration	2,825	10	-0.30%*	-0.89%***	-1.27%***	-1.78%***	-2.04%***
	2,349	5	-0.34%*	-0.84%**	-1.20%***	-1.68%***	-2.05%***
	1,657	3	-0.49%**	-0.92%**	-1.13%**	-1.65%***	-2.17%***
Low concentration	3,990	10	-0.28%*	-0.37%	-0.52%\$	-0.48%	-0.42%
	3,078	5	-0.17%	-0.27%	-0.40%	-0.20%	-0.25%
	2,001	3	-0.19%	-0.33%	-0.30%	-0.28%	-0.49%

Panel B. Results of cross-sectional regressions

Variable	ROA		Capexp. & R&D		Volatility		Change in Mkt. Beta		Permanency		Analyst Dispersion	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Return window	(-1, +9)	(-1,30)	(-1, +9)	(-1,30)	(-1, +9)	(-1,30)	(-1, +9)	(-1,30)	(-1, +9)	(-1,30)	(-1, +9)	(-1,30)
PS * Concentration Dummy	-0.061** (-2.48)	-0.089** (-2.00)	-0.063** (-2.53)	-0.094** (-2.11)	-0.070*** (-2.70)	-0.142*** (-3.24)	-0.052** (-2.11)	-0.101** (-2.42)	-0.057** (-2.11)	-0.096** (-2.10)	-0.096*** (-3.26)	-0.117** (-2.28)
Control Variable												
PS * Maturity Dummy	-0.043* (-1.65)	0.011 (0.25)	-0.006 (-0.22)	-0.001 (-0.02)	0.034 (1.38)	-0.005 (-0.12)	0.008 (0.31)	-0.025 (-0.63)	0.066** (2.43)	0.098** (2.22)	-0.039 (-1.33)	-0.026 (-0.53)
Payout Size (PS)	0.044* (1.91)	-0.023 (-0.72)	0.026 (1.15)	-0.018 (-0.55)	-0.008 (-0.35)	-0.015 (-0.42)	-0.007 (-0.31)	-0.019 (-0.56)	-0.023 (-0.84)	-0.0856** (-2.13)	0.032 (1.18)	-0.064 (-1.40)
Previous Month CAR	0.0003 (0.02)	0.092*** (3.72)	-0.002 (-0.11)	0.091*** (3.69)	0.010 (0.72)	0.118*** (5.11)	0.002 (0.10)	0.102*** (4.59)	0.027 (1.62)	0.130*** (4.37)	-0.023 (-1.60)	0.061** (2.48)
Size	0.121 (1.13)	-0.162 (-0.89)	0.135 (1.21)	-0.149 (-0.79)	0.200** (1.99)	-0.092 (-0.54)	0.201** (2.04)	-0.118 (-0.70)	0.182 (1.60)	-0.024 (-0.12)	0.354*** (3.25)	-0.269 (-1.36)
Market to Book	-0.129* (-1.76)	-0.449*** (-3.68)	-0.254*** (-2.88)	-0.799*** (-4.58)	-0.133** (-2.26)	-0.458*** (-4.43)	-0.124 (-2.13)	-0.447*** (-4.37)	-0.119 (-1.51)	-0.338** (-2.55)	-0.209*** (-2.85)	-0.606*** (-4.41)
Debt to Equity	-0.022 (-0.38)	0.202 (1.36)	0.011 (0.20)	0.257* (1.82)	0.006 (0.12)	0.259** (2.01)	0.001 (0.02)	0.254** (2.03)	-0.086 (-0.93)	-0.112 (-0.73)	-0.176* (-1.72)	-0.028 (-0.16)
Intercept	-0.686 (-0.97)	1.269 (1.05)	-0.443 (-0.61)	2.191* (1.70)	-0.920 (-1.40)	1.175 (1.03)	1.073* (-1.67)	1.003 (0.89)	-0.909 (-1.20)	0.730 (0.55)	-1.730** (-2.28)	3.326** (2.36)
R-squared	0.002	0.015	0.003	0.019	0.004	0.023	0.002	0.019	0.006	0.021	0.010	0.018
Number of Observations	3,904	3,904	3,894	3,894	4,030	4,030	4,195	4,195	2,969	2,969	3,130	3,130

sizable if we compare them with the abnormal returns experienced by the repurchasing firms themselves, which are of the order of 2.7%–3% in the three-day window surrounding the repurchase announcement. In the unconcentrated industries, instead, the abnormal returns for the rival firms are not significant. This confirms the intuition of the MH.

We then carry out tests in a multivariate setting in which we control for the payout size of the repurchasing firm and other characteristics of the non-repurchasing firms, including its stock price performance in the month prior to the announcement and its maturity. Indeed, the market model used to calculate abnormal returns ignores momentum, as well as other factors such as book-to-market and size. We regress CAR of non-repurchasing rival firms on *Payout Size* of the competing repurchasing firm and *PS*Concentration Dummy*, which is the interaction of *Payout Size* with *Concentration Dummy* that takes a value of zero for low concentration industries and a value of one otherwise. If the share price reaction for rival firms is stronger in concentrated industries, we would expect this term to be negative.

To control for rival maturity, we include a *Maturity Dummy* along with an interaction term denoted by *PS*Maturity Dummy*. *Maturity Dummy* takes a value of one for mature firms and zero for non-mature firms. Maturity is measured using six different proxies, which are changes in ROA, changes in capital and R&D expenditures, changes in stock return volatility, changes in market beta, permanency of cash flow shocks, and dispersion of analyst forecasts. All the measures are calculated using procedures analogous to the ones described above. For changes in ROA and capital and R&D expenditures, we take the average change over the years (–2 to –1) and (–1 to 0). If this average change is negative (positive), we classify the firm as mature (non-mature). Similarly, if the stock return volatility or the market beta is decreasing (increasing) in the post-announcement period in comparison with its pre-announcement values, the firm is classified as mature (non-mature). As far as the permanence of cash flow shocks is concerned, the measure for the firm is compared with the median measure for all the rival firms in the concentration category. If the measure is greater (smaller) than the sample median, the firm is classified as mature (non-mature). Lastly, if the lagged dispersion of analyst forecasts is smaller (larger) than the lagged median for the entire sample, the firm is classified as mature (non-mature).

The results are reported in Table 4, Panel B. For the sake of brevity, we report only two event windows: [–1, +9) and (–1, +30)] and focus on the results for the set of ten rival firms only. The results show that *PS*Concentration Dummy* turns out to be negative and significant in all the 12 specifications. Despite controlling for rival maturity, the negative reaction is more pronounced among the rival firms in concentrated industries. Apart from the first specification in which it is marginally significant, *PS*Maturity Dummy* is either insignificant or is significant with the wrong sign. Moreover, in none of the specifications does it kill the significance of *PS*Concentration Dummy*. These results confirm that the reaction on a firm's share price as a result of a rival's repurchase is not driven by the firm's maturity but by the concentration of the industry. Hence, we can reject SH2 and accept MH2.¹⁷

¹⁷Our results also hold for the other two event windows of (–1, +15) and (–1, +21) days as well as for the other four measures of operating performance (i.e., ROCAA, ROS, ROE, and CFROA) used to distinguish mature firms from the non-mature firms. These results are available upon request.

7. The decision to repurchase

We now proceed to test how the strategic interaction within the industry affects the firm's choice to repurchase. We explain the ratio of repurchases to total payout by the interaction of the degree of product market competition with the intensity of repurchase activity in the industry along with a set of other control variables. We estimate a tobit model in which the dependent variable is the ratio of repurchase to total payout and is bounded between zero and one. We consider different specifications based on an expanding set of control variables. Following Fenn and Liang (2001), we concentrate on firms with positive payouts. We estimate specifications based on the entire sample as well as those based on firms increasing their payouts. Following Jagannathan, Stephens, and Weisbach (2000), we define payout increasing firms as those that paid a dividend in at least one of the last two years and during the current year are either increasing their dividends (measured as the increase in dividend per share of at least 0.5% following Amihud and Li, 2003), are initiating a repurchase, or are engaged in both simultaneously. Because our main objective is to observe the correlation in repurchase activity in concentrated and unconcentrated industries, we focus on the *Conc/RW Interaction* defined as the product of *Repurchase Wave* and *Concentration*.

The results are displayed in Table 5, Panel A for the full sample and in Panel B for the breakdown according to maturity.¹⁸ Across all the specifications, we see that there is significantly more correlation in the repurchase activity of firms located in concentrated industries. The *Conc/RW Interaction* term is positive and highly significant across all the specifications showing that the higher the concentration of the industry and the higher the number of repurchase announcements that occurred in the previous six months, the greater the likelihood that the firm in question also makes a repurchase. This effect is not only statistically significant but also economically relevant. For example, in the case of the fully-fledged specification (Table 5, Panel A, Column 3), a one standard deviation increase in *Conc/RW Interaction* raises the likelihood of a repurchase by around 15%.¹⁹ This clearly suggests that, overall, firms in concentrated industries are more likely to repurchase if other firms in the industry are repurchasing. The strategic interaction with the competitors becomes stronger as the concentration of the industry increases and this is consistent with the MH.

The results in Table 5, Panel B analyze the correlation of repurchase activity within the groups of mature and non-mature firms separately. Using four different measures of maturity (changes in ROA, changes in capital and R&D expenditures, changes in volatility, and dispersion of analyst forecasts), we find that, across all specifications, repurchase activity among mature and non-mature firms is equally correlated if the firms belong to concentrated industries. These findings support the MH and go against the prediction of the SH according to which repurchase activity should have been correlated only among mature firms in the industry because of declining profitability and growth

¹⁸We also construct the *Repurchase Wave* at the 12-month level. The results are qualitatively identical and are available upon request.

¹⁹This calculation has been made as follows. The coefficient of *Conc/RW Interaction* in Table 5, Panel A, Column (3) is 0.218, while its standard deviation for this specification is 0.32. The mean value of the dependent variable from this column is 0.47. Hence, the impact of one standard deviation change in *Conc/RW Interaction* changes the dependent variable to $0.47 + (0.218) \cdot (0.32) = 0.54$. In percentage terms, this would imply an increase in the dependent variable of $(0.54 - 0.47) / 0.47 = 14.9\%$.

Table 5

The decision to repurchase.

This table presents the results for the firm's decision to repurchase using tobit regressions on firm year observations. The dependent variable is defined as the ratio of repurchase divided by total payout, defined as the sum of dividends plus share repurchases. This variable is left and right censored at zero and one respectively. *Conc/RW Interaction* is the product of *Repurchase Wave* (RW) and *Concentration*. *Conc/Gov Interaction* is the product of *Concentration* and a governance dummy that takes a value of one if *Governance Index* (GI) exceeds 9 and is zero otherwise. Panel A presents the results for regressions estimated over the full sample, Panel B controls for firm maturity, and Panel C controls for the quality of corporate governance. *Payout Increasing Firms* are defined following Jagannathan, Stephens, and Weisbach (2000) and are firms that increase their dividends, or initiate a repurchase, or do both. Following Amihud and Li (2003), for a firm to be classified as dividend increasing, its dividend per share must increase by at least 0.5% from the previous year. The time period of the analysis ranges from 1984 to 2002. All specifications contain year dummies and industry dummies at the one-digit SIC level (following Grinstein and Michaely, 2005). ***, ** and * denote significance levels at 1%, 5%, and 10%, respectively. *T*-statistics are in parentheses. See the appendix for detailed definitions of the variables.

Panel A presents the results of tobit regressions estimated over the full sample. Column 4 contains the results only for payout increasing firms (*Payout Increasing*).

Panel B presents the results of tobit regressions while controlling for firm maturity. Firms are classified into mature and non-mature categories using the following four proxies for maturity: change in return on assets (ROA), change in capital and R&D expenditures (Capexp & R&D), changes in volatility (vol.), and dispersion of analyst forecasts (Analysts). Each of these measures is defined in Section 4. For ROA and capital and R&D expenditures, we calculate the change for the years (–2 to –1). If this is missing, we take the change over (–1 to 0). If this change is negative (positive) the firm is classified as mature (non-mature). For *Stock Return Volatility*, the average *Stock Return Volatility* for stocks for years (–1,–2) is subtracted from the average volatility for years (+1, +2). If the change is negative (positive) we classify the firm as mature (non-mature). For analyst dispersion, firms have been divided into mature and non-mature groups using the lagged *Adjusted Standard Deviation* and comparing it with the lagged annual median *Adjusted Standard Deviation* for all the firms. If the value for the firm is greater (lower) than the median, the firm is classified as non-mature (mature).

Panel C presents the results of tobit regressions for the firm's repurchase decision by analyzing firms with *Good Governance* and *Bad Governance* separately. Firms are classified into *Good Governance* and *Bad Governance* using *Governance Index*. Firms with a score of less than or equal to 9 are classified as *Good Governance* while those above 9 are classified as *Bad Governance*. Tobit regressions are conducted separately on each group as well as on the whole sample (*Combined*). *Conc/RW/Gov Interaction* is the product of *Conc/RW Interaction* and the governance dummy that takes a value of one if *Governance Index* exceeds 9 and is zero otherwise. Columns 4–6 contain the results only for firms that are increasing payout (*Payout Increasing Firms*).

Panel A. Results of Tobit regressions for the complete sample

Variable	All firms			Payout increasing
	(1)	(2)	(3)	(4)
Conc/RW Interaction	0.097*** (3.19)	0.238*** (6.44)	0.218*** (5.35)	0.128*** (4.30)
Control Variables				
Repurchase Wave (RW)	0.060*** (11.81)	0.017*** (3.23)	0.013** (2.50)	0.005 (1.35)
Concentration	–0.501*** (–13.48)	–0.451*** (–8.92)	–0.426*** (–7.43)	–0.316*** (–7.00)
Governance Index (GI)		–0.031*** (–8.97)	–0.035*** (–8.97)	–0.027*** (–8.71)
Conc/Gov Interaction		0.303*** (4.89)	0.301*** (4.35)	0.271*** (4.96)
Size	–0.129*** (–29.27)	–0.022*** (–3.49)	–0.033*** (–4.48)	–0.034*** (–6.05)

Table 5 (continued)

Panel A. Results of Tobit regressions for the complete sample

Variable	All firms			Payout increasing
	(1)	(2)	(3)	(4)
M/B Ratio	0.012*** (5.44)	0.002 (0.66)	-0.003 (-1.19)	-0.005** (-2.49)
D/E Ratio	0.004 (0.99)	0.012** (2.40)	0.003 (0.48)	0.030*** (4.59)
Operating Income	-1.802*** (-22.3)	0.202* (1.84)	0.433*** (3.42)	-0.082 (-0.81)
Non-Operating Income	-0.410 (-1.26)	2.708*** (4.94)	1.318** (2.18)	0.058 (0.12)
Std. Dev. Of Op. Income	4.077*** (23.34)	-0.018 (-0.08)	-0.288 (-0.94)	1.081*** (4.21)
Lag Dividend Payout Ratio	-0.001* (-1.68)	0.0002 (0.53)	0.001 (1.05)	0.001 (0.81)
Liquid Assets	0.051 (1.19)	0.158*** (2.94)	0.201*** (3.31)	0.104** (2.21)
Prior Year Stock Return	-0.016 (-1.42)	0.065*** (3.72)	0.062*** (3.31)	0.039** (2.53)
Price Earnings Ratio	-0.0002* (-1.87)	-0.0002* (-1.83)	-0.001** (-2.23)	-0.001 (-0.45)
Capital Expenditures	0.368*** (2.70)	-0.241 (-1.39)	-0.334* (-1.69)	-0.035 (-0.22)
Institutional Holdings	-0.015* (-1.70)	0.035 (0.69)	0.058 (0.99)	0.151*** (3.24)
Stock Liquidity		0.145*** (10.68)	0.138*** (8.31)	0.125*** (9.49)
Stock Return Volatility		15.442*** (13.66)	11.599*** (8.56)	13.711*** (12.22)
Equity-Based Compensation		0.449***	0.290*** (11.47)	(9.49)
Managerial Holdings			0.212** (2.15)	0.127* (1.64)
Intercept	0.893*** (6.58)	0.308* (1.69)	0.802 (1.33)	0.604*** (2.67)
Number of observations	28,636	9,433	6,906	5,495
Pseudo <i>R</i> -squared	0.141	0.156	0.178	0.290

Table 5 (continued)

Panel B. Results of Tobit regressions—controlling for firm maturity

Variable	Mature firms				Non-mature firms			
	ROA (1)	Capexp & R&D (2)	Vol. (3)	Analysts (4)	ROA (5)	Capexp & R&D (6)	Vol. (7)	Analysts (8)
Conc/RW Interaction	0.143** (2.35)	0.279*** (4.75)	0.273*** (3.79)	0.154*** (3.85)	0.285*** (5.15)	0.172*** (3.01)	0.152*** (3.06)	0.484*** (4.09)
Control Variables								
Repurchase Wave (RW)	0.013 (1.53)	0.013* (1.68)	0.010 (0.81)	0.014*** (2.58)	0.014* (1.95)	0.014* (1.79)	0.018*** (3.06)	-0.002 (-0.15)
Concentration	-0.517*** (-6.27)	-0.391*** (-4.94)	-0.408*** (-4.45)	-0.503*** (-8.18)	-0.362*** (-4.55)	-0.474*** (-5.69)	-0.398*** (-5.10)	-0.146 (-1.10)
Governance Index (GI)	-0.032*** (-5.77)	-0.032*** (-5.99)	-0.027*** (-4.08)	-0.030*** (-7.03)	-0.038*** (-6.96)	-0.038*** (-6.46)	-0.036*** (-6.82)	-0.039*** (-4.42)
Conc/Gov Interaction	0.274*** (2.70)	0.197** (2.07)	0.227** (2.00)	0.305*** (4.07)	0.329*** (3.47)	0.405*** (4.00)	0.373*** (4.00)	0.116 (0.74)
Size	-0.036*** (-3.41)	-0.028*** (-2.83)	-0.036*** (-2.81)	-0.019** (-2.44)	-0.031*** (-3.11)	-0.035*** (-3.26)	-0.022** (-2.30)	-0.039** (-2.24)
M/B Ratio	0.002 (0.58)	0.002 (0.65)	-0.010** (-2.48)	-0.010*** (-3.99)	-0.007** (-2.11)	-0.007* (-1.85)	-0.003 (-0.60)	0.014* (1.73)
D/E Ratio	-0.007 (-0.81)	-0.007 (-0.84)	0.015* (1.73)	0.021** (2.50)	0.012 (1.57)	0.009 (1.20)	-0.011 (-1.04)	-0.013 (-1.00)
Operating Income	0.374** (2.02)	0.489*** (2.77)	0.869*** (3.85)	0.758*** (5.08)	0.493*** (2.83)	0.333* (1.80)	0.168 (0.96)	-0.824** (-2.47)
Non-Operating Income	1.184 (1.40)	1.163 (1.39)	4.159*** (3.48)	4.038*** (4.56)	1.527* (1.76)	1.371 (1.56)	0.150 (0.17)	0.789 (0.71)
Std. Dev. of Op. Income	-1.273*** (-2.99)	-0.948** (-2.32)	-0.718 (-1.25)	0.204 (0.48)	0.890** (1.97)	0.242 (0.52)	-0.069 (-0.17)	-1.135* (-1.90)
Lag Dividend Payout Ratio	0.0004 (0.54)	0.0006 (1.22)	-0.003 (-0.90)	0.001 (1.56)	0.001 (1.07)	0.0002 (0.33)	0.0004 (0.98)	-0.006* (-1.70)
Liquid Assets	0.301*** (3.42)	0.277*** (3.34)	0.196* (1.91)	0.021 (0.32)	0.122 (1.44)	0.136 (1.51)	0.141* (1.71)	0.704*** (4.58)
Prior Year Stock Return	0.068** (2.07)	0.067*** (2.64)	0.045 (1.36)	0.031 (1.37)	0.027 (1.13)	0.057** (2.03)	0.087*** (3.25)	0.114*** (2.98)
Price Earnings Ratio	-0.0001 (-0.53)	-0.0001 (-1.04)	-0.001*** (-3.04)	-0.0003*** (-2.75)	-0.0003*** (-2.66)	-0.0003** (-2.01)	-0.0001 (-0.56)	-0.0001 (-0.41)
Capital Expenditures	0.148 (0.54)	-0.019 (-0.07)	-0.612* (-1.89)	-0.311 (-1.31)	-0.741*** (-2.59)	-0.614** (-2.02)	-0.226 (-0.85)	0.496 (1.23)
Institutional Holdings	0.067 (0.79)	-0.016 (-0.19)	-0.050 (-0.48)	0.182*** (2.76)	0.021 (0.25)	0.152* (1.74)	0.089 (1.17)	-0.093 (-0.71)
Stock Liquidity	0.157*** (6.53)	0.160*** (7.10)	0.160*** (5.43)	0.147*** (7.63)	0.123*** (5.41)	0.110*** (4.50)	0.101*** (4.55)	0.171*** (4.67)
Stock Return Volatility	13.429*** (7.16)	10.927*** (6.02)	11.514*** (4.82)	8.674*** (5.14)	8.684*** (4.35)	12.825*** (6.26)	11.768*** (5.62)	15.934*** (5.60)
Equity Based Compensation	0.428*** (7.48)	0.380*** (7.08)	0.334*** (5.00)	0.328*** (7.85)	0.457*** (8.47)	0.513*** (8.86)	0.449*** (8.58)	0.620*** (6.82)

Table 5 (continued)

Panel B. Results of Tobit regressions—controlling for firm maturity								
Variable	Mature firms				Non-mature firms			
	ROA (1)	Capexp & R&D (2)	Vol. (3)	Analysts (4)	ROA (5)	Capexp & R&D (6)	Vol. (7)	Analysts (8)
Managerial Holdings	0.407*** (2.81)	0.223 (1.63)	0.114 (0.70)	0.153 (1.33)	0.003 (0.02)	0.204 (1.44)	0.281** (2.07)	0.874*** (3.65)
Intercept	0.785 (1.25)	0.524 (1.07)	1.053*** (4.87)	0.266 (0.80)	1.060*** (6.19)	0.990*** (5.44)	0.464*** (2.78)	1.113*** (3.54)
Number of observations	3,450	3,616	2,410	4,304	3,392	3,217	3,572	2,374
Pseudo R-squared	0.1903	0.1934	0.2063	0.1915	0.1790	0.1752	0.1613	0.1971
Panel C. Results of Tobit regressions—controlling for quality of corporate governance								
Variables	All firms			Payout increasing firms				
	Good governance (1)	Bad governance (2)	Combined (3)	Good governance (4)	Bad governance (5)	Combined (6)		
Conc/RW Interaction	0.279*** (4.09)	0.170*** (3.43)	0.262*** (5.06)	0.173*** (3.52)	0.101*** (2.77)	0.161*** (4.28)		
Conc/RW/Gov Interaction			−0.073 (−1.38)			−0.056 (−1.45)		
<i>Control variable</i>								
Repurchase Wave (RW)	0.011 (1.35)	0.016** (2.16)	0.012** (2.25)	0.002 (0.30)	0.007 (1.38)	0.004 (1.11)		
Concentration	−0.457*** (−6.50)	−0.036*** (−5.43)	−0.429*** (−7.48)	−0.353*** (−6.41)	−0.013 (−0.27)	−0.319*** (−7.06)		
Governance Index (GI)	−0.016** (−1.96)	−0.111* (−1.86)	−0.035*** (−8.79)	−0.017** (−2.60)	−0.028*** (−5.11)	−0.027*** (−8.52)		
Conc/Gov Interaction			0.309*** (4.45)			0.278*** (5.07)		
Size	−0.045*** (−4.03)	−0.009 (−0.98)	−0.032*** (−4.44)	−0.047*** (−5.47)	−0.015** (−1.98)	−0.034*** (−5.99)		
M/B Ratio	−0.009** (−2.20)	0.003 (1.02)	−0.003 (−1.18)	−0.011*** (−3.16)	−0.0001 (−0.05)	−0.005** (−2.49)		
D/E Ratio	0.016** (2.02)	−0.022** (−2.50)	0.003 (0.46)	0.069*** (5.33)	0.002 (0.32)	0.030*** (4.57)		
Operating Income	0.261 (1.32)	0.465*** (2.79)	0.433*** (3.42)	0.020 (0.13)	−0.274*** (−2.10)	−0.083 (−0.82)		
Non-Operating Income	2.406*** (2.83)	0.376 (0.42)	1.321** (2.18)	0.620 (0.90)	0.031 (0.04)	0.062 (0.12)		
Std. Dev. of Op. Income	−0.275 (−0.61)	−0.279 (−0.64)	−0.287 (−0.93)	0.685* (1.89)	1.664*** (4.40)	1.081*** (4.21)		
Lag Dividend Payout Ratio	0.00003 (0.04)	0.001 (1.33)	0.0004 (1.05)	0.00001 (0.02)	0.0004 (1.18)	0.0002 (0.81)		
Liquid Assets	0.010 (0.11)	0.373*** (4.57)	0.201*** (3.30)	−0.019 (−0.27)	0.234*** (3.65)	0.103** (2.19)		

Table 5 (continued)

Panel C. Results of Tobit regressions—controlling for quality of corporate governance

Variables	All firms			Payout increasing firms		
	Good governance (1)	Bad governance (2)	Combined (3)	Good governance (4)	Bad governance (5)	Combined (6)
Prior Year Stock Return	0.039 (1.38)	0.089*** (3.54)	0.063*** (3.33)	0.028 (1.22)	0.052** (2.49)	0.039** (2.54)
Price Earnings Ratio	-0.0002 (-1.44)	-0.0002 (-1.55)	-0.0002** (-2.21)	-0.0001 (-0.90)	0.00001 (0.13)	-0.00003 (-0.43)
Capital Expenditures	-1.120*** (-3.78)	0.542** (2.05)	-0.334* (-1.69)	-0.457** (-1.97)	0.515** (2.40)	-0.036 (-0.23)
Institutional Holdings	0.106 (1.20)	-0.046 (-0.58)	0.058 (0.99)	0.166** (2.38)	0.072 (1.13)	0.150*** (3.23)
Stock Liquidity	0.209*** (8.27)	0.073*** (3.29)	0.138*** (8.32)	0.182*** (9.25)	0.068*** (3.82)	0.125*** (9.51)
Stock Return Volatility	16.274*** (7.81)	5.365*** (3.00)	11.597*** (8.55)	15.369*** (9.21)	10.841*** (7.03)	13.715*** (12.22)
Equity Based Compensation	0.627*** (10.38)	0.221*** (4.29)	0.448*** (11.44)	0.393*** (8.46)	0.162*** (3.98)	0.289*** (9.45)
Managerial Holdings	0.294** (2.34)	0.528*** (2.76)	0.213** (2.16)	0.160 (1.63)	0.363** (2.44)	0.128* (1.66)
Intercept	0.678*** (3.81)	0.488*** (2.97)	0.800 (1.33)	0.614 (1.30)	0.618*** (2.66)	0.594*** (2.63)
Number of observations	3,457	3,449	6,906	2,852	2,643	5,495
Pseudo R-squared	0.2158	0.1323	0.1786	0.3257	0.2297	0.2901

opportunities and non-mature firms should not have repurchased owing to better economic prospects. These findings, thus, support MH3a and reject SH3a.

We now consider MH3b and SH3b and analyze firms with *Good Governance* and *Bad Governance* separately. Firms with *Governance Index* less than or equal to nine are classified as *Good Governance* while those having *Governance Index* above nine are classified as *Bad Governance*. Tobit regressions are conducted separately on each group. SH3b posits the *Conc/RW Interaction* term to be positive and significant only for firms with *Good Governance*. Furthermore, we also test for the difference in the strength of the clustering activity across the two sub-samples by interacting *Conc/RW Interaction* with a governance dummy that takes a value of zero for *Good Governance* and a value of one for *Bad Governance*. The resulting term is labelled *Conc/RW/Gov Interaction*. According to the SH, this term should be significantly negative if the strength of the clustering activity among well-governed firms outweighs that among poorly governed firms.

The results are reported in Table 5, Panel C. We present the results for the fully-fledged specifications for the entire sample, as well as for the subset of firms that are increasing their payouts (*Payout Increasing Firms*). *Conc/RW Interaction* is positive and significant for both *Good Governance* and *Bad Governance* firms in all specifications. Furthermore, the

Conc/RW/Gov Interaction term is insignificant in all cases. This shows that firms with good and bad governance react alike to repurchase activity of other firms within their industry and the clustering of this activity cannot be explained by differences in the quality of corporate governance. This supports the MH and rejects the SH.²⁰

We now consider the other variables. The choice of repurchase is negatively related to *Governance Index* and positively related to the *Conc/Gov Interaction*. This is robust across all the alternative specifications. The fact that the quality of governance is negatively related to the value of the index suggests that there is a positive relation between the quality of governance and the choice to repurchase in general. However, this relationship gets weaker with concentration. The more concentrated the industry becomes, the more firms with poor governance prefer repurchases to dividends as payout. The results for the other control variables are consistent with the literature (see, for example, Fenn and Liang, 2001; Kahle, 2002; Jagannathan, Stephens, and Weisbach, 2000).

8. Repurchases and long-run abnormal returns

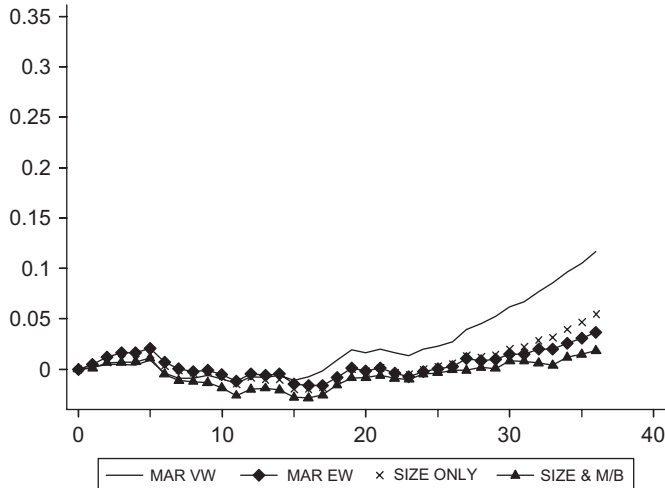
We now explore the long-run performance of repurchasing firms conditioning on the level of their industry concentration. The MH posits that because repurchases in more concentrated industries are less motivated by market timing, a significant difference should be observed between the post-announcement performance of repurchasing firms in concentrated and unconcentrated industries.

We start by relating to previous findings on long-run performance of repurchasing firms. We reproduce Fig. 1 of Ikenberry, Lakonishok and Vermaelen, (1995) for repurchasing firms belonging to high and low concentration industries. Fig. 2 shows the average CARs for matched repurchasing firms in high and low concentration industries for the 36 months following the open-market repurchase announcement. Abnormal returns are calculated using four different methods: market-adjusted returns using the CRSP value-weighted index (*MAR VW*), market-adjusted returns using the CRSP equal-weighted index (*MAR EW*), size-adjusted returns using equal-weighted portfolio returns from the same size decile (*SIZE ONLY*), and size- and market-to-book-adjusted returns using equal-weighted portfolio returns from the same size decile and market-to-book quintile (*SIZE & M/B*). Panel A contains the graphs for repurchasing firms in high concentration industries, and Panel B contains graphs for those in low concentration industries.

Fig. 2 shows that the long-run over-performance of share repurchasing firms is a phenomenon that applies mostly for low concentration industries. In the case of low-concentration industries, the long-run (36 months) over-performance is never below 20%, regardless of the methodologies used to aggregate returns, while for high-concentration industries, it is never above 10%. On average, the long-run over-performance in low concentration (high concentration) industries is around 24% (5%) at the end of 36 months.

²⁰As an additional robustness check, we focus directly on distribution announcements. We follow Jagannathan Stephens, and Weisbach (2000) and Kahle (2002) and study the announcements of payout increase. We use a probit regression in which the dependent variable takes the value of one if the firm announces an open-market repurchase (i.e., if there is a repurchase announcement from SDC) and zero if it increases its cash dividend (i.e., if there is an increase in dividend per share of at least 0.5%, following Amihud and Li, 2003) conditional on a dividend payment in either of the previous two years. The explanatory variables are the same as the ones used in the tobit specification. The results (not reported but available upon request) are consistent with those of the tobit regressions reported above.

Panel A. Monthly average cumulative abnormal returns for repurchasing firms in high concentration industries



Panel B. Monthly average cumulative abnormal returns for repurchasing firms in low concentration industries

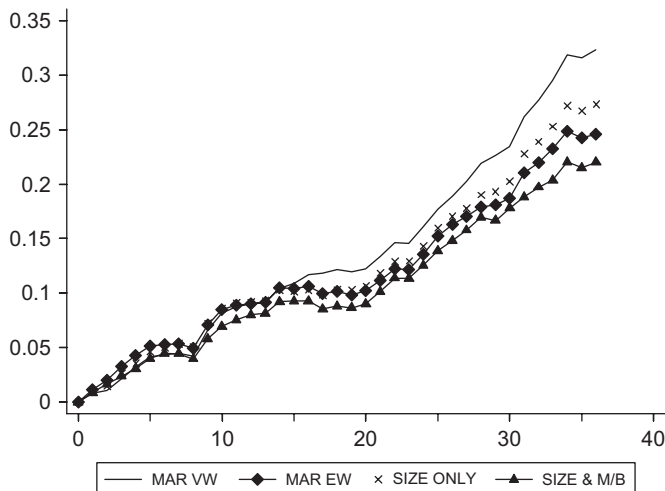


Fig. 2. The graphs show comparative average cumulative abnormal returns (CAR) for repurchasing firms in *High Concentration* and *Low Concentration* industries for the 36 months following the open-market repurchase announcement. CAR are depicted on the y-axis while the number of months relative to the announcement date are shown on the x-axis. Abnormal returns have been calculated using four different methods: market-adjusted returns using the CRSP value-weighted index (*MAR VW*), market-adjusted returns using the CRSP equal-weighted index (*MAR EW*), size-adjusted returns using equal-weighted portfolio returns from the same size decile (*SIZE ONLY*), and size- and market-to-book-adjusted returns using equal-weighted portfolio returns from the same size decile, and market-to-book quintile (*SIZE & M/B*). Repurchasing firms in high and low concentration industries represent the top and bottom quintile of repurchasing firms ranked on the basis of concentration, and these have been matched with each other on the basis of time of announcement, size, and market-to-book ratio. Both groups are made up of 679 repurchasing firms. Panel A contains the graphs for repurchasing firms in *High Concentration* industries, and Panel B contains graphs for those in *Low Concentration* industries.

We then consider the long-run over-performance in more detail. We proceed as follows. First, we measure the post-announcement performance of matched and unmatched repurchasing firms in event time using the RATS method of Ibbotson (1975). In the next step we employ the CTPR approach of Ikenberry, Lakonishok, and Vermaelen (2000). To properly control for other confounding effects, we create a sample of non-repurchasing control firms for each repurchasing firm and analyze the differences in their performance in the post-announcement period. We also directly test the alternative SH by studying whether our results are driven by differences in the speed with which information flows within industries or the maturity of repurchasing firms.

8.1. Returns across time and securities

The RATS method developed by Ibbotson (1975) allows us to estimate the long-run abnormal returns without imposing the constancy of the factor loadings (i.e., betas). We display the results of the RATS regressions for both matching and non-matching firms in Table 6, Panel A. The analysis shows that repurchasing firms in low concentration industries outperform their counterparts in high concentration industries (in both groups) by highly significant amounts over 12, 24, and 36 months. For example, 36 months after the announcement, repurchasing stocks in unconcentrated industries give a highly significant average monthly CAR of about 25%, whereas their peers in concentrated industries only manage to provide a statistically insignificant CAR of 3%. These results support the intuition of the MH showing that the repurchase decisions of firms in concentrated industries are not driven by the market timing motive.

8.2. Calendar time portfolio regressions

As an alternative methodology, we focus on long run abnormal returns based on the CTPR approach of Ikenberry, Lakonishok, and Vermaelen (2000). In particular, we construct portfolios made up of firms that have just announced an open market repurchase going long in the quintile of repurchasing firms in unconcentrated industries and short in the quintile of repurchasing firms in concentrated industries. These portfolios are rebalanced every month to include in the portfolio stocks that have announced a repurchase program in the previous month and to drop stocks that have reached the end of their holding period of 36 months. We then calculate the abnormal returns both with respect to a three-factor model (i.e., the three Fama and French, 1993, factors) and a four-factor model, which also includes the Carhart (1997) momentum factor. The intercept of the time-series regression is used as a proxy for the abnormal return. Given that in the literature there is a debate on whether the more proper measure is based on value-weighted or equally weighted returns (Fama, 1998; Mitchell and Stafford, 2000; Loughran and Ritter, 2000), we consider both value- and equal-weighted portfolios.

We report the results for the abnormal returns in Table 6, Panel B. For the three-factor model, using equal-weighted portfolios, stocks of repurchasing firms in unconcentrated industries outperform their peers in concentrated industries by nearly 50 basis points per month, which is significant at the 1% level. The value-weighted portfolio similarly yields 51 basis points (bps) per month. Likewise, equal- and value-weighted portfolios yield highly significant abnormal returns of 61 and 48 bps per month, respectively, in the case of the four-factor model. The results clearly show that portfolios of repurchasing firms in low

Table 6

Post announcement performance of repurchasing firms in high and low concentration quintiles.

Panel A contains monthly cumulative average abnormal returns for repurchasing firms falling in high and low concentration quintiles, conducted using the Ibbotson (1975) Returns Across Time and Securities (RATS) method combined with the Fama and French three-factor model. The results for both unmatched and matched (on the basis of size, market to book, and time of announcement) repurchasing firms are provided. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant time periods expressed in percentage terms. Number of observations for each column is given in parentheses. ***, **, *, and \$ denote significance levels of 0.1%, 1%, 5%, and 10%, respectively, using two-tailed tests.

Panel B reports the abnormal return results obtained using the calendar-time portfolio regression (CTPR) approach of Ikenberry, Lakonishok, and Vermaelen (2000) conducted using both equal- and value-weighted portfolios. The dependent variable is the monthly return on a portfolio that goes long in repurchasing stocks located in unconcentrated industries and short in repurchasing stocks located in concentrated industries in the month following the repurchase announcement. Each stock is kept in the portfolio for a period of 36 months after which it is dropped. Abnormal performance is measured by the intercept of a time-series regression. Abnormal returns for both the three-factor model (containing the three Fama and French, 1993, factors) and the four factor model (also containing the Carhart, 1997, momentum factor) are reported. *T*-statistics are calculated using heteroskedasticity robust standard errors. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively. ‘Obs.’ denotes the number of observations.

Panel C compares the post-announcement performance of repurchasing firms falling in high and low concentration quintiles and their controls. The repurchasing firms in each quintile are matched with each other on the basis of time of announcement, size, and market to book ratio. A control firm for each repurchasing firm is then selected from a pool of non-repurchasing firms. The control firm is chosen as the firm that falls in the same three-digit SIC classification as the repurchasing firm and that has the smallest absolute percentage difference (computed as the sum of the absolute percentage difference for size and market to book) with respect to the repurchasing firm. The number of controls for firms in high concentration industries are fewer in number because in their three-digit SIC code industry in the particular year of announcement, control firms had missing data on matching variables. To control for this, only those repurchasing firms are reported in high concentration industries for which control firms have been found. The table depicts cumulative market-adjusted returns (MAR) using both value-weighted (VWI) and equal-weighted (EWI) market indices. Returns on portfolios with a long position in repurchasing stocks and a short position in control stocks are also shown. (+1, +12), (+1, +24), and (+1, +36) denote average cumulative abnormal returns starting from the first month after the announcement to 12, 24, and 36 months following the announcement respectively. ***, **, *, and \$ denote significance levels of 0.1%, 1%, 5%, and 10%, respectively, using two-tailed tests. ‘Obs.’ denotes the number of observations.

Panel A. Results for the Ibbotson (1975) RATS procedure

	Unmatched quintiles		Matched quintiles	
	High concentration	Low concentration	High concentration	Low concentration
Months	(1,404)	(1,383)	(679)	(679)
(+1, +12)	-0.24%	5.83%***	-1.29%	6.73%**
(+1, +24)	0.56%	13.40%***	-0.48%	11.92%***
(+1, +36)	2.87%	25.94%***	3.44%	25.47%***

Panel B. Abnormal returns obtained from calendar time portfolio regressions

	Equally-weighted portfolios			Value-weighted portfolios		
	Coefficient	<i>T</i> -statistic	Adjusted- <i>R</i> ²	Coefficient	<i>T</i> -statistic	Adjusted- <i>R</i> ²
α (3-Factor)	0.0048	2.91***	0.39	0.0051	2.38**	0.16
α (4-Factor)	0.0061	3.46***	0.42	0.0048	2.05**	0.16
Obs.		239			239	

Table 6 (continued)

Panel C. Comparing long-run performance of repurchasing and non-repurchasing control firms

Category	Months	Repurchasing firms		Control firms		Long-short Portfolio Returns
		MAR—VWI	MAR—EWI	MAR—VWI	MAR—EWI	
High concentration industries (627)	(+ 1, + 12)	−0.79%*	−0.61%	−2.43%	−2.08%	0.96%
	(+ 1, + 24)	1.96%	−0.17%	−2.18%	−3.75%\$	2.14%
	(+ 1, + 36)	9.98%***	3.10%	2.73%	−2.97%	3.70%*
Low concentration industries (679)	(+ 1, + 12)	8.80%***	8.77%***	2.98%	2.86%	4.02%**
	(+ 1, + 24)	15.54%***	12.98%***	8.84%**	6.51%*	6.81%***
	(+ 1, + 36)	29.69%***	22.63%***	19.48%***	11.34%**	11.13%***

concentration industries deliver significantly higher post-announcement returns than their counterparts in high concentration industries. Therefore, the findings are again consistent with the MH.

8.3. Controlling for market power

One alternative explanation could be that firms in concentrated industries have consistently higher prices than firms in unconcentrated industries. Indeed, firms in concentrated industries, because of their being shielded from competition and their ability to collude, are able to deliver higher mark-ups and returns during a recession (Chevalier and Scharfstein, 1996). This would imply lower required rate of return and therefore higher prices for firms located in concentrated industries (Hou and Robinson, 2006).

To control for this possibility, we use a “matching firms” methodology. In particular, for each repurchasing firm, we identify a control firm that lies in the same three-digit SIC classification as the repurchasing firm and is the closest to the repurchasing firm in terms of market-to-book ratio and size. This is achieved by computing the absolute percentage difference of size and market to book for each non-repurchasing firm (that lies in the same three-digit industry as the repurchasing firm in the year of announcement) with respect to the repurchasing firm and selecting as a control firm the firm that is closest in terms of the sum of these absolute percentage differences. We then compare the repurchasing firms with their controls. If firms from concentrated industries are bound to have higher and more stable cash flows than firms from unconcentrated industries, this would be picked up by the controls.

Applying this algorithm, we are able to find 679 (629) control firms for the repurchasing firms located in unconcentrated (concentrated) industries.²¹ We report our findings for only those repurchasing firms in concentrated industries for which we could find suitable control firms. We then compute the cumulative market adjusted returns using the value- and equal-weighted market indices for each group of firms as well as returns for portfolios that are long in the repurchasing firms and short in their respective controls.

²¹The number of control firms for repurchasing firms in concentrated industries is smaller because the data required for the matching algorithm is missing for some control firms in the announcement year.

Table 7

Post announcement performance of repurchasing stocks (quintiles) in high and low concentration industries: Controlling for firm maturity.

This table presents the results for the long-run post repurchase announcement performance of repurchasing stocks located in concentrated and unconcentrated industries using the Return Across Time and Securities (RATS) method of Ibbotson (1975). The numbers represent the monthly cumulative average abnormal returns (CAR) calculated using the Fama and French three factor model and are sums of the intercepts of cross-sectional regressions over the relevant time periods expressed in percentage terms. Panel A controls for the speed of information flow within the industry using three proxies: *Average Industry Analyst Following*, *Average Industry Stock Turnover*, and *Average Industry Dispersion of Analyst Forecasts*. The analyst following of each stock in the industry is averaged to obtain the *Average Industry Analyst Following*. Stocks belonging to industries with average analyst following greater (lower) than the median for that particular concentration group are classified under *High Information Flow (Low Information Flow)*. The *Average Industry Stock Turnover* is constructed using lagged average annual turnover for each stock in the industry. Turnover is calculated as the ratio of trading volume to the shares outstanding using monthly data. Stocks belonging to industries with average turnover greater (lower) than the median for that particular concentration group are classified under *High Information Flow (Low Information Flow)*. For the *Average Industry Dispersion of Analyst Forecasts* the lagged dispersion of estimates for each stock is standardized by the mean estimate for that stock and then the average for the industry is computed using all stocks in the industry. Stocks belonging to industries with average dispersion lower (greater) than the median for that particular concentration group are classified under *High Information Flow (Low Information Flow)*. In the table, *High Information Flow (Low Information Flow)* has been denoted with HIF (LIF). In Panel B we divide concentrated and unconcentrated quintiles of repurchasing stocks into mature and non-mature firms using three different proxies for firm maturity: change in return on assets (ROA), change in capital and R&D expenditures, and permanence of cash flow shocks. For definitions of ROA and capital and R&D, see Section 4. Mature and non-mature firms are identified by observing the change in each measure over the interval (–2 to –1) relative to the year of the repurchase announcement. If this value is missing, only then the change over the years (–1 to 0) is taken. If the change is negative (positive), the firm is classified as mature (non-mature). Permanence of cash flow shocks is defined in Section 4. If the value of this measure for the firm is greater (smaller) than the sample median, the firm is classified as mature (non-mature). (+1, +12), (+1, +24), and (+1, +36) denote average monthly CAR starting from the first month after the announcement to 12, 24, and 36 months after the announcement respectively. The number of observations appears in the parentheses. ***, **, *, and \$ represent significance levels of 0.1%, 1%, 5%, and 10%, respectively.

Panel A. Analyzing the impact of information flow on long-run performance

	Average industry analyst following				Average industry stock turnover				Average industry dispersion of analyst forecasts			
	High Concentration		Low Concentration		High Concentration		Low Concentration		High Concentration		Low Concentration	
	HIF	LIF	HIF	LIF	HIF	LIF	HIF	LIF	HIF	LIF	HIF	LIF
Months	(692)	(692)	(664)	(719)	(703)	(701)	(692)	(691)	(683)	(682)	(685)	(698)
(+1, +12)	0.30%	-0.69%	3.27%\$	8.39%***	-1.12%	0.64%	9.93%***	2.67%	-1.82%	2.05%	7.08%***	5.81%*
(+1, +24)	-0.11%	0.52%	5.78%*	20.06%***	2.19%	-0.97%	22.35%***	5.65%*	-0.28%	0.00%	13.26%***	14.79%***
(+1, +36)	1.85%	2.75%	10.66%**	39.71%***	4.30%	1.60%	39.83%***	11.28%***	2.38%	2.32%	18.62%***	34.94%***

Panel B. Analyzing the impact of maturity on long-run performance

	Change in return on assets (ROA)				Change in capital and R&D expenditures				Permanence of cash flow shocks			
	High Concentration		Low Concentration		High Concentration		Low Concentration		High Concentration		Low Concentration	
	Mature	Non-mature	Mature	Non-Mature	Mature	Non-Mature	Mature	Non-Mature	Mature	Non-Mature	Mature	Non-mature
Months	(568)	(699)	(616)	(628)	(642)	(613)	(625)	(597)	(502)	(503)	(474)	(474)
(+1, +12)	-1.49%	2.39%	5.10%*	6.66%**	2.68%	-1.05%	4.04%\$	7.44%***	-2.23%	-2.31%	3.13%	4.14%\$
(+1, +24)	0.73%	2.30%	13.26%***	12.84%***	3.86%	-1.22%	13.53%***	11.64%***	-4.02%	-2.14%	11.11%**	9.10%**
(+1, +36)	2.70%	4.52%	25.03%***	25.82%***	5.72%	1.98%	24.18%***	26.00%***	-1.92%	1.56%	23.62%***	21.03%***

The results are documented in Table 6, Panel C. They show that repurchasing firms in unconcentrated industries outperform their controls by a margin greater than the one by which repurchasing firms in concentrated industries outperform their controls. Portfolio returns computed using long positions in repurchasing firms and short positions in their respective controls show that, while repurchasing firms in high concentration industries outperform their controls by a meager 3.7% over 36 months, repurchasing firms in low concentration industries do so by a highly significant 11.13%. These findings allow us to conclude that the higher long-term returns of repurchasing stocks in unconcentrated industries are not simply due to the fact that firms in more concentrated industries should have lower expected rates of return because they are less risky.

8.4. Distinguishing the MH from the SH

According to SH4, within concentrated industries, the share price drift should be larger for repurchasing firms located in industries in which information travels more slowly. In contrast, the MH does not posit any difference based on information. Moreover, the SH predicts a positive drift only for mature firms located in unconcentrated industries and is mute for the case in which unconcentrated industries contain firms that are not mature.

We first provide results for the case of repurchasing stocks within concentrated industries after having further identified within this group the industries in which information travels slower or faster. We use a number of proxies for the speed of information flow that have been identified in the literature (see Hou, 2003). Information disseminates more slowly for industries that have lower levels of analyst coverage and trading volume and higher levels of analyst dispersion. Based on these findings, we use *Average Industry Analyst Following*, *Average Industry Stock Turnover*, and *Average Industry Dispersion of Analyst Forecasts* to capture the speed of information flow. This allows us to control the speed with which the information signalled by the announcements of repurchasing firms in the industry might be impounded into the prices of other firms in the same industry.

The analyst following of each stock in the industry is averaged to obtain the *Average Industry Analyst Following*. Stocks belonging to industries with average analyst following greater (lower) than the median for that particular concentration group are classified under *High Information Flow (Low Information Flow)*. The *Average Industry Stock Turnover* is constructed using lagged average annual turnover for each stock in the industry. Turnover is calculated as the ratio of trading volume to the shares outstanding using monthly data. Stocks belonging to industries with average turnover greater (lower) than the median for that particular concentration group are classified under *High Information Flow (Low Information Flow)*. For the *Average Industry Dispersion of Analyst Forecasts* the lagged dispersion of estimates for each stock is standardized by the mean estimate for that stock and then the average for the industry is computed using all stocks in the industry. Stocks belonging to industries with average dispersion lower (greater) than the median for that particular concentration group are labeled as *High Information Flow (Low Information Flow)*. According to the SH, within concentrated industries, we would expect to see a larger post-announcement drift for repurchasing firms located in *Low Information Flow* industries.

The results reported in Table 7, Panel A show that within concentrated industries, the long-run returns for the repurchasing firms are insignificantly different from zero

regardless of the speed with which the information flows within the industry. According to the SH, the drift for repurchasing stocks classified under *Low Information Flow* should have exceeded the drift for the stocks classified under *High Information Flow*, but this is not supported by the data. As for the repurchasing stocks located in unconcentrated industries, we observe a positive significant share price drift regardless of the information flow characteristics of the industries. The results, therefore, support MH4 and reject SH4.

We now distinguish the SH from the MH by identifying mature and non-mature repurchasing firms within concentrated and unconcentrated industries and analyzing their drift in the post-announcement period. We recall that, according to SH, post-announcement share price drift only results from a decline in the cost of capital that can be observed for mature repurchasing firms. The market impounds the decrease in cost of capital for all firms within concentrated industries (based on the argument that these firms are more similar), and hence, when these firms do make repurchases, there is no drift. In the unconcentrated industries, the SH can similarly explain the drift in the share price of mature repurchasing firms. However, if SH is true, then there should be no share price drift when the repurchasing firms located in unconcentrated industries are non-mature because, for these companies, there should be no decline in the cost of capital. The MH, on the other hand, does not make this claim as all repurchasing firms within unconcentrated industries should have a significant drift because these firms take advantage of stock underpricing at the time of the announcement.

We test this by dividing repurchasing firms in concentrated and unconcentrated industries into mature and non-mature firms using three different proxies for maturity: changes in ROA, changes in capital and R&D expenditures, and the permanence of cash flow shocks. The procedures used for identifying mature and non-mature firms are analogous to the ones described above.²² The results for these tests are reported in Table 7, Panel B. The findings show that, no matter which proxy for firm maturity we use, and contrary to the prediction of the SH, non-mature firms in unconcentrated industries exhibit significant share price drift in the long-run. Moreover, both mature and non-mature repurchasing firms in low concentration industries out-perform their respective counterparts in high concentration industries. This provides clear support for the MH and rejects the SH.²³

9. Conclusion

We study how the degree of product market competition affects the firm's decision to repurchase shares, using a broad sample of US firms for the period 1984–2002. We argue that, in the case of strategic interaction between firms, repurchasing shares acquires a mimicking dimension. This is because a repurchase announcement sends a positive signal

²²To ensure that our sorting variable is not being driven by the firm's repurchase decision, for changes in ROA and capital and R&D expenditures, we classify firms as mature (non-mature) if the change in the relevant statistic measured over years (–2 to –1) is negative (positive). Only if the change over this interval is missing, we consider the change over (–1 to 0) years.

²³We also identify mature and non-mature firms using the other seven measures of maturity discussed in Section 4. The results are consistent with the reported ones. Furthermore, we also perform robustness tests to check for other explanations based on corporate governance, institutional holdings, or asymmetric information about the companies. We find that our results are not driven by any of these confounding factors. These results are available upon request.

about the repurchasing firm but a negative one about its competitors, which lowers the price of these other firms in the same industry. This negative signal results from the lack of a repurchase announcement and conveys to the market that the economic prospects as well as the competitive position of these non-repurchasing firms are bleak in comparison with those of repurchasing firms.

We show that this negative impact on the share prices of non-repurchasing firms induces them to reciprocate by repurchasing themselves. Thus, we find that repurchases in concentrated industries are chosen mostly as a reaction to other firms' repurchase decisions and are not driven by the desire to take advantage of significantly undervalued stock prices.

The decoupling of the repurchase decision from the degree of undervaluation of the firm suggests that repurchasing firms in more concentrated industries experience a lower increase in value than that experienced by repurchasing firms in less concentrated industries. We confirm this intuition by showing that repurchasing firms in less concentrated industries outperform the market, their non-repurchasing peers, and their counterparts in more concentrated industries by an amount that is both economically and statistically significant.

Our results provide a new way of looking at repurchases, from a perspective that blends corporate finance and industrial organization. They also provide some new intuition regarding why firms tend to cluster their repurchases and why we observe repurchases happening in waves.

Appendix. Variable definitions

A detailed description of construction of all variables is shown in Table A.1

Table A.1

Panel A: Firm Characteristics

Characteristic	Description
Repurchases	Dollar amount of the stock bought back by the firm: CRSP-Compustat Merged Industrial Database (CCM) data 115.
Dividends	Dollar amount of dividends: CCM data 21.
Total payout	Sum of repurchases and dividends: data 115 + data 21.
Firm size	The logarithm of the total assets of the firm: CCM data 6. (Equal-weighted moving average over the past three years.)
Market-to-book ratio	Ratio of the market value of equity, calculated as the price per share multiplied by the number of shares outstanding and divided by the book value of equity: CCM (data 24 * data 25)/data 60. (Equal-weighted moving average over the past three years.)
Debt-to-equity ratio	Ratio of long-term debt to the total equity of the firm: CCM data 9/data 60. (Equal-weighted moving average over the past three years.)
Operating income	Ratio of operating income to total assets: CCM data 13/ data 6. (Equal-weighted moving average over the past three years.)
Non-operating income	Ratio of non-operating income to total assets: CCM data 61/ data 6. (Equal-weighted moving average over the past three years.)
Standard deviation of operating income	Standard deviation of the ratio of operating income to the total assets measured over the past five years (the current year inclusive).

Table A.1 (continued)

Panel A: Firm Characteristics

Characteristic	Description
Lagged dividend payout ratio	The ratio of total dividends to the net income available to common shareholders for the previous year: CCM data 21 _{<i>t-1</i>} /data 237 _{<i>t-1</i>} .
Liquid assets	Current assets minus current liabilities, divided by the total assets: CCM (data 4 – data 5)/data 6. (Equal-weighted moving average over the past three years.)
Price earnings ratio	Share price divided by the basic earnings per share: CCM data 24/data 58. (Equal-weighted moving average over the past three years.)
Capital expenditures	Ratio of capital expenditure to the total assets of the firm: CCM data 128/data 6. (Equal-weighted moving average over the past three years.)
Prior year stock return	Compounded monthly return for the previous year: CRSP Monthly Stocks.
Institutional holdings	Ratio of firm's shares held by the institutional investors relative to the total shares outstanding: CDA/Spectrum Database.
Stock liquidity	The logarithm of the sum of the monthly share volume over the previous year divided by the number of shares outstanding at the end of the year: CRSP Monthly Stocks.
Stock return volatility	Computed as the standard deviation of daily stock returns for the previous year. Data obtained from CRSP Daily Stocks.

Panel B: Variables capturing product market competition and strategic interaction between firms

Variable	Description
Concentration	Sum of the squared market share of each firm in the same industry during a year. Market share is defined as the total sales of the firm in a given year divided by the total sales of the industry in the year. The industry is defined at the three-digit SIC code level, where the SIC codes have been obtained from CRSP Monthly Stocks (SICCD). The sales data comes from CCM: data 12. (Equal weighted moving average over the past three years.)
Repurchase wave	Calculated as the sum of the number of repurchase announcements that occur in the same three-digit SIC code industry for all the other firms in the previous six months.

Panel C: Additional controls

Control	Description
Governance Index	Measured on the same principle as Gompers, Ishii, and Metric (2003): sum of the number of provisions restricting shareholder rights. Data obtained from IRRC. (In each case, we take the lagged value of this variable in each regression.)
Equity based compensation	Options granted to the firm executive divided by the total compensation of the executive: Compustat Executive Compensation Database BLK_VALU/TDC1. (Equal-weighted moving average of the top five firm executives for the previous year.)
Managerial holdings	Shares owned (excluding options) by the manager divided by the number of shares outstanding: Compustat Executive Compensation Database SHROWN/SHRSOUT. (Equal-weighted moving average of the top five firm executives for the previous year.)

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