



Takeover Deterrent Effect of On-market Share Buyback in Australia

Dong Hai Trieu Doan¹ Chee Jin Yap² Gerard Gannon³

Abstract

This study examines whether Australian firms use on-market share buybacks to deter unwanted takeover risk. We found a statistically significant and positive relationship between a firm's ex-ante takeover probability and its on-market share buyback activities. Our result is robust to alternative modelling techniques, namely TOBIT and Censored Quantile Regressions. This paper found evidence that in a dividend imputation credit taxation system the yield of share buyback is positively related to dividend payments. However, on-market share buyback activity is closely related to temporary cash flows rather than to permanent operating cash flows. This might indicate that, besides dividend payments, Australian firms take advantage of the financial flexibility that comes with share buybacks to redistribute non-permanent cash flows to their shareholders.

Key Words: Share buyback; Open-market; takeover deterrent

JEL Classification: G30, G32, G35.

¹ Monash University

² Swinburne University, email: cheejinyap@swin.edu.au

³ Deakin University

Acknowledgement: Data supplied by Securities Industry Research Centre of Asia-Pacific (SIRCA) on behalf of Reuters. Comments from conference participants from the 18th PBFEM & ICBA 2009, School of Business, UTCC, Bangkok, Thailand, and the two anonymous reviewers of the journal.

Introduction

Firms could buy back shares from its shareholders either on-market or off-market. The purchasing price share buyback via on-market depends on the prevailing market price. In contrast, off-market share buyback is similar to a tender offer, where the firm decides a buyback price and the success of the deal depends on the shareholders' response to the offer. The share buyback market in Australia is considered to be the most organised and transparent in the world.⁴ There are five types of share buyback in Australia: on-market, equal access scheme, selective, employee, and minimum holding buybacks. Except for the first type, these types are actually off-market buybacks. Similar to other markets, on-market buyback is the dominant type in the Australian market. It has the highest number of announcements as well as the greatest total value of purchased shares compared to other types of share buyback.

Research Aim and Motivation

Most previous research investigating aspects of Australian share buyback have been empirical investigations focusing on the differences in microstructure in comparison to other markets and how those differences affect share buyback activities. This paper investigates the relationship between takeover threat and firms' buyback behaviour in Australia. We focus on Australian firms' open-market share buybacks and whether they are influenced by the perceived threat of takeover. By focusing on open-market share buyback, this paper emphasises the ex-ante takeover deterrent effect rather than the ex-post takeover defence effect, as commonly referred to in the literature. As Dittmar (2000) suggests, and confirmed by Billett and Xue (2007), open-market share buyback allows firms to go a step further to prevent takeover bids from materialising. The effect should therefore differ from off-market share buyback, which has been found to be an effective defensive tool during a takeover attempt. This paper investigates the takeover deterrent effect hypothesis proposed in Billett and Xue (2007) that a firm's ex-ante probability of being taken over has a positive correlation with its repurchasing behaviours. Intuitively, it means that when firms perceive a high takeover risk from the market, they are more likely to buy back more shares. To achieve this, we used an ex-ante rather than an ex-post takeover probability measure in our study.

With the higher transparency requirements in the Australian market, the true motivation of firm buyback is also an interesting subject of investigation. The market's reaction to share buyback announcements by Australian companies should be more direct than that revealed by empirical studies of the US market, where investors are required to speculate about the actual motives. The current literature on share buyback in Australia suggests it is driven mainly by a set of motivations that are quite different to other markets in which takeover defence is one of the driving factors. A survey by Mitchell, Dharmawan and Clark (2001) showed that none of the 112 Australian firm managers mentioned takeover defence as their motivation for repurchasing shares from the stock market. This is reinforced by the fact that the Australian buyback policy framework is much more organised and

⁴ Different rules apply depending on the types of buyback. With on-market share buyback, firms need to follow the following requirements: (1) The firm requires an ordinary resolution (approval from shareholders' representatives) if it intends to buy back more than 10% of total shares in a given year; (2) During an on-market buyback, the firm is not permitted to pay more than 5% above the average price of the last five trading days; (3) The firm must inform The Australian Securities and Investments Commission (ASIC) of the intention to buy back at least 14 days before the actual announcement; (4) The same announcement is also required to be filed to The Australian Securities Exchange (ASX) on the same day; (5) The firm must also inform the market whether managing directors will be involved in the buybacks; and (6) The firm needs to inform the ASX at least half an hour before the market opens of how many shares have been bought back and their prices during the previous days, and the buyback must be completed within six months after the announcement.

transparent than other markets. However, Mitchell and Dharmawan (2007) stated that the motivations revealed in their survey may not be the true motivations of the surveyed firms. Therefore, based on firms' actual buyback behaviours, it should be of interest to discover if takeover deterrent is also a motivation for firms to conduct open-market share buybacks.

This paper contributes to the literature in the following ways. There does not appear to be any previous research that has specifically examined the takeover deterrent effect of open-market share buyback in the Australian context. Although the underlying hypothesis has been suggested by several different authors (Otchere and Ross 2002; Mitchell and Dharmawan 2007), there are yet to be any empirical investigations testing the claim. The most recent research by Mitchell and Dharmawan (2007) investigates numerous factors that could affect firms' buyback behaviours, but ignored the takeover deterrent effect. This paper aims to fill this gap in the share buyback literature. Furthermore, in terms of the scope of the research, it should provide a more comprehensive study in the Australian context by providing a more complete picture of how different motivations might impact on firms' buyback decisions. The outcomes of this study could be used as a robustness check for previously documented evidence in Australia.

The structure of the remainder of this paper is as follows. In the second section, the motivations for firms to conduct on-market share buybacks are reviewed. Given the nature of the methodology, the literature on the likelihood of firm takeover is also reviewed. The third section describes the research design of the study, including the hypotheses to be tested for firms' on-market share buyback behaviour and for firms' takeover likelihood. The fourth section includes discussion of data collection techniques, and testing methodologies including the specification test. The fifth section reports on the main regression results and discusses the results and findings in the sixth section. The seventh section concludes the paper.

Literature on Share Buyback

The initial motivation for the study of share buyback explores the empirical evidence of abnormal returns around a share buyback event. That develops into different hypotheses to explain both the underlining reasons for such abnormal returns and the overall motivations for firms to undertake share buybacks. On the issue of the motivations for conducting share buyback, the literature is broadly classified into two categories: internal and external motivations. Internal motivations relate to those factors within a firm which might affect its share buyback activities, such as investment decision, payout policy, compensation policy, or capital structure. External forces originate from outside the firm and include the situation where a firm might use share buyback as a defensive tool against a takeover threat from the market.

Internal Motivations for Share Buyback

Signalling undervaluation is one of the most commonly-cited motivations, it assumes that asymmetric information exists between a firm's managers and the market. A firm conducts on-market share buyback to signal its private information about the firm's true value to the market (Dittmar 2000). Another component to the hypothesis argues that management also actively attempts to signal some unexpected improvement in a firm's future performance through share buyback (Bartov 1991; Vermaelen 1981).

Share buyback might also be used to reduce the amount of excess capital at the disposal of management and minimise the problem of over-investment (Grullon and Michaely 2004). There are at least two reasons explaining a firm's increasing favour of share

buyback as a payout method for dividend payout. One reason is that share buyback is more flexible and requires less commitment from a firm. A firm might announce a share buyback intention but it may eventually not buy back anything at all. The other reason is based on the advantage of personal tax rates, although this only applies to the taxation policies in certain countries.

The management incentive hypothesis proposes that management share options might have a positive correlation with the firm's on-market share buyback behaviour. Managers will start to consider using share buyback when they have more exercisable share options (Dunsby 1994; Fenn & Liang, 1997 cited in Dittmar, 2000). An increase in a firm's share buyback activities might also be interpreted in terms of management's preference for debt rather than for equity (Mitchell and Dharmawan 2007). When a firm is operating at the sub-optimal level of debt, share buyback actions could be used as a strategy to increase its debt concentration and adjust the leverage ratio of the firm to its desired level (Bagwell and Shoven, 1988 cited in Dittmar, 2000).

External Motivations for Share Buyback

Studies investigating the effectiveness of such a strategy initially focused on off-market share buyback activities because they were very popular in the market. There is a recent shift to on-market share buyback in the literature. This is probably because on-market share buyback provides similar takeover defensive effects but with additional flexibility.

Harris and Raviv (1988) studied the motivation of share buyback when firms use debt to finance their buyback activities. Through buying back shares, a firm is able to redistribute voting rights among its shareholders. Stulz (1988) asserted that such redistribution might further lead to an increase in the voting power of firms' managers and their supporters, thereby making it more unlikely of being taken over. Bagwell (1992) supported the voting redistribution argument and further argued that given that firms' share supply curves are upward sloping, share buyback activities might help a firm to acquire most available shares at low valuation, which may leave the firm with all high valuation shareholders.⁵ This process therefore increases the takeover cost to the acquirers. Empirical studies have found supporting evidence for the voting redistribution argument as well as for an upward-sloping supply curve for shares (see for example Ikenberry, Lakonishok & Theo 1995; Hodrick 1999).

On-market share buyback has only recently captured the attention of scholars (Dittmar 2000; Billett and Xue 2007). Those authors claim that on-market share buyback might be used to prevent or deter the takeover threat even before it materialises. By actively conducting on-market share buyback, a firm might prevent potential acquirers from announcing the bid or make it less attractive.

The Likelihood of Firm Takeover

Various researchers have made attempts to identify a potential target firm prior to a takeover event, either by distinguishing the features of the target firms (Ambrose and Megginson 1992) or by modelling the takeover likelihood based on the firm's characteristics (Palepu 1986; Comment and Schwert 1995; Barnes 1998; Espahbodi and Espahbodi 2003). There are five main hypotheses widely accepted in the literature to explain a firm's takeover likelihood. They are the inefficient management hypothesis, the size hypothesis, the market to book ratio

⁵ Bagwell (1991) found that the difference in shareholders' valuation might be explained by the differences in taxation between shareholders.

hypothesis, the growth and resource mismatch hypothesis, and the industry disturbance hypothesis.⁶

The inefficient management argument is based on the fundamental theory in corporate finance in which the takeover market or the market for corporate control is an external monitoring mechanism for management performance. If a firm's managers were unable to maximise the value of the firm, a better management team should replace them. The size hypothesis effect relates to the transaction cost in a takeover event. It is argued that large firms tend to have a lower takeover likelihood compared with small firms since the associated transaction costs for taking over large firms are much higher compared to those for small firms (Palepu 1986). The relevant transaction costs include not only the acquisition cost which the acquirer initially pays for the target firm, but also costs associated with the absorption of the target firm into the acquirer's organisation (Palepu 1986; Ambrose and Megginson 1992; Billett 1996).

A firm with a low market to book ratio is more likely to become a takeover target (Palepu 1986). Since the book value of the firm is not fully reflected in the market value, firms with low market to book ratios are considered a good investment opportunity. A mismatch between a firm's future growth and its available resources might also trigger a takeover attempt. Two types of firm are more likely to have such imbalance and both are found to be attractive to potential acquirers in the market (Billett 1996). The first type is young firms that may have very high potential future growth but do not have enough resources or the required capital might be too costly to finance their projects. The second type is mature firms that have excess cash-in-hand or comparatively easy access to low-cost capital. However, at the mature stage of their business cycle, such firms do not have many profitable investment opportunities. A range of different variables are used to capture this imbalance, such as sales growth, leverage ratio, and liquidity ratio (Palepu 1986; Ambrose and Megginson 1992; Billett 1996).

The industry disturbance hypothesis, proposed by Gort (1969), suggests that takeover waves might be triggered by the difference in valuation perceived among market participants and as such clustered by industry. The valuation differential could be initiated by economic shocks in the market such as a change in technology, policy frameworks, or industrial structure. A factor that might signal a firm's takeover likelihood is the recent takeover history within its particular industry.

Testing of Hypotheses

Takeover Deterrent Hypothesis: The External Motivation

Following Billett & Xue (2007), we hypothesise that a firm is more likely to conduct share buyback as a deterrent, when it perceives a high takeover threat from the market. We aim to capture the ex-ante takeover probability rather than the ex-post takeover probability. The firm's takeover probability (**TO**) variable is measured at the beginning of the fiscal year to encapsulate any takeover threat that exists prior to any on-market share buyback activities.

⁶ These hypotheses were initially collected and organised by Palepu in 1986. Subsequent researchers in this field have included new independent variables into the model. However, the basic argument still holds over time.

Takeover Deterrent Hypothesis: Internal Motivation Hypotheses

SIGNALLING HYPOTHESIS

To test for the signalling hypothesis, previous literature has focused on testing its two main assumptions: information asymmetry and signal of undervaluation. Managers conduct share buyback when there is a high degree of information asymmetry between them and outside investors. Vermaelen (1981) found that information asymmetry is more prominent in small firms because these firms tend to have less media coverage and less attention from analysts, and are therefore more likely to be misvalued. We used a firm's size (*SIZEASS*) as a proxy for information asymmetry. It is defined as the natural log of total asset (with adjustment for inflation)⁷ at the end of the fiscal year. If the hypothesis holds, *SIZEASS* should have a negative relationship with firms' buyback activities.

With regard to the second assumption, a firm is more likely to conduct share buyback if its managers think the firm is undervalued by the market. One of the indicators for undervaluation is a low historical return. Empirical evidence also shows that shares generally performed poorly in the year prior to the share buyback announcement (Ikenberry, Lakonishok & Theo 1995; Jagannathan, Stephens & Weisbach 2000). We used the value-weight market adjusted cumulative annual return (*EXRETURN*) to measure firms' historical returns. In addition, the market to book ratio (*MKBK*, the market value of common stock divided by its book value) was included to measure the potential of current misvaluation of a firm. Previous literature has found that firms with low market to book ratios tend to earn abnormal returns in the subsequent periods (Ikenberry, Lakonishok & Theo 1995). Unlike the return ratio, the market to book ratio provides an indicator of a firm's potential misevaluation, both *EXRETURN* and *MKBK* should have negative correlations with firms' buyback behaviours.

FREE CASH FLOW HYPOTHESIS (DISTRIBUTION OF EXCESS CASH FLOW)

This hypothesis argues that a firm uses on-market share buyback to distribute its excess cash flow to shareholders. A firm's buyback activities should be positively correlated with its cash in excess of investment (Dittmar 2000). To test this hypothesis, the free cash flow ratio (*FCF*), which is calculated from the operating income before depreciation minus the interest expenses, the sum of preferred and common dividends, and income tax, is scaled by the total assets at the end of the fiscal year prior to the share buyback. In order to control for firms' investment opportunities, we followed Grullon and Michaely (2004) by including the return on equity ratio (*ROE*) in our analysis. A firm which experiences a reduction in its return on equity is more likely to pay out excess capital in the form of buying back shares (Grullon and Michaely 2004).

DIVIDEND SUBSTITUTION HYPOTHESIS

If a firm intends to use share buyback as a substitute for dividend payout, then firms with a lower dividend payout are more likely to conduct share buyback. We include the payout ratio of firms (*PR*), which equals the ratio of cash dividend to net income in the fiscal year prior to the buyback event, to determine the relationship between a firm's share buyback behaviour and its dividend payout. If the hypothesis is true, then firms' dividend payout ratios should have a negative correlation with their share buyback behaviours.

⁷ Where total assets is inflated to 1996 dollars using the consumer price index (CPI).

Jagnnathan, Stephens and Weisbach (2000) found that firms with higher temporary or non-operating cash flows tend to use share buyback to distribute cash flow rather than using dividend payout. The non-operating income scaled by total assets prior to the year of share buyback (*NONOPI*) was used as a measure of a firm's non-permanent cash flow, and this is expected to have a positive correlation with a firm's share buyback activity.

OPTIMAL LEVERAGE RATIO HYPOTHESIS

This hypothesis maintains that a firm might conduct share buyback if its leverage ratio is lower than its target ratio. The industry-adjusted market value of debt ratio (*LEVIA*) was used, which equals the book value of debt divided by the sum of the book value of debt and the market value of equity, minus the median ratio for firms within the same industry in the fiscal year prior to the firm's share buyback activities. If a firm actually seeks an optimal capital structure, then the *LEVIA* should have a negative correlation with the firm's buyback activities.

Data Sources and Filtering Methods

A sample set was captured comprising all the listed firms in the Australian Securities Exchange in any fiscal year within the period from 1997 to 2006. From this initial sample, the Bloomberg and the Signal-G database provided by the Securities Industry Research Centre of the Asian Pacific (SIRCA) were used to identify all the on-market share buyback and takeover announcements within this period.

The initial number of on-market share buyback announcements within the period was 725 announcements. We then used the Signal-G database to examine the details of each of the announcements, including the announcement date, the submission date, the number of shares the firm actually bought back, the number of shares outstanding, and the industry code of the firm. During this process, we filtered out all the on-market buyback of non-ordinary shares⁸. To construct the share buyback ratio variable (*REP*), we scaled the volume of buyback by dividing the actual volume of shares included in a firm's buyback within a fiscal year by the total shares outstanding from the previous year-end.

As with the takeover announcements, our main criterion is that the target firms must be listed firms; we are indifferent as to whether the bidder is a private or public firm. The initial takeover announcement sample contained 693 announcements. The information was used to construct the takeover dummy (*TODUM*), which is equal to one if a firm receives a bid within a fiscal year and is equal to zero otherwise.

In addition, we constructed explanatory variables that have been identified in the literature as important variables relating to a firm's perceived takeover probability and its on-market share buyback behaviour. The raw accounting data were collected from the FinAnalysis database. We also formed five time trend dummy variables *D1*, *D2*, *D3*, *D4*, and *D5* derived respectively from the 1997-1998, 1999-2000, 2001-2002, 2003-2004, and 2005-2006 fiscal years period. These dummy variables were equal to one for the observations during the respective period, and zero otherwise.

We adopted the following criteria to filter the dataset: (1) Drop any firm year combination that does not have sufficient required information; (2) Drop all the firms within

⁸ While there is a chance for firms to have long term strategic plan of repurchasing its shares or firms which just display a pattern of renewing their repurchases announcement from year to year. The continuously renew pattern only appears on four firms throughout the sample period, which were subsequently removed from our sample. Other than that, most of time, firms completed their repurchase within the financial year or completely deserted the plan.

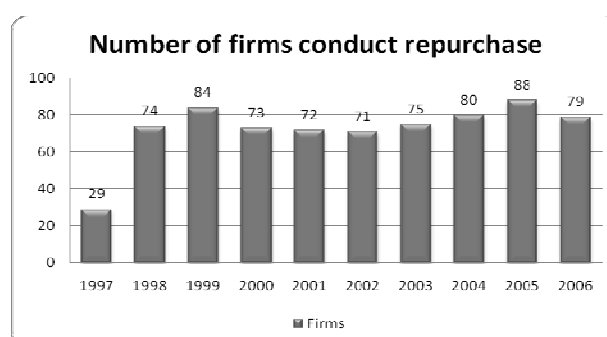
the financial and utility sector.⁹ Finally, all the accounting variables except for *SIZEASST*, *SIZEEQ*, and *REP* were winsorised at the 1% and 99% percentiles to minimise the effects from outliers. The final sample from 1997 to 2006 consisted of 6435 firm-year observations.

Descriptive Statistics

SHARE BUYBACK DATA (*REP*)

The number of firms that announced and conducted on-market share buyback by year is presented in Figure 1. Except for the year 1997, which had only 29 firms conducting on-market share buyback, the rest of the sampling period (1998-2006) had a very stable number of firms, with between 71 and 88 firms conducting share buyback per year.

Figure 1
Number of firms conducting on-market share buyback between 1997 and 2006 (by year)



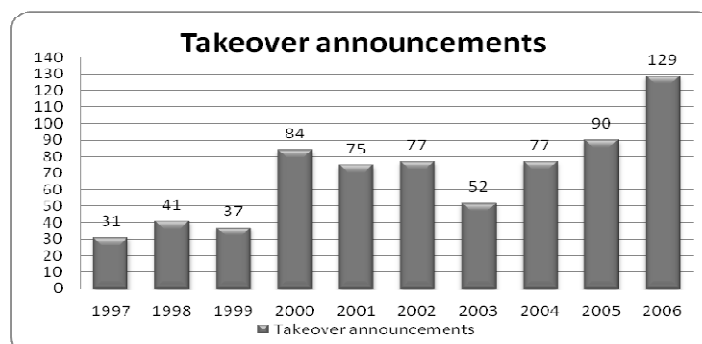
The total number of firms conducting on-market share buyback contained in the final sample is slightly less than the initial number of 725 because some firms did not have enough required information. After the filtering process, out of the 6361 firm-year observations, 412 firms actually announced and conducted on-market share buyback. *REP*, therefore, is a highly censored variable. In fact, the mean value of *REP* (reported in Table 1, Panel A) is almost equal to zero.

Takeover Announcement Variable (TODUM)

Unlike the firm's share buyback behaviour, the number of firms that received takeover bids, year by year over the sampling period, is much more volatile (Figure 2). The number of announcements before 2000 was quite low at around 30 to 40 firms per year. This number suddenly increased in the following three years to around 80 announcements per year. The number of announcements then dropped sharply in 2003 to 52 announcements. In 2006, it reached the peak of 129 announcements. As reported in Panel A of Table 1, on average 4.9% of firms received a takeover bid in a given year (mean of *TODUM* equals 0.049).

⁹ Specifically, we dropped all the firms with industry code starting with 40 (financial sector) and 55 (utility sector).

Figure 2
Number of takeover announcements between 1997 and 2006 (by year)



Other Explanatory Variables¹⁰

Following the spirit of Ditmar (2000), we checked if there are any differences in the characteristics displayed by share buyback and non-share buyback firms. We test this issue by running the Wilcoxon rank-sum test on all the explanatory variables used to test for the takeover deterrence (internal motivations) discussed above. The results of the test will help to distinguish the key independent variables from the two samples.

Panel B in Table 1 reports descriptive statistics of explanatory variables for the two sub samples, some of the explanatory variables are significantly different between share buyback firms and non-share buyback firms. The median of size of firms (*SIZEASS*) for firms with share buyback is considerably larger than for non-share buyback firms. This contradicts our initial signalling hypothesis that share buyback firms are characterised as possessing lower degrees of information asymmetry. We also could not find any difference in the market to book ratio and the historical return between the two groups. Results from our comparison do not support the hypothesis of signalling of undervaluation.

The results from the summary statistics also present mixed evidence on the free cash flow hypothesis. In most years of the sampling period, share buyback firms have a higher median free cash flow ratio (*FCF*) than do non-share buyback firms, which indicates that firms might have used on-market share buyback to redistribute excess capital back to shareholders. Share buyback firms have a higher return on equity ratio (*ROE*) than non-share buyback firms in all years, which contradict the free cash flow hypothesis since share buyback firms should have a lower ROE ratio.

We also found mixed evidence concerning the dividend substitution hypothesis. The payout ratios (*PR*) of share buyback firms are significantly higher than those of non-share buyback firms. This indicates that the relationship between dividend payout and on-market share buyback is one of complementation rather than a substitution. However, there is evidence that firms might use share buyback to redistribution non-permanent cash flow, as we found share buyback-firms have a higher median ratio of non-operating income compared with non-share buyback firms.

¹⁰ A summary of the full descriptive statistics for all the variables is available from the authors upon request. We have used 1996 as base year because of a one year lag between our dependent and independent variables.

Table 1
Summary of descriptive statistics

Panel A: Descriptive statistic of Share buyback data and takeover dummy variables								
VARIABLE	N	MEAN	Std Dev	MIN	MAX			
REP	6361	0.002	0.011	0.000	0.305			
TODUM	6361	0.049	0.216	0.000	1.000			
ITODUM	6361	0.803	0.398	0.000	1.000			

Panel A presents the descriptive statistics for the firm-year sample in the period from 1996 to 2006. Share buyback ratio(REP) is the actual amount of on-market share buyback divided by the prior year-end total share outstanding; Takeover dummy (TODUM) equal one if firm is a takeover target in year t, and zero otherwise; Industry Takeover dummy (ITODUM) equals one if at least one firm within the same industry (same two-digit code) is a takeover target in year t-1

Panel B: Summary of the Wilcoxon rank-sum test on explanatory variables								
Share buyback firms								
PERIOD	SIZEASS	LEVIA	MKBK	NONOPI	ROE	PR	FCF	EXRETURN
1997-1998	18.388 ***	0.054	1.565	0.031 ***	0.107***	0.445 ***	0.005	-0.029
1999-2000	19.449 ***	0.086	1.270	0.031 ***	0.115 ***	0.550***	0.032**	-0.028
2001-2002	18.956 ***	0.045	1.200*	0.012**	0.095 ***	0.400***	0.051 ***	-0.001
2003-2004	20.102 ***	0.012	1.705	0.008*	0.128 ***	0.445***	0.071 ***	-0.117
2005-2006	19.389 ***	0.051	1.845	0.005	0.145 ***	0.590***	0.078***	-0.200
1997-2006	19.328 ***	0.047	1.540	0.013 ***	0.118 ***	0.510 ***	0.048 ***	-0.089

Non-share buyback firms								
PERIOD	SIZEASS	LEVIA	MKBK	NONOPI	ROE	PR	FCF	EXRETURN
1999-2000	17.770 ***	0.044	1.310	0.012 ***	0.060 ***	0.000***	-0.010**	-0.029
2001-2002	17.475 ***	0.013	1.380*	0.005**	0.002 ***	0.000***	-0.012***	0.022
2003-2004	17.457 ***	0.003	1.690	0.005*	0.025 ***	0.000***	-0.022***	-0.118
2005-2006	17.666 ***	0.005	2.060	0.003	0.030 ***	0.000***	-0.049***	-0.182
1997-2006	17.604 ***	0.011	1.590	0.007 ***	0.042 ***	0.000 ***	0.020 ***	-0.086

Panel B shows the median for the firm-year sample in five different periods (1997-1998, 1999-2000, 2001-2002, 2003-2004, 2005-2006, and the entire period from 1997-2006). Size of Asset (SIZEASS) is the natural log of total assets, which is inflated to 1996 dollar using CPI; Industry- adjusted Market Value of Leverage (LEVIA) is book value of debt divided by the sum of book value of debt and the market value of equity, minus the median ratio for all firms within the same industry; Market to Book ratio (MKBK) is the market value of ordinary share divided by the book value of equity; Non-operating income (NONOPI) is non-operating income scaled by total assets; Return on equity (ROE) is net income divided by the book value of equity; Payout ratio (PR) is ratio of cash dividends paid to net income; Free Cash Flow (FCF) is operating income before depreciation minus interest expenses, the sum of preferred and common dividends, and income taxes (excluding deferred taxes), all scaled by total assets; Excess return (EXRET) is the annual cumulative return on the firm's share in the previous calendar year minus the annual cumulative return on the All ordinary index market portfolio

Superscript symbols indicate that the buyback and non-buyback firms come from significantly different populations using the Wilcoxon-rank sum test. * Significant at 10% level ** Significant at 5% level *** Significant at 1% level

Research Methodology

Testing Procedure

We applied the two-stage analogous procedure proposed by Hodrick (1999). The procedure emphasises the importance of the timing between the takeover measures relative to a firm's buyback decision. As the main research focus of this study is the takeover deterrent effect, it is critical that a firm's perceived takeover likelihood is measured prior to any of its share buyback activities within a fiscal year. Such a measure is an ex-ante measurement and, under the takeover deterrent hypothesis, it is expected to have a positive correlation with its share buyback behaviour.

This procedure, according to Billett and Xue (2007), produces less measurement error than the using of a takeover dummy variable. The dummy variable approach has a higher probability of producing measurement errors since firms with high takeover risk will be included in the dummy variable but a takeover bid may not necessarily eventuate. Hodrick's approach is likely to produce a more consistent result. In the first stage, we measured a firm's takeover probability as the probability of becoming a takeover target at the beginning of the year prior to any share buyback activities. Using the prediction result from the takeover

probability model as a latent variable together with other explanatory variables we estimated the firm's subsequent on-market share buyback behaviour.

Firms' Takeover Likelihood

The firm's latent takeover process (TO_{it}^*) was initially modelled as a linear relation, as follows (Equation 1).

$$TO_{it}^* = \beta_0 + \beta_1 ROAIA_{it-1} + \beta_2 NPPE_{it-1} + \beta_3 SG_{it-1} + \beta_4 LEVBIA_{it-1} + \beta_5 ITODUM_{it-1} + \beta_6 SIZEEQ_{it-1} + \beta_7 MKBK_{it-1} + D_1 + D_2 + D_3 + D_4 + D_5 + u_i, u \sim N(0, \sigma^2) \quad (1)$$

The TO_{it}^* variable however cannot be observed in practice. What can be observed is whether or not a firm receives a bid. Following Billett and Xue (2007), we define the takeover dummy variable as follows:

$$TODUM_{it} = \begin{cases} 1 & \text{If } TO_{it}^* > 0 \\ 0 & \text{Otherwise,} \end{cases}$$

Following previous literature on researching a firm's takeover likelihood (Comment and Schwert 1995; Schwert 2000; Billett and Xue 2007) we used a binary Probit model to measure a firm's takeover probability. Since the sample comprises pooled firm-year observations data, it is very likely that the Probit model might suffer from heteroskedasticity in the error terms. This problem might lead to inconsistent estimation of the binary choice model (Yatchew & Griliches 1984). To control for this problem, we adopted the heteroskedastic-corrected Probit model in which the disturbances are a function of all the explanatory variables ($ROAIA$, $SIZEEQ$, $LEVBIA$, $MKBK$, SG , and $NPPE$).¹¹ We modelled a firm's ex-ante probability of being a takeover target using a binary model as follows (Equation 2):

$$TOPROB_{it} = \Pr ob(TODUM_{it} = 1) = \Phi(\beta_0 + \beta_1 ROAIA_{it-1} + \beta_2 NPPE_{it-1} + \beta_3 SG_{it-1} + \beta_4 LEVBIA_{it-1} + \beta_5 ITODUM_{it-1} + \beta_6 SIZEEQ_{it-1} + \beta_7 MKBK_{it-1} + D_1 + D_2 + D_3 + D_4 + D_5) \quad (2)$$

Φ is the cumulative distribution function of a standard normal distribution.

- TO_{it}^* Firms' latent takeover process variable at year t
- $TODUM_{it}$ Takeover dummy variable at year t
- $TOPROB_{it}$ The takeover probability at the beginning of year t
- $ROAIA_{it}$ Industry-adjusted return on asset at the end of year t-1
- $NPPE_{it}$ Fixed asset ratio at the end of year t-1
- SG_{it} Sales growth at the end of year t-1
- $LEVBIA_{it}$ Industry-adjusted book value of debt at the end of year t-1
- $ITODUM_{it}$ Industry takeover dummy at the end of year t-1
- $SIZEEQ_{it}$ Size of equity at the end of year t-1
- $MKBK_{it}$ Firm's market to book ratio at the end of year t-1
- D_1, D_2, D_3, D_4, D_5 Time trend dummy variables (1997-1998, 1999-2000, 2001-2002, 2003-2004, and 2005-2006)

As noted, in both Equation (1) and (2), all the explanatory variables are measured as of the end of year_{t-1} to ensure that the takeover probability measurement corresponds to the beginning of year t prior to any share buyback activities. Therefore, the estimation of takeover probability is not affected by the firm's share buyback activities during year t.

¹¹ These explanatory variables have been previously found to be related to the form of heteroskedasticity (Billett & Xue 2007).

Firms' Motivations for Conducting On-Market Share Buyback

In the second step of the two-stage procedure, we used the predicted estimation of a firm's takeover probability as a latent variable together with other characteristics of the firm to model its on-market share buyback behaviour. Equation 3 provides the detail of the on-market share buyback model. The γ coefficient captures the effect of the ex-ante takeover probability in year t on firm share buyback behaviour. The β coefficients represent a firm's characteristics in year t-1. The difference in the coefficient symbols (γ and β) is to emphasise the importance of the takeover threat effect in this model.

$$REP_{it}^* = \beta_0 + \gamma TOPROB_{it} + \beta_1 ROE_{it-1} + \beta_2 SIZEASS_{it-1} + \beta_3 MKBK_{it-1} + \beta_4 EXRETURN_{it-1} + \beta_5 FCF_{it-1} + \beta_6 PR_{it-1} + \beta_7 NONOPI_{it-1} + \beta_8 LEVIA_{it-1} + D_1 + D_2 + D_3 + D_4 + D_5 + \varepsilon_i$$

Where

$$REP_{it} = \begin{cases} REP_{it}^* & \text{IF } REP_{it}^* > 0 \\ 0 & \text{Otherwise} \end{cases} \quad (3)$$

REP_{it}^*	Firm's actual share buyback value scaled by its total equity value at the end of the financial year
$TOPROB_{it}$	Takeover probability at the beginning of year t
ROE_{it-1}	Firm's return on equity at the end of year t-1
$SIZEASS_{it-1}$	Firm size at the end of year t-1
$MKBK_{it-1}$	Market to book ratio at the end of year t-1
$EXRETURN_{it-1}$	Excess return at the end of year t-1
FCF_{it-1}	Free cash flow ratio at the end of year t-1
PR_{it-1}	Payout ratio at the end of year t-1
$NONOPI_{it-1}$	Non-operating income at the end of year t-1
$LEVIA_{it-1}$	Industry-adjusted market value of debt at the end of year t-1
D_1, D_2, D_3, D_4, D_5	Time trend dummy variables (1997-1998, 1999-2000, 2001-2002, 2003-2004, 2005-2006)

As noted above in the descriptive statistics, the **REP** variable is a censored variable. Out of a total of 6450 firm-year observations, only 412 firms actually conducted on-market share buyback. Therefore, we applied two different censored regression techniques to model a firm's share buyback behaviours, namely the Parametric Censored Linear regression model (TOBIT) and the Censored Quantile regression model (CQR).

TOBIT Model

The TOBIT model is based on the two main assumptions of homoskedasticity and normality distribution of the disturbances. If the TOBIT model violates either of these assumptions, it might lead to an inconsistent and biased estimation of the model (Buchinsky 1991; Buchinsky 1998; Chay and Powell 2001). To address this concern, we cross checked the coefficient estimation of the error terms of the TOBIT model with robust disturbances to control for the effect of heteroskedasticity. Furthermore, we implemented the conditional moment test of Skeels and Vellar (1999) and Drukker (2002) in order to test for the normality of the distribution of the error terms. These checks allowed us to determine whether the TOBIT model was well specified.

Censored Quantile Regression (CQR)

To further address the specification concerns of the TOBIT model, we also applied the CQR model for a firm’s on-market share buyback behaviour. This model was proposed by Powell in 1986, and the model is robust to both the heteroskedasticity and non-normality distribution of the error terms. The only assumption is that the distribution of the error term is independent or unknown (Powell 1984). Equation 4 gives the detail for the CQR model.

$$REP_{it}^* = \beta_0 + \gamma TOPROB_{it} + \beta_1 ROE_{it-1} + \beta_2 SIZEASS_{it-1} + \beta_3 MKBK_{it-1} + \beta_4 EXRETURN_{it-1} + \beta_5 FCF_{it-1} + \beta_6 PR_{it-1} + \beta_7 NONOPI_{it-1} + \beta_8 LEVIA_{it-1} + D_1 + D_2 + D_3 + D_4 + D_5 + \varepsilon_i$$

Where

$$REP_{it} = \begin{cases} REP_{it}^* & \text{IF } REP_{it}^* > 0 \\ 0 & \text{Otherwise} \end{cases}$$

$$Quant_{\theta}(\varepsilon_{\theta i} | TOPROB_i, x_i) = 0 \tag{4}$$

REP_{it}[*]	Firm’s actual share buyback value scaled by its total equity value at the end of the financial year
TOPROB_{it}	Takeover probability at the beginning of year t
ROE_{it-1}	Firm’s return on equity at the end of year t-1
SIZEASS_{it-1}	Firm size at the end of year t-1
MKBK_{it-1}	Market to book ratio at the end of year t-1
EXRETURN_{it-1}	Excess return at the end of year t-1
FCF_{it-1}	Free cash flow ratio at the end of year t-1
PR_{it-1}	Payout ratio at the end of year t-1
NONOPI_{it-1}	Non-operating income at the end of year t-1
LEVIA_{it-1}	Industry-adjusted market value of debt at the end of year t-1
D₁, D₂, D₃, D₄, D₅	Time trend dummy variables (1997-1998, 1999-2000, 2001-2002, 2003-2004, 2005- 2006)
Quant_θ(ε_{θi})	the θth conditional quantile of the error term

We estimated the CQR model using the procedure developed by Buchinsky (1991) termed the interactive linear programming algorithm (ILPA). Given that the share buyback variable is highly censored (over 90% of the **REP** value in the sample is equal to zero), it is important to choose the suitable quantile for the regression. We chose to estimate the CQR model at the 95% quantile following Billett and Xue (2007).

RESULTS

Estimation of a Firm’s Takeover Probability

Table 2 reports the results from using the Probit model. Most of the results are similar to those found in previous literature. Specifically, a firm’s takeover probability positively correlates with the industry-adjusted return on assets (**ROAIA**), industry dummy variable (**ITODUM**), and net fixed asset ratio (**NPPE**), are negatively correlated with firm’s size (**SIZEEQ**). The firm’s market to book ratio (**MKBK**) and leverage ratio (**LEVIA**) were found not to significantly affect a firm’s takeover probability. The overall models are significant with the Wald χ^2 statistics both being significant at the 5% level.

Table 2
Firms' takeover probability estimation

INTERCEPT	-6.3716 (-3.3700)***
ITODUM	1.3780 (2.0400)**
LEV BIA	-1.2559 (-1.0800)
MKBK	-0.2102 (-1.7200)
NPPE	1.7970 (1.9800)**
ROAIA	1.3989 (1.5400)*
SIZEEQ	-0.0061 (-0.0100)*
D2	1.6973 (1.8700)**
D3	2.2601 (2.1400)**
D4	1.8068 (1.9400)**
D5	2.4006 (2.2000)**
Wald Chi ²	21.6900 **
Degree Of Freedom	11
Log Pseudo Likelihood	-1018.323

The table reports the regression results of the probability that a firm would become a takeover target using the heteroskedasticity-corrected Probit model. Firm's takeover probability (TOPROB) at the beginning of year t ; Takeover dummy (TODUM) equal one if firm is a takeover target in year t , and zero otherwise; Industry Takeover dummy (ITODUM) equals one if at least one firm within the same industry (same two-digit code) is a takeover target in year $t-1$; Size of Equity (SIZEEQ) is the natural log of equity, which is the number of shares outstanding times the previous year-end price inflated to 1996 dollars using the CPI; Industry-adjusted Book value of Leverage (LEV BIA) is book value of debt divided by total assets, minus the median ratio for all firms within the same industry; Market to Book ratio (MKBK) is the market value of ordinary share divided by the book value of equity; Fixed Assets (NPPE) is net plant, property, and equipment scaled by total assets; Industry-adjusted Return on Assets (ROAIA) is operating income before depreciation divided by total assets, minus the median ratio for firm with the same industry; Sales Growth (SG) is the natural log of the ratio of sales over the sales of the previous year. Time trend variable D1,D2,D3,D4,D5 which are equal to one if the observation, accordingly, comes from the 1997-1998,1999-2000,2001-2002,2003-2004, and 2005-2006 fiscal years periods, and zero if otherwise. standard errors are Huber-White quasi-maximum likelihood standard errors

* Significant at 10% level ** Significant at 5% level *** Significant at 1% level D1 has been dropped due to collinearity

Table 3
Descriptive statistics of the predicted takeover probability variable

Percentiles	Takeover probabilities		
1%	0.0008		
5%	0.0026	Min	0.0001
10%	0.0065	Max	0.2398
25%	0.0319	Median	0.0524
50%	0.0584	Mean	0.0558
75%	0.0782	Std. Dev.	0.0354
90%	0.1016		
95%	0.1183	Variance	0.0012
99%	0.1532	Skewness	0.5738
		Kurtosis	3.3815

Table 3 reports the descriptive statistics of the firms' predicted takeover probability variable (TO). The mean and median probabilities are not significantly different (5.58% and 5.24%, respectively). The probabilities at 5th and 95th percentiles are 0.26% and 11.83%.

The large range and high standard deviation (3.54%) indicate that takeover probability varies significantly among firms.

Estimation Results – TOBIT Model

We adopted the TOBIT model using maximum likelihood (ML) to estimate firms' on-market share buyback behaviour (Equation 3). The dependent variable is a firm's on-market share buyback ratio at year_t. The explanatory variables include the takeover probability latent variable at year_t and a firm's characteristics variables at year_{t-1}, namely **SIZEASS**, **MKBK**, **LEVIA**, **NONOPI**, **ROE**, **PR**, **FCF**, and **EXRETURN**. Time trend dummy variables **D1**, **D2**, **D3**, **D4**, and **D5** are also included.

Table 4 gives two sets of results for the regression: the first set includes the results from the winsorised data (left-hand columns), and the second set is for data that are not winsorised (right-hand columns). Most of the results from the TOBIT model are rather similar to those reported in previous literature, with on-market share buyback increasing for **TOPROB**, **SIZEASS**, **NONOPI**, and **PR**. However, the results from the TOBIT model show that the coefficients of **MKBK**, **LEVIA**, and **EXRETURN** are not statistically significant.

Table 4
Firms' on-market share buyback estimation – Tobit model

	Winsorised data		Non-winsorised data	
	Coefficient	T-value	Coefficient	T-Value
Intercept	-0.3803	(-8.93)***	-0.2155	(-8.62)***
TOPROB	0.4312	(4.44)***	0.4415	(4.43)***
SIZEASS	0.0058	(4.55)***	0.0061	(5.11)***
MKBK	0.0007	1.13	-0.0000	-0.10
LEVIA	0.0155	1.35	0.0113	1.05
NONOPI	0.0844	(4.07)***	0.0711	(4.10)***
ROE	0.0068	0.85	0.0011	0.23
PR	0.0279	(4.11)***	0.0317	(5.69)***
FCF	0.0062	0.58	-0.0001	-0.29
EXRETURN	-0.0022	-0.44	-0.0024	-0.86
D1	0.0251	(2.92)***		
D2		0	-0.0254	(-2.96)***
D3	-0.0209	(-2.89)***	-0.0473	(-4.01)***
D4	-0.0079	-1.46	-0.0338	(-3.76)***
D5	-0.0236	(-3.52)***	-0.0496	(-4.35)***
LR chi2 (df=-13)		269.97***		279.01***
Log Pseudo Likelihood		-247.141		-243.646

The table presents the regression result for firm's on-market share buyback using Tobit model. Share buyback ratio (REP) is the actual amount of on-market share buyback divided by the prior year-end total share outstanding; Takeover probability (TOPROB); Size of Asset (SIZEASS) is the natural log of total assets, which is inflated to 1996 dollar using CPI; Industry-adjusted Market Value of Leverage (LEVIA) is book value of debt divided by the sum of book value of debt and the market value of equity, minus the median ratio for all firms within the same industry; Market to Book ratio (MKBK) is the market value of ordinary share divided by the book value of equity; Non-operating income (NONOPI) is non-operating income scaled by total assets; Return on equity (ROE) is net income divided by the book value of equity; Payout ratio (PR) is ratio of cash dividends paid to net income; Free Cash Flow (FCF) is operating income before depreciation minus interest expenses, the sum of preferred and common dividends, and income taxes (excluding deferred taxes), all scaled by total assets; Excess return (EXRET) is the annual cumulative return on the firm's share in the previous calendar year minus the annual cumulative return on the All ordinary index market portfolio. Time trend variable D1,D2,D3,D4,D5 which are equal to one if the observation, accordingly, comes from the 1997-1998,1999-2000,2001-2002,2003-2004, and 2005-2006 fiscal years periods, and zero if otherwise. * Significant at 10% level ** Significant at 5% level *** Significant at 1% level We dropped D2, D1 because of collinearity

This result is surprising given that *MKBK* and *LEVIA* have been found to be significant in a number of previous studies¹². Furthermore, under the information-signalling hypothesis, *SIZEASS* is expected to be negatively correlated to a firm's *REP*, as firm size is the proxy for information asymmetry and small firms are argued to be more likely to be opaque.

On the issue of the takeover deterrent, the TOBIT model indicates that a firm's on-market share buyback behaviour is positively related to firm's takeover probability. The coefficient of a firm's takeover probability (*TOPROB*) is significant at the 1% level in both the TOBIT models. A coefficient of 0.4315, it indicates that a firm moving from the 5th percentile (0.26%, Table 3) to the 95% percentile (11.8%, Table 3) of takeover probability is likely to buy back an additional 5% of total equity in a fiscal year. Given that the median ratio of firms' on-market share buyback in the Australian market is 2.8%, this result is economically significant.

Specification Testing Results

The TOBIT model is based on the two main assumptions of homoskedasticity and normal distribution of the error terms. A violation of either of these assumptions might lead to inconsistent estimates (Buchinsky 1991; Buchinsky 1998; Chay and Powell 2001). We adopted a conditional moment test to check the null hypothesis that the error terms are normally distributed. Our results strongly rejected the null hypothesis in both the models.

To address the concern of using winsorised data with respect to the non-normal distribution issue, we used the unwinsorised sample to run the Tobit regression (right-hand columns of Table 4). The result from conditional moment test strongly rejects the null hypothesis of a normal distribution of the error terms. It implies that the test result is not caused by winsorising the data.

Robustness Check

As there are some discrepancies between our results and those reported in current literature, and given also that the TOBIT model and the condition moment test indicate that the TOBIT model is not well specified, we also estimated a firm's on-market share buyback behaviour using the CQR model. The ILPA procedure developed by Buchinsky (1991) was applied to estimate the CQR model.

Table 5 shows the results from the CQR model. In general, the results are consistent with the TOBIT model except for some differences in the coefficients' magnitudes. A firm's on-market share buyback activities increase for *TOPROB*, *SIZEASS*, *NONOPI*, and *PR*. The CQR results also indicate that the coefficients for *MKBK*, *LEVIA*, and *EXRETURN* are insignificant.

Compared to the TOBIT model, the CQR model yields a much lower magnitude coefficient for takeover probability (*TOPROB*) (0.1639 compared with 0.4315 from the TOBIT model). In economic terms, this means that a firm moving from the 5th percentile (0.26%) to the 95% percentile (11.8%) of takeover probability is likely to buy back an additional 2% of total equity in a fiscal year. Unlike the results from current literature, the current results from both the TOBIT and CQR models generated similar estimates of the

¹² *MKBK* and *EXRETURN* are indicators for a firm's undervaluation. *LEVIA* is an indicator for a firm's optimal leverage ratio. These characteristics of a firm have been found to be significant in previous studies, namely: Billett and Xue (2007); Dittmar (2000); Grullon and Michaely (2004).

takeover deterrent effect and of other internal motivations for firms to conduct on-market share buyback.

Table 5
Firms' on-market share buyback – Censored Quantile Regression Model

	Coefficient	T-value
Intercept	-0.0758	(-5.03)***
TOPROB	0.1639	(3.16)***
SIZEASS	0.0045	(5.60)***
MKBK	-0.0005	-0.70
LEVIA	-0.0022	-0.36
NONOPI	0.0709	(4.94)***
ROE	-0.0014	-0.38
PR	0.0197	(4.37)***
FCF	0.0012	0.20
EXRETURN	-0.0067	-1.72
D2	-0.0134	(-2.65)***
D3	-0.0208	(-3.36)***
D4	-0.0246	(-4.63)***
D5	-0.0222	(-3.31)***

The table presents the regression result for firm's on-market share buyback using CQR model. Share buyback ratio (REP) is the actual amount of on-market share buyback divided by the prior year-end total share outstanding; Takeover probability (TOPROB); Size of Asset (SIZEASS) is the natural log of total assets, which is inflated to 1996 dollar using CPI; Industry-adjusted Market Value of Leverage (LEVIA) is book value of debt divided by the sum of book value of debt and the market value of equity, minus the median ratio for all firms within the same industry; Market to Book ratio (MKBK) is the market value of ordinary share divided by the book value of equity; Non-operating income (NONOPI) is non-operating income scaled by total assets; Return on equity (ROE) is net income divided by the book value of equity; Payout ratio (PR) is ratio of cash dividends paid to net income; Free Cash Flow (FCF) is operating income before depreciation minus interest expenses, the sum of preferred and common dividends, and income taxes (excluding deferred taxes), all scaled by total assets; Excess return (EXRET) is the annual cumulative return on the firm's share in the previous calendar year minus the annual cumulative return on the All ordinary index market portfolio. Time trend variable D1,D2,D3,D4,D5 which are equal to one if the observation, accordingly, comes from the 1997-1998,1999-2000,2001-2002,2003-2004, and 2005-2006 fiscal years periods, and zero if otherwise. * Significant at 10% level ** Significant at 5% level *** Significant at 1% level D1 was dropped due to collinearity

Discussion

The Takeover Deterrent Effect of On-Market Share Buyback

The regression results show that ex-ante takeover probability has a significant impact on a firm's on-market share buyback behaviour. The **TOPROB** coefficient estimations from both the TOBIT and CQR models are positive and statistically significant at the 1% level. The economic significance of this finding is, however, questionable. A firm might buy back an additional 5% (TOBIT) or 2% (CQR) of its total common equity in a fiscal year given that it moves from a low perceived risk level of takeover to a high-risk level. These results are economically significant if compared to the median ratio of buyback of only 2.18% total equity in a fiscal year. These results are significantly lower in magnitude than what has been found in the US market.¹³ From the perspective of the takeover threat, such share buyback actions might not carry any substantial deterrent effect.

One possible explanation for this dissimilarity may be due to the differences in market microstructure. Australian firms have to follow stricter rules and obligations if they want to conduct on-market share buyback activities. For example, Australian firms cannot buy back more than 10% of their total common equity in a given fiscal year unless they have approval

¹³ Billet and Xue (2007) found US firms at a high level of takeover risk is likely to buy back an additional 15.67% of its total equity to deter the takeover threat.

from the board of directors. This is confirmed in our study sample in which only 2% of participating firms bought back more than 10% of total equity in a fiscal year.

Signalling hypothesis

Our study does not find sufficient evidence to support signalling hypothesis found in previous investigations being the most common motivation for firms to engage in on-market share buyback. We find that a firm's size has a significant and positive effect on a firm's on-market share buyback behaviour. In our case, firm size serves as a proxy for the financial capacity to conduct share buyback rather than as a proxy for information asymmetry assumed in some of the current literature.

Dividend Substitutions

In contrast to the findings of Grullon and Michaely (2002, 2004), that share buyback is used as a substitute for dividend payout, we find that a firm's payout ratio has a complementary relationship with its on-market share buyback activities. We suspect the difference in the payout-buyback relationship between Australia and the US might be due to the difference in taxation policy. Share buyback is categorised as capital gain tax and could avoid double taxation. As a result, share buyback in the US has a comparative advantage over dividend payments in terms of tax treatment. Such advantage does not exist under the Australian imputation tax system.

Conclusion

This paper has examined the takeover deterrent effect of on-market share buyback in Australia for the years 1997-2006. The relationship between threat and buyback has been found to be positive and statistically significant. The result is robust to alternative modelling techniques used, namely TOBIT and CQR. The results suggest that a firm's on-market share buyback activities will increase if it perceives a high takeover risk from the market. These findings help extend the understanding of on-market share buyback in Australia and provide a more complete picture of the various motivations of Australian firms conducting on-market share buybacks.

References

- Ambrose, B. W. & Megginson W. L. 1992 'The Role of Asset Structure, Ownership Structure, and Takeover Defenses in Determining Acquisition Likelihood', *The Journal of Financial and Quantitative Analysis*, vol.27, pp575-589.
- Bagwell, L 1991 'Shareholder Heterogeneity: Evidence and Implications', *American Economic Review*, vol.81, pp218-21.
- Bagwell, L 1992 'Dutch Auction Repurchases: An Analysis of Shareholder Heterogeneity', *The Journal of Finance*, vol.47, pp71-105.
- Barnes, P. 1998 'Can Takeover Targets be Identified by Statistical Techniques?: Some UK Evidence', *The Statistician*, vol.47, pp573-591.
- Bartov, E 1991 'Open-market Stock Repurchases as Signals for Earnings and Risk Changes', *Journal of Accounting and Economics*, vol.14, pp275-294.
- Billett, M. T. 1996 'Targeting Capital Structure: The Relationship Between Risky Debt and the Firm's Likelihood of Being Acquired', *The Journal of Business*, vol.69, pp173-192.
- Billett, M. T. & Xue H. 2007 'The Takeover Deterrent Effect of Open Market Share Repurchases', *The Journal of Finance*, vol.62, pp1827-1850.
- Buchinsky, M. 1991 'The Theory and Practice of Quantile Regression', Harvard University.
- Buchinsky, M 1998 'Recent Advances in Quantile Regression Models: A Practical Guideline for Empirical Research', *The Journal of Human Resources*, vol.33, pp88-126.
- Chay, K. Y. & Powell J. L. 2001 'Semiparametric Censored Regression Models', *The Journal of Economic Perspectives*, vol.15, pp29-42.
- Comment, R. & G. W. Schwert 1995 'Poison or placebo? Evidence on the Deterrence and Wealth Effects of Modern Antitakeover Measures', *Journal of Financial Economics*, vol.39, pp3-43.
- Dittmar, A. K. 2000 'Why Do Firms Repurchase Stock?', *The Journal of Business*, vol.73, pp331-355.
- Drukker, D. 2002 'Bootstrapping a Conditional Moments Test for Normality after Tobit Estimation', *Stata Journal*, vol.2, pp125-139.
- Dunsby, A 1994 'Share repurchases, dividends, and corporate distribution policy', Wharton School Working paper.
- Espahbodi, H. & Espahbodi P. 2003 'Binary choice models and corporate takeover', *Journal of Banking & Finance*, vol.27, pp549-574.
- Gort, M 1969 'An Economic Disturbance Theory of Mergers', *Quarterly Journal of Economics*, vol.83, pp624-642.
- Grullon, G. & Michaely R. 2002 'Dividends, Share Repurchases, and the Substitution Hypothesis', *The Journal of Finance*, vol.57, pp1649-1684.
- Grullon, G. & Michaely R. 2004 'The Information Content of Share Repurchase Programs', *The Journal of Finance*, vol.59, pp651-680.
- Harris, M & Artur R 1988 'Corporate control contests and capital structure', *Journal of Financial Economics*, vol.20, pp55-86
- Hodrick, L. S. 1999 'Does Stock Price Elasticity Affect Corporate Financial Decisions?' *Journal of Financial Economics*, vol.52, pp225-256.
- Ikenberry, D., J. Lakonishok, & Theo V 1995 'Market Underreaction to Open Market Share Repurchases', *Journal of Financial Economics*, vol.39, pp181-208.
- Jagannathan, M., C. Stephens & Weisbach M. 2000 'Financial flexibility and the Choice between Dividends and Stock Repurchases', *Journal of Financial Economics*, vol.57, pp355-384.
- Mitchell, J. D. Dharmawan G. V & Clarke A.W. 2001 'Managements' views on share buy-backs: an Australian survey', *Accounting and Finance*, vol.41, pp93-129

- Mitchell, J. D. & Dharmawan G. V. 2007 'Incentives for on-market buy-backs: Evidence from a transparent buy-back regime', *Journal of Corporate Finance*, vol.13, pp146-169.
- Mitchell, J. Dharmawan, G & Clarke, A. 2001 'Managements' Views on Share Buy-backs: An Australian Survey', *Accounting and Finance*, vol.41, pp93-129.
- Otchere, I. & Ross M. 2002 'Do share buy back announcements convey firm-specific or industry-wide information? A test of the undervaluation hypothesis." *International Review of Financial Analysis*, vol.11, pp511-531.
- Palepu, K. G. 1986 'Predicting takeover targets : A methodological and empirical analysis', *Journal of Accounting and Economics*, vol.8, pp3-35.
- Powell, J. L. 1984 'Least absolute deviations estimation for the censored regression model', *Journal of Econometrics*, vol.25, pp303-325.
- Schwert, G. W. 2000 'Hostility in Takeovers: In the Eyes of the Beholder?', *The Journal of Finance*, vol.55, pp2599-2640.
- Skeels, C. & Vella F. 1999 'A Monte Carlo investigation of the sampling behavior of conditional moment tests in Tobit and Probit models', *Journal of Econometrics*, vol.92, pp275-294
- Stulz, R. 1988 'Managerial control of voting rights : Financing policies and the market for corporate control', *Journal of Financial Economics*, vol.20, pp25-54
- Vermaelen, T 1981 'Common Stock Repurchases and Market Signalling', *Journal of Financial and Quantitative Analysis*, vol.19, pp163-181.
- Yatchew, A & Griliches Z. 1985 'Specification Error in Probit Models', *The Review of Economics and Statistics*, vol.67, pp134-39