SHARE ISSUES AND REPURCHASES RELATED TO EQUITY MARKET TIMING ON THE JSE

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DECLARATION

I hereby declare that the research reported in this dissertation is my own, unless otherwise stipulated in the paper. This dissertation, whether wholly or in part, has not been submitted in the past nor will it be submitted in future for any degree from any university.

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ABSTRACT

Information asymmetry creates a gap between management's perception of the firm's value and the market value of the firm. It is thought that management engage in information signalling activities in order to close the gap created by information asymmetry.

There is a need to understand why management engage in their chosen transactions as this will provide investors with insight into market activities, as well as allow for more accurate investment strategies. While research is available on the market's reactions to signalling events, the problem is whether management's intentions have been correctly interpreted by the market. The starting point to gaining this understanding is to ask the question: What signals do management send when they issue and repurchase shares?

This study attempts to answer this question by investigating whether companies listed on the Johannesburg Stock Exchange (JSE) issue shares because management perceive their market values to be overvalued and repurchase shares because their market values are undervalued. For the period 1 January 2003 to 31 December 2012, a total of 295 share issue announcements are considered for 102 companies; and a total of 183 share repurchase announcements are considered for 83 companies.

The results of this study reveal that managerial equity market timing may exist in the presence of excess returns, where management are better able to predict returns in advance than the market. However, there is also evidence suggesting share repurchases are made to return excess cash to shareholders and issues and repurchases decisions are linked to capital structure planning. The fact that there are other potential reasons for share issues and repurchases, means that the market must be able to determine what the real intentions of management are when shares are issued and repurchased; and hence determine whether their intentions suggest equity market mispricing.

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1. INTRODUCTION

1.1 Purpose of the study

The purpose of this study is to understand one of the dimensions of corporate strategy, namely equity market timing, specifically on the JSE. The study will ascertain whether companies listed on the JSE issue shares because management perceive their market values to be overvalued and repurchase shares because their market values are undervalued.

1.2 Context of the study

It is widely accepted that theory of finance concepts are based on the assumption that the main objective of companies is to maximise shareholder value (BPP Learning Media, 2007). Part of maximising shareholder value entails obtaining the lowest possible cost of capital so as to maximise returns earned in excess of the cost of funding. Since the cost of capital is largely influenced by the capital structure of companies, debt and equity is relevant to persons interested in investigating the maximisation of shareholder wealth. In South Africa, companies were unable to manage the equity component of their capital structures through share buybacks prior to July 1999 (Crotty, 2013). South Africa's share repurchase activity is thus limited to less than fifteen years, which means that research on share repurchases in the country is also limited to less than fifteen years. Since the management of equity entails both equity issues and repurchases, this study investigates both of these scenarios.

There are numerous reasons for entities to actively manage their equity, some of which include the need to enhance financial flexibility, to maintain a target capital structure, avoid a hostile takeover or to send certain signals to the market. 'Equity market timing in corporate finance refers to the issuing of shares when share prices are high and repurchasing shares when share prices are low, in an attempt to benefit from temporary movements in the cost of equity' (Baker & Wurgler, 2002). While this research attempts to control for the possible reasons for managing equity, the focus of this study is on whether management takes advantage of equity market mispricing by issuing or repurchasing shares.

1.3 Problem statement

1.3.1 Main Problem

The purpose of the research is to ascertain whether companies listed on the JSE attempt to engage in equity market timing by issuing shares because management perceive their market values to be overvalued and repurchasing shares because their market values are undervalued.

1.3.2 Sub-problems

The first sub-problem is to ascertain whether companies listed on the JSE issue shares because management perceive their market values to be overvalued.

The second sub-problem is to ascertain whether companies listed on the JSE repurchase shares because management perceive their market values to be undervalued.

1.4 Significance of the study

Since share buy-backs have only been allowed in South Africa since 30 June 1999 (Republic of South Africa, 1999), this study fills a gap by providing up-to-date information about share repurchases. Prior to 2007, there were no databases containing details of share buybacks of companies listed on the JSE; while many such databases were in existence for countries that have a longer history of share buybacks (de Goede, 2007). In addition, South Africa's limited history of share buybacks translates into a need for any analysis that relate to these types of transactions. This study provides additional insight into how listed companies attempt to manage their equity to create shareholder value in South Africa. The results of this study will assist the market to more accurately interpret management's actions and this will increase market efficiency and reduce information asymmetry between the market and management. The results can be used as a basis for future research to determine how equity issues and repurchases affect capital structure in the long run. Furthermore, the results of this study not only provides the market with further insight into managerial behaviour, but investors will be in a better position to plan their investment strategies and possibly benefit from excess returns due to a better understanding of the dynamics behind share issues (repurchases).

1.5 Delimitations of the study

This study only focuses on equity market timing as part of corporate strategy. Details regarding reasons for debt issues have not been directly investigated. This study does also not investigate the impact of equity market timing on capital structure. Furthermore, while this study attempts to ascertain if share issues (repurchases) have occurred because of mispricing, it does not attempt to investigate management's behaviour at times when no share issues (repurchases) are announced. For the purposes of this study, initial public offerings (IPOs) and stock splits do not constitute share issues.

2. DEFINITION OF TERMS

Assets - total assets as per the Statement of Financial Position

Capital - total debt plus equity as per the Statement of Financial Position

Capital asset pricing model (CAPM) - calculated as the risk free rate plus beta multiplied by the equity risk premium

Equity market timing - 'the issuing of shares when share prices are overvalued and repurchasing shares when share prices are undervalued, in an attempt to benefit from temporary movements in the cost of equity' (Baker & Wurgler, 2002)

Excess return - calculated as the difference between actual return in a future period and required return on announcement date

Managerial equity market timing - used interchangeably with the term 'equity market timing' in corporate finance

Market-to-book (MTB) value of shares – calculated as market price per share divided by the net asset value per share; where the net asset value equals total assets less total liabilities

Mispricing metric – any metric used to ascertain the over or undervaluation of shares

Price earnings ratio (PE) - refers to historical / trailing PE ratio. The market accepts the calculation as market price per share divided by the latest historical earnings per share

Price earnings to growth ratio (PEG) - refers to historical / trailing PEG ratio. Calculated as PE ratio divided by the latest annual 3 year earnings per share growth

Share buy-back - used interchangeably with the term 'share repurchase'

Share repurchase - refers to the actions taken by management to repurchase ordinary equity from existing shareholders. Shares can be repurchased by way of a tender offer, purchase in the open market or by way of a private purchase (Vermaelen, 1981)

Share issue - refers to the actions taken by management to issue new equity in the market. For the purpose of this research, share issues constitute the issue of ordinary share capital

Total debt - amounts (both long and short term) owing to creditors. This does not include accounting adjustments such as accruals and deferred tax. Identified as per the Statement of Financial Position

Total Equity - total equity as per the Statement of Financial Position

3. LITERATURE REVIEW

3.1 Introduction

This section contains the review of related literature. Firstly, shareholder value creation will be linked to the significance of equity in capital structure. Thereafter, market signalling and information asymmetry will be explained, followed by a review of managerial equity market timing. Lastly, a brief explanation will be provided for various other potential reasons for share issues and repurchases. The themes that have surfaced from the review of related literature will form the backdrop of all analysis that is conducted in this study.

3.2 Equity in capital structure and shareholder value creation

It is widely accepted that theory of finance concepts are based on the assumption that the main objective of companies is to maximise shareholder value (BPP Learning Media, 2007). With the globalisation of capital markets, increased corporate governance which has led to shareholders demanding accountability from management as well as management's concern with self-preservation, the need to create shareholder value has become increasingly topical (Institutue of Management Accountants, 1997). The Institute of Management Accountants (1997) identify two examples of shareholder value-creation strategies, namely, the increase of cash flow from operations as well as the reduction of the capital charge. Some could argue that the latter is concerned with obtaining an optimal capital structure in which the cost of capital is minimised. According to Modigliani and Miller (1958), firms would not derive material cost benefits from switching between debt and equity since the cost of different forms of capital do not vary significantly in efficient and integrated capital markets. Although this research has formed the foundation of finance theory studied in today's world, the era in which it was undertaken is significantly different to today's era of capital markets. Differing tax rates for different forms of capital, credit rating requirements and capital market regulations are among the factors that have changed since 1958. Furthermore, in the United States (US), management's actions have contradicted Modigliani and Miller's (1958) theory of the irrelevancy of debt and equity, when they admitted that they are reluctant to issue common equity when they feel their market values are high (Graham & Harvey, 2002).

Tasked with maximising shareholder value, it is up to management to ensure that the cost of funding is minimised. Historically, South African regulation has restricted the management of equity. Firstly, share repurchases were disallowed until the Companies Amendment Act 37 of 1999 was implemented. Secondly, companies were required to have a minimum amount of issued share capital so that creditors could assess whether shareholders have assumed adequate risk associated with the company (Makapela, 2010). The latter capital maintenance rule has however been replaced with rules based on solvency and liquidity in order to protect creditors under the new Companies Act No 71 of 2008 (Republic of South Africa, 2008). With the restrictions on share repurchases and capital maintenance rules lifted, management have been allowed more freedom to manage the equity component of their capital structures. Management therefore have no excuse to ignore the equity component of capital structure in their task to maximise shareholder value through minimising the cost of funding.

Two of the more prominent theories concerning the raising of capital are the so-called 'pecking order theory' and 'trade-off theory'. Under the pecking-order theory, firms are said to first utilise internally generated funds to pursue value-creating investments, followed by new debt and then lastly would resort to issuing new equity as a source of finance (Kaplan Schweser, 2012). Under the static trade-off theory, firms are said to balance the benefits of debt with the costs of financial distress (Kaplan Schweser, 2012). Once an optimal debt level is reached, further changes to the capital structure can only be achieved by altering the level of equity. In a survey conducted by Graham and Harvey (2002), moderate support was found for the application of the trade-off theory in Fortune 500 firms. This suggests that managers believe that value can be created for shareholders by working toward some type of optimal debt equity mix. It should however be noted that Graham and Harvey's (2002) survey of Fortune 500 firms is limited to the number of respondents (392 chief financial officers (CFOs) responded, which represented a mere response rate of 9%). Not only is there a risk that the respondents' views do not represent the views of the entire population, but there is also no certainty that South African CFOs think in the same manner as those Fortune 500 CFOs. It has however been found that South African firms follow a pecking order theory (Mohohlo, 2013), which is consistent with the strong statistical evidence found by Shyam-Sunder and Myers (1999), that the pecking order theory is the preferred method of corporate financing behaviour among mature industrial Compustat firms.

If South African firms behave according to the pecking order theory, the need to manage equity would be limited and possibly even non-existent. Shareholder value would be created by the optimal utilisation of internally generated funds and the cost of capital focus would be primarily on the cost of debt. If however, the trade-off theory is more prominent among South African firms, firms will look to optimise their capital structure and corporate actions such as equity issues and repurchases would be prominent in the market.

In inefficient capital markets, managers have the opportunity to create value for on-going shareholders at the expense of new and exiting shareholders (Baker & Wurgler, 2002). This finding is re-iterated by Babenko, Tserlukevich & Wan (2012) who found that share issues usually lead to share price declines. The authors firstly conclude that incoming and exiting shareholders are worse off due to managerial equity market timing. Furthermore, current shareholder wealth is maximised when managers time the market with share repurchases; and lastly, future shareholders' wealth is maximised when managers time the market with equity issuances.

Baker and Wurgler (2002) state that "capital structure evolves as the cumulative outcome of past attempts to time the equity market". In other words, equity market timing leads to capital structure decisions, instead of the traditional notions that capital structure policies lead to equity market timing.

3.3 Signalling and information asymmetry

Agency theory suggests that managers act as agents to perform functions on behalf of shareholders, who are the principals; and an agency problem exists when the agents do not act in the best interests of the principals (Kaplan Schweser, 2012). Jensen and Meckling (1976) suggest that the agency problem ultimately results in agency costs that are dependent on factors such as regulation and the sophistication of contracts between the various stakeholders of the firm.

The issuing of managerial stock options is one method that can be used to counteract the agency problem (Ramorwa, 2011). The presumption is that if managers are granted shares in the respective company, their actions which are driven by self-interest, would automatically result in them acting in the best interest of the shareholders, since they are both equity holders. It has however been proven, that this is not the case (Jensen & Meckling, 1976). Although the manager with stock options will seek to maximise his own utility, the smaller the manager's ownership claim, the smaller the incentive to seek innovative ventures that would maximise shareholder value since the reward of pursuing such ventures may not necessarily outweigh the effort of doing so (Jensen & Meckling, 1976). Ultimately, managers have information that outside shareholders do not have. This information gap is often referred to as 'information asymmetry'. Unless management explicitly communicate this information to the shareholders, shareholders have no choice but to infer the knowledge from managers' behaviour.

The 'signalling theory' refers to the phenomenon whereby users look to management's decisions and actions as signals about the state of the firm (Correia, Flynn, Uliana, & Wormald, 2003). When companies repurchase shares, the signal could either be interpreted in a negative way (as the implication could be that management cannot find a better use for the funds due to a lack of growth opportunities), or the signal could be positive especially if shares are being repurchased at a premium (as the implication could be that management believe the company is undervalued) (Vermaelen, 1981). Other signals that are linked to share repurchases include the notion that management are confident about the company's ability to generate future cash inflows through earnings and therefore they are willing to commit to an outflow of funds through the share repurchase (Miller & Rock, 1985). If it is found that South African managers purchase shares when the share price is low and issue shares when the share price is high, then the market will know that share issues (repurchases) imply that management believe that the company's shares are overvalued (undervalued).

Due to information asymmetry and the resulting need for signalling, it follows that the issue or repurchase of equity could simply be an attempt by management to send a signal, whether truthful or not, to the market. On the other hand, management could simply be acting on the information unknown to the market, in which case management's actions would still carry some sort of signal. It therefore follows that the signalling effect of equity decisions is inevitable, as long as there is a separation of ownership and control and an information gap exists between the owners and managers. This is confirmed by the empirical finding that 'firms engage in signalling activities' (Vermaelen, 1981) but is rejected in a study conducted by Butler, Cornaggia, Grullon & Weston (2011), whereby they found no evidence that firms mislead investors through market timing. Babenko *et al*. (2012) confirms that CEOs are rewarded for share repurchases that have been successfully timed although no reward is provided for successfully timed share issues. Babenko *et al*.'s (2012) finding implies that a strong incentive exists for managers to signal to the market through share repurchases.

Between the period October 2000 – March 2003, managers used share repurchases to signal to investors that they believed the company's shares were undervalued, thus providing support for the signalling theory in the context of share repurchases on the JSE (Bhana, 2007). There are however relevant limitations to this study that will be discussed later in this paper.

Chang, Dasgupta & Hilary (2006) found that the greater the information asymmetry, the more likely it is that the firm has been incorrectly valued by the market. The firm will therefore make fewer equity issues, because if managers want to avoid issuing at a discount they will have to wait for the undervaluation to disappear; but then on the other hand they will have to issue equity to correct the mispricing and they will also have to issue equity in larger quantities (because opportunities to issue in future are limited). The authors used the number of analysts covering the respective firms as a measure of the degree of information asymmetry, and found that the lower the level of information asymmetry, the more likely it was that firms issued equity instead of debt.

If the signalling theory holds, and managers can use equity issues and repurchases as an opportunity to send signals to the market, they could be tempted to run up the share price at the expense of maximising exiting shareholders' value (Miller & Rock, 1985).

3.4 Managerial equity market timing

It has been found that the primary reason for share repurchases by US companies is to correct the mispricing of companies' stock (Chan, Ikenberry, & Lee, 2004). From this it can be inferred that if companies look towards share repurchases to correct mispricing, then surely share issues are also possibly considered to achieve the same goal.

By analysing US firms during the period 1968-1990, Bayless and Chaplinsky (1996) identified periods during which equity capital can be raised at favourable terms. The authors found that during periods of large volumes of equity issuance announcements, the market prices the equity lower than during periods of low volumes of equity issuance announcements. It therefore follows that windows of opportunities exist for equity issues, which makes the timing of equity issues very important (Bayless & Chaplinsky, 1996).

Baker and Wurgler (2002) found evidence for market timing in four different kinds of studies. Firstly, actual historical past financing decisions of firms show that when the market value is high, relative to the book value and past market values, firms tend to issue equity instead of debt. On the other hand, when the market value is low, relative to the book value and past market values, firms tend to repurchase equity. Secondly, by analysing the long-run stock returns that follow corporate financing decisions, it is suggested that equity market timing is successful. Thirdly, firms tend to issue equity when investors are too enthusiastic about earnings prospects and lastly, in a survey conducted by Graham and Harvey (2002), two thirds of CFOs admit that their perception of whether the stock is over or undervalued is an important consideration in their decision to issue equity.

In a study conducted by Hovakimian (2006) it was found that while equity transactions may be due to equity market timing, the effects on capital structure are not long-lasting, as indicated by Baker and Wurgler (2002). Hovakimian (2006) found strong evidence that equity market timing exists for equity issues, but the evidence for equity market timing in share repurchases is weaker. Similar to the study conducted by Baker and Wurgler (2002), Hovakimian (2006) only considered MTB values when investigating the over or undervaluation of shares and the conclusion that equity issues occur when shares are overvalued is based on the fact that the MTB values of the shares are high at the time of issue.

Share repurchases could act as a substitute for dividends and could be a less risky form of returning cash to shareholders, since it does not constitute an obligation towards shareholders. In a South African context, it has been found that share repurchases are not financed by a reduction in dividends (Ramorwa, 2011). Because the author has identified share repurchases by analysing the actual number of shares outstanding at the end of each calendar year, the results of the study may be compromised because during the calendar years where share issues and repurchases occurred, the repurchases could be understated or not considered at all. That said, the finding of this study implies that South African firms are not substituting dividends with share repurchases, and instead their reason for share buy-backs must be linked to something else. It follows that with one of the most popular academically taught reasons for share repurchases now potentially having been eliminated in the South African market, the possible argument for equity market timing is thus much stronger in South Africa.

In a study conducted by Bhana (2007), it was found that market timing exists for South African companies engaging in share repurchases. The author found that companies repurchase shares when the shares are undervalued and determined whether shares are undervalued by investigating abnormal returns. The South African market reported abnormal returns of 4,38% at the time of announcement and 14,35% three years thereafter (Bhana, 2007). The limitation of this study was that the sample size was limited to 117 companies, mainly due to the limited period that was used (October 2000 – March 2003) in the study (Bhana, 2007). Despite these limitations, Bhana's (2007) study has provided a foundation off which to build equity market timing research in South Africa.

3.5 Other possible reasons for equity issues and repurchases

There are numerous potential reasons for entities to issue or repurchase equity, some of which include the need to exploit potential tax benefits linked to the equity transactions, to avoid a hostile takeover or to send certain signals to the market (Bhana, 2007; BPP Learning Media, 2007; Correia, *et al*., 2003; Graham & Harvey, 2002). Firms may also manage their equity in order to enhance financial flexibility or maintain a target capital structure (Correia, *et al*., 2003; Graham & Harvey, 2002). Reasons for share repurchases are often noted in academic literature as the decision to return excess cash to shareholders (Bhana, 2007; BPP Learning Media, 2007) or to substitute cash dividends with share repurchases; while share issues may be used to raise finance for new projects (Correia, *et al*., 2003). Finally, it has also been found that directors repurchase shares when earnings per share (EPS) is diluted due to outstanding employee stock options (Bens, Nagar, Skinner, & Wong, 2003).

4. RESEARCH DATA AND METHODOLOGY

4.1 Introduction

This section outlines the method that was used to ascertain whether share issues (repurchases) are linked to managerial equity market timing. A quantitative approach has been followed to conduct the research. First, the sample and data collection will be discussed. Next, the research methodology will be discussed specifically focusing on the justification of the use of historical averages, the determination of the mispricing metrics, analysis of the mispricing metrics, the determination of the control variables and analysis of the control variables. Lastly, the research hypothesis will be presented, followed by the methodology, robustness, internal validity and reliability of the regression analysis.

4.2 Sample and data collection

4.2.1 Sample

This study considers companies listed on the Main Board of the JSE. The purpose of selecting companies listed on the Main Board of the JSE is so that the research is applicable to shares that are publically traded. Even though shares listed on the Alternative Exchange (AltX) (South Africa's junior board that lists smaller growing firms) are also publically traded, this index was only launched in 2003 (Johannesburg Stock Exchange, 2013), thus providing a limited history of the metrics required for the purposes of this study. Furthermore, the fact that the Main Board has three times as many shareholders as the AltX (Johannesburg Stock Exchange, 2013), means that the shares traded on the Main Board are more liquid.

Only companies that have made share issues (repurchases) announcements are considered in this study. It should be noted that announcements are considered, irrespective of whether management actually issued or repurchased shares subsequent to the announcement. The reason for considering announcements and not the actual event/action of issuing (repurchasing) shares, is that management's intentions (which would already have existed at the time of the announcements) are what is being considered in this study. Share issue and repurchase announcements were obtained from Corporate Actions available in the McGregor BFA database. The 2003 year was used as the starting period for the study, as information from this period was readily and accurately available on McGregor BFA. The cut-off date for announcements considered in this study was 31 December 2012. This cut-off date ensures that the data used is up-to-date while still allowing for the use of the 2013 calendar year's data when calculating excess returns.

Where the study relies on information from the annual financial statements, the last published annual or interim financial statements were taken as the information on announcement date. For events to be included in the sample there must have been a minimum of three years' financial information available from the announcement date. This three year period is necessary to calculate historical averages for the chosen metrics. The requirement for three years' historical financial information also ensures that IPOs are excluded from this study. The inclusion of IPOs might distort the results of the study, since it is known and accepted in industry that the key reasons for IPOs is an exit strategy for pioneer investors or for the company to have greater access to funds.

If there was a change in the reporting currency of the affected companies within the three years preceding the latest set of available information, the affected events are ignored. The reason for ignoring these events is that it would result in inconsistent variable results when calculating the necessary historical averages. A total of three announcements are excluded from this study based on the fact that there was a change in the reporting currency of the company within the affected periods.

If companies have delisted within twelve months after the announcement date, the said announcements are ignored, since this research relies on calculating excess returns using actual returns twelve months after announcement date. It should be noted that only the affected events are ignored, and not all the events of the affected company. Furthermore, it has been observed that certain companies did not submit information to McGregor BFA if they were pending delisting (or for any other reason). Announcements affected by this incomplete information are also excluded from this research, as the reliability of the research results is dependent on complete and consistent information.

This study further excludes stock split announcements since stock splits do not alter reserves (BPP Learning Media, 2007) and thus provide no opportunity for management to repurchase or issue additional shares at the time of the stock split.

Companies whose information is not available on McGregor BFA due to participation in merger activities during the period under review, are also excluded from the sample (based on this criteria a total of two companies, and thus all announcements of these companies, have been excluded from this study).

The financial services sector are excluded from this study, since their capital structure is largely dictated by regulation (Mohohlo, 2013) and this could influence managements' decisions surrounding the issue or repurchase of equity. To illustrate this, assume a scenario in which a bank needs to raise finance and would ideally like to do so by issuing debt. However, by applying Basel regulations which require a minimum level of equity in the capital structure (Basel Committee on Banking Supervision, 2006), the bank is unable to issue further debt and would have to issue equity to raise the required finance. It is therefore arguable that the dynamics surrounding equity issues and repurchases in the financial services sector is too different from other sectors to apply the same research tests. The exclusion of the financial sector also follows from prior related research (Baker & Wurgler, 2002; Chang, *et al*., 2006; Fraser & Page, 1999; Hovakimian, 2006; Mohohlo, 2013).

Since the events included in the sample are chosen for a specific reason, this study can be seen to make use of a purposive sample (Leedy & Ormrod, 2010). This study might however be subject to slight survivorship bias due to the requirement that a company is listed for at least twelve months after the announcement date.

After applying the above exclusions, a total of 295 share issue announcements are considered for 102 companies; and a total of 183 share repurchase announcements are considered for 83 companies. A total of 145 companies are included in this study, with a total of 478 announcements. A summary of the sample is presented in Table 1 of Appendix A.

4.2.2 Data collection

The main data source utilised for this study was the McGregor BFA database which contains publically available financial and statutory information of all companies listed on the Main Board of the JSE. Data was exported and managed with Microsoft Excel. The statistical tool STATA was used to perform statistical tests.

Upon selection of the sample announcements, a check was performed to establish whether the latest set of publically available information related to year-end or interim results. Because this study relies on historical averages, it is critical that there is consistency when calculating these averages. Due to discrepancies between the manner in which year-end and interim information is presented and summarised on McGregor BFA, it is necessary to make use of either an entire set of annual or an entire set of interim information, for all required years, when studying an event (i.e. one event cannot be studied by using a mixture of annual and interim information). For this reason, it was necessary to utilise year-end information in the following cases, when the latest set of publically available information was in fact interim results:

- Any announcements that required interim information for the period prior to 2009, since the interim information required for this study was incomplete prior to 2006 on McGregor BFA
- Where required interim information was incomplete for any year in the three years preceding the latest set of available information and that information could not be sourced elsewhere within McGregor BFA

It should be noted that throughout this study, when referring to all financial statement information on announcement date, that the reference is to the latest set of publically available information prior to the announcement.

4.3 Research methodology

This study makes use of a quantitative method which involves the robust application of probit regression analysis.

4.3.1 Historical averages

The study attempts to determine whether financial information deviated from historical averages on the announcement dates/dates closest to the announcement dates. The three year historical average of the relevant metrics were used to assess the possible mispricing of shares and reasons for share issues (repurchases) announcements, other than equity market timing. The use of a three year period is consistent with prior research (Hovakimian, 2006) and relevant for this study since the period under review includes the 21st century global economic recession. The South African economy is said to have been in recession since the fourth quarter of 2008 until the third quarter of 2009 (Ruch, 2013; Theunissen, 2009).

The financial crisis significantly altered capital structure for the period 2006 – 2008, but these effects were almost completely reversed by the end of 2010 (Fosberg, 2012). This renders a five year period for the study of historical averages too long (since the five year averages may be distorted to correct the effects of the financial crisis towards the end of the five year period). A one or two year period was not used to analyse historical averages as it is arguable whether a one or two year period is long enough for firms to establish a metric that represents a general average. A three year period was thus deemed appropriate for this study.

When calculating PE and PEG ratios, trailing (as opposed to forward) ratios have been used, since historical figures are known with certainty. In order to use forward ratios, earnings and growth estimates would have to be made for the future at the point of the share issue (repurchase) announcement; which requires the researcher to have all relevant knowledge of market conditions at each point of share issue (repurchase) in history. The use of forward PE and PEG ratios would thus rely on subjective estimations which would compromise the accuracy of the information.

4.3.2 Determining the mispricing metrics

The use of the following metrics assist in determining whether shares are under or overvalued: MTB value of shares, trailing PE, excess returns as determined by the capital asset pricing model (CAPM) and trailing PEG. These measures (with the exception of excess returns) have been identified, both directly and indirectly, by Brandes (2004) as value-creating measures. The use of value creating measures is justified since value strategies could have been used to earn superior returns one month into the future for JSE listed industrial firms, during the period January 1973 and October 1997 (Fraser & Page, 1999). The use of excess returns is justified since it is industry practice, seen both in academic textbooks and published journal articles, to value shares using excess returns. (Bhana, 2007; BPP Learning Media, 2007)

Table 2 depicts the definition of each of the mispricing metrics. When calculating the metrics, the latest set of publically available information prior to the issue (repurchase) announcement, was used.

Table 2: Definition of mispricing metrics

Metric	Definition
MTB	Average monthly close market price per share / NAV per share
PE	Share price / $EPS_{(t)}$
PEG	PE / 3 year annual EPS growth
Excess return	$Re_{(t+1)} - Ke_{(t)}$
K_e (required return)	K_e calculated by using CAPM Risk free rate + beta(equity risk premium)
R_e	[Share price $_{(t+1)}$ – share price $_{(t)}$] / share price$_{(t)}$

*t equals the year of the share issue (repurchase) announcement

4.3.2.1 Market-to-book values

The MTB value of shares was used in numerous studies that attempted to investigate market timing (Baker & Wurgler, 2002; Butler, *et al.*, 2011; Hovakimian, 2006) and has thus been adopted to detect mispricing. The market values were obtained from McGregor BFA's monthly price data. The monthly average close prices were used (instead of the close price on the day of the announcement), since it was evident that the declaration dates for the share issue (repurchase) announcements stated in McGregor BFA, are sometimes a few days later than the actual announcement to the market by way of news articles. The result is that the exact announcement dates are not known with 100% certainty and therefore the next best price data (i.e. average monthly) was utilised.

NAV per share was calculated as follows:
(Total assets – total liabilities) / number of issued shares

The number of issued shares were obtained from the financial statements. When using year-end financial statements, the number of issued ordinary shares were used, whereas the interim financial statements only provided weighted average issued shares (for lack of more detailed information, this number was used as the issued shares for interim financial statement information). The fact that the number of shares used differs when using year-end and interim information, does not compromise the results of this study, since each event is analysed using a consistent set of information in all cases (i.e. if year-end information is used then all information relating to the affected event would make use of year-end figures and the same applies for the use of published interim information).

4.3.2.2 Price earnings ratio

The use of the trailing PE ratio as a measure to assess the intrinsic value of shares is based on the fact that Graham and Harvey's (2002) survey revealed that nearly 70% of CFOs identified EPS dilution as an important or very important factor in their decision to issue equity. It is therefore important to relate earnings (which is highly valued by managers) to the market price of shares (which is set by investors).

The PE ratios were obtained from McGregor BFA's monthly price data. The research report used average monthly price data (rather than actual data on the announcement date) for the same reasons depicted in 4.3.2.1.

4.3.2.3 PEG ratio

By investigating the trailing PEG ratio, this study sought to ensure that the trade-off between the share price, EPS and company growth is not ignored in the quest to determine the over and undervaluation of shares (Stocktrade, 2013). Due to the factor analysis explained in 5.1.2, this variable has however been removed from this study as a mispricing metric but remains as an input to one of the control variables (avoidance of a hostile takeover).

The PE ratios were obtained from McGregor BFA's monthly price data. Average monthly price data (rather than actual data on the announcement date) was used for the same reasons depicted in 4.3.2.1. EPS was calculated based on McGregor BFA's monthly price data, in which PE and the close market price per share was given. Annual EPS growth was based on the historical 36 month EPS growth.

4.3.2.4 Excess returns

Excess returns are analysed based on the assumption that due to information asymmetry, management are better able to estimate future excess returns than the market (Bhana, 2007). The return one year after the issue (repurchase) announcement date was compared to the required return on announcement date in order to ascertain the existence of excess returns. The required return on announcement date was based on the CAPM.

By viewing excess returns as the difference between the actual returns in a future period after the event and the required returns at the time of the event, it is assumed that management are able to predict returns in advance and could expect returns to be above or below market expectations. If this is the case, the assumption is that they will try to capitalise on this difference in expectations.

Share prices were obtained from McGregor BFA's monthly price data in order to calculate actual returns. Average monthly close prices (rather than actual close prices on the announcement date) were used for the same reasons depicted in 4.3.2.1.

In the calculation of required return using CAPM, the average yield on all government bonds with a maturity period of 0 to 3 years, that were traded on the stock exchange during the declaration year, was used as proxy for the risk free rate; in line with standard practice in the South African market, an equity risk premium of 6% was used; betas were calculated by regressing the 36 monthly share price returns against the three year monthly JSE All Share returns. All calculations were performed for the month in which the respective announcement occurred.

4.3.3 Analysis of the mispricing metrics

For equity market timing to exist, shares must be overvalued on the issue announcement date or undervalued on the repurchase announcement date. It is expected that the identification of the mispricing happens more than 3 months before the announcement. The assumption is that management uses this period to identify the exact level of mispricing and the best tool to signal the mispricing to the market. However, on announcement date the mispricing would not have been corrected and hence this study identifies the mispricing on the announcement date.

In order to ascertain whether the shares were over or undervalued on announcement date, the MTB value of shares and PE ratios were recorded in the month of the issue (repurchase) announcements. In addition, R_e was calculated one year after the issue (repurchase) announcement. Thereafter, the average MTB value of shares and PE ratios were examined for a period of three years prior to each share issue (repurchase) announcement date. The required return was also calculated on the issue (repurchase) announcement date. The MTB value and PE, as calculated on the announcement date of issue (repurchase) was compared to the historical three year average. Excess returns were calculated by subtracting the K_e on announcement date from the R_e one year after.

A retrospective prediction of whether a share issue (repurchase) should have occurred based on this comparison, was made as follows:

Table 3: Expected outcomes of share mispricing

Metric	**Indication of mispricing***	**Share trading value$_{(t)}$ ***	**Prediction**
MTB	$MTB_{(t)}$ *less* 3 year average > 0	Overvalued	Share issue
MTB	$MTB_{(t)}$ *less* 3 year average < 0	Undervalued	Share repurchase
PE	$PE_{(t)}$ *less* 3 year average > 0	Overvalued	Share issue
PE	$PE_{(t)}$ *less* 3 year average < 0	Undervalued	Share repurchase
Excess return	$Re_{(t+1)}$ *less* $Ke_{(t)} < 0$	Overvalued	Share issue
Excess return	$Re_{(t+1)}$ *less* $Ke_{(t)} > 0$	Undervalued	Share repurchase

*t equals the year of the share issue (repurchase) announcement

4.3.4 Determining the control variables

The following metrics were used to capture the potential reasons, other than equity market timing, for share issues and repurchases:

Table 4: Possible reasons for share issues

Potential reason for share issue	**Fundamental metric representing reason**
Enhance/ maintain financial flexibility	Total debt / capital
Maintain target capital structure	Total debt / total capital
Raise finance for new projects	Cash flow from investment activities / cash flow from operating activities

Table 5: Possible reasons for share repurchases

Potential reason for share repurchase	Fundamental metric representing reason
Avoid hostile take-over	Interest / net profit, PEG, MTB
Maintain target capital structure	Total debt / capital
Return excess cash to shareholders	Positive cash balance / total assets
Substitution for cash dividends	Dividend per share / earnings per share
Dilution of EPS due to employee stock options	Issue of additional employee shares within 12 months preceding announcement

4.3.4.1 Total debt / capital

In order for companies to have access to finance, they would have to consider their credit ratings since many large financial institutions are prevented, by law, from investing in non-investment grade companies (Kisgen, 2006). It is therefore appropriate to make use of a metric that rating agencies would use to represent the need to enhance or maintain financial flexibility. The total debt to capital ratio has been identified as one of the credit ratios used by Standard and Poors (S&P) in order to assign a credit rating to companies (Gunter & Vazza, 2012).

The total debt to capital ratio was also used to represent the potential reason of maintaining a target capital structure. Initially, the suitable ratio identified to capture this potential reason was debt to equity, however due to multicollinearity with other variables in the model; this ratio was replaced by total debt to capital. Details of the total debt and capital calculations are presented in Appendix B.

4.3.4.2 Cash flow from investment activities / cash flow from operating activities

An analysis of cash flow from investment activities to cash flow from operating activities is used in order to assess whether companies issued shares to raise funds for a new project or investment. An increase in this ratio in the year following the issue announcement could be an indication that shares were issued in order to raise finance for investment opportunities, at least in the short term. The financial line items used to calculate cash flow from investment activities and cash flow from operating activities are presented in Appendix B.

4.3.4.3 Debt/capital, MTB, PEG

In order to assess whether share repurchases were conducted in an attempt to avoid a hostile takeover, the debt to capital, MTB and PEG ratios, as at announcement date, were captured as an interaction term in the regression analysis.

A matrix analysis conducted by Cohen (2008) attempted to identify the top takeover targets in South Africa. Having made use of the criteria that PEG exceed 0.35 without exceeding 0.75 and interest cover exceed 3 times, a list of ten companies subject to a takeover bid was published. To further refine this list to account for investors' need for cheap investments, Cohen then excluded all companies not trading at a discount to NAV. Just short of six years later, an investigation into these identified companies found that 6 out of the 10 were involved in some form of merger/ takeover/ ownership restructure activity in the period following the publishing of Cohen's article. For this reason, the same basis used by Cohen to identify potential takeover targets was used for the purposes of this study. The only two differences are that firstly, this study uses debt to capital, instead of interest cover. This was done since debt to capital is viewed as a more reliable measure of gearing in the South African context, given the volatility of interest rates during the period under review. Secondly, Cohen calculated PEG by dividing PE by the five year aggregate prospective growth; while this study has calculated PEG by dividing PE by the three year annual historical earnings growth. In essence, the differing growth grates used between the two should not significantly alter the results, since the five year prospective growth would have had to be based, at least to some degree, on the historical growth rates.

4.3.4.4 Cash / total assets

An appropriate metric to use to assess whether companies repurchase shares because they have excess cash, would be the company's favourable cash balances to total assets. The assumption is that if this ratio was significantly higher on the announcement date than historically, management have decided not to use the cash to fund additional projects and thus have excess cash available for distribution to shareholders.

4.3.4.5 Dividend per share / earnings per share

In order to assess whether share repurchases were used as a substitute for dividends, the dividend payout ratio was analysed. The assumption is that if this ratio was significantly higher on announcement date than historically, management's motivation for the repurchase could have been a substitution of dividends.

4.3.4.6 Employee stock options

An assessment of employee shares issued could provide an indication of whether share repurchases have been used in an attempt to reverse the negative dilutive effect of employee stock options on EPS. Bens, Nagar, Skinner & Wong. (2003) concluded that share repurchases increase when the dilutive effective of outstanding share options on diluted EPS increases.

4.3.5 Analysis of the control variables

Control variables were introduced in the final probit model, in order to establish whether the share issues (repurchases) announcements were made for reasons other than equity market timing. The table below explains the relevant calculations applied for each control variable which represents potential other reasons for the issue (repurchase) announcements.

Table 8: Definition of control variables

Other potential reason for announcement	**Control variable**	**Method of calculation ***
Financial flexibility	Total debt / capital	(Total debt / capital)$_{(t)}$ – 3 yr historical average
Target capital structure	Total debt / capital	(Total debt / capital) $_{(t)}$ – 3 yr historical average
Investment in new project	Cash flow from investment activities / cash flow from operating activities	(Cash flow from investment activities / cash flow from operating activities)$_{(t+1)}$ – 3 yr historical average
Hostile takeover threat	MTB, Debt/capital, PEG	Values for each variable brought into regression as interaction term
Excess cash	Total cash asset / total assets	(Total cash asset / total assets) $_{(t)}$ – 3 yr historical average
Substitution of dividends	Dividends / earnings	(Total dividends / total earnings)$_{(t)}$ – 3 yr historical average
EPS dilution due to employee stock options	No of employee shares issued	Employee shares issued$_{(t)}$ – employee shares issued $_{(t-1)}$

*Where t represents the year of the announcement

4.3.6 Research Hypothesis 1: Share issues are not related to market timing

If shares are found to be overvalued, management would be able to benefit from this overvaluation by issuing shares and thus earning excess returns (at least in the short term) from these share issues. Similarly if share issues are not related to market timing, the overvaluation of the shares would be irrelevant in management's decision to issue shares.

4.3.7 Research Hypothesis 2: Share repurchases are not related to market timing

If shares are found to be undervalued, management would be able to benefit from this undervaluation by repurchasing shares at cheaper than market prices. Management would essentially receive a discount on the share repurchase, thus saving the company money. If share repurchases are however not related to market timing, the undervaluation of shares would be irrelevant in management's decision to repurchase shares.

4.4 Regression Analysis

4.4.1 Methodology

Multivariable probit regression analysis is used, as the dependent variable in this study is categorical. The regression aims to determine the relationship between the actual announcements and the mispricing metrics. The probit model predicts the probability of an event (i.e. issue or repurchase) happening and the significance of the contribution of each factor to the probability.

Initially PEG was included as an independent mispricing variable, but was removed due to high multicollinearity between PEG and the other variables in the study.

The probit regression analysis controls for each of the other potential reasons for share issues (repurchases) by incorporating the fundamental metrics that best capture these reasons (tabled in 4.3.4 above). Together with the valuation metrics used to ascertain mispricing, these fundamental metrics form the independent variables in the probit regression analysis.

The dependent variables in the probit regression analysis are the indicator variables that represent whether share issues or repurchase announcements have been made. The indicator variables for the actual announcements are represented as follows:

Table 9: Indicator variables

Event	**Indicator variable**
Share issue	+1
Share repurchase	0

Each share issue (repurchase) announcement is seen as one event in which the calculations for the mispricing metrics and control variables are regressed. Inclusion of the control variables ensures that the impact of other potential reasons for share issues (repurchases) are captured, and so do not lead to misrepresentation of the relationship between mispricing and management's strategy.

4.4.2 Robustness

Heteroskedasticity exists when the variance of the error terms are different across observations. This study tested for heteroskedasticity using the heteroskedastic probit model. The individual independent variables were used as the control for heteroskedasticity.

4.4.3 Internal validity

A study is said to have higher internal validity when there is greater control exercised over the various independent variables (Ryan, Scapens, & Theobald, 2002). This study has ensured that internal validity was achieved as the regression has controlled for various other potential reasons for share issues (repurchases). The interpretation of the results of these reasons serves as stronger evidence of the existence or lack of causality between management's announcements of issuing (repurchasing) shares and equity market timing.

Coefficient of correlation was used in an attempt to test for multicollinearity. While it is understood that multicollinearity is an econometric problem that cannot definitively be tested for using correlation, this study has made use of coefficient of correlation as a potential (not definite) indication of multicollinearity. Due to the possible existence of multicollinearity, factor analysis was used to identify the key factors that explain most of the variation across all variables. Coefficient of correlation in conjunction with factor analysis resulted in the revision of the independent variables. Results are detailed in section 5.1.1 of this paper.

Despite the fact that all share issue and repurchase announcements, for which there was information available, was included irrespective of whether the said companies were active or delisted, it should be noted that the results of this study should be interpreted with caution as there may be slight survivorship bias. This is due to the fact that this research relies on calculating excess returns using actual returns twelve months after announcement date, thus for companies that have delisted within twelve months after the announcement date, the said announcements were ignored. It should be noted that only the affected events are ignored, and not all the events of the affected company.

4.4.4 Reliability

Reliability refers to the extent to which the study can be replicated in other settings (University of Southern California, 2013). This study can be said to be reliable due to the objective research method that was applied in this study.

5. EMPIRICAL RESULTS

5.1 Variable definitions

The variables used in the probit regression are explained in Appendix C.

5.1.1 Coefficient of correlation

Coefficient of correlation was used to test for multicollinearity. Results are shown in the correlation matrix in Appendix D.

All independent variables, measured at the time of the announcement as well as the difference between the announcement date values and historical averages where applicable, were included in the test. At a 1% significance level, there is significant multicollinearity among most of the variables used in this study. The debt to equity ratio was removed since the relationship with MTB and debt/equity were positively moderate at r values above 0.40. The debt/equity ratio would initially have controlled for the potential reason of maintaining a target capital structure as the rationale for the share issue or repurchase. The elimination of the debt/equity ratio has thus resulted in the inclusion of variables that, although significant at a 1% level, depict weak correlations with r values not exceeding 0.20. The shaded cells in Table 11 of Appendix D depict the variables that are utilised in this study, along with their respective correlation coefficients.

5.1.2 Factor analysis

Due to the detection of multicollinearity and the fact that no stepwise regression exists for probit regression, factor analysis was used to identify the key factors that explain most of the variation across all variables.

Factor analysis results displayed in Appendix E reveal that the following variables (shown in Table 13), ordered from most significant to least significant, should be included in the study. Appendix E also graphically displays the Eigenvalues, confirming that all factors have Eigenvalues greater than 1 (and are thus significant). Note that only the variables applicable to this study have been considered in the below results.

Table 13: Significant factors as per factor analysis

Significant factors
$MTB_{(t)}$ *less* historical average
$PE_{(t)}$ *less* historical average
$DPS/EPS_{(t)}$ *less* historical average
Cash from investments/Cash from operations$_{(t+1)}$ *less* historical average
Total Cash/total assets$_{(t)}$ *less* historical average
Debt/capital$_{(t)}$ *less* historical average
Number of employee share options

The lack of importance of PEG in the factor analysis has resulted in the removal of PEG from the independent variables. Although factor analysis did not suggest the inclusion of excess returns as a variable, this variable is included in the study since excess returns are closely linked to the accepted market signally theory (Bhana, 2007).

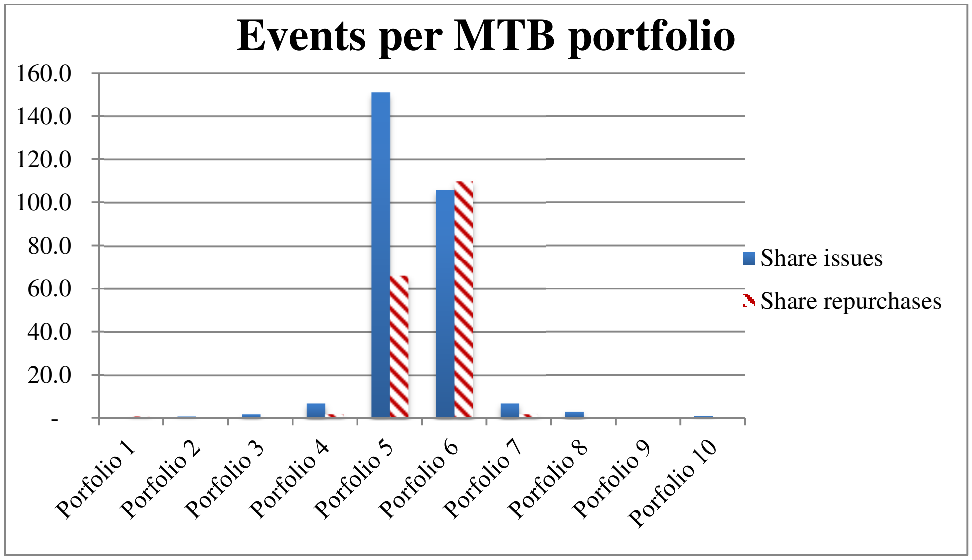
5.1.3 Portfolio analysis

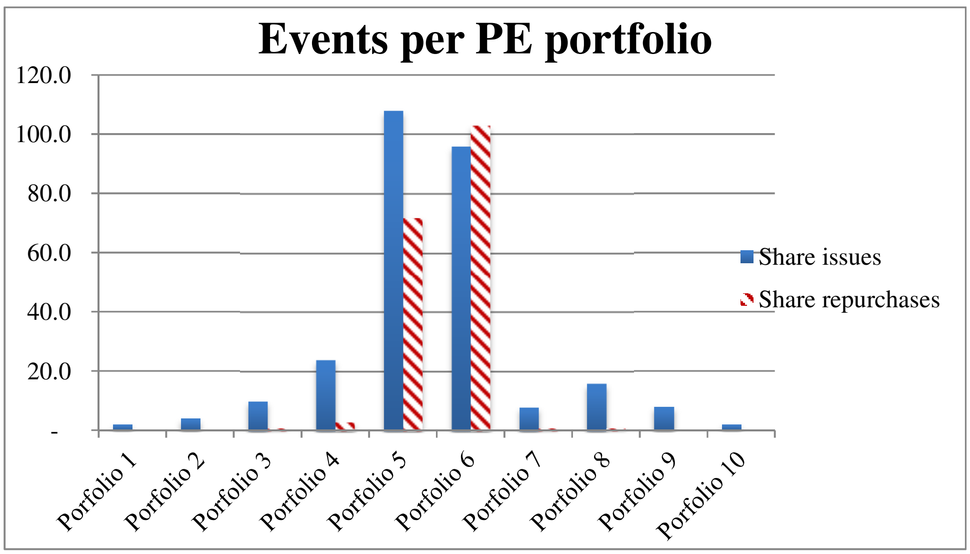
After removing outliers from the data, all sample events used in the study were divided into ten portfolios based on MTB. The same was done using the PE ratios. The number of events in each portfolio was counted and compared to the probit regression results. Details of the portfolios are depicted in Appendix F.

It should be noted that this analysis is a crude one, not having controlled for any other potential reasons for issues (repurchases) and utilising data that has not been controlled for heteroskedasticity and multicollinearity. The analysis should thus only be used for comparative purposes to the actual, more reliable, probit regression results.

For both the MTB and PE portfolios, the expectation is that if management engaged in equity timing, most of the observations would be closer to Portfolio 1 or Portfolio 10, which are the portfolios representing extremely mispriced companies.

Based on the analysis of these portfolios alone, there is very weak evidence of equity market timing since share issues (repurchases) mainly occur in Portfolios 5 and 6; where portfolios closer to the centre are correctly priced. The results of the portfolio analysis does not support the findings of the regression analysis; which indicate a possibility of equity market timing on the JSE, based on excess returns.





5.2 Regression

5.2.1 Regression definitions

The probit regression formula is written as

$$Y' = \phi(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon)$$

Where

Y' = probability of Y=1 or 0 for a chosen variable while all other X_i's are held constant

ϕ = probability under a normal standard distribution curve

X_1 = difference between MTB ratio above average MTB (mtbvsavg)

X_2 = difference between PE ratio above average PE (Pe)

X_3 = excess returns (Exreturns)

X_4 = difference between cash from investments and operating activities ratios above the average ratios (cficfotvsavg)

X_5 = difference between debt to capital above average debt to capital (debt_capit~g)

X_6 = difference between cash to assets above average cash to assets (cash_tasse~g)

X_7 = difference between dividends to earnings above average dividends to earnings (dps_epstvs~g)

X_8 = number of employee shares issued (esopt)

X_9 = interaction term of MTB, debt to capital and PEG (c.mtbvsavg#c.debt_capitg#cpeg)

ε = error term

β_i = coefficients to be determined

Where the independent variables of the model are defined in more detail as follows:

Table 16: Regression definition of independent variables

Independent variable	**Independent variable description**	**Method of calculation ***
Mtbvsavg	MTB	$MTB_{(t)}$ *less* 3yr average
Pe	PE	$PE_{(t)}$ *less* 3yr average
Exreturns	Excess Returns	$Re_{(t+1)}$ *less* $Ke_{(t)}$
Cficfotvsavg	Cash flow from investment activities / cash flow from operating activities	(Cash flow from investment activities / cash flow from operating activities)$_{(t+1)}$ *less* 3yr historical average
debt_capit~g	Total debt / capital	(Total debt / capital)$_{(t)}$ *less* 3yr historical average
cash_tasse~g	Total cash assets/ total assets	(Total cash asset / total assets)$_{(t)}$ – *less* 3yr historical average

dps_epstvs~g	Dividends / earnings	(Total dividends / total earnings)$_{(t)}$ *less* 3yr historical average
Esopt	No of employee shares issued	Employee shares issued$_{(t)}$ *less* employee shares issued$_{(t-1)}$
c.mtbvsavg#c.debt_capitg#c.peg	Interaction term of MTB, total debt / capital, PEG	N/A

*Where t represents the year of the announcement

5.2.2 Heteroskedastic probit regression

To eliminate possible heteroskedasticity, this research makes use of the heteroskedastic probit model, because the existence of heteroskedasticity in probit models would lead to inconsistent results (Soderbom, 2009). With the heteroskedastic probit model, a generalised probit model is estimated. Eight heteroskedastic probit models were run, in which the eight regression ratios were each tested separately for heteroskedasticity. The eight tables are presented in Appendix G, where it is evidenced that when tested individually, excess returns, cash assets/total assets and dividends/earnings each influence heteroskedasticity. Convergence was not achieved when MTB was tested for heteroskedasticity, but this was not a problem in the research as the model ultimately used for this study has been verified as one that does not contain heteroskedasticity.

It was necessary to re-specify the model by including the squares of the three variables identified as contributors to heteroskedasticity. Since the conditions of heteroskedasticity can change when new variables are added to the model, the heteroskedastic probit model was re-run after inclusion of the three additional variables. Table 25 shows the results of the retested model.

Table 25: Heteroskedastic probit model – retested

```
                                                  LR chi2(11)       =      36.32
Log likelihood = -269.3647                        Prob > chi2       =     0.0001

------------------------------------------------------------------------------
issuerepur~e |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
issuerepur~e |
sq_exreturns |   .4037993    .1063534     3.80   0.000     .1953505    .6122481
   exreturns |  -.9819491    .1547905    -6.34   0.000    -1.285333   -.6785652
dps_epstvs~g |  -.0010431    .0012525    -0.83   0.405     -.003498    .0014118
sq_dps_eps~g |  -1.64e-06    3.19e-06    -0.51   0.608    -7.89e-06    4.62e-06
cficfotvsavg |   .0005441    .0001771     3.07   0.002     .0001969    .0008913
debt_capit~g |   1.584339    .4468435     3.55   0.000     .7085415     2.46036
cash_tasse~g |  -.7657542    .8734991    -0.88   0.381     -2.47781    .9462726
sq_cash_ta~g |   -1.25652    1.608226    -0.78   0.435    -4.408585    1.895546
   mtbtvsavg |  -.0026836    .0020406    -1.32   0.188     -.006683    .0013159
          pe |   .0000871    .0006909     0.13   0.900     -.001267    .0014412
       esopt |  -5.64e-08    3.53e-08    -1.60   0.110    -1.26e-07    1.28e-08
             |
 c.mtbtvsavg#|
          c. |
debt_capit~g#|
       c.peg |  -.0154209    .0758062    -0.20   0.839    -.1639984    .1331566
             |
       _cons |   .2106094    .0742415     2.84   0.005     .0650987    .3561201
-------------+----------------------------------------------------------------
lnsigma2     |
   exreturns |  -.0821706    .1491283    -0.55   0.582    -.3744567    .2101155
dps_epstvs~g |    .001122    .0013874     0.81   0.419    -.0015972    .0038412
cash_tasse~g |    2.95543           .        .       .            .           .
------------------------------------------------------------------------------
Warning: convergence not achieved
Likelihood-ratio test of lnsigma2=0: chi2(3) =     4.57   Prob > chi2 = 0.2059
```

It is evident from Table 25 that the results of this model cannot be relied upon, since convergence was not achieved. It was thus necessary to remove the cash assets/total assets variable from the Insigma2 test.

Table 26 presented below, indicates that the control for excess returns and dividends/earnings was sufficient to remove the problem of heteroskedasticity, with Prob > chi2 of the likelihood test being greater than 0.1. Results reveal a quadratic relationship between the variables and the model. Furthermore, there is overwhelming evidence based on a p-value equal to zero, that the model is suitable for the data.

Table 26: Heteroskedastic probit model – final

Log likelihood = -271.2861 LR chi2(12) = 51.02
Prob > chi2 = 0.0000

issuerepur~e	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issuerepur~e						
sq_exreturns	.3174499	.1625225	1.95	0.051	-.0010883	.6359882
exreturns	-.815432	.2017996	-4.04	0.000	-1.210952	-.419912
dps_epstvs~g	-.0012918	.0014688	-0.88	0.379	-.0041706	.0015871
sq_dps_eps~g	-2.09e-06	3.40e-06	-0.61	0.540	-8.76e-06	4.58e-06
cficfotvsavg	.0003821	.0001732	2.21	0.027	.0000427	.0007216
debt_capit~g	1.4833	.4993816	2.97	0.003	.5045302	2.46207
cash_tasse~g	-1.739832	.8088844	-2.15	0.031	-3.325216	-.1544479
sq_cash_ta~g	1.722826	1.27042	1.36	0.175	-.767151	4.212803
mtbtvsavg	-.0067199	.0092497	-0.73	0.468	-.0248491	.0114092
pe	.000187	.0008198	0.23	0.820	-.0014198	.0017939
esopt	-6.50e-08	4.04e-08	-1.61	0.108	-1.44e-07	1.43e-08
c.mtbtvsavg# c. debt_capit~g# c.peg	-.0215627	.0883288	-0.24	0.807	-.194684	.1515586
_cons	.1891487	.0775226	2.44	0.015	.0372071	.3410903
lnsigma2						
exreturns	.1318327	.303133	0.43	0.664	-.462297	.7259623
dps_epstvs~g	.0010966	.0013644	0.80	0.422	-.0015775	.0037708

Likelihood-ratio test of lnsigma2=0: chi2(2) = 0.73 Prob > chi2 = 0.6943

The final regression formula is written as

$$Y' = \phi(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \varepsilon)$$

Where

Y'= probability of Y=1 or 0 for a chosen variable while all other X_i's are held constant

ϕ = probability under a normal standard distribution curve

X_1 = difference between MTB ratio above average MTB (mtbvsavg)

X_2 = difference between PE ratio above average PE (Pe)

X_3 = excess returns (Exreturns)

X_4 = difference between cash from investments and operating activities ratios above the average ratios (cficfotvsavg)

X_5 = difference between debt to capital above average debt to capital (debt_capit~g)

X_6 = difference between cash to assets above average cash to assets (cash_tasse~g)

X_7 = difference between dividends to earnings above average dividends to earnings (dps_epstvs~g)

X_8 = number of employee shares issued (esopt)

X_9 = interaction term of MTB, debt to capital and PEG (c.mtbvsavg#c.debt_capitg#cpeg)

X_{10} = square of excess returns (sq_exreturns)

X_{11} = square of the difference between dividends to earnings above average dividends to earnings (sq_dps_eps~g)

X_{12} = square of the difference between cash to assets above average cash to assets (sq_cash_ta~g)

ε = error term

β_i = coefficients to be determined

Table 27 contains the variables which are significant when share issues (repurchases) are made. More detailed analysis is conducted in section 5.2.3 of this paper.

Table 27: Significant variables in share issues (repurchases)

Variable	**Reason represented**
Excess returns	Share mispricing
Total debt / capital	Target capital structure Financial flexibility
Cash flow from investment activities/ cash flow from operating activities	Investment in new project
Total cash assets / total assets	Excess cash

Since only one mispricing metric is identified as significant, versus three of the control variables, it can be concluded that while there is a strong case for equity market timing on the JSE, one cannot ignore the fact that there are other significant reasons for engaging in share issues and repurchases.

In order to ascertain whether share issues are sensitive to different factors than share repurchases, the final heteroskedastic probit model was re-run; but the indicator variables were swapped around (i.e. share issues were coded as 0 and share repurchases coded as +1). Table 30 in Appendix I confirms that when the coding is swapped around, results remain consistent with the initial model. The same variables are significant. The conclusion is thus that share issues are not sensitive to different factors than share repurchases.

As can be seen in Table 27, only one of the four mispricing metrics initially identified, is significant in this study. Surprisingly, MTB as a mispricing metric, does not appear to be as heavily relied upon in South Africa, as is the case in other markets. While MTB was used in numerous studies to investigate market timing historically (Baker & Wurgler, 2002; Butler, *et al.*, 2011; Hovakimian, 2006), it is advisable to use excess returns in the South African context instead, since evidence suggests excess returns are relied upon by management in the issue (repurchase) decision. This result is consistent with Bhana's (2007) study which found that market timing exists for South African companies engaging in share repurchases. The author found that companies repurchase shares when the shares are undervalued and determined whether shares are undervalued by investigating abnormal returns. Furthermore, the fact that the PE ratio is not significant, suggests that unlike the 70% of CFOs identified in Graham and Harvey's (2002) survey, perhaps South African CFOs are not as fixated on EPS dilution as an important factor in their decision to issue equity.

The fact that total debt to capital is a significant factor suggests that South African firms look to optimise their capital structure through share issues and repurchases. The trade-off theory is thus more prominent amongst South African firms. This contradicts the evidence found by Mohohlo (2013), that South African firms follow a pecking order theory.

At a glance, it is seen that share issues are made in order to raise finance for new projects. It is however explained in 5.2.3.2 of this paper, that because the probability of share issues is so low for every one unit change in the investigated ratios, these results cannot be used to strongly infer a link between share issues and the need to raise finance for new projects.

Consistent with reasons noted by Bhana (2007), this study finds that share repurchase decisions are possibly made to return excess cash to shareholders. In addition, share repurchases do not appear to be a substitute for dividends, which is consistent with results found by Ramorwa (2011). Share repurchases further do not appear to be embarked upon to avoid hostile takeovers, neither to reverse the negative dilutive effect of employee stock options on EPS.

5.2.3 Results interpretation – marginal effects

When interpreting the results of probit regression models, the marginal effect of a unit change in the exploratory variable on the dependent variable cannot be determined by simply investigating the associated coefficient, since probit models are non-linear (Soderbom, 2009).

Table 28 contains results of the average marginal effects of the four significant variables for share repurchases. Appendix H contains the average marginal effects results for share issues, which is simply the inverse of the results contained in Table 28.

Table 28: Average marginal effects – share repurchases

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
exreturns	.2881825	.0437232	6.59	0.000	.2024867	.3738784
cficfotvsavg	-.0001398	.0000457	-3.06	0.002	-.0002293	-.0000503
debt_capit~g	-.5027037	.1477183	-3.40	0.001	-.7922262	-.2131812
cash_tasse~g	.5077434	.205374	2.47	0.013	.1052176	.9102691

5.2.3.1 Excess returns

Based on Table 28, on average for every 1% increase in excess returns, the probability of a share repurchase increases by 29%. Conversely, for every 1% increase in excess returns, there is a 29% reduction in the probability of a share issue. This result implies the potential existence of managerial equity market timing, however the marginal effects, depicted in Figure 1 below, shows that it is not a linear relationship. When excess returns are between -2 and 0 (an indication that the share might be overvalued), the probability of a share issue increases. When there are no excess returns, management are more likely to issue shares. When excess returns are expected, there is a strong move towards share repurchases. On average however, an increase in excess returns increases the probability of share repurchases. These results strongly suggest that management engage in equity market timing, based on their expectation of excess returns.

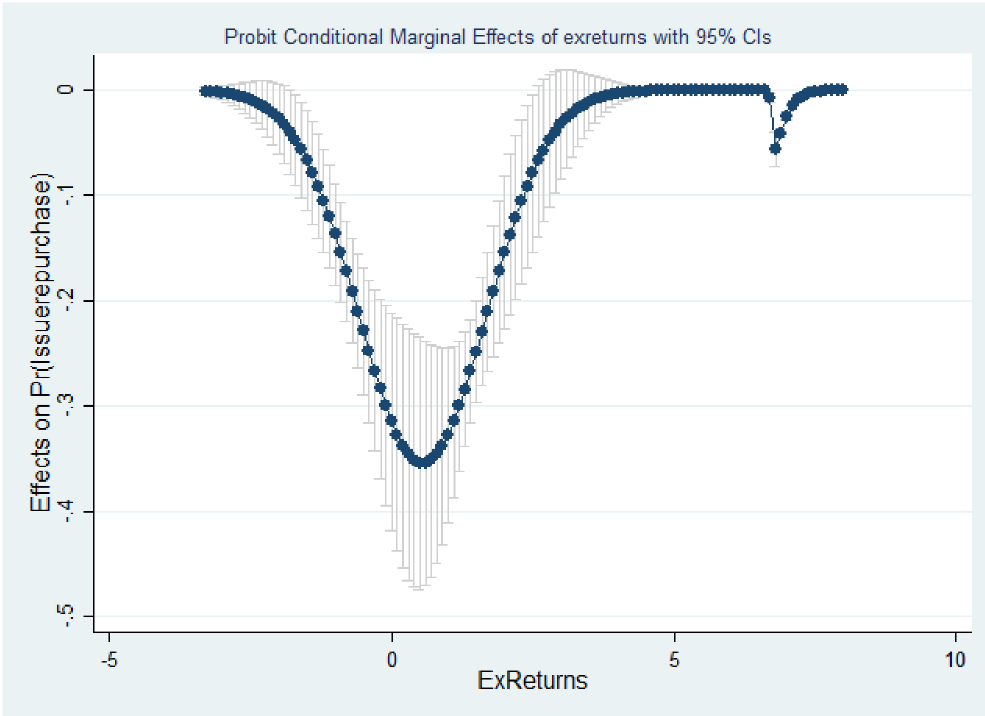


Figure 1: Probit conditional marginal effects of excess returns, depicting an extract of the range where there is deviation from the average. The dots represent the mean that give excess returns and the lines represent confidence intervals.

5.2.3.2 Investment in new project

On average, for every one unit increase in the cash flow from investment activities to cash flow from operating activities ratio in the year after the announcement, versus the 3 year historical average, the probability of a share issue increases by 0.01%. The expectation was that if the ratio in the year after announcement was higher than the historic average; that shares were issued in order to raise finance to fund new projects. These results support this expectation, however because the probability of share issues is so low, these results cannot be used to strongly infer a link between share issues and the need to raise finance for new projects. Figure 2 shows an extract of the results, highlighting the non-linear relationship of the data. When the 3 year average of cash flow from investment activities to cash flow from operating activities, exceeds the ratio in the year after the announcement by between 1,000 and 3,000 units, the likelihood of a share issue reduces. As soon as the historic average exceeds the ratio in the year after announcement, by up to 1,000 units, there is a move to issue shares. When the ratio in the year after the announcement then exceeds the 3 year historical average, the probability of a share issue increases. At a glance it appears that share issues are made in order to raise finance for new projects in the short term; however the low probability associated with the results as well as the fact that the marginal effect depicts movements that aren't significantly different to the mean, suggests that perhaps share issues are not predominantly linked to the need to raise finance for new projects; at least not in the short term.

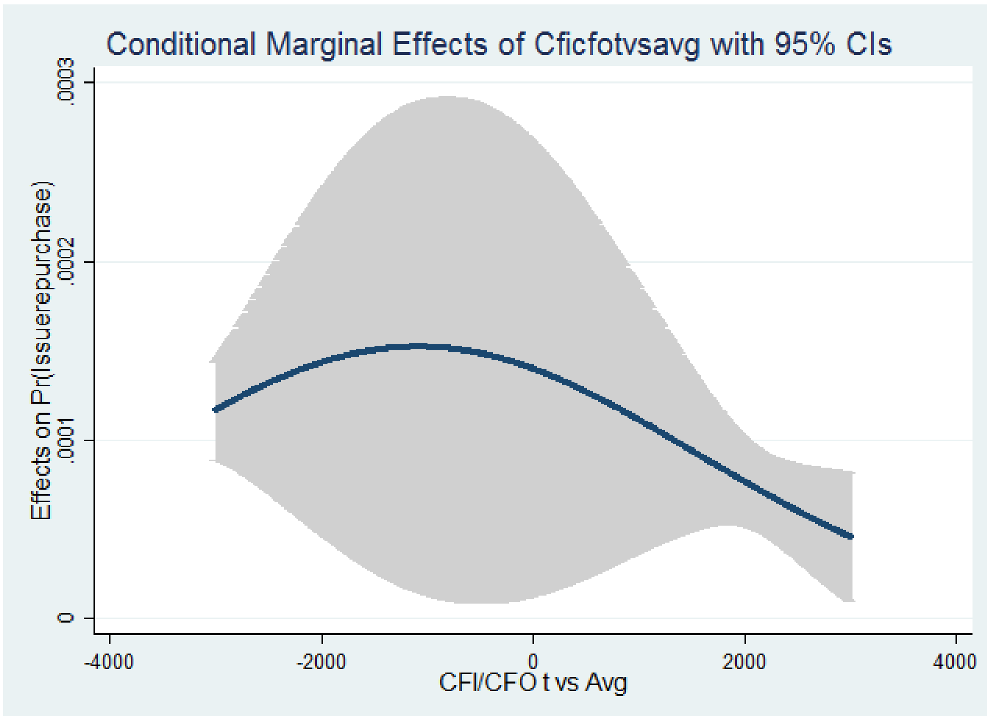


Figure 2: Conditional marginal effects of the cash flow from investment activities to cash flow from operating activities ratio in the year after the announcement, versus the 3 year historical average; depicting an extract of the range where there is deviation from the average.

5.2.3.3 Capital structure and financial flexibility

Table 28 suggests that on average, a change in the capital structure of a firm (relative to its historical structure) would increase (reduce) the probability of a share issue (repurchase) by 50%. For every one unit that the debt to capital ratio in the year of announcement exceeds the 3 year historical average, there is a 50% increase in the probability of a share issue. Figure 3, further indicates that this relationship is not linear. If, in the announcement year the debt to capital ratio is lower than the 3 year historical average, by between 0.5 and 3 units, the probability of a share repurchase increases. When the difference is lower than 0.5 units, there is a move toward issue shares. On average however, for every one unit that the debt to capital ratio in the year of issue exceeds the 3 year historical average, the probability of a share issue increases by 50%. These results provide evidence that share issues are made in order to enhance financial flexibility since, when the ratio exceeds the historical average, the increased probability to issue shares implies that there may be an attempt to reduce the debt to capital ratio (favourable credit ratings are linked to low debt to capital ratios). Furthermore, the results strongly suggest that capital structure plays a significant role in share issue and repurchase decisions.

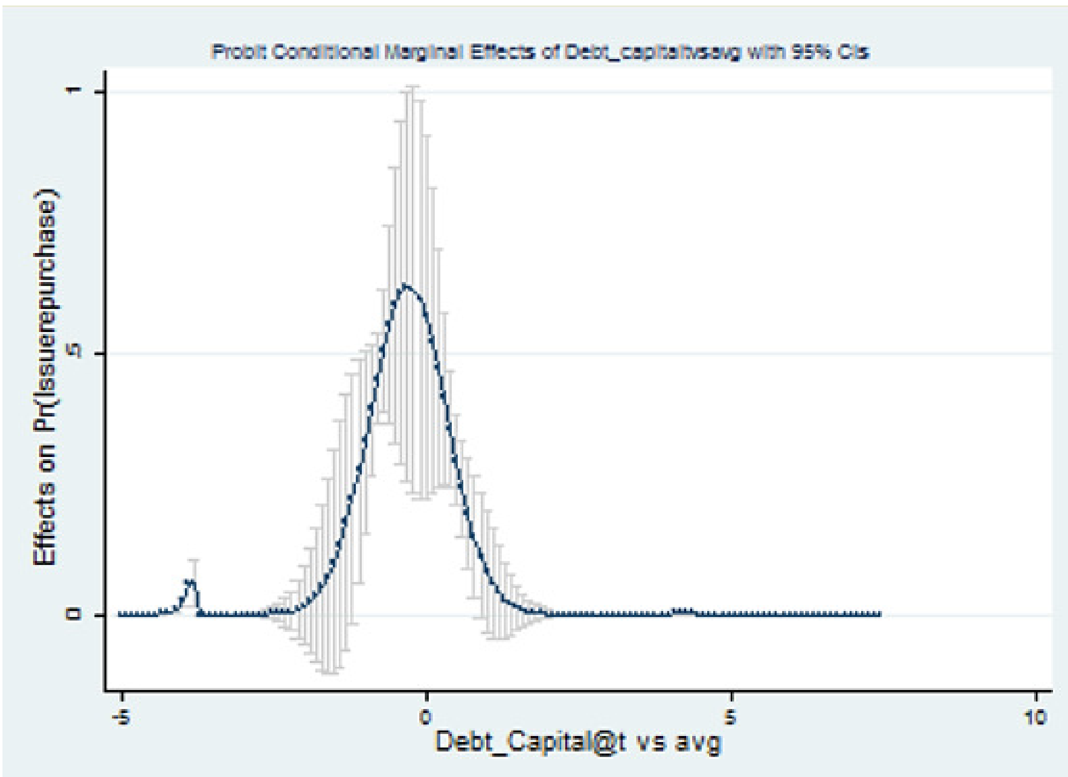


Figure 3: Conditional marginal effects of the debt to capital ratio in the year of the announcement, versus the 3 year historical average; depicting an extract of the range where there is deviation from the average. The dots represent the difference between the debt to capital ratio on announcement date and the historical average; and the lines represent the confidence interval.

5.2.3.4 Return excess cash to shareholders

On average, when the positive cash balance to total assets increases by one unit when compared to the 3 year historical average, there is a 51% increase in the probability of a share repurchase. The expectation was if the ratio is higher on announcement date than the historical average, that excess cash exists and would be returned to shareholders via a share repurchase. This result therefore suggests that, on average, management repurchase shares in order to return excess cash to shareholders. Figure 4 shows that when the ratio of positive cash to total assets is the same as the 3 year historical average (i.e. at point 0 on the x intercept), management are more likely to issue shares. When the ratio is up to 1.5 units lower than the 3 year historical average, the probability of a share issue increases. The moment that the cash balance to total assets increases above the 3 year historical average, the probability of a share repurchase increases. On average however, for every one unit that the positive cash balance to total assets on announcement date exceeds the historic average, the probability of a share repurchase increases by 51%. These results thus suggest that share repurchases are made in an attempt to return excess cash to shareholders.

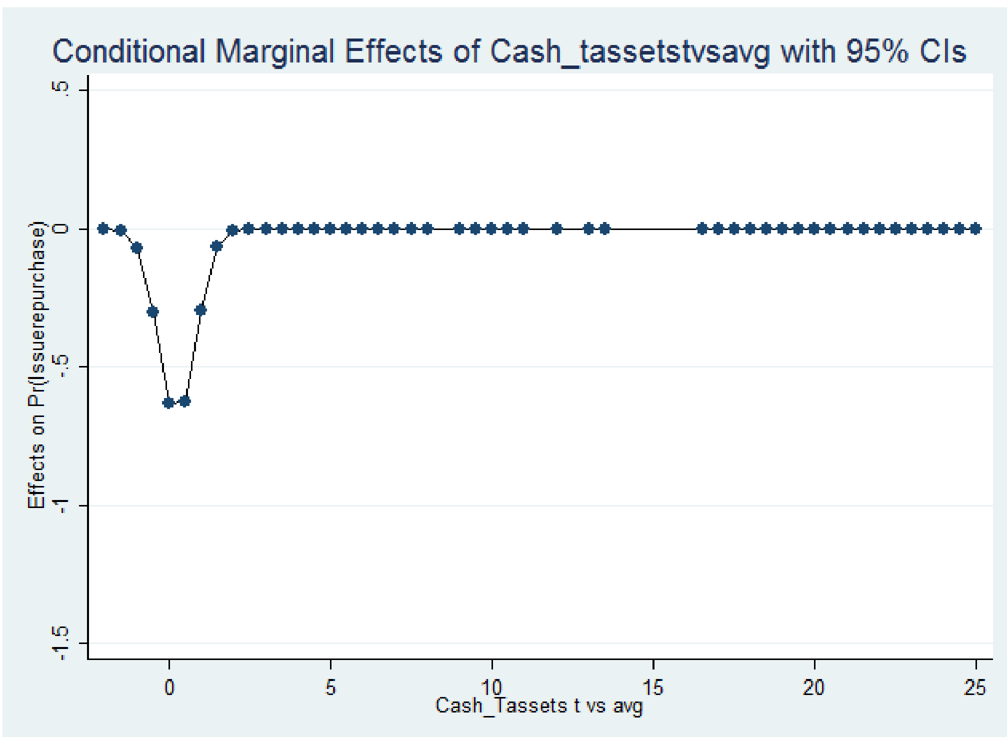


Figure 4: Conditional marginal effects of the positive cash to assets ratio in the year of the announcement, versus the 3 year historical average; depicting an extract of the range where there is deviation from the average. The dots represent the difference between the ratio on announcement date and the historical average.

5.3 Summary and conclusion

In summary, for every 1% increase in excess returns, the probability of a share repurchase increases by 29%. Management thus appear to be better informed than the market and even attempt to benefit from the over and undervaluation of shares by embarking on share issues and repurchases. When share issues and repurchases are announced, the market now knows that management believe the company's shares are overvalued / undervalued. MTB and PE ratios don't appear to be relied upon by management as mispricing metrics when share issues (repurchases) are announced. At first glance, the other factors that appeared to be significant in the issue (repurchase) decisions are the need to invest in new projects, capital structure, the need for financial flexibility and the existence of excess cash. Upon further investigation, there is not strong enough evidence to suggest that share issues are made mainly in an attempt to raise finance for new projects in the short term. There is however evidence to suggest that share repurchases are made in attempt to return excess cash to shareholders; since an increase in excess cash is linked to an increased probability of share repurchases. Furthermore, there is evidence to suggest that share issues are made to enhance financial flexibility and issues (repurchases) decisions are strongly linked to capital structure deviations. Issues and repurchases are announced when the debt to capital ratios deviate from the historic average.

All of the above lead to the conclusion that managerial equity market timing may exist in the presence of excess returns; where excess returns are viewed as the difference between the actual returns in a future period after the event and the required returns at the time of the event. With management better able to predict returns in advance than the market, they appear to attempt to capitalise on this difference in expectations. While evidence exists that share issues and repurchases are made because shares are over and undervalued, there is also evidence that suggests repurchases are made in attempt to return excess cash to shareholders. Furthermore, issues and repurchases are linked to the capital structure of firms involved. Due to the existence of other potential reasons for share issues and repurchases, the market must determine what the real intentions of management are when shares are issued and repurchased; and hence determine whether management's intentions suggest equity market mispricing.

6. LIMITATIONS OF THE STUDY AND RECOMMENDATIONS FOR FUTURE RESEARCH

The results of this study are indirect results in that they were not derived from surveys or discussions with actual management. A more accurate result would be obtained if questionnaires are sent to management to capture what would influence their decision to issue or repurchase shares. The questionnaire would have to be issued to senior management who preferably have been part of the decision making-process involving an issue or a repurchase. Access to such individuals would be difficult and due to the time constraint on this report the more unobtrusive approach was adopted.

Since this study has only focused on ascertaining the potential reasons for share issue (repurchase) announcements, a potential area for future research is the investigation of management's behaviour when no share issues (repurchases) announcements are made. This would not only further explore managerial equity market timing, but could provide more conclusive evidence than the results of the current study. It should however be noted that in order to address this limitation, insider information may be required as management's decision-making processes are not made public.

Since this study has found that capital structure is strongly considered in share issues (repurchases), a potential area for further research would be to investigate the lasting effects of share issues (repurchases) on the capital structures of JSE firms. Reference to research techniques employed by Baker and Wurgler (2002) could be useful in this quest.

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Appendix A

A summary of the study's sample is presented in Table 1:

<u>Table 1: Summary of sample</u>

	Announcements	**Companies**
Issues	295	102
Repurchases	183	83
Both issues and repurchases	-	(40)
Total	**478**	**145**

Appendix B

Total debt and capital were calculated by adding the following statement of financial position line items, as per the published financial statements extracted from McGregor BFA:

Table 6: McGregor BFA line items for capital structure calculation

	Year-end financial statements	Interim financial statements
Total debt	Convertible Debentures	Long Term Liabilities
	Director's & Shareholders Loans	Interest Bearing Short-Term Debt
	Long Term Non Interest Bearing	Non-Interest Bearing Short-Term Debt
	Long Term Interest Bearing	
	Short-Term Interest Bearing	
Capital	Total debt	Total debt
	Total equity	Total equity

Cash flows from investment activities and operating activities have been calculated by adding the following cash flow statement line items, as per the published financial statements depicted on McGregor BFA:

Table 7: McGregor BFA line items for calculation of cash flow movements

	Year-end financial statements	Interim financial statements
Cash flow from investment activities	Cash from Investment Activities	Cash Flow from Investing Activities
Cash flow from operating activities	Cash from Operating Activities	Cash Flow from Operating Activities

Appendix C

Table 10: Probit regression variables

Variable name in STATA	**Method of calculation ***	**Control / mispricing variable represented**
cash_tasse~g	(Total cash asset / total assets)$_{(t)}$ – 3 yr historical average	Total cash asset / total assets
cashtotala~t	(Total cash asset / total assets)$_{(t)}$	Total cash asset / total assets
cficfot1	(Cash flow from investment activities / cash flow from operating activities)$_{(t+1)}$	Cash flow from investment activities / cash flow from operating activities
cficfotvsavg	(Cash flow from investment activities / cash flow from operating activities)$_{(t+1)}$ – 3 yr historical average	Cash flow from investment activities / cash flow from operating activities
debt_capit~g	(Total debt / capital)$_{(t)}$ – 3 yr historical average	Total debt / capital
debt_equit~g	(Total debt / equity)$_{(t)}$ – 3 yr historical average	Total debt / equity
Debtcapitalt	(Total debt / capital)$_{(t)}$	Total debt / capital
Debtequityt	(Total debt / equity)$_{(t)}$	Total debt / equity
dps_epst	(Dividends / earnings)$_{(t)}$	Dividends / earnings
dps_epstvs~g	(Total dividends / total earnings)$_{(t)}$ – 3 yr historical average	Dividends / earnings
esopt	No of employee shares issued	Employee shares issued$_{(t)}$ – employee shares issued$_{(t-1)}$
exreturns	Re$_{(t+1)}$ *less* Ke$_{(t)}$	Excess return
mtb_4yravg	MTB$_{(t)}$ *less* 4 year average	MTB
mtb_5yravg	MTB$_{(t)}$ *less* 5 year average	MTB
mtbt	MTB$_{(t)}$	MTB
mtbtvsavg	MTB$_{(t)}$ *less* 3 year average	MTB
pe	PE$_{(t)}$ *less* 3 year average	PE
pe_4yr	PE$_{(t)}$ *less* 4 year average	PE
pe_5yr	PE$_{(t)}$ *less* 5 year average	PE
peg	PE$_{(t)}$/ 1 year annual EPS growth	PEG
pet	PE$_{(t)}$	PE
takeoverrisk	MTB$_{(t)}$, debt / capital, PEG$_{(t)}$**	MTB, debt / capital, PEG

*Where t represents the year of the announcement

** Captured as an interaction term

Appendix D

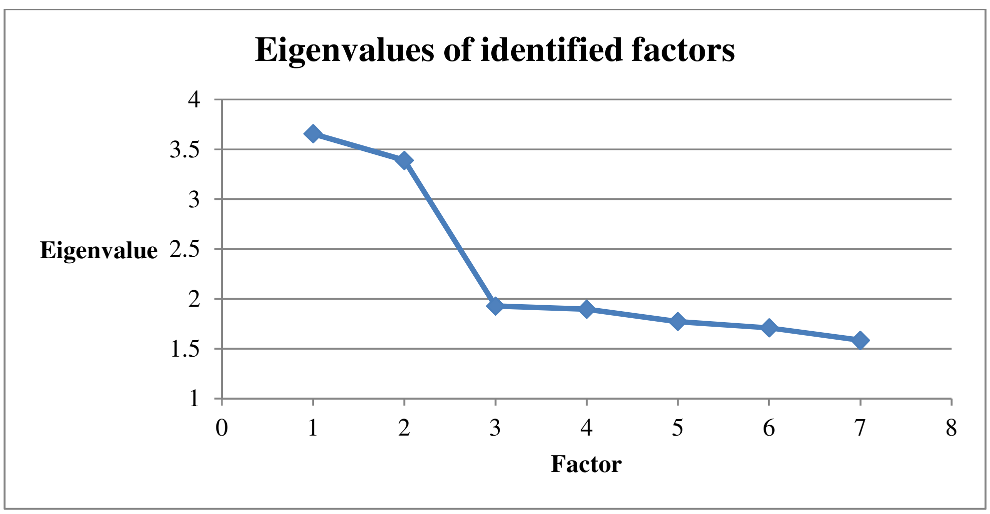
Table 11: Correlation matrix

	cficfot1	cficfo~g	debtca~t	debt_c~g	debteq~t	debt_e~g	cashto~t	cash_t~g	dps_epst	dps_ep~g	takeov~k	mtbt	mtbtvs~g	mtb_4y~g	mtb_5y~g	pet	pe	pe_4yr	pe_5yr	peg	exretu~s	esopt
cficfot1	1.00																					
cficfotvsavg	0.8402*	1.00																				
debtcapitalt	-0.04	0.09	1.00																			
debt_capit~g	-0.1460*	-0.1236*	0.3688*	1.00																		
debtequityt	-0.07	0.02	0.4011*	0.1991*	1.00																	
debt_equit~g	-0.10	-0.07	-0.00	0.1844*	0.1943*	1.00																
cashtotala~t	-0.01	-0.00	-0.2146*	-0.1371*	-0.1233*	-0.03	1.00															
cash_tasse~g	-0.03	-0.02	0.00	-0.1510*	-0.00	-0.04	0.5623*	1.00														
dps_epst	-0.00	-0.04	-0.05	-0.04	-0.02	-0.00	-0.06	0.02	1.00													
dps_epstvs~g	-0.00	0.00	-0.07	-0.07	-0.06	-0.01	-0.03	0.00	0.8469*	1.00												
takeoverrisk	-0.00	0.01	0.03	0.05	0.02	0.00	0.02	0.05	0.00	-0.00	1.00											
mtbt	-0.02	-0.02	-0.06	-0.2320*	0.01	-0.3479*	0.02	0.09	-0.02	-0.01	0.01	1.00										
mtbtvsavg	-0.01	0.00	-0.03	0.1391*	-0.06	0.4452*	0.03	-0.03	0.03	-0.00	-0.01	-0.6749*	1.00									
mtb_4yravg	-0.01	0.00	-0.06	0.07	-0.1221*	0.4288*	0.02	-0.02	0.03	-0.00	-0.01	-0.6242*	0.9451*	1.00								
mtb_5yravg	-0.01	0.00	-0.07	0.06	-0.1899*	0.3725*	0.02	-0.01	0.03	-0.00	-0.01	-0.5057*	0.8719*	0.9488*	1.00							
pet	-0.07	-0.06	0.01	-0.05	-0.00	-0.01	-0.2128*	-0.2182*	0.3307*	0.2718*	-0.00	-0.02	0.01	0.01	0.01	1.00						
pe	-0.03	-0.05	-0.05	-0.02	-0.04	0.00	-0.2321*	-0.1670*	0.1733*	0.1973*	-0.00	-0.01	0.00	-0.01	-0.02	0.5974*	1.00					
pe_4yr	-0.03	-0.06	-0.07	-0.01	-0.06	-0.00	-0.2271*	-0.1683*	0.1598*	0.1802*	-0.00	-0.01	0.00	-0.01	-0.01	0.5778*	0.8228*	1.00				
pe_5yr	-0.05	-0.10	-0.10	-0.02	-0.07	-0.00	-0.2217*	-0.2533*	0.2042*	0.2217*	-0.00	-0.01	-0.00	-0.01	-0.02	0.6830*	0.8032*	0.9861*	1.00			
peg	0.01	0.00	-0.09	-0.06	-0.1565*	0.02	0.10	0.09	-0.07	-0.06	-0.02	0.01	0.00	0.00	0.01	-0.2391*	-0.1400*	-0.1373*	-0.1717*	1.00		
exreturns	0.05	-0.04	-0.07	-0.09	-0.04	0.00	0.1723*	0.1605*	0.11	0.10	-0.08	-0.02	0.08	0.08	0.06	0.08	0.01	-0.04	-0.02	-0.04	1.00	
esopt	0.00	-0.03	-0.01	0.00	-0.02	-0.00	0.05	0.09	0.2008*	0.03	0.01	-0.02	0.03	0.03	0.03	0.05	0.01	0.01	0.01	0.03	0.05	1.00

Appendix E

Table 12: Factor analysis

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7
cficfot1	-0.0011	-0.0224	0.0004	0.9493	-0.0087	-0.0662	0.0162
cficfotvsavg	0.0083	-0.0720	-0.0121	0.9505	-0.0324	0.0428	-0.0440
esop	-0.0385	-0.0176	-0.0892	0.0146	-0.0284	0.0082	-0.8761
debtcapitalt	-0.0430	-0.1121	-0.0298	0.0453	-0.1523	0.7348	-0.0111
debt_capit~g	0.2055	-0.0668	-0.0587	-0.2265	-0.2591	0.5543	-0.0350
debtequityt	-0.0925	-0.0537	-0.0180	-0.0245	0.0173	0.7368	-0.0281
debt_equit~g	0.5922	-0.0084	-0.0215	-0.1392	-0.0312	0.1728	-0.0680
cashtotala~t	0.0271	-0.1795	-0.0649	-0.0285	0.8158	-0.1598	-0.0157
cash_tasse~g	-0.0473	-0.2306	0.0025	-0.0518	0.8245	-0.0112	0.0575
dps_epst	0.0218	0.1274	0.9442	-0.0188	-0.0151	-0.0042	0.1559
dps_epstvs~g	-0.0072	0.1404	0.9498	0.0075	0.0074	-0.0291	-0.0320
mtbt	-0.7429	-0.0028	-0.0071	-0.0219	0.0870	-0.1706	-0.0004
mtbtvsavg	0.9629	0.0059	0.0044	0.0057	0.0141	0.0251	0.0145
mtb_4yravg	0.9692	-0.0042	0.0074	0.0056	0.0084	-0.0398	0.0250
mtb_5yravg	0.9074	-0.0063	0.0088	0.0098	0.0190	-0.1397	0.0369
pet	0.0038	0.7729	0.2444	-0.0170	-0.0729	0.0781	0.0762
pe	-0.0064	0.8819	0.1020	-0.0286	-0.0909	-0.0242	-0.0023
pe_4yr	0.0015	0.9295	0.0422	-0.0347	-0.0863	-0.0615	-0.0194
pe_5yr	-0.0031	0.9515	0.0738	-0.0434	-0.0940	-0.0444	-0.0070
peg	0.0207	-0.3073	-0.0273	-0.0676	-0.0851	-0.4333	-0.0681
exreturns	0.0764	0.0613	0.1842	0.0549	0.5360	0.0618	0.0517
esopt	0.0231	-0.0083	0.0572	-0.0195	0.0182	-0.0161	0.8728
Eigenvalue	***3.6571***	***3.3901***	***1.9266***	***1.8949***	***1.7721***	***1.7078***	***1.5829***



Appendix F

Table 14: Portfolio analysis of MTB mispricing metric

	Start Range	End Range	Total events	Share issues	Share repurchases
Portfolio 1	-63.67	-51.75	1	-	1
Portfolio 2	-51.74	-39.83	1	1	-
Portfolio 3	-39.82	-27.90	2	2	-
Portfolio 4	-27.89	-15.97	9	7	2
Portfolio 5	-15.96	-0.09	217	151	66
Portfolio 6	-	11.92	216	106	110
Portfolio 7	11.93	23.84	9	7	2
Portfolio 8	23.85	35.77	3	3	-
Portfolio 9	35.78	47.70	-	-	-
Portfolio 10	47.71	55.50	1	1	-

Table 15: Portfolio analysis of PE mispricing metric

	Start Range	End Range	Total events	Share issues	Share repurchases
Portfolio 1	-172.43	-135.73	2	2	-
Portfolio 2	-135.72	-99.02	4	4	-
Portfolio 3	-99.01	-62.31	11	10	1
Portfolio 4	-62.30	-25.60	27	24	3
Portfolio 5	-25.59	-	180	108	72
Portfolio 6	0.01	36.70	199	96	103
Portfolio 7	36.71	73.41	9	8	1
Portfolio 8	73.42	110.11	17	16	1
Portfolio 9	110.12	146.82	8	8	-
Portfolio 10	146.83	194.55	2	2	-

Appendix G

Table 17: Exreturns as a contributor to heteroskedasticity

Heteroskedastic probit model

Log likelihood = -274.2733 LR chi2(9) = 45.29 Prob > chi2 = 0.0000

issuerepur~e	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issuerepur~e						
exreturns	-.6437278	.155593	-4.14	0.000	-.9486845	-.338771
cficfotvsavg	.0002192	.0001194	1.84	0.066	-.0000149	.0004533
debt_capit~g	1.127754	.4882426	2.31	0.021	.1708156	2.084691
cash_tasse~g	-1.829819	.6312556	-2.90	0.004	-3.067057	-.5925806
dps_epstvs~g	-.0013004	.0010179	-1.28	0.201	-.0032954	.0006945
mtbtvsavg	-.0129357	.0088499	-1.46	0.144	-.0302812	.0044097
pe	.0000508	.0007029	0.07	0.942	-.0013269	.0014285
esopt	-6.83e-08	4.04e-08	-1.69	0.091	-1.48e-07	1.09e-08
c.mtbtvsavg# c. debt_capit~g# c.peg	-.0179746	.092883	-0.19	0.847	-.2000219	.1640728
_cons	.2026767	.0739641	2.74	0.006	.0577097	.3476436
lnsigma2						
exreturns	.6554246	.2296352	2.85	0.004	.2053479	1.105501

Likelihood-ratio test of lnsigma2=0: chi2(1) = 30.29 Prob > chi2 = 0.0000

Table 18: Cficfotvsavg as a contributor to heteroskedasticity

Heteroskedastic probit model

Log likelihood = -281.9192 LR chi2(8) = 43.74 Prob > chi2 = 0.0000

issuerepur~e	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issuerepur~e						
exreturns	-.2099203	.0947815	-2.21	0.027	-.3956886	-.024152
cficfotvsavg	.000012	.0000401	0.30	0.765	-.0000666	.0000906
debt_capit~g	1.554633	.4680492	3.32	0.001	.6372736	2.471993
cash_tasse~g	-.7383664	.5289229	-1.40	0.163	-1.775036	.2983033
dps_epstvs~g	-.0019187	.0011428	-1.68	0.093	-.0041586	.0003213
mtbtvsavg	-.0021271	.0020144	-1.06	0.291	-.0060753	.0018211
pe	.0010845	.000955	1.14	0.256	-.0007872	.0029563
esopt	-6.12e-08	3.60e-08	-1.70	0.089	-1.32e-07	9.43e-09
c.mtbtvsavg# c. debt_capit~g# c.peg	.0189985	.0895126	0.21	0.832	-.156443	.19444
_cons	.2497405	.065782	3.80	0.000	.1208101	.3786709
lnsigma2						
cficfotvsavg	-.010856	.0195749	-0.55	0.579	-.0492221	.0275101

Likelihood-ratio test of lnsigma2=0: chi2(1) = 15.00 Prob > chi2 = 0.0001

Table 19: Debt_capit~g as a contributor to heteroskedasticity

Heteroskedastic probit model

Log likelihood = -288.8337	LR chi2(9) = 43.42	Prob > chi2 = 0.0000

issuerepur~e	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issuerepur~e						
exreturns	-.2824787	.0901953	-3.13	0.002	-.4592583	-.1056992
cficfotvsavg	.0003334	.0001406	2.37	0.018	.0000578	.000609
debt_capit~g	1.402311	.5891051	2.38	0.017	.247686	2.556936
cash_tasse~g	-.8520046	.5418936	-1.57	0.116	-1.914096	.2100873
dps_epstvs~g	-.0013872	.0010028	-1.38	0.167	-.0033527	.0005784
mtbtvsavg	-.0029283	.002765	-1.06	0.290	-.0083477	.0024911
pe	.0002178	.0006938	0.31	0.754	-.0011419	.0015776
esopt	-6.92e-08	3.27e-08	-2.12	0.034	-1.33e-07	-5.21e-09
c.mtbtvsavg# c. debt_capit~g# c.peg	-.0000339	.0818483	-0.00	1.000	-.1604536	.1603858
_cons	.2948427	.0648553	4.55	0.000	.1677286	.4219567
lnsigma2						
debt_capit~g	-.6203526	.6239286	-0.99	0.320	-1.84323	.6025251

Likelihood-ratio test of lnsigma2=0: chi2(1) = 1.17 Prob > chi2 = 0.2792

Table 20: Cash_tasse~g as a contributor to heteroskedasticity

Heteroskedastic probit model

Log likelihood = -277.0049	LR chi2(9) = 71.31	Prob > chi2 = 0.0000

issuerepur~e	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issuerepur~e						
exreturns	-.5298379	.0970885	-5.46	0.000	-.7201279	-.339548
cficfotvsavg	.0004706	.000155	3.04	0.002	.0001667	.0007744
debt_capit~g	1.714838	.4439317	3.86	0.000	.8447478	2.584928
cash_tasse~g	-1.026536	.4561757	-2.25	0.024	-1.920624	-.132448
dps_epstvs~g	-.0010915	.0009382	-1.16	0.245	-.0029304	.0007474
mtbtvsavg	-.0023662	.0018306	-1.29	0.196	-.0059541	.0012216
pe	.0001205	.0006013	0.20	0.841	-.001058	.001299
esopt	-6.04e-08	3.39e-08	-1.78	0.075	-1.27e-07	6.16e-09
c.mtbtvsavg# c. debt_capit~g# c.peg	-.0171358	.075022	-0.23	0.819	-.1641763	.1299048
_cons	.2688867	.0655883	4.10	0.000	.140336	.3974374
lnsigma2						
cash_tasse~g	2.668839	.7039474	3.79	0.000	1.289127	4.04855

Likelihood-ratio test of lnsigma2=0: chi2(1) = 24.83 Prob > chi2 = 0.0000

Table 21: Dps_epstvs~g as a contributor to heteroskedasticity

Heteroskedastic probit model

Log likelihood = -284.1751		LR chi2(9) =	64.88
		Prob > chi2 =	0.0000

issuerepur~e	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issuerepur~e						
exreturns	-.2535814	.0802385	-3.16	0.002	-.4108461	-.0963168
cficfotvsavg	.0003655	.0001346	2.72	0.007	.0001018	.0006292
debt_capit~g	.9527042	.4441594	2.14	0.032	.0821677	1.823241
cash_tasse~g	-.4994164	.4075646	-1.23	0.220	-1.298228	.2993956
dps_epstvs~g	.0001614	.0006669	0.24	0.809	-.0011457	.0014685
mtbtvsavg	-.0022524	.0023985	-0.94	0.348	-.0069534	.0024486
pe	.0005322	.0007117	0.75	0.455	-.0008626	.0019271
esopt	-1.04e-07	3.62e-08	-2.87	0.004	-1.75e-07	-3.30e-08
c.mtbtvsavg# c. debt_capit~g# c.peg	.0155234	.0818469	0.19	0.850	-.1448937	.1759404
_cons	.339986	.0602115	5.65	0.000	.2219737	.4579982
lnsigma2						
dps_epstvs~g	.0161336	.0058398	2.76	0.006	.0046879	.0275794

Likelihood-ratio test of lnsigma2=0: chi2(1) = 10.49 Prob > chi2 = 0.0012

Table 22: Mtbtvsavg as a contributor to heteroskedasticity

Heteroskedastic probit model

Log likelihood = -281.9693		LR chi2(5) =	64.84
		Prob > chi2 =	0.0000

issuerepur~e	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issuerepur~e						
exreturns	-.4094862	.1244916	-3.29	0.001	-.6534852	-.1654873
cficfotvsavg	.0004215	.0001395	3.02	0.003	.0001481	.000695
debt_capit~g	1.718997	.	.	.	.	.
cash_tasse~g	-.8307635	.	.	.	.	.
dps_epstvs~g	-.0012624	.0009635	-1.31	0.190	-.0031508	.0006259
mtbtvsavg	-.0007591	.0000371	-20.48	0.000	-.0008317	-.0006864
pe	.0000797	.0006259	0.13	0.899	-.0011469	.0013064
esopt	-6.47e-08	3.36e-08	-1.92	0.054	-1.30e-07	1.18e-09
c.mtbtvsavg# c. debt_capit~g# c.peg	-.0073441	.	.	.	.	.
_cons	.3067423	.	.	.	.	.
lnsigma2						
mtbtvsavg	.0200666	.0060764	3.30	0.001	.0081571	.0319761

Warning: convergence not achieved
Likelihood-ratio test of lnsigma2=0: chi2(1) = 14.90 Prob > chi2 = 0.0001

Table 23: PE as a contributor to heteroskedasticity

Heteroskedastic probit model

	LR chi2(9)	=	43.14
Log likelihood = -289.12	Prob > chi2	=	0.0000

issuerepur~e	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issuerepur~e						
exreturns	-.2464329	.0922887	-2.67	0.008	-.4273154	-.0655504
cficfotvsavg	.0003842	.0001411	2.72	0.006	.0001077	.0006607
debt_capit~g	1.663516	.4904192	3.39	0.001	.7023123	2.62472
cash_tasse~g	-.3970653	.4828633	-0.82	0.411	-1.34346	.5493294
dps_epstvs~g	-.0013199	.0009859	-1.34	0.181	-.0032523	.0006125
mtbtvsavg	-.0024818	.0023521	-1.06	0.291	-.0070919	.0021283
pe	.0000394	.0007606	0.05	0.959	-.0014514	.0015302
esopt	-7.07e-08	3.46e-08	-2.05	0.041	-1.38e-07	-3.00e-09
c.mtbtvsavg# c. debt_capit~g# c.peg	.0005307	.0878249	0.01	0.995	-.171603	.1726643
_cons	.2937077	.0678839	4.33	0.000	.1606577	.4267578
lnsigma2						
pe	.0043745	.0060433	0.72	0.469	-.0074703	.0162192

Likelihood-ratio test of lnsigma2=0: chi2(1) = 0.60 Prob > chi2 = 0.4392

Table 24: Esopt as a contributor to heteroskedasticity

Heteroskedastic probit model

	LR chi2(9)	=	52.23
Log likelihood = -285.9474	Prob > chi2	=	0.0000

issuerepur~e	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issuerepur~e						
exreturns	-.2470759	.0893579	-2.77	0.006	-.4222142	-.0719377
cficfotvsavg	.0003911	.0001361	2.87	0.004	.0001244	.0006578
debt_capit~g	1.690012	.4777478	3.54	0.000	.7536431	2.62638
cash_tasse~g	-.6928352	.5153243	-1.34	0.179	-1.702852	.3171819
dps_epstvs~g	-.0028241	.0014408	-1.96	0.050	-.0056481	-1.33e-07
mtbtvsavg	-.0022646	.0021504	-1.05	0.292	-.0064794	.0019501
pe	.0004226	.0007152	0.59	0.555	-.0009792	.0018243
esopt	-3.59e-07	2.54e-07	-1.41	0.158	-8.57e-07	1.40e-07
c.mtbtvsavg# c. debt_capit~g# c.peg	.0050227	.0889862	0.06	0.955	-.169387	.1794324
_cons	.341529	.0651539	5.24	0.000	.2138297	.4692284
lnsigma2						
esopt	2.28e-07	1.60e-07	1.42	0.155	-8.64e-08	5.41e-07

Likelihood-ratio test of lnsigma2=0: chi2(1) = 6.94 Prob > chi2 = 0.0084

.

Appendix H

Table 29: Average marginal effects – share issues

Average marginal effects

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
exreturns	-.2881783	.0437232	-6.59	0.000	-.3738741	-.2024824
cficfotvsavg	.0001398	.0000457	3.06	0.002	.0000503	.0002293
debt_capit~g	.5026949	.1477151	3.40	0.001	.2131787	.7922111
cash_tasse~g	-.5077358	.2053733	-2.47	0.013	-.9102601	-.1052116

Appendix I

Table 30: Heteroskedastic probit model – indicator variables swapped

Heteroskedastic probit model

Log likelihood = -271.2861

Wald chi2(12) = 62.54
Prob > chi2 = 0.0000

issrep2	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
issrep2						
sq_exreturns	-.3174499	.1625225	-1.95	0.051	-.6359882	.0010883
exreturns	.815432	.2017996	4.04	0.000	.419912	1.210952
dps_epstvsavg	.0012918	.0014688	0.88	0.379	-.0015871	.0041706
dps_epstvsavg	0	(omitted)				
sq_dps_epstvsavg	2.09e-06	3.40e-06	0.61	0.540	-4.58e-06	8.76e-06
cficfotvsavg	-.0003821	.0001732	-2.21	0.027	-.0007216	-.0000427
debt_capitaltvsavg	-1.4833	.4993816	-2.97	0.003	-2.46207	-.5045302
cash_tassetstvsavg	1.739832	.8088844	2.15	0.031	.1544479	3.325216
sq_cash_tassetstvsavg	-1.722826	1.27042	-1.36	0.175	-4.212803	.767151
mtbtvsavg	.0067199	.0092497	0.73	0.468	-.0114092	.0248491
pe	-.000187	.0008198	-0.23	0.820	-.0017939	.0014198
esopt	6.50e-08	4.04e-08	1.61	0.108	-1.43e-08	1.44e-07
c.mtbtvsavg#c.debt_capitaltvsavg#c.peg	.0215627	.0883288	0.24	0.807	-.1515586	.194684
_cons	-.1891487	.0775226	-2.44	0.015	-.3410903	-.0372071
lnsigma2						
exreturns	.1318327	.303133	0.43	0.664	-.462297	.7259623
dps_epstvsavg	.0010966	.0013644	0.80	0.422	-.0015775	.0037708

Likelihood-ratio test of lnsigma2=0: chi2(2) = 0.73 Prob > chi2 = 0.6943