The rise before the close

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Abstract

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1. Introduction

We examine rights issues on the Australian Securities Exchange (ASX) for evidence of potential price manipulation. Examining underlying stock prices on the closing date of a rights issue, we observe a disproportionately higher number of stocks with a closing price at or above their issue price ('in the money'), compared to stocks that close just below the issue price ('out of the money'). This study provides an in depth analysis of the price patterns of rights issues leading up to the closing date. Of particular interest are rights issues which trade just below their issue price ('under the money') in the lead up to the closing date. Our findings show that rights issues which close below their issue price ('out of the money') on the closing date have a significantly lower take-up rate, as compared to rights issues that close 'in the money'. Some agents, such as the underwriter or the issuing firm, could potentially manipulate the price of 'under the money' rights issues to encourage higher take-up.

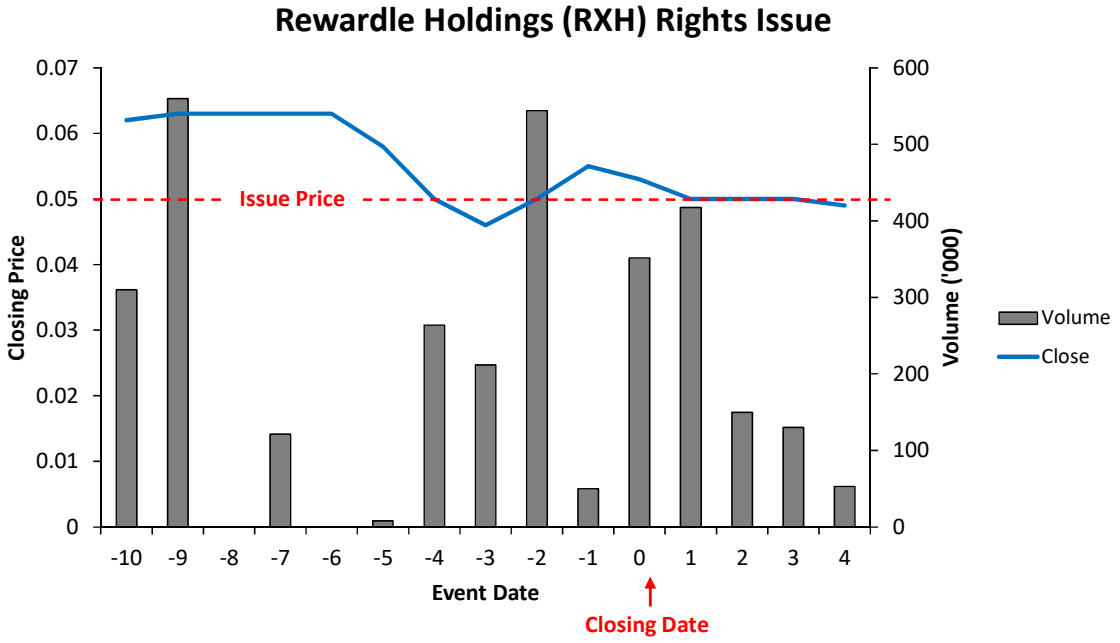
Figure 1 shows the price history of Rewardle Holdings (RXH) (2016), which completed a rights offering in August 2016. The rights offer price is $0.05 per share, and the closing date of the offer is on 26th August 2016, which is reflected in Figure 1 as event day [0]. In this example, the share price momentarily falls 'under the money' a few days prior to the closing date. Specifically, on event day [-3], the price of RXH falls below the issue price and closes at $0.046. Immediately after, on event day [-2], the share price rises back to $0.05, this is accompanied by abnormally high trading volume. The share price then remains 'in the money' until the closing date. We aim to determine whether this behaviour is commonplace or an abnormality. Specifically, we address the following questions: 1) Does price manipulation occur prior to a rights issue date? 2) If so, why and when does price manipulation occur? 3) Are there agents with incentives to

manipulate the closing price? 4) Is this behaviour observed in all rights issues or only in a subset of issues?

Figure 1

Rewardle Holdings rights issue share price history

Figure 1 shows the price and volume of Rewardle Holdings (RXH) in the days leading up to the rights issue closing date, indicated on the x-axis as event day 0. RXH conducted a rights issue with an issue price of $0.05 as shown by the red dotted line. The blue solid line shows the closing price of RXH in the 10 day period before the closing date. Total trading volume for each day is indicated by the grey solid bars. The price action of RXH shows the share price rebounding immediately after the closing price falls below the issue price on event day [-3].



1.1 Background

A rights issue is a subset of secondary equity offerings (SEO) whereby stock is sold to the public by a listed company. SEOs are an important source of capital for firms; DeAngelo, DeAngelo and Stulz (2007) find that without SEO funding, 62.6% of issuers would encounter cash flow problems in the subsequent year. Companies often raise capital through secondary offerings to fund growth projects or for refinancing purposes. A rights issue is an offer to all existing shareholders to subscribe for additional securities at a fixed ratio, proportional to the size of their holdings. This rights offer can either be renounceable, which enable investors to sell their rights, or non-renounceable (see ASX

2010, Balachandran, Faff and Theobald 2009). The key dates in a rights issue timeline are the 'announcement date', 'record date', 'closing date', and 'issue date'. The company publicly reveals news of the rights issue on the 'announcement date'. Shareholders who appear on the company's books on the 'record date' are eligible to participate in the rights issue. The 'closing date' is the date by which applications to participate in the rights issue must be received by the company, while the 'issue date' is the date when the company issues new shares to shareholders who have exercised their rights. Between the 'record date' and 'closing date', shareholders have on average, two and a half weeks to decide if they will subscribe to the rights issue. As new information is generated daily, a rational shareholder would likely wait until the closing date before deciding whether to subscribe to the rights issue. Shareholders are unlikely to participate in the rights offering if the rights issue price exceeds the stock price on the closing date. Thus, the closing prices of a rights issue in the days leading to the closing date become susceptible to manipulation in an attempt to influence the take-up rate.

As the take-up rate is unknown until the closing date, firms have the option of engaging an underwriter to ensure a minimum amount of capital raised. Companies can choose either to underwrite their issues fully, partially or not at all. In an underwritten rights issue, the underwriter enters a formal agreement to purchase unsubscribed stock in the event of a shortfall. The underwriter then has to liquidate his holdings, or is forced to hold on to the shares if market conditions are unfavourable, making failed rights issues costly (Balachandran, Faff and Theobald 2009). These potential costs create strong incentives for underwriters to manipulate closing prices prior to the closing date to encourage a higher take-up rate of the firm's securities.

Underwriters are likely to behave differently depending on the price of the underlying security, relative to the issue price, which we refer to as the moneyness of the

offer. Underwriters have an incentive to manipulate the closing price 'into the money' if the cost of manipulation is less than the anticipated cost savings in underwriting due to the increased take-up. Typically, the cost of manipulation is lower for rights issues whose price is very close to the issue price or just 'under the money', as only a small amount of price manipulation is required. On the other hand, it is much more costly to manipulate a rights issue that is deep 'out of the money', as these issues require a large price increase to encourage investor take-up. A rights issue is defined as 'under the money' (UTM) if the previous day's closing price falls between 1 to 5 ticks below the issue price and 'out of the money' (OTM) if the previous day's closing price is greater than 5 ticks below the issue price. This definition allows me to study if UTM rights issues show signs of trade manipulation in the very next trading day. We hypothesise that underwritten, UTM rights issues will show signs of trade-based manipulation in the form of higher abnormal buying volumes and returns, relative to OTM issues.

1.2 Summary of findings

Our findings indicate that for underwritten rights issues, take-up rates are sensitive to a rights issue closing 'in the money' (ITM), and that higher closing prices relative to the issue price do not equate to significantly higher take-up rates. Underwritten rights issues which close 'in the money' experience 12.6% higher take-up rates on average, as compared to rights issues which close 'out of the money'. This finding provides evidence that underwriters could have strong incentives to manipulate a stock's closing price to encourage a higher take-up. Using a regression discontinuity design, we find a significantly higher proportion of underwritten rights issues closing just ITM, compared to those closing just UTM. In contrast, we do not observe the same price patterns for non-underwritten rights issues. In the absence of an underwriter, there are fewer incentives to manipulate the stock price.

To determine whether these price patterns are due to manipulation, we examine changes in trading volume and returns around the time of the closing date.[1] We observe that underwritten, UTM rights issues are associated with higher abnormal trading volumes in the five days immediately prior to the closing date. Underwritten, UTM rights issues also experience daily returns that are 1.1% higher than non-underwritten, non-UTM rights issues in the trading window [-4,0]. These abnormal returns and trading volumes are not observed in the window [-9,-5], suggesting that underwritten, UTM rights issues display signs of manipulation in the days immediately prior to the closing date, when a high stock price is most critical for investor take-up.

Next, we examine whether these abnormal trading volumes are due to the underwriting broker's trading activity. To identify underwriting brokers, we match the identity of the underwriter to a list of brokers on the ASX. Using a dataset which identifies the buying and selling broker of every trade, we observe that underwriting brokers engage in excess buying when a rights issue they are underwriting is trading UTM.[2] We document that excess buying by underwriting brokers correspond to significant increases in stock prices, which is consistent with underwriter price manipulation immediately prior to the closing date.

[1] This methodology is consistent with Comerton-Forde and Putniņš (2011).

[2] While it is not possible to determine from the data whether these excess buying trades by underwriting brokers are proprietary in nature or for client facilitation, Amihud, Mendelson and Pedersen (2012) document that price impact results in significant transaction costs. Thus, it is likely that retail traders avoid these trades with such large price impacts. Foley et al. (2016) find that underwriting brokers engage in abnormal selling behaviour in dividend reinvestment plans (DRIPs) when they have an incentive to do so. Therefore, while we are unable to rule out client facilitation trades, evidence from these two papers suggest that these excess buy trades are proprietary in nature, and hence manipulative.

2. Literature and Hypotheses

2.1 Factors affecting take-up rate

Rights issues are typically offered to shareholders at a discount to the stock's market price. Altinkilic and Hansen (2003) find that this discount helps to increase the take-up rate of a rights issue. This is because the offer discount is necessary to mitigate the winner's curse problem as documented by Rock (1986). In addition, Karpoff, Lee and Masulis (2013) show that a greater discount will encourage investor participation due to the asymmetric informational advantage that managers have over investors. Finally, Corwin (2003) theorises that the offer discount is necessary to compensate shareholders for dilution.

The following factors are found to affect shareholder take-up rate. First, 'moneyness', which is defined as the price of the underlying security relative to the issue, has the greatest effect on take-up rates since investors will not subscribe to a rights issue if the market price of the underlying share falls below the issue price in the offer (Black 2014). Second, Balachandran, Faff and Theobald (2009) find that investors perceive the structure of the rights issue as a signal of firm quality; as such, fully underwritten issues are positively correlated with a higher participation rate whereas partial and non-underwritten issues are negatively correlated with participation rate. Third, renounceable rights should be positively correlated with participation rate as a renounceable rights issue signals a manager's belief that their rights will be of value (Balachandran, Faff and Theobald 2009). Fourth, Karpoff, Lee and Masulis (2013) find that the presence of a lockup agreement reduces risks for investors and thus encourages greater participation. Finally, because of certification effects, higher underwriter quality should be positively correlated with participation rates as underwriters also stake their reputations on the success of the rights issue (Silva and Bilinski 2015). The identification of the factors

which affect take-up rates is important as it allows me to control for these variables when examining the effect of moneyness on take-up rate.

2.2 Motivations for manipulation

In exchange for a fixed fee, underwriters agree to bear the risk of a shortfall in subscriptions of new rights issues. Handley (1995) finds that lower underwriting risk for rights issues is correlated with lower volatility stocks and deeply discounted issues. However, if the shortfall is large, the underwriter faces a significant financial cost of purchasing the shortfall (Balachandran, Faff and Theobald 2009). A further cost of a failed rights issue is the damage to an underwriter's reputation (Fang 2005). Underwriter reputation is a valuable asset as it allows the underwriter to select projects with lower risk, and negotiate for higher commissions (Almeida 2011). Therefore there is an incentive for underwriters to manipulate the closing prices of the underlying security to achieve a higher take-up rate. Thus the closing price of a rights issue can be subjected to manipulation in the same way as option expiries (Ni, Pearson and Poteshman 2005) and portfolio valuation (Comerton-Forde and Putniņš 2011) provide an external incentive to manipulate the closing price. This leads to hypothesis 1 and 2:

> ***H1****: Underwritten rights issues will exhibit higher returns and abnormal trading volume than non-underwritten issues.*

> ***H2****: If higher returns are driven by the underwriter, the underwriting broker should exhibit unusual buying activity.*

2.3 Underwriter manipulation model

In this section, we develop a theoretical model to examine factors which can influence underwriter behaviour. In a firm commitment underwriting agreement, the underwriter agrees to purchase all of the unsubscribed shares from the issuer before attempting to place them to other institutional investors or to sell them on the secondary market. To reduce his risk, the underwriter can obtain firm commitments from institutional investors, in exchange for a fee, to take-up additional shares in the event of a shortfall. Remaining shares from the shortfall are then placed to other investors or sold at a discount. The lead underwriter can further reduce his risks by appointing sub-underwriters, however for the purpose this model, a sole underwriter is assumed.

Manipulators often submit large orders before the close with the goal of causing a price impact large enough to increase price before the close; Comerton-Forde and Putniņš (2010) argue that this action has the effect of consuming the depth of the order book on the ask side and is more effective when liquidity is low. Raising the price of the underlying security relative to the issue price has a positive effect on take-up rate, and thus lowers the shortfall. Therefore in addition to the moneyness of a rights issue, the probability of manipulation by an underwriter is also a function of order book depth.

The underwriter needs to compare the cost of taking up the shortfall against the cost of manipulating the closing price. In the underwriter manipulation model shown in equation (1), an underwriter has an incentive to manipulate the closing price if the following equality holds:

$$Shortfall_i.(1 - FirmCommitment_i).Cost_i.P_{issue,i} \geq \left(P_{issue,i} - P_{t,i}\right).Depth_{ask,i} \quad (1)$$

where $Shortfall_i$ represents the proportion of unsubscribed shares for rights issue i, i.e. the total shortfall amount. $FirmCommitment_i$ represents the proportion of shortfall

which the underwriter has secured firm commitments from institutional investors to take-up. $Cost_i$ represents the cost incurred by the underwriter in placing the shortfall shares. $P_{issue,i}$ represents the issue price of the rights issue i. $P_{t,i}$ represents the price of the underlying security, i, at time, t. $Depth_{ask,i}$ represents the ask-side depth of the order book of stock, i, for all prices between $P_{t,i}$ and $P_{issue,i}$.

The left-hand-side (LHS) of equation (1) represents the cost of taking up the shortfall. $Shortfall_i.(1 - FirmCommitme\ _i)$ represents the outstanding shortfall amount that the underwriter is obligated to purchase, less the portion taken up by investors with firm commitments. $Cost_i.P_{issue,i}$ represents the cost per share involved in placing the short fall shares. Together, they represent the total direct cost of taking up the shortfall for the underwriter. The right-hand-side (RHS) of equation (1) shows the cost to manipulate the closing price of the underlying security to the issue price. On the RHS, $P_{issue,i} - P_{t,i}$ represents the moneyness of a rights issue, which is the relative price difference between the issue price and the current price of the underlying security. Multiplied by $Depth_{ask,i}$, the RHS represents the total cost to raise the underlying security price to the issue price.

This model predicts that the underwriter has more incentive to manipulate the closing price if the cost of taking up the shortfall (LHS) is greater than the cost of manipulation (RHS). As the underlying stock price approaches the issue price, the cost of manipulation (RHS) decreases, increasing the incentive for manipulation. It is predicted that both 'moneyness' and the depth of the order book, which is a proxy for liquidity, are two key factors which determine an underwriter's incentive for manipulation. Furthermore, as intangible costs such as reputation costs are omitted from the LHS, the underwriter manipulation model is conservative and understates the incentive for manipulation. The underwriter manipulation model leads to the following hypothesis:

***H3**: Underwritten rights issues which are marginally UTM will exhibit higher next day returns and abnormal trading volume, compared to those which are 'deep out of the money' or 'in the money'.*

2.4 Types of manipulation

This study draws on literature from the related fields of closing price manipulation, window dressing and announcement effects to explain the behaviour of stock prices around the SEO closing date. Comerton-Forde and Putniņš (2011) define closing price manipulation as trading in order to achieve an artificial closing price. Prices may be manipulated at the end-of-day for a variety of reasons, particularly with the existence of external contracts, such as derivatives valuation, fund valuation, fund performance benchmarking (Comerton-Forde and Putniņš 2011) and in stock exchange closing mechanisms (Cordi and Foley 2014; Hsieh 2015; Huang and Chan 2010).

'Window dressing' is a form of manipulation by fund managers to artificially inflate the portfolio's performance at certain period-ends (Bullard 2000). Carhart et al. (2002) document that fund managers tend to inflate quarter and year-end portfolio prices through last minute purchases. Similar to Michayluk and Sanger (2006), they find evidence of stock price inflation in the last five to thirty minutes before the close, attributing this to closing price manipulation. Likewise, Pope and Yadav (2006) find that on option expiration days, the underlying security exhibits both abnormal returns and higher trading volumes, which they attribute to the expiration day effect. The form and context of 'window dressing' share many similarities with closing date manipulation around rights issues.

The last form of relevant manipulation is the management of media coverage with the aim of driving stock prices above their fundamental value (Huberman and Regev 2001). Barber and Odean (2008) document that increased media coverage can produce a short-term abnormal increase in stock prices, while Engelberg and Parsons (2011) find that media coverage greatly increases trading activity in the stock shortly after the announcement. As such, Ahern and Sosyura (2014) argue that firms have an incentive to actively manage their media releases, finding evidence to suggest that firms manage the timing and content of their media coverage in order to manipulate stock prices during important events. Tan, Chng and Tong (2002) find that when favourable announcements regarding earnings, investment or capital expenditure are announced simultaneously with the SEO announcement, the additional effect on the stock returns are both positive and significant. Thus positive announcements can be used to drive short-term abnormal returns, and managers could time the release of information to take advantage of this effect around rights issues.

2.5 Previous literature and contribution

Previous research on SEO manipulation has focused on examining the effects of short selling on the issue discount. Gerald and Nanda (1993) create a model showing the relationship between manipulative trading before a SEO, and the setting of the issue price. Their model predicts that a larger discount is related to higher levels of manipulative trading before the announcement date. Empirical work by Kim and Shin (2004), and Safieddine and Wilhelm (1996) find no evidence of such manipulative trading. However a recent study by Henry and Koski (2010) documents evidence of manipulative trading around SEO issue dates. As previous studies on SEO manipulation document manipulative trading around the announcement and issue dates, this study

expands the literature by examining possible manipulation around the closing date of rights issues. This is important as manipulation around the closing date affects the take-up rate of rights issues and further impacts the capital raising process of firms.

Underwriter manipulation has rarely been documented in the SEO literature, however Foley et al. (2016) find evidence of abnormal underwriter selling behaviour surrounding DRIPs in Australia. Apart from Foley et al.'s (2016) study, to the best of our knowledge, there are no other papers documenting underwriters as potential manipulators. A second contribution of this study is to further the research on underwriter trading behaviour. The findings have potential implications as manipulation impairs price discovery by distorting prices from their natural levels. This would be of interest to regulators seeking to improve the integrity of the primary markets, for exchanges who design rules to guard against price manipulation, and for companies choosing to underwrite future rights issues.

3. Data

The data identifying rights issues and entitlements in the ASX is provided by the Connect 4 database. In total, 2,405 rights issues are identified for the period January 2005 and April 2016. For each rights issue, we collect the following data: ASX stock code, announcement date, issue type, issue ratio, issue price, amount sought, underwritten comments and underwriter name. The individual rights issue prospectus and ASX Appendix 3B documents are examined to obtain the record date, closing date, issue date and renounceable status of the rights issue. Stock price data is obtained from the Thomson Reuters Tick History (TRTH) database where the daily open, high, low, and closing prices are collected together with transaction volume.

The underwriter's identity is obtained through the Connect 4 database, the underwriter's name is then matched to a corresponding Participation Identification (PID) number using ASX's (2015) list of active participants. The PID is a broker identification number which is used to identify broker trades. By matching the list of underwriters in the sample with the list of ASX brokers, underwriting brokers can then be identified. Order level data is obtained from the Securities Industry Research Centre of Asian-Pacific (SIRCA) Australian equities database, which contains information on all orders and trades executed in the ASX. For each order, we obtain the broker identification codes of the buyer and seller, as well as the trade qualifiers, time stamp, volume and prices transacted at. Trade qualifier information enables us to identify the type of trade, including buyer-initiated, seller-initiated, cross trades and auctions.

Rights issues denominated in foreign currency are excluded. Stocks which undergo consolidations or share splits within ten days of the closing date are also excluded. Convertible notes rights issues and observations with missing or erroneous data are also excluded. From the initial sample of 2,405 rights issues, the final sample size consists of 2,071 rights issues, of which 62.0% are underwritten.

3.1 Summary statistics

Panel A of Table 1 reports summary statistics of the timeline of rights issues. The period from the announcement date to the closing date determines how quickly companies are able to raise capital. This capital raising duration takes on average 34.5 calendar days (median of 31 days), with underwritten rights issues taking significantly less time, being on average, 1.4 days quicker. This implies that underwritten rights issues benefit from a faster capital raising process. Companies in the ASX have a maximum of

three business days from the record date to send rights issue documents to eligible shareholders. As the average duration between record and closing date is 21 days, this implies that shareholders have approximately 18 calendar days to decide if they are going to participate in the rights issue.

Panel B of Table 1 provides descriptive statistics of rights issues. Shareholders who receive rights issues are not obligated to purchase newly issued securities from the issuing company, which is reflected in the average shareholder take-up rate of 54.8%. Shareholder take-up rate includes both valid subscriptions by eligible shareholders and additional shares purchased through oversubscription facilities. The take-up rate of 54.7% found is considerably lower than those found in Cronqvist and Nilsson's (2005) average of 84% and Holderness and Pontiff's (2016) 95%. This difference likely reflects structural differences of the Swedish and American stock exchanges as compared to the ASX. For instance, the median market capitalisation of Australian companies in this sample is AUD$10 million, whereas Holderness and Pontiff (2016) report that the median market capitalisation in their sample of American rights issues is US$137 million (approximately AUD$151 million[3]). This indicates that a larger portion of stocks in this sample are small cap stocks, as compared to the Swedish and American samples. The lower take-up rate also highlights the greater shortfall risk that underwriters in Australia face.

Panel B separates key statistics for underwritten and non-underwritten rights issues. The offer price discount is calculated by $\frac{P-OP}{P}\ x\ 100$, where P represents the market price at the close of the trading day before the announcement date and OP is the offer price. The average discount of 21.4% appears high in comparison to other studies

[3] Using the Australian to US dollar exchange rate on 7th March 2014, which is the date Holderness and Pontiff's (2016) paper is first received. The AUDUSD exchange rate used is 0.9068.

such as Corwin (2003), and Huang and Zhang (2016), who report an average discount of 2.2% and 3.2% respectively for U.S. SEOs. The large discount rate is attributable to the presence of penny stocks in the ASX sample. As the median issue price is $0.04, a discount rate of 20% equates to $0.01. This higher discount for underwritten rights issues is consistent with Corwin (2003), who finds that underwriter pricing practices such as offer price rounding to even or whole numbers causes larger under-pricing for lower priced stocks as compared to non-underwritten rights issues. The average offer price discount for underwritten rights issues is also 2.4% higher compared to non-underwritten rights issues, this is consistent with the effects of underwriter certification (Silva and Bilinski 2015). Based on the average issue size of $17.3 million, a discount rate of 24.1% translates to approximately $4.2 million in dilution and represents a substantial direct cost.

Underwritten rights issues are conducted by larger firms on average, with average market capitalisations of $19,772 million, compared to $3,601 million for non-underwritten rights issues. Despite the large difference in market capitalisation, both underwritten and non-underwritten rights issues have a similar issue size of approximately 19% to 20% of shares outstanding. The shortfall amount for both underwritten and non-underwritten rights issues are both approximately $3 million, indicating that non-underwritten rights issues have a significantly larger shortfall when measured as a proportion of issue size.

Table 1

Summary statistics of rights issues

Panel A shows the duration in days between key dates of rights issues on the ASX. Panel B displays the summary statistics. In total, 2,071 rights issues were identified on the ASX between 2005 and 2016, of which 62.0% are underwritten. This sample does not include rights issues that are offered in foreign currencies, convertible notes or issues which coincide with a share consolidation within +/-10 trading days from the closing date. Difference in means for the underwritten and non-underwritten sample and the respective p-values for pooled T-test, Satterthwaite's T-tests for difference in mean, and Pearson's Chi-Squared test for difference in proportion are reported. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

	Full Sample		**Underwritten**		**Non-Underwritten**			
Panel A: Timeline (Days)	*Mean*	*Median*	*Mean*	*Median*	*Mean*	*Median*	*Difference in Means*	*P-Value*
Announcement to Closing date	34.5	31	34.0	30	35.4	*32*	-1.4**	3.3%
Announcement to Record date	13.5	10	13.6	10	13.4	10	0.2	74.0%
Record to Closing date	21.0	20	20.4	19	22.0	20	-1.6***	0.0%
Closing to Issue date	7.9	8	8.0	8	7.7	8	0.3***	0.1%
Panel B: Descriptive Statistics	*Mean*	*Median*	*Mean*	*Median*	*Mean*	*Median*	*Difference in Means*	*P-Value*
Shareholder take-up rate	54.8%	54.1%	58.4%	59.5%	49.1%	47.6%	9.3%***	0.0%
Discount rate	21.4%	20.0%	22.3%	20.6%	19.9%	18.5%	2.4%**	3.2%
Issue size ($Millions)	$17.3	$2.8	$23.2	$3.0	$7.8	$2.5	$15.4	22.7%
Shortfall amount ($Millions)	$3.0	$1.1	$3.0	$1.0	$3.0	$1.2	$0.0	94.3%
Issue price	$0.20	$0.04	$0.21	$0.04	$0.18	$0.04	$0.03	30.1%
Market capitalisation ($Millions)	$13,619.0	$10.0	$19,771.7	$11.5	$3,600.6	$8.4	$16171.1**	1.2%
% of issue size to market capitalisation	19.4%	18.4%	19.0%	17.8%	20.0%	19.2%	-1.0%	24.0%
Issue have attached options	12.4%		12.7%		11.9%		0.8%	60.3%
Issues are renounceble	22.8%		28.2%		14.0%		14.2%***	0.0%
Proportion that close 'out of the money'	25.9%		21.4%		33.1%		-11.7%***	0.0%
Proportion that close 'at the money'	14.7%		14.0%		16.0%		-2.0%	20.4%
Proportion that close 'above the money'	59.4%		64.6%		50.9%		13.7%***	0.0%
Number of issues	2071		1283		788			

Panel B also provides statistics on the proportion of underwritten and non-underwritten rights issues whose price on the closing date is below, at, or above the issue price. 33.1% of non-underwritten rights issues close below the issue price, significantly more than the 21.4% of underwritten rights issues. Rights issues that close below the issue price are termed 'out of the money' (OTM). Approximately 14% to 16% of all rights issues close exactly at their issue price, which is similar for both underwritten and non-underwritten rights issues. Finally, 64.6% of underwritten rights issues close above their issue price on the closing date, 13.7% more than non-underwritten issues.

The data in Table 1 indicates that the shareholder take-up rate for underwritten rights issues is 9.3% higher than non-underwritten rights issues. However, underwritten rights issues are associated with larger market capitalisations and higher shareholder take-up rates. This creates an endogeneity problem when examining the effect of underwriters on take-up rates as firms that engage underwriter services also tend to be larger, more established firms which are more likely to have higher take-up rates. In studying the effects of underwriters on rights issues, it is important to employ econometric methods that enable me to isolate causality.

4. Method

4.1 Moneyness

'Moneyness' describes the relative price difference between the underlying stock price at time, t, and the issue price of the rights issue. The closing prices of the underlying securities are first converted into ticks, which is the minimum pricing increment of a security. We measure price in terms of ticks rather than cents as the minimum price movement of a

security in the ASX varies from 0.1 to 1 cent according to a price band. [4] As rights issues are termed OTM when the price of the security is trading below the issue price, moneyness of OTM rights issues take a negative value. Rights issues which close 'at the money' are assigned a moneyness value of zero as there is no relative price difference between the closing price and the issue price. Likewise, 'above the money' rights issues have a positive moneyness value. Rights issues which have a moneyness of zero and above are collectively termed 'in the money' (ITM). Therefore, moneyness is a continuous variable spanning both positive and negative values depending on the relative difference between the closing and issue prices.

4.2 Trading windows

In the analysis of underwriter trading behaviour, we determine if underwritten rights issues are associated with higher abnormal trading volumes and returns. In order to determine when these trading characteristics are observed, a suitable trading window must be selected. Summary statistics regarding the timeline of rights issues in section 3.1 reveal that shareholders have on average eighteen calendar days (approximately two and a half weeks) from the time they receive the rights issue prospectus to the closing date. Therefore to document changes in selected trading variables such as abnormal volume traded and daily returns, data from the last ten trading days (approximately two weeks) before the rights issue closing date are analysed. Specifically, two five-day trading windows comprising event days [-9,-5] and [-4,0] are created. These two windows provide an indication if changes in trading variables are occurring just before the closing date, as in window [-4,0], or in the week prior, i.e. [-9,-5].

[4] Tick sizes on the ASX are as follows: 1) Stock prices less than 10c, tick size = 0.1c. 2) Stock prices ranging from 10c to $2, tick size = 0.5c. 3) Stock prices greater than $2, tick size = 1c.

4.3 Under the Money (UTM)

In section 4.1, indicator variables for OTM and ITM were introduced to categorise rights issues which are 'out of the money' and ITM respectively. An additional indicator variable, UTM is introduced to capture rights issues with a previous day's closing price that is just below the issue price. As a greater proportion of underwritten rights issues close ITM compared to non-underwritten rights issues, the trading characteristics of rights issues which are trading just below the issue price are examined. According to the underwriter manipulation model presented in section 2.3, the closer a rights issue which is UTM is to the issue price, the higher the incentive for manipulation. Therefore, we define UTM rights issues to be within a moneyness range of -5 to -1 ticks. If the rights issue has a moneyness of zero or greater, it is already trading ITM, and there is less incentive for increased moneyness. Consequently, if a rights issue has a moneyness of -6 or less, the cost to manipulate the rights issue from UTM to ITM is larger, reducing the incentive to manipulate 'deep out of the money' (DOTM) rights issues.

If a UTM rights issue is being manipulated, we expect to see higher trading volumes and returns, which are both characteristics of closing price manipulation (Pope and Yadav 1992). To test if a UTM rights issue experiences increased trading volumes and returns on the next day of trading, $UTM_{t,i}$ takes a value of one if the closing price at $t - 1$ falls within a moneyness range of -5 to -1 ticks, and zero otherwise. Hence if a rights issue closes UTM on day $t - 1$, $UTM_{t,i}$ takes a value of one on day t. However, if this same rights issue subsequently trades higher and closes ITM on day t, then the classification of $UTM_{t,i}$ changes accordingly and takes a value of zero for day $t + 1$. This 'rolling UTM' definition allows us to analyse the trading characteristics of UTM rights issues on a daily basis.

5. Results and Analysis

5.1 Shareholder take-up rate

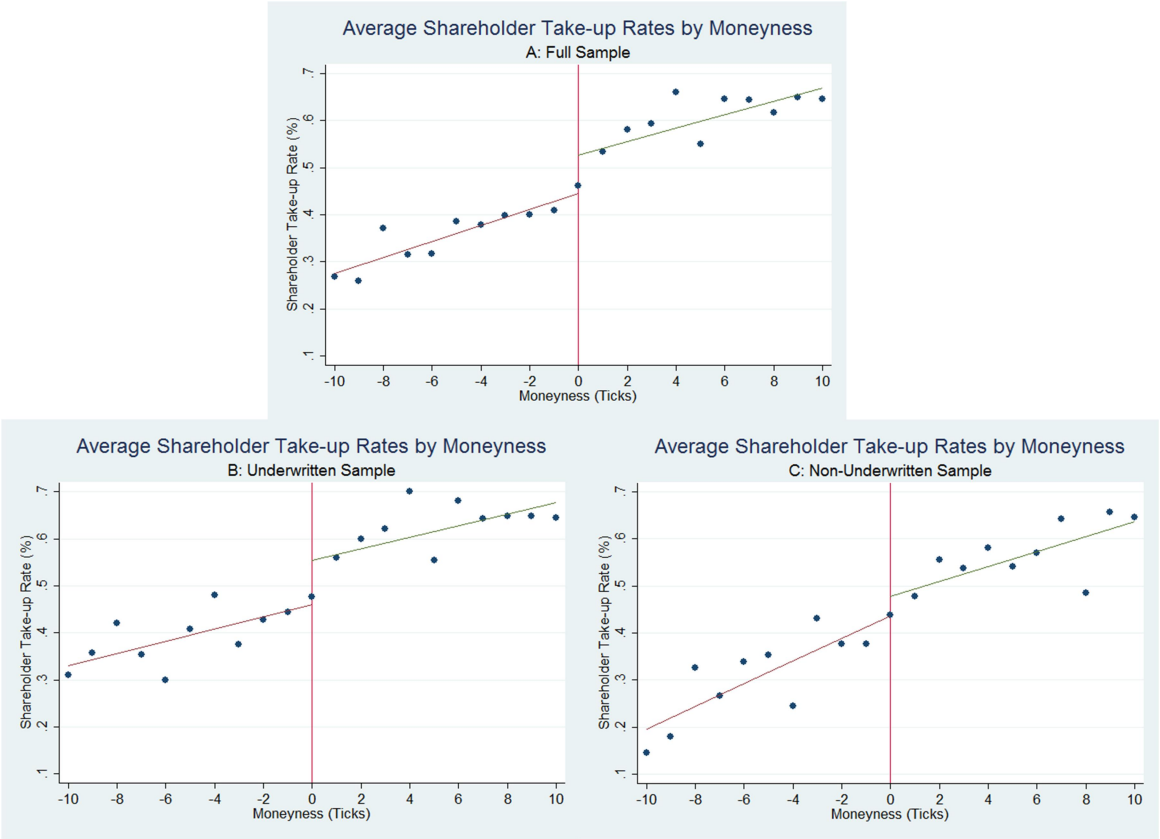
In order for the underwriter manipulation model to hold, there must be a positive relationship between moneyness and take-up rates. We analyse how average take-up rates vary with moneyness. In Figure 2, each plot represents the average take-up rates for moneyness values between -10 to +10 ticks, with a line of best fit plotted for moneyness values between -10 to 0 and 0 to +10 ticks. The average take-up rates of the full, underwritten, and non-underwritten samples are shown in panels A, B and C respectively.

The graphs show that while both underwritten and non-underwritten average take-up rates increase with moneyness, underwritten issues are sensitive to a rights issue closing ITM. This is evident from the sharp increase in average take-up rates observed around the issue price. For non-underwritten rights issues, only a small increase in average take-up rates is observed around the issue price. This implies that there is a larger incentive for underwritten rights issues to close at or just above the issue price, to take advantage of the significant jump in average take-up rates. In contrast, because the average take-up rates for non-underwritten rights issues increases more uniformly between moneyness values of -10 to +10, there is a general incentive for closing prices at higher moneyness values, rather than at the issue price

Figure 2

Average shareholder take-up rates by moneyness

Figure 2 shows the average take-up rates for each moneyness value ranging from -10 to +10 ticks. Solid lines indicate the line of best fit for moneyness values between -10 to 0 and 0 to +10 ticks. Panel A, B and C show the average take-up rates for the full, underwritten and non-underwritten samples respectively. Panel B shows a distinct jump in average take-up rates around the issue price whereas Panel C shows a more gradual increase in average take-up rates as moneyness increases from -10 to +10 ticks.



To test this relationship, a fixed effects regression controlling for both industry and year, is used to model the determinants of shareholder take-up rate. Following Balachandran, Faff and Theobald (2009), Eckbo and Masulis (1992) and Slovin, Sushka and Lai (2000), other factors such as underwritten status, renounceability, and the offer price discount which have been shown to have an effect on shareholder take-up rate are included as independent variables. Other control variables including the presence of embedded options in the rights issue, the ratio of equity raised to market capitalisation, a measure of liquidity, and the log of both market capitalisation and issue size are included. As some of the less liquid stocks in the sample do not trade on a daily basis, we use Chelley-Steeley, Lambertides and Steeley's (2015) adjusted Amihud ratio, which provides a correction to Amihud's (2002) illiquidity ratio to take into account the effects of non-trading. The adjusted Amihud ratio is computed using daily trading data during a 6-month window before the announcement date of a rights

issue. The specification of the fixed effects model is as follows, where $I(Variable)_i$ denotes an indicator variable:

$$TakeupRate_i =$$

$$\beta_0 + \beta_1 I(ITM)_i + \beta_2 I(ITM)_i * Moneyness_i + \beta_3 Moneyness_i + \beta_4 I(Underwriter)_i + \sum_{c=1}^{7} Controls_{i,c} + \varepsilon_i \quad (2)$$

where for issue *i*, *I(ITM)* takes the value of one if the closing price is above the issue price, and zero otherwise. *Moneyness* is the relative price difference between the closing price and the issue price. Control variables include *I(Underwriter), I(Renounceable)* and *I(Options)* which take the value of one, if the rights issue is underwritten, renounceable, or has attached options respectively, and zero otherwise. As this regression measures the determinants of take-up rate, the values of *I(ITM)* and *Moneyness* are determined on the closing date. The coefficients of *I(ITM), Moneyness* and *I(ITM) * Moneyness* enables me to observe how take-up rates are affected by changes in moneyness.

The results are shown in Table 2. *Moneyness* has a positive effect for rights issues which close ITM, and a negligible effect for OTM rights issues. For rights issues that close ITM, each additional tick that the share price closes above the issue price results in an increase in the take-up rate of 0.1%. This shows that shareholders rationally prefer to exercise their rights when the rights issue is ITM.

For the full, underwritten and non-underwritten samples, as the range of rights issues now spans across both moneyness regimes, the indicator variable *I(ITM)* is introduced. Given the results presented in Figure 2, we expect *I(ITM)* to significantly increase take-up rates above the issue price. The results show that whether a rights issue closes ITM has the largest impact on take-up rates. Underwritten rights issues which close ITM experience take-up rates 12.5% higher than those which close OTM. This result illustrates the importance of a rights issue closing at or above the zero-tick threshold. ITM non-underwritten rights issues display a

similar increase in take-up rates for ITM rights issues.

The interaction term *I(ITM)*Moneyness* captures the relationship between take-up rates and moneyness. For underwritten rights issues, there is no significant difference in take-up rates if a rights issue closes 'at the money' or 'deep in the money'. If an underwriter desires a higher take-up rate, it is sufficient to increase the closing price up to the issue price, any further increases in moneyness above the issue price has limited impacts on take-up rate and will increase the cost of manipulation. In contrast, non-underwritten rights issues experience higher take-up rates of 0.5% for a one tick increase in moneyness above the issue price. This suggests that the benefit of closing 'at the money' is diluted for non-underwritten rights issues as closing 'deep in the money' will yield higher take-up rates. Therefore there is less incentive for a non-underwritten rights issue to close at the issue price, compared to underwritten issues.

As expected, the presence of an underwriter and having renounceable rights issues both increase take-up rates, consistent with findings of Balachandran, Faff and Theobald (2009). Contrary to expectation, rights issues with attached options have a negative but insignificant impact on take-up rates. This may reflect the riskier nature of issues with

Table 2

Determinants of shareholder take-up rates

Table 2 reports the determinants of shareholder take-up rates for the various samples consisting of OTM, ITM, full sample, underwritten and non-underwritten rights issues. All regressions control for industry and year fixed effects. Robust standard errors clustered by industry and year are in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

	Dependent Variable: Shareholder Take-up Rate				
Variable	OTM	ITM	Full Sample	Underwritten	Non-Underwritten
I(ITM)			0.147***	0.125***	0.136***
			(0.016)	(0.025)	(0.022)
*I(ITM) * Moneyness*			0.002	-0.003	0.005***
			(0.001)	(0.003)	(0.001)
Moneyness	-0.001	0.001**	-0.001	0.004	-0.002**
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)
I(Underwriter)	0.067***	0.048***	0.048***		
	(0.024)	(0.014)	(0.012)		
I(Renounceble)	0.067**	0.039**	0.050***	0.057***	0.046
	(0.029)	(0.016)	(0.014)	(0.017)	(0.028)
I(Options)	-0.030	-0.042*	-0.034*	-0.038*	-0.014
	(0.032)	(0.022)	(0.018)	(0.022)	(0.029)
Discount Rate	0.139***	0.135***	0.120***	0.106***	0.150***
	(0.043)	(0.035)	(0.027)	(0.035)	(0.041)
Ratio Of Equity Raised	0.000	0.000	0.000	0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted Amihud Ratio	51.821***	-2.213***	-1.591*	-195.690	-2.156**
	(15.305)	(0.314)	(0.912)	(178.461)	(0.906)
Log Market Capitalisation	0.000	0.046***	0.027***	0.033***	0.022***
	(0.008)	(0.006)	(0.005)	(0.007)	(0.006)
Log Issue Size	-0.013	-0.017**	-0.009	-0.007	-0.028**
	(0.015)	(0.009)	(0.007)	(0.009)	(0.070)
Constant	0.525**	-0.342**	-0.181	-0.317	0.222
	(0.262)	(0.151)	(0.145)	(0.143)	(0.265)
Number of Observations	523	1506	2035	1262	773
R-Squared	18.0%	20.8%	25.5%	24.2%	21.5%

options, or a correlation with less attractive offers. Consistent with Handley's (1995) findings, rights issues with larger discounts correspond to higher take-up rates. ITM rights issues with higher liquidity correspond to higher take-up rates. The positive relationship between liquidity and take-up rate is evidence of the positive relationship between liquidity

and stock returns documented by Hartian and Sitorus (2015). However, a negative relationship between liquidity and take-up rate is observed for OTM rights issues, which suggests that take-up rates in OTM rights issues may be driven by institutional shareholders seeking to acquire large positions without price impacts.

5.2 Deal Frequency of Rights Issue

As documented in section 5.1, the marked increase in average take-up rates observed around the issue price provides an incentive for underwriters to ensure rights issues close ITM. The percentage of issues closing at each tick around the issue price is examined to determine if there is a significant difference in underwritten rights issues closing at or above the issue price, as compared to below. The percentage of issues is calculated as:

$$Percentage\ of\ Issues_{m,j} = \frac{Frequency\ of\ Rights\ Issues_{m,j}}{Total\ Number\ of\ Rights\ Issues_{j}} \quad (3)$$

where for each moneyness value *m,* and sample type j, the $Frequency\ of\ Rights\ Issues_{m,j}$ represents the number of rights issues closing at each moneyness value, m. $Total\ Number\ of\ Rights\ Issues_{j}$ represents the total number of rights issues per type, j. As approximately two-thirds of the sample is underwritten, this measure eliminates any biases caused by the higher number of underwritten deals.

Figure 3 plots the frequency distributions of rights issues over the moneyness range -5 to +5 for the full, underwritten, and non-underwritten samples in Panels A, B and C respectively. There is a larger proportion of non-underwritten rights issues closing just below the zero-tick threshold (at -1 and -2 ticks) compared to underwritten rights issues. Specifically, 10% of underwritten rights issues close at -1 to -2 ticks, compared to 18% for non-underwritten rights issues. The smaller proportion of underwritten rights issues closing

marginally UTM, as compared to non-underwritten rights issues is consistent with the larger incentive for underwritten rights issues to close ITM. Examining the trading characteristics of underwritten, UTM rights issues will determine if this subset of rights issues show signs of manipulation.

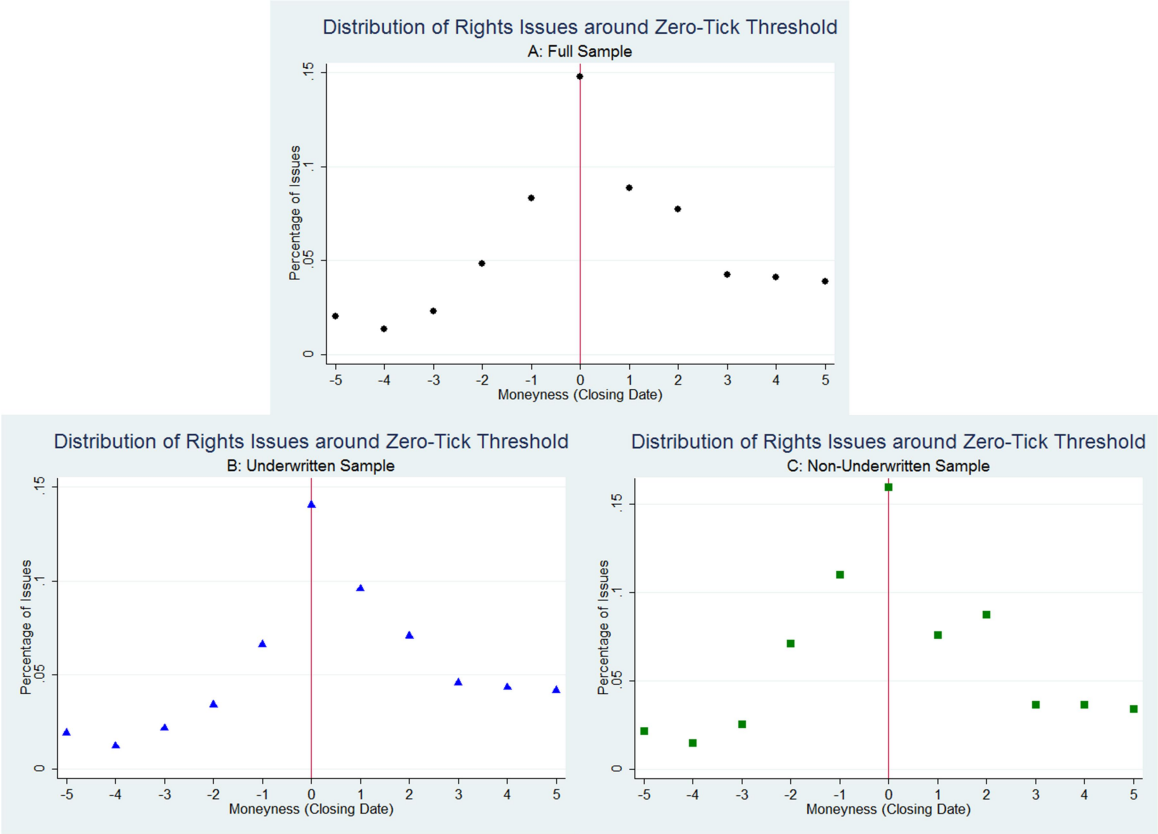
Approximately 15% of all rights issues closes at the issue price, which is the modal closing price. Given the average offer price discount is 21.4%, it is unusual that after approximately one month of trading, the share price clusters around the issue price. If prices do indeed follow a random walk, a uniform distribution of prices would be expected. Rights issues may be influenced by certain heuristics such as 'anchoring bias', which is the tendency for individuals to use an initial piece of information (the issue price) to guide their subsequent decisions (Ackert and Deaves 2009). To overcome potential biases, regression discontinuity design (RDD) is a used to formally test whether a disproportionately higher number of deals close at or above the issue price. The key idea behind the RDD method is that rights issues falling just below the zero-tick threshold can be directly compared to issues that fall just above it (Bloom 2012). Thus, in the absence of price manipulation, we expect the number of issues closing just below the issue price to be approximately equal to the number of issues closing at or above the issue price. Consequently, if underwriters engage in price manipulation, we expect a greater number of issues closing at or above the issue price, relative to issues closing just below.

To set up the RDD, only rights issues that close within a moneyness range of +5 to -5 ticks are selected. This ensures that the rights issues selected are within a narrow band around the zero tick cut-off, which makes comparison possible. Rights issues are then sorted according to their respective moneyness value. Finally, the frequency of rights

Figure 3

Frequency distribution of rights issues around the zero-tick threshold

Figure 3 shows the frequency distribution of rights issue deals for moneyness values ranging from -5 to +5 ticks. The full, underwritten and non-underwritten samples are shown in Panels A, B and C respectively. Each point indicates the percentage of rights issues that close at each moneyness value. The graphs show that there is a higher proportion of non-underwritten rights issues closing just UTM at -1 to -2 ticks.



issues which closes at each moneyness value is then computed. To estimate if there is a discontinuity in the frequency of deals around the issue price, the following RDD is estimated:

$$Frequency_i = \beta_0 + \beta_1 I(ITM_i) + \beta_2 I(ITM_i) * Moneyness_i + \beta_3 Moneyness_i + \varepsilon_i \quad (4)$$

where for issue *i, I(ITM)* and *Moneyness* takes the same definition as in equation (3). To examine the effects of underwriting, the rights issues are further divided into underwritten and non-underwritten rights issues.

Table 3

Regression discontinuity of deal frequency of rights issues

Table 3 reports regression discontinuity design results for the percentage of issues at various closing prices. The RDD is run for the full, underwritten and non-underwritten samples within +/- 5 ticks of the issue price. Huber-White robust standard errors are presented in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

Dependent Variable: Percentage of Issues			
Variable	Full Sample	Underwritten	Non-Underwritten
I(ITM)	0.038	0.056**	0.010
	(0.024)	(0.020)	(0.032)
I(ITM) Moneyness*	-0.037***	-0.031***	-0.046***
	(0.008)	(0.006)	(0.010)
Moneyness	0.016**	0.012**	0.023***
	(0.005)	(0.004)	(0.006)
Constant	0.086***	0.065***	0.119***
	(0.016)	(0.015)	(0.019)
Moneyness Range	-5 to +5	-5 to +5	-5 to +5
Number of Observations	11	11	11
R-Squared	86.0%	89.0%	80.0%

Panel B of Figure 3 shows a larger percentage of underwritten rights issues closing at or above the issue price, as compared to just below. Therefore in the regression specified by equation (4), we expect the coefficient of *I(ITM)* to be positive and significant for the underwritten sample but insignificant for the non-underwritten sample. Table 3 presents the results of the RDD. Only underwritten rights issues experience a significant discontinuity in the percentage of rights issues closing at the issue price. Approximately 5.6% more rights issues close at or above the issue price when the issue is underwritten. This discontinuity is not observed in non-underwritten rights issues. This result is consistent with a greater incentive for underwriters to ensure issues close ITM to increase the take-up rate. The signs and significance of *I(ITM)*Moneyness* and *Moneyness* are as expected, and reflects the inverted 'V' shape observed in Figure 3.

5.3 Abnormal trading volumes of UTM rights issues

To determine if the significantly larger percentage of underwritten rights issues closing 'at the money' is driven by manipulation, we examine if underwritten, UTM rights issues display signs of trade-based manipulation. Underwriters have an increased incentive to manipulate UTM rights issues, as the cost of doing so is lower for these issues as compared to DOTM rights issues. This makes UTM rights issues a likely subset in which manipulation may occur. Comerton-Forde and Putniņš (2011) and Pope and Yadav (1992) find that manipulation is often accompanied by higher trading volumes and end of day returns. As such, we investigate whether underwritten UTM rights issues experience significantly higher abnormal trading volumes.

To examine abnormal trading volume, a period of six months is examined, starting from the day before the rights issue announcement, is used to calculate the average daily clean trading volume. As daily volume is a function of the total shares on issue, abnormal trading volume is scaled by the number of shares on issue. Thus abnormal scaled volume is an indicator of the abnormal proportion of a firm's shares traded each day:

$$Abnormal\ Scaled\ Vol_{i,t} = \frac{Vol_{i,t} - Avg\ Clean\ Vol_i}{Shares\ on\ Issue_i} \tag{5}$$

where for issue *i* on trading day *t,* $Vol_{i,t}$ represents the daily trading volume, $Avg\ Clean\ Vol_i$ represents the average daily volume over the six months period before the announcement date, and $Shares\ on\ Issue_i$ represents the number of ordinary shares on issue on the closing date. The determinants of abnormal scaled volume are investigated using the following specification:

$$Abnormal\ Scaled\ Vol_{i,t} =$$
$$\beta_0 + \beta_1 I(UTM)_{i,t} * I(Underwriter)_{i,t} + \beta_2 I(UTM)_{i,t} + \beta_3 Underwriter_{i,t} +$$
$$\beta_4 Lag\ Moneyness_{i,t} + \sum_{c=1}^{9} \beta_c Controls_{i,t,c} + \varepsilon_{i,t} \tag{6}$$

where for issue *i* and event date *t, I(UTM)* takes the value of one if the moneyness value on event *t – 1* is between -1 and -5, and zero otherwise. *Lag Moneyness* represents the moneyness value on event *t – 1*. This regression is run for the trading windows [-9,-5] and [-4,0] to provide an indication of when trading effects are observed. Fixed effects for industry and year are used to account for structural characteristics unique to different industries and variations in market conditions across different years.

Table 4 presents the results of the analysis. An underwritten rights issue which is UTM experiences significantly higher abnormal trading volumes in the next day of trading. This behaviour is only present in the five trading days immediately before the closing date. This finding is consistent with Hillion and Suominen (2004), who document that manipulation in closing prices is accompanied by a sharp rise in trading volume and volatility just before the close. On average, these underwritten, UTM rights issues experience higher abnormal scaled volumes of 26% compared to non-underwritten, non-UTM rights issues. A possible explanation for this effect is that there is higher urgency in the [-4,0] window to ensure that a rights issue closes ITM by the closing date.

In contrast, non-underwritten rights issues which are UTM are found to exhibit significantly lower abnormal trading volumes just before the closing date. Non-underwritten, UTM rights issues experience an average decrease in abnormal scaled volume of 28.5%, as compared to non-underwritten, non-UTM rights issues. The difference in magnitudes of *I(UTM)*I(Underwriter)* and *I(UTM)* illustrate the impact of underwriters on UTM rights issues. This shows that underwritten rights issues experience significantly higher abnormal trading volume in the five days immediately before the closing date, as compared to non-underwritten rights issues.

Table 4

Abnormal trading volume of UTM rights issues

Table 4 analyses if underwritten, UTM rights issues experience higher abnormal trading volumes. The dependent variable measures the difference in daily trading volume and clean trading volume, as a percentage of the number of shares on issue. The indicator variable *I(UTM)* takes a value of one if the previous day's closing price was between -1 to -5 ticks from the issue price, and zero otherwise. All regressions control for industry and year fixed effects. Huber-White robust standard errors are indicated in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

Dependent Variable: Abnormal Scaled Volume				
Variable	Event [-9.-5]	Event [-4,0]	Event [-9.-5]	Event [-4,0]
*I(UTM)*I(Underwriter)*	0.009	0.251**	0.016	0.260**
	(0.065)	(0.105)	(0.064)	(0.106)
I(UTM)	-0.001	-0.314***	0.028	-0.285***
	(0.051)	(0.093)	(0.054)	(0.093)
I(Underwriter)	0.087***	0.079***	0.082***	0.075***
	(0.034)	(0.024)	(0.031)	(0.029)
Lag Moneyness	0.000	0.000	0.001*	0.000
	(0.000)	(0.000)	(0.001)	(0.000)
I(Renounceble)			0.059**	0.025
			(0.026)	(0.024)
I(Options)			0.019	0.017
			(0.032)	(0.042)
Discount Rate			0.014	0.025
			(0.064)	(0.050)
Ratio Of Equity Raised			0.000	0.000
			(0.000)	(0.000)
Adjusted Amihud			-0.319	-0.670
			(0.715)	(0.797)
Shares On Issue			-0.000***	-0.000**
			(0.000)	(0.000)
Event Day			0.026***	-0.002
			(0.009)	(0.008)
Log Market Capitalisation			0.061***	0.084***
			(0.023)	(0.025)
Log Issue Size			-0.069***	-0.098***
			(0.026)	(0.026)
Constant	-0.021	0.003	-0.257	-0.519
	(0.037)	(0.043)	(0.337)	(0.334)
Number of Observations	10317	10324	10132	10139
R-Squared	1.5%	2.2%	2.2%	2.9%

In the five days immediately prior to the closing date, UTM rights issues experience larger abnormal scaled volumes of 18.5% as compared to non-UTM rights issues. The results

in this section support hypotheses H1 and H3 as underwritten, UTM rights issues are associated with higher abnormal trading volume, however this effect is present in the trading window [-4,0], but not in the window [-9,-5]. The findings of Comerton-Forde and Putniņš (2011), and Hillion and Suominen (2004) suggest that the rise in abnormal trading volume prior to the closing date is likely a sign of price manipulation.

5.4 Returns of UTM rights issues

As Hillion and Suominen (2004) show that manipulation is often accompanied by an increase in returns just before the close, we analyse daily stock returns to determine if underwritten, UTM rights issues are associated with higher returns just prior to the closing date. We run the regression specified by equation (6) with returns as the dependent variable:

$$Return_{i,t} = \frac{Closing\ Price_t - Closing\ Price_{t-1}}{Closing\ Price_{t-1}} x\ 100 \qquad (7)$$

Given the results in section 5.3 of higher abnormal trading volumes in the trading window [-4,0], we expect similar behaviour for returns. Table 5 shows the results of this regression, where *I(UTM)*I(Underwriter)* represents the percentage change in daily returns for underwritten, UTM rights issues. Similar to abnormal trading volume, underwritten, UTM rights issues experience significant daily returns only in the days leading up to the closing date. On average, underwritten, UTM rights issues are associated with a 1.1% increase in daily returns compared to non-underwritten, non-UTM rights issues. This increase in daily returns spans a period of five days before the close; in contrast, studies such as Carhart et al. (2002) and Comerton-Forde and Putniņš (2011) document significant end-day returns which occur in the last minute of trading before the close. This illustrates the difference in manipulation for rights issues, compared to closing price manipulation for external contracts such as mutual fund performance and options. As the payout for manipulation of rights issues

depends on shareholder's participation, manipulation is no longer confined to the last minutes of trading, but instead occurs across several days before the closing date. As shareholders can exercise their rights anytime between the record to closing date, manipulation of share prices in the days before the closing date allows shareholders sufficient time to process the information and to exercise their rights.

Table 5

Daily returns of UTM rights issues

The dependent variable measures the daily returns of the underlying security in the rights issue. I(UTM) takes a value of one if the previous day's closing price was between -1 to -5 ticks from the issue price, and zero otherwise. These regressions determine if underwritten, UTM rights issues experience higher daily returns. All regressions control for industry and year fixed effects. Huber-White robust standard errors are indicated in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

Dependent Variable: Daily Returns (%)				
Variable	Event [-9,-5]	Event [-4,0]	Event [-9,-5]	Event [-4,0]
*I(UTM)*I(Underwriter)*	0.369	1.077**	0.382	1.101**
	(0.466)	(0.550)	(0.470)	(0.552)
I(UTM)	2.203***	1.604***	2.172***	1.621***
	(0.353)	(0.366)	(0.358)	(0.375)
I(Underwriter)	0.151	0.209	0.204	0.175
	(0.189)	(0.189)	(0.190)	(0.200)
Lag Moneyness	-0.001*	-0.001***	-0.019***	-0.017***
	(0.001)	(0.000)	(0.003)	(0.004)
I(Renounceble)			-0.393**	0.288
			(0.218)	(0.221)
I(Options)			-0.205	0.073
			(0.243)	(0.298)
Discount Rate			0.123	0.484
			(0.480)	(0.653)
Ratio Of Equity Raised			0.000***	0.000
			(0.000)	(0.000)
Adjusted Amihud			218.1	-17.8
			(184.3)	(13.0)
Shares On Issue			-0.000	-0.000
			(0.000)	(0.000)
Event Day			0.079	0.133**
			(0.057)	(0.063)
Log Market Capitalisation			0.283***	0.269***
			(0.064)	(0.065)
Log Issue Size			-0.132	-0.378
			(0.094)	(0.110)
Constant	0.991	-0.684	-2.994	-1.293
	(1.461)	(0.932)	(1.867)	(1.673)
Number of Observations	10317	10324	10132	10139
R-Squared	1.2%	1.1%	1.9%	1.4%

Comparing the results of *I(UTM)* in Table 4 and 5, non-underwritten, UTM rights issues experience lower abnormal scaled volumes but higher returns in the window [-4,0]. Non-underwritten, UTM rights issues experience on average -28.5% lower abnormal scaled volumes but 1.6% higher returns compared to non-underwritten, non-UTM rights issues. This result suggests that there is a negative relationship between trading volumes and returns which exists only for non-underwritten, UTM rights issues. This unusual relationship is

consistent with Gallagher, Gardner and Swan (2009) who document a negative relationship between liquidity and daily returns.

5.5 Proportion of UTM rights issues closing ITM

In this section, we utilise a different method to isolate the impact an underwriter has on UTM rights issues. We examine the proportion of UTM rights issues which close ITM on the closing date. As UTM is determined on a daily basis depending on the previous day's closing price, a list of UTM rights issues is compiled for each day. Using this list of UTM issues, we determine the proportion of underwritten and non-underwritten UTM rights issues that successfully close ITM. Analysing the differences in proportions of underwritten and non-underwritten UTM rights issues that close ITM provides evidence on the effects of underwriting. The same test is performed for DOTM rights issues which act as a control group.

Results in Panel A of Table 6 shows that for UTM issues, a larger proportion of underwritten, rights issues close ITM compared to those which are non-underwritten. This finding is robust to alternative definitions of UTM, ranging from event date [-2] to [-10]. On average, 8.5% more underwritten rights issues close ITM as compared to non-underwritten issues. This difference is significant for five out of ten of the UTM samples. However, if a rights issue closes UTM on the day immediately prior to the closing date, it is much less likely that such an underwritten rights issue will close ITM. This finding indicates that potentially manipulative trading likely occurs in the days leading to the close, and does not extend to the closing date. As the deadline for rights issue applications is typically one hour after the close, manipulation on the closing day may not provide shareholders sufficient time to respond.

42.7% of rights issues which are UTM on day [-10] close ITM. This proportion steadily decreases, where only 15.8% of underwritten rights issues which are UTM on day [-1] close ITM. A similar decreasing trend is observed for non-underwritten rights issues. This suggests that with more time available to manipulation, underwriters are better able to ensure issues close ITM. Rights issues which are defined as UTM on event day [-10] have a longer duration of trading for the share price to close ITM. Because of the incentives to manipulate UTM rights issues, this increases the probability of these rights issues closing ITM.

Since the underwriter manipulation model predicts that rights issues which are DOTM are less likely to be manipulated as the cost of doing so is higher, the proportion of rights issues that close ITM should be similar for both underwritten and non-underwritten issues. Panel B shows that there is no significant difference in the proportion of DOTM rights issues (either underwritten or not) which close ITM on the closing date. This is consistent with reduced incentives to manipulate DOTM rights issues due to the increased cost of ensuring they close ITM. Overall, this shows that underwriters increase the closing prices of rights issues, with this effect being highly dependent on the moneyness of the rights issue.

Table 6

Proportion of UTM and DOTM rights issues which close ITM on the closing date

Table 6 documents the proportion of underwritten and non-underwritten UTM and DOTM rights issues which close ITM on the closing date. The *event date* indicates the trading day relative to the closing date, in which the rights issue closes UTM / DOTM. *n* shows the number of rights issues on each event date. *Underwritten* and *Non-underwritten* describes the proportion of underwritten and non-underwritten rights issues which close ITM on the closing date. *Difference* describes the difference between the underwritten and non-underwritten proportions where ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively, while *P-Value* shows the p-value of the Chi-Squared test statistic for the difference in proportions.

Panel A: Under the Money (UTM)					
Event Date	*n*	*Underwritten*	*Non-Underwritten*	*Difference*	*P-Value*
-10	269	0.427	0.333	0.093	0.116
-9	283	0.403	0.299	0.104*	0.066
-8	308	0.414	0.291	0.123**	0.024
-7	305	0.376	0.263	0.113**	0.034
-6	322	0.351	0.278	0.073	0.162
-5	328	0.341	0.277	0.064	0.214
-4	341	0.332	0.232	0.100**	0.043
-3	341	0.281	0.218	0.063	0.181
-2	332	0.239	0.142	0.097**	0.026
-1	328	0.158	0.134	0.024	0.537

Panel B: Deep Out of the Money (DOTM)					
Event Date	*n*	*Underwritten*	*Non-Underwritten*	*Difference*	*P-Value*
-10	161	0.205	0.141	0.064	0.286
-9	157	0.179	0.137	0.042	0.478
-8	151	0.141	0.123	0.018	0.748
-7	161	0.119	0.156	-0.037	0.497
-6	164	0.155	0.138	0.017	0.755
-5	164	0.133	0.123	0.009	0.862
-4	166	0.123	0.118	0.006	0.908
-3	161	0.158	0.129	0.028	0.606
-2	160	0.040	0.094	-0.054	0.606
-1	162	0.036	0.051	-0.014	0.650

5.6 Broker excess buy volumes and trades

Comerton-Forde and Putniņš (2010) find that large orders submitted before the close are often able to create enough price impact to increase the share price. Examining underwriter trades, it is possible to determine if they are aggregate buyers or sellers, and if these buy trades increase the share price. Out of 1,283 underwritten rights issues, 429 have an underwriting broker. We identify underwriting brokers who trade as those with a minimum of one buy trade in the ten days prior to the closing date. 200 issues are removed due to non-trading, leaving a final sample of 229 issues with underwriting brokers.

As all trades are tagged with a buyer and seller PID, both the frequency and volume of an individual brokers' trading behaviour can be observed. To examine if brokers exhibit abnormal buying activity in rights issues they are underwriting, Chordia, Roll and

Subrahmanyam's (2002) order imbalance metric is adapted to provide a trading volume imbalance metric:

$$P(Vo_{u,t}) = \frac{Vol^{B}_{u,t} - Vol^{S}_{u,t}}{Total\ Volume_{i,t}} \tag{8}$$

where for rights issue *i,* underwriting broker *u* and event day *t,* $Vol^{B}_{u,t}$ represents the total volume of buyer-initiated, cross trades and auctions in which the buyer broker PID matches the underwriter's PID. In rights issues with more than one underwriter, both the lead and sub-underwriter's buy trades are considered. $Vol^{S}_{u,t}$ is calculated the same way for trades in which the seller broker PID matches the underwriter's. $Total\ Volume_{i,t}$ represents the total volume of trades conducted on day *t* by all brokers. If an underwriting broker exhibits excess buying, the trading volume imbalance metric will take a positive value, with a negative value indicating excess selling behaviour. An underwriting broker with a higher trading imbalance is more likely to be manipulating the price.

As it costs less to consume the ask-side depth of the order book for less liquid stocks, the incentive for manipulation increases when liquidity is low. This is shown by Gallagher, Gardner and Swan (2009) who find that movements in share price are negatively related to liquidity. This implies that large trading volume is not a pre-requisite for manipulation. As a form of robustness, the frequency of broker trades is also analysed using the trading frequency imbalance metric shown below:

$$P(Freq_{u,t}) = \frac{NTrade^{B}_{u,t} - NTrade^{S}_{u,t}}{To \quad Number\ of\ Trades_{i,t}} \tag{9}$$

where for underwriting broker *j* on event day *t,* $NTrade^{B}_{u,t}$ represents the total number of trades where the buyer PID matches the underwriter's PID, and vice versa for sell trades. $Total\ Number\ of\ Trades_{i,t}$ measures the sum of total trades on day *t.*

To examine if underwriters display abnormal trading behaviour for UTM rights issues, the following specification is run:

$$P(Vol_{u,t}) = \beta_0 + \beta_1 I(UTM_{i,t}) + \beta_2 Lag\ Moneyness_{i,t} + \sum_{c=1}^{9} Controls_{i,t,c} + \varepsilon_{i,t} \qquad (10)$$

where for underwriting broker *u*, rights issues *i* on event day *t,* $P(Vol_{u,t})$ represents the trading volume imbalance metric*,* $I(UTM_{i,t})$ and $Lag\ Moneyness_{i,t}$takes the same definition as in equation (6). For this regression, the sample is limited to rights issues with *Lag Moneyness* values less than zero. This allows me to examine the difference in trading imbalances for UTM rights issues as compared to DOTM rights issues. To analyse imbalances in trading frequencies, the dependent variable in equation (10) is replaced by the trading imbalance metric, $P(Freq_{u,t})$.

In accordance to hypothesis H3, we expect UTM rights issues to be associated with excess buying volume and trades, which will be indicated by a positive and significant *I(UTM).* The results are shown in Table 7. Underwriting brokers engage in significant buying activity in the five days before the closing date, and not before. If a rights issues closes OTM on day *t – 1,* in the next day of trading, underwriting brokers of UTM issues exhibit excess buying volumes 12.3% higher than DOTM rights issues. For all rights issues regardless of moneyness, the average trading volume imbalance metric of underwriting brokers is -1%. This implies that there is significant deliberate buying by underwriting brokers for UTM rights issues, which is evidence of potential trade-based manipulation. The findings are also robust when analysing the frequency of excess buying trades, with UTM rights issues experiencing on average 10.2% more buy trades (as a proportion of the daily number of trades), when compared to DOTM rights issues. This finding is consistent with Comerton-Forde and Putniņš (2011) who document that manipulators place many large sized trades with the goal of consuming the ask-side depth.

It is not possible to determine if these excess buying trades by underwriting brokers are proprietary in nature or represent client facilitation. This unusual buying activity is, however, only observed in the trading window [-4,0] for UTM rights issues, the subset of our sample most susceptible to manipulation. Foley et al. (2016) document that underwriting brokers engage in manipulative selling activity during the pricing period for DRIPs. My results provide support for their findings that underwriting brokers engage in manipulative trading behaviour when given the incentive to do so. A limitation of the results in this section is the low number of OTM observations for underwriting brokers. These results support the findings in sections 5.3 and 5.4, that underwritten rights issues experience higher abnormal trading volumes and returns in the [-4,0] window.

Table 7

Broker excess buying activity

Table 7 utilises broker trading data to analyse broker trading behaviour for stocks in which the brokers are also acting as underwriters of the rights issue. The dependent variables are the trading volume / trade imbalance metric, which represents of the difference between the underwriting broker's daily buy-initiated trading volume and his seller-initiated trading volume, as a proportion of the total trading volume for the day. All regressions control for industry and year fixed effects. Standard errors are indicated in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

Dependent Variable: Underwriting Broker Excess Buy Volumes / Trades				
Variable	Volume [-9,-5]	Volume [-4,0]	Trades [-9,-5]	Trades [-4,0]
I(UTM)	0.035	0.123**	0.022	0.102*
	(0.073)	(0.061)	(0.068)	(0.056)
Lag Tick Close	0.010	-0.010	0.005	-0.009
	(0.008)	(0.007)	(0.008)	(0.006)
I(Renounceble)	-0.066	0.008	-0.028	0.030
	(0.087)	(0.050)	(0.081)	(0.045)
I(Options)	-0.085	0.078	-0.087	0.051
	(0.149)	(0.091)	(0.138)	(0.083)
Discount Rate	-1.013***	-0.114	-0.785***	-0.098
	(0.307)	(0.152)	(0.285)	(0.139)
Ratio Of Equity Raised	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted Amihud	8390	13819**	5667	5546
	(7108)	(6076)	(6589)	(5551)
Shares On Issue	0.000**	-0.000	0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Event Day	-0.012	0.035**	-0.006	0.023*
	(0.016)	(0.013)	(0.014)	(0.012)
Log Market Capitalisation	0.002	0.059**	0.011	0.027
	(0.049)	(0.023)	(0.045)	(0.021)
Log Issue Size	-0.021	-0.041	-0.002	0.009
	(0.078)	(0.046)	(0.072)	(0.042)
Constant	-10.282**	-0.757	-6.904*	-0.946
	(4.356)	(0.673)	(4.038)	(0.614)
Sample	Lag Moneyness < 0	Lag Moneyness < 0	Lag Moneyness < 0	Lag Moneyness < 0
Number of Observations	106	105	106	105
Adjusted R-Squared	13.8%	5.6%	14.6%	10.2%

5.7 Returns relating to broker excess buy trades

A limitation in examining broker trades is that there is no delineation between broker trades which are proprietary or for client facilitation. Amihud, Mendelson and Pedersen (2012) document that trading in illiquid conditions results in a large price impact, significantly increasing transaction costs. It is likely that retail investors will avoid trades with such large price impacts. In contrast, Comerton-Forde and Putniņš (2011) find that a large price impact is desirable for manipulators who seek to inflate prices. To examine if

these imbalances in underwriting broker buying result in a significant price impact, a regression controlling for industry and year fixed effects is run:

$$Returns_{i,t} = \beta_0 + \beta_1 P(Vol_{u,t}) + \beta_2 I(UTM)_{i,t} + \beta_3 LagMoneyness_{i,t} + \sum_{c=1}^{9} Controls_{i,t,c} + \varepsilon_{i,t} (11)$$

where for underwriting broker *u,* rights issue *i,* on trading day *t,* $Returns_{i,t}$ represents the daily returns in percentage. $P(Vol_{u,t})$ represents the trading volume imbalance metric of the underwriting broker *u*, for rights issue *i*. Other control variables are as previously described. For robustness, $P(Freq_{u,t})$, which represents the trading frequency imbalance metric is also analysed to determine if excess broker buy trades are associated with higher returns.

Table 8 shows that the two metrics of trading imbalances are significantly associated with higher returns throughout both trading windows. Significance of $P(Vol_{u,t})$ implies that excess broker buy volumes do result in a significant price impact on the underlying security. An increase of 10% in the proportion of excess broker buy volumes is associated with an increase in daily returns of 0.34% on average across the

Table 8

Relationship between broker excess buying activity and returns

Table 8 shows the relationship between underwriting broker excess buying activity and daily returns. The independent variables P(Vol) and P(Freq) represent the excess buyer initiated volumes / trades of the underwriting broker as a proportion of the daily trading volume / trades respectively. All regressions control for industry and year fixed effects. Huber-White robust standard errors are indicated in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

Dependent Variable: Daily Returns in Basis Points				
Variable	Event [-9,-5]	Event [-4,0]	Event [-9,-5]	Event [-4,0]
P(Vol)	3.637***	3.246***		
	(0.972)	(0.829)		
P(Freq)			4.738***	3.690***
			(1.200)	(0.957)
I(UTM))	2.561***	2.078***	2.516***	2.086***
	(0.000)	(0.708)	(0.638)	(0.709)
Lag Moneyness	-0.070***	-0.056***	-0.070***	-0.055***
	(0.019)	(0.015)	(0.019)	(0.015)
I(Renounceble)	-1.412*	0.685	-1.373*	0.712
	(0.762)	(0.461)	(0.760)	(0.462)
I(Options)	0.369	0.472	0.405	0.458
	(0.587)	(0.687)	(0.585)	(0.692)
Discount Rate	1.831	2.094	1.854	2.066
	(1.522)	(2.125)	(1.516)	(2.125)
Ratio Of Equity Raised	0.000**	0.000	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted Amihud	-42896	21946	-43091	21792
	(88748)	(73237)	(88730)	(73305)
Shares On Issue	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Event Day	0.219	0.213	0.217	0.210
	(0.184)	(0.147)	(0.184)	(0.147)
Log Market Capitalisation	0.900**	0.577**	0.898**	0.570**
	(0.398)	(0.237)	(0.397)	(0.237)
Log Issue Size	-1.074	-0.509	-1.080	-0.501
	(0.801)	(0.361)	(0.800)	(0.361)
Constant	18.262***	-2.188	18.301***	-2.139
	(5.236)	(5.606)	(5.232)	(5.603)
Sample	Underwriting Broker	Underwriting Broker	Underwriting Broker	Underwriting Broker
Number of Observations	1732	1718	1732	1718
Adjusted R-Squared	2.5%	4.1%	2.6%	4.1%

[-9,-5] and [-4,0] trading windows. As the composition of the trading volume imbalance metric consists only of buyer initiated trades by the underwriting broker, these buyer initiated trades have the effect of consuming the ask-side depth of the order book.

Given that the average trading volume imbalance metric for all underwriting brokers in the sample represents just 1% of the daily trading volume, the significance of the results

imply that underwriting brokers' trades are associated with a significant price impact. As underwriter excess buying result in significant price impacts, it is likely that these trades do not represent client facilitation, but are proprietary in nature. The results in this section also demonstrate that underwriting brokers have the means to positively influence the price of the underlying security by exerting excess buying pressure.

Lag Moneyness is negative and significant for both trading windows; this implies that rights issues with lower closing prices relative to the issue price are associated with higher returns. An explanation for this result is that if a rights issue is already trading ITM, returns are lower as there is little incentive to increase prices further. This result supports the findings in section 5.1, where we show that an increase in moneyness beyond the issue price is not associated with an increase in take-up rates.

5.8 Robustness tests

The robustness of the findings are tested using a number of alternate specifications. A key variable in this study is *I(UTM)*. The range of moneyness values between -1 to -5 ticks is selected to provide a balance between rights issues which are just UTM and have a greater incentive of being manipulated, as well as having sufficient number of observations. For robustness, a new variable 'near the money' (NTM) is introduced where *I(NTM)* is an indicator variable which takes a value of one for rights issues with a one day lag moneyness value between -1 and -3 ticks, and zero otherwise. To examine if the results are robust to a stricter definition of UTM, the regression as specified by equation (5) is run with the new term *I(NTM)* replacing *I(UTM)*. Equation (5) analyses if underwritten, NTM rights issues are associated with an increase in abnormal trading volumes.

Table 9

Abnormal trading volumes of NTM rights issues

In Table 9, UTM is replaced by the indicator variable I(NTM), which takes a value of one for rights issues with a one-day moneyness lag value of between -3 and -1, and zero otherwise. The dependent variable, abnormal scaled volume, measures the difference in daily trading volume and clean trading volume, as a percentage of the number of shares on issue. All regressions control for industry and year fixed effects. Huber-White robust standard errors are indicated in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

	Dependent Variable: Abnormal Scaled Volume			
Variable	Event [-9.-5]	Event [-4,0]	Event [-9.-5]	Event [-4,0]
*I(NTM)*I(Underwriter)*	-0.001	0.281**	-0.001	0.280**
	(0.067)	(0.112)	(0.066)	(0.111)
I(NTM)	0.021	-0.359***	0.057	-0.320***
	(0.053)	(0.099)	(0.055)	(0.097)
I(Underwriter)	0.090***	0.076***	0.085***	0.073***
	(0.034)	(0.024)	(0.031)	(0.028)
Lag Moneyness	0.000	0.000	0.001*	0.000
	(0.000)	(0.000)	(0.001)	(0.000)
I(Renounceble)			0.059**	0.023
			(0.026)	(0.024)
I(Options)			0.018	0.017
			(0.032)	(0.042)
Discount Rate			0.017	0.019
			(0.063)	(0.050)
Ratio Of Equity Raised			0.000	0.000
			(0.000)	(0.000)
Adjusted Amihud			-0.240	-0.756
			(0.731)	(0.802)
Shares On Issue			-0.000**	-0.000**
			(0.000)	(0.000)
Event Day			0.026***	-0.002
			(0.009)	(0.008)
Log Market Capitalisation			0.062***	0.083***
			(0.023)	(0.025)
Log Issue Size			-0.070***	-0.097***
			(0.026)	(0.026)
Constant	-0.025	0.003	-0.269	-0.498
	(0.037)	(0.043)	(0.339)	(0.332)
Number of Observations	10317	10324	10132	10139
R-Squared	1.5%	2.2%	2.2%	3.0%

Table 9 shows the results of changes to abnormal trading volumes for rights issues which are NTM. Consistent with the regression results for UTM in Table 4, underwritten, NTM rights issues experience significantly higher abnormal trading volumes in the trading window [-4,0]. This implies that a large portion of the abnormal trading volumes are driven by rights issues in the NTM range and that the results are robust to a different definition of UTM.

We also test the robustness of the results for individual event days. Our findings consistently indicate that signs of manipulative trading occur during the window [-4,0] only, and is not present in the [-9,-5] window. To test the robustness of these findings, we breakdown these two trading windows into ten individual trading days spanning [-9] to [0]. We run regression (5) to test for significance of *I(UTM)*Underwriter* on each trading day. This test analyses if underwritten, UTM rights issues are associated with an increase in abnormal trading volumes for the ten individual trading days prior to the closing of the rights issue.

The results of this test are presented in Table 10. Panel A shows the results for the event days from [-9] to [-5]. Underwritten, UTM rights issues are not found to experience higher abnormal trading volumes on each event day between [-9] to [-5]. On the contrary, *I(UTM)*Underwriter* is negative on event day [-8], indicating that underwritten, UTM issues experience on average 20.1% less abnormal trading volume compared to non-underwritten, non-UTM issues. Positive coefficients on *I(UTM)*Underwriter* for only three of the five days suggests that there is little consistency in underwriter trading behaviour during this period. This result supports our findings that signs of manipulation are not present in the trading window [-9.-5].

Table 10

Changes in abnormal trading volume by event days

Table 10 analyses changes in abnormal trading volumes for the individual event days. Panel A consists of event days between [-9] to [-5], while Panel B shows the results for event days [-4] to [0]. The dependent variable measures the difference in daily trading volume and clean trading volume, as a percentage of the number of shares on issue. The indicator variable I(UTM) takes a value of one if the previous day's closing price is between -1 to -5 ticks from the issue price, and zero otherwise. All regressions control for industry and year fixed effects. Standard errors are indicated in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

Panel A: Event Days Between [-9] to [-5]					
Dependent Variable: Abnormal Scaled Volume					
Variable	Event [-9]	Event [-8]	Event [-7]	Event [-6]	Event [-5]
*I(UTM)*I(Underwriter)*	0.056	-0.201*	0.053	-0.038	0.107
	(0.212)	(0.119)	(0.133)	(0.072)	(0.133)
I(UTM))	-0.107	0.147	0.075	0.141*	-0.030
	(0.212)	(0.115)	(0.075)	(0.085)	(0.092)
I(Underwriter)	0.054	0.090	0.106	0.157**	0.083
	(0.058)	(0.078)	(0.065)	(0.072)	(0.051)
Lag Moneyness	0.001	-0.000	0.004	0.000	0.001*
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
I(Renounceble)	0.103	0.033	0.057	0.024	0.043
	(0.085)	(0.046)	(0.051)	(0.049)	(0.056)
I(Options)	0.005	0.003	-0.005	-0.004	0.093
	(0.067)	(0.073)	(0.064)	(0.068)	(0.080)
Discount Rate	-0.346	0.111	-0.005	0.208	0.029
	(0.203)	(0.143)	(0.134)	(0.126)	(0.089)
Ratio Of Equity Raised	-0.000	0.000	-0.000**	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted Amihud	-0.598	-0.338	-0.187	1.281	0.339
	(1.472)	(1.445)	(1.395)	(1.688)	(1.294)
Shares On Issue	-0.000	-0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log Market Cap	0.070	0.077	0.051	0.117**	0.015
	(0.049)	(0.056)	(0.050)	(0.051)	(0.032)
Log Issue Size	-0.067	-0.064	-0.060	-0.176***	-0.055*
	(0.041)	(0.044)	(0.048)	(0.048)	(0.032)
Constant	-0.523	-0.920	-0.370	-0.172	0.385
	(0.879)	(0.818)	(0.776)	(0.693)	(0.432)
Number of Observations	2028	2025	2026	2026	2027
R-Squared	6.2%	3.3%	10.4%	26.8%	10.4%

Table 10 (Continued)

Changes in abnormal trading volume by event days

Panel B: Event Days Between [-4] to [0] Dependent Variable: Abnormal Scaled Volume					
Variable	Event [-4]	Event [-3]	Event [-2]	Event [-1]	Event [0]
*I(UTM)*I(Underwriter)*	0.384***	0.103	0.349**	0.433***	0.089
	(0.111)	(0.204)	(0.178)	(0.157)	(0.157)
I(UTM))	-0.362***	-0.075	-0.425***	-0.383***	-0.220**
	(0.083)	(0.157)	(0.135)	(0.119)	(0.116)
I(Underwriter)	0.009	0.119	0.085	0.058	0.080
	(0.047)	(0.087)	(0.077)	(0.067)	(0.067)
Lag Moneyness	0.000	0.001	0.000	0.000	0.001
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
I(Renounceble)	0.050	0.015	0.027	0.011	0.028
	(0.051)	(0.095)	(0.084)	(0.073)	(0.072)
I(Options)	0.034	0.017	-0.028	0.062	-0.008
	(0.061)	(0.114)	(0.085)	(0.086)	(0.086)
Discount Rate	-0.030	0.079	0.014	0.029	0.040
	(0.093)	(0.173)	(0.151)	(0.131)	(0.130)
Ratio Of Equity Raised	0.000	-0.000***	0.000	0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted Amihud	-0.307	-0.269	-2.562	0.121	-0.928
	(9.332)	(17.312)	(15.223)	(13.213)	(13.185)
Shares On Issue	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log Market Cap	0.078***	0.063**	0.087***	0.102***	0.089***
	(0.015)	(0.028)	(0.025)	(0.035)	(0.022)
Log Issue Size	-0.080***	-0.085*	-0.087**	-0.136***	-0.087**
	(0.025)	(0.046)	(0.040)	(0.035)	(0.035)
Constant	-0.616	-0.271	-0.572	-0.371	-0.818
	(0.571)	(1.058)	(0.930)	(0.807)	(0.806)
Number of Observations	2027	2027	2028	2028	2029
R-Squared	5.4%	5.6%	3.0%	11.5%	4.1%

Panel B shows the results for the events days from [-4] to [0]. Underwritten, UTM rights issues experience higher abnormal trading volumes on event days [–4], [-2] and [-1]. The fact that all the coefficients are positive and that three of the five days before the close show strong significance is an indication that the observed effect is present and is not driven by one particular event day. However, a crucial observation from this result is that this effect is not significant on the closing day. This result supports the findings in Table 6 that for

rights issues which are UTM on event day [-1], the proportion of underwritten rights issues closing ITM is no different from non-underwritten rights issues. A possible reason for this behaviour is that shareholders have typically until 5pm to submit their applications, given that the ASX closes at 4pm, most shareholders will likely have subscribed for their rights before the closing date. This would explain why manipulation in rights issues is observed in the days leading up to the closing date, but not on the closing date itself.

6. Conclusion

We develop an underwriter manipulation model, which demonstrates that there are incentives for underwriters to manipulate the closing prices of rights issues which are trading just below the issue price. Analysis of take-up rates reveal that underwritten rights issues experience a sharp increase in take-up rates when an issue closes at or above its issue price. Any further increase in closing prices beyond the issue price has an insignificant effect on take-up rates for underwritten rights issues. In contrast, take-up rates for non-underwritten rights issues continue to increase with moneyness. Incentivised by higher take-up rates, underwriters may inflate the closing price of UTM rights issues. Using a RDD framework, we find a significantly larger proportion of underwritten rights issues closing at the issue price as compared to just below it, which is consistent with underwriter price manipulation. In contrast, for deals with no underwriter, we do not observe similar patterns in price behaviour.

Our findings are consistent with studies of closing price manipulation such as Carhart et al. (2002), Comerton-Forde and Putniņš (2011), and Hillion and Suominen (2004). We find that underwritten, UTM rights issues display higher levels of abnormal trading volumes and daily returns in the five days preceding the closing date of rights issues. My results show that during this trading window, underwritten, UTM rights issues experience on average 26% higher

abnormal trading volumes and 1.1% higher daily returns as compared to non-underwritten, non-UTM rights issues. This increase in abnormal trading volume and returns is not present in the trading window [-9.-5], indicating that these signs of price manipulation occur only in the five days immediately prior to the closing date.

We further exploit broker level data to determine if underwriting brokers are responsible for the excess trading volumes. We find that underwriting brokers engage in significant buying activity for UTM rights issues during the trading window [-4,0], increasing their excess buying volume by an average of 12.3%. This effect is not present in the trading window [-9,-5], nor in DOTM rights issues. The trading imbalance metric is constructed using buyer-initiated trades, such that excess buying by underwriting brokers has the effect of consuming the ask side depth. We find that abnormal trading activity of underwriting brokers result in a significant price impact. These results support the findings of Foley et al. (2016), who document that underwriting brokers engage in unusual selling activity during the pricing period in DRIPs, when they have an incentive to reduce prices. This finding is consistent with underwriting brokers actively engage in abnormal trading activity to increase the profitability of their underwriting activities.

The results are robust to a number of alternate specifications, including using an abnormal trading frequency metric, a narrower definition of UTM, as well as examining the manipulative conduct for each event date. A consistent finding is that manipulation in rights issues occurs predominantly during the five days before the closing date. However, our results indicate that signs of manipulative trading are not present on the closing date itself. This presents a key difference between the manipulation of rights issues and the types of closing price manipulation previously documented. In 'typical' closing price manipulation, the effects are localised in the last half hour (Carhart et al. 2002) or in the last minute before the close (Comerton-Forde and Putniņš 2011). This is because the payoff of derivatives and

mutual fund performance depend on the closing price on a pre-determined date. As the payoff for underwriters in a rights issue is determined by the take-up rate, sufficient time must be provided for shareholders to process changes in price and to submit their rights applications. For this reason, manipulation in rights issues typically spans across a period of time before the closing date itself.

A caveat to the findings is that the data does not enable the differentiation between broker trades which are proprietary in nature or represent client facilitation. It is possible that the increase in broker buying activity is driven by retail traders who purchase UTM rights issues for speculation. However, Amihud, Mendelson and Pedersen (2012) document that a large price impact results in significant transaction costs, while Comerton-Forde and Putniņš (2011) argue that price impacts are favoured by manipulators. My findings show that a 10% increase in the proportion of excess broker buy volumes correspond to a significant increase in returns of approximately 0.32%. The price impact caused by excess broker buying trades suggest that these trades are likely proprietary in nature (and hence manipulative) as retail traders typically avoid incurring such large transaction costs.

Our findings have strong implications for companies, exchanges and regulators. My findings show that companies who choose to underwrite their rights issues are not only guaranteed a minimum amount of capital raised, but because of the underwriter's trading behavior, they are likely to achieve a higher take-up rate. This reflects a hidden benefit in underwriting which companies should consider for future rights issuances. Currently, there are no restrictions on underwriters trading in companies which they are underwriting. The findings may prompt exchanges to require underwriting brokers to declare their trades, in the same way insiders are required to do so. Manipulation also negatively affects pricing accuracy and liquidity, which according to Comerton-Forde and Putniņš (2011), are two

fundamental aspects of market quality. Hence, these findings also have implications for regulatory authorities who seek to maintain fair and transparent markets.

Further research into the trading behavior of directors or institutional shareholders would provide additional insights. We document that for non-underwritten rights issues, take-up rates continue to increase with moneyness, providing company insiders with an incentive to achieve higher moneyness for non-underwritten rights issues. Analysing the trading behavior of directors or institutional shareholders of non-underwritten rights issues will determine if such an effect exists for non-underwritten rights issues. As Ahern and Sosyura (2014) argue, firms have an incentive to time the release of announcements to coincide with important events. A further area of research could incorporate the analysis of news announcements around the closing date of rights issues. The strategic release of company announcements provides firms with a form of non-trade based manipulation to influence stock prices around the closing date.

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