Value Uncertainty, Price Impact and The Choice of the Equity Issuing Method

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Abstract

We develop a model for the choice of the equity issuing method, where the major determinants of the choice are 1) over- and undervaluation of shares and 2) the price impact from selling shares in the market. The price impact is larger for rights issues than for public offerings, as in the latter case the investment bank through its marketing effort attracts new investors to the market, which reduces the price impact. The model makes new predictions and accounts for several previously observed patterns around seasoned equity offerings. Our empirical tests using European data provide support for the model's predictions.

Key words: Dispersion, price impact, equity issuing method, long-run returns

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Introduction

In this paper we develop a model for the choice of the equity issuing method: the choice between rights vs. public cash offerings. In our model, the major determinants of this choice are 1) over- and undervaluation of shares and 2) the price impact from selling shares in the market. We argue that the price impact is larger for rights issues than for public equity offerings, as in the latter case the investment bank through its marketing efforts attracts new traders to the market, which reduces the price impact. Because of this, when investors are risk averse, rights issues occur only when companies are undervalued.[1] To our knowledge we are the first ones to formally argue that price impact is a major determinant in the choice of the equity issuing method.

The model rests upon two main assumptions: First, we assume limited market participation, so that only a limited number of investors are present in the market at the time of the equity issue. Because of this, as investors are risk-averse, there is a price impact from selling shares. Second, we assume that investors have differences in opinion along the lines of Harris and Raviv (1993) to the extent that they also under-react to public signals as in Daniel, Hirshleifer and Subrahmanyam (1998). Under the second assumption, market values companies incorrectly, allowing rational companies to benefit from possible misvaluations, by being opportunistic in their choice of the equity issuing method. In our model, companies finance their new investments by public equity offerings when being overvalued and by rights offerings to existing shareholders when being undervalued.

The model can account for several observed phenomena around equity offerings, for instance, the poor long-run returns following public equity offerings. This phenomenon has been documented *e.g.*, in Loughran and Ritter (1995) and Baker and Wurgler (2000). Behavioral explanations similar to ours have been proposed as a reason for these poor long-run returns, see *e.g.,* Herzel and Li (2007). The idea that differences in opinion leads to overvaluation was originally presented in

Miller (1977) and it has been proposed also as a reason for the poor long-run returns following Initial Public Offerings (see Houge *et al*., 2001). Besides being consistent with the negative long-run returns following public equity offerings, our model explains the positive run-up to such offers (see *e.g.*, Korajczyk *et al.,* 1992). More surprisingly, the model predicts that there is a smaller run-up to rights offerings (empirically documented below) followed by positive long-run returns (documented below). An additional prediction is that these patterns are more pronounced when there is large uncertainty about the fair value of the stock. Our model makes also additional predictions about the types of firms selecting rights offerings.

The intuition behind our results regarding long-run returns is simple: When there is value uncertainty, there is possible under- and overvaluation of shares, which affects the company's choice of the issuing method. When companies have become overvalued (price run-up) they issue equity to outsiders using the public offering method. This implies a long-run underperformance following such public equity offers as the true value is eventually revealed. When companies have become undervalued (possible price run-down), but have a positive NPV project, they issue equity using the rights offering method, as public offers would then be more costly to existing shareholders due to the undervaluation of the shares. As the true value is eventually revealed, the long-run returns following rights issues are positive. When there is no value uncertainty, and hence shares are fairly valued, such differences in price patterns before or after equity offerings do not exist.

In the empirical part of the paper we analyze all equity issues of the STOXX 600 firms, *i.e.*, the largest publicly traded European firms, between 1992 and 2006. We focus on European companies as in contrast to the US, in Europe rights issues are relatively common, see Eckbo and Masulis, 1992. Our empirical results strongly support the predictions of the theoretical model. The empirical part completes the empirical literature on the stock price run-ups and the long-run returns following

different types of stock offerings, described *e.g.* for the case of the Norwegian markets in Eckbo and Norli (2004), by doing a comprehensive study on the long-run returns around equity issues of the largest European firms. Secondly, we document the effect of value uncertainty on these phenomena and the frequency of rights offerings. A critical variable in the theoretical model is value uncertainty. In the empirical part we proxy value uncertainty with the dispersion in analysts' earnings per share forecasts.

The main new empirical findings are: First, we find evidence of a price impact from selling shares in both types of equity offerings, but that the price impact is both larger and longer lasting in the case of rights offerings. Second, the negative long-run returns following seasoned public equity offerings occur only for companies that have high value uncertainty, *i.e.*, a high dispersion in their analysts' forecasts. Third, firms that both complete a rights offering and have a high value uncertainty experience a price run-down, followed by large post issue abnormal returns. The latter result shows that high dispersion (our measure of value uncertainty) can also lead to positive future abnormal returns in contrast to the findings in Diether *et al.* (2002). These findings on the price patterns around rights issues are particularly important as they are inconsistent with the recently proposed rational real options based theory of equity offerings, see Carlson *et al.* (2006).[2] Fourth main empirical finding is that the frequency of rights issues increases in value uncertainty. Finally, we find that companies with large value uncertainty sell a larger fraction of their shares in equity offerings compared to other firms.

The paper is organized as follows. In section I we present the theoretical model. In section II, after presenting the data in subsection A, we document our empirical results in subsections B-E. In subsection B we look at the price impact, in subsection C the frequency of rights issues, in subsection D the returns around public equity offerings, while in subsection E the evidence

regarding the returns around rights offerings. In subsection F we look at the relation between value uncertainty and offer size. Section III concludes the paper. All proofs are collected in the Appendix.

I. The Model

A. The basic set-up

Agents and the initial assets

The agents in our model are: one company, large number of competitively behaving investors and two investment banks with analysts α and β. The investors rely on the two analysts, $i \in \{\alpha,\beta\}$, for their information about the fair value of the company's assets. The amount of investors who follow each of the two analysts is initially equal to n. The investment banks may, through marketing, increase the number of investors following their analyst to $n + m$, where $m > 0$. There are two assets: the company's stock and a risk free asset, whose return is normalized to zero. The risk free asset is available only to the investors.[3]

There are six periods $t \in \{0,1,2,3,4,5\}$. We assume that at $t = 0$, the company has completed an Initial Public Offering (IPO) to investors, to finance its initial investments. The total proceeds from this IPO were equal to the purchasing price of its initial assets $\underline{A}$. These initial assets of the firm have a random per share payoff equal to A in period $t = 5$.

The two analysts observe a signal S of A in period $t = 1$, where S is uniformly distributed between one and minus one:

$$S \sim u[-1,1].$$

For simplicity, we assume that the signal is perfect, so that $A = \underline{A} + S$. The two analysts cannot trade themselves, but make recommendations to their investors based on the signal that they have observed. As in Harris and Raviv (1993), they are overconfident about their own ability to interpret the signal and, in fact, typically interpret the signal incorrectly. In particular, they believe that the payoff to initial assets is $A = \underline{A} + \theta_i S$. Analyst α underweights the signal compared to analyst β so that

$$\theta_\beta = \theta_\alpha + \Delta,$$

where $1 > \Delta > 0$. We assume that θ_α, realized at $t=1$, is uniformly distributed along 0 and $2 - \Delta$ and θ_β is thus uniformly distributed along Δ and 2. Analyst β thus on average overweights the signal while analyst α underweights it. Given this structure, the dispersion in analyst forecasts is:

$$\text{Dispersion (Value Uncertainty)} = D = \Delta \left| S \right|.$$

We assume that investors are risk averse and have a constant absolute risk aversion:

$$U = -exp\ (-W), \tag{1}$$

for their period $t = 5$ wealth, W.

Project and equity offering

At $t = 1$, with probability $p < 1$, the company obtains a new investment project, which requires one unit of additional cash. Whether the company has such a project or not is public information. If it does, it needs to finance the project by issuing additional equity to investors. The net present value

(NPV) from the project equals $N + \varepsilon$, where $N > 0$ and ε is a normally distributed random variable with zero mean and variance σ^2. At the time of the equity issue, ε is unobservable to the company and the investors.

At $t = 1$, the company observes also the signal S, interprets it correctly, and at $t = 2$ makes a decision whether to issue equity in the market. Its objective is to maximize the payoff to its existing shareholders (as in Myers and Majluf, 1984). If the company does issue equity, it can choose between two types of equity issues: Public Offering (*PO*) and Rights Offering (*RO*). In a rights offering the shares are sold to the firms' existing n shareholders, in a public equity offering the investment bank markets the offer more widely so that m additional investors become aware of (and participate in) the equity offering. Denote the cost of a public offering to the firms' existing shareholders by C_p and the cost of a rights offering by C_r. We assume that $N > max\{C_p, C_r\}$, so that all firms that have a project complete an equity issue.[4]

Timing

Timing is as follows:

0. Company sells its equity to investors in an IPO at a price $\underline{A}$.
1. Company and investors observe if there is an investment opportunity. S, θ_A, θ_B are realized.
2. The company decides whether to issue one unit of equity and if so, the type of its equity issue. Company completes the equity issue.
3. ε is realized.
4. The payoff from existing assets, A, is observed by all agents.
5. A and the final payoff from the investment, $1 + N + \varepsilon$, are distributed to the shareholders.

Equilibrium concept and further assumptions

An equilibrium exists when 1) the stock price in all periods is determined through competitive trading, 2) all players correctly anticipate the current and future strategies of players, 3) the actions of the investors maximize their payoff given their beliefs, 4) the period t actions of the company's management maximize the payoff to its beginning of period t investors and 5) investors believe that they break even.

Before proceeding we make some simplifying assumptions. First, assume that short selling is prohibited.[5] Secondly, as it does not affect our results but greatly simplifies the analysis, assume that the variance of the return from the investment, σ^2, is lower than dispersion, Δ:

$$\Delta > \sigma^2. \tag{A1}$$

As we show below, this assumption implies that the shares are always held only by the more optimistic group of investors. Let us introduce some more helpful notation: Denote by $\theta_h = argmax_{\theta_i \in \{\theta_\alpha, \theta_\beta\}} \theta_i S$ the analyst weighting on the signal that results in a higher $\theta_i S$ and by h the (more optimistic) group of investors who follow analyst h. For completeness, assume $h = \alpha$, when $S = 0$.

Assume that the amount of existing shares outstanding is one. Finally, assume that N, σ^2 and the probability p of having a project are such that the fair value of the firm at $t = 0$ is $\underline{A}$. We have now completed the description of the model and proceed to the equilibrium analysis.

B. Price impact, value uncertainty and choice of the issuing method

We consider now the case where a firm finds a positive NPV project. If the company implements the project, it must raise one unit of cash from either only the current investors (*RO*), or current and new investors (*PO*). Next, let us measure the price development and the cost of an equity issue for rights offerings and public offerings separately. For expositional reasons, although we have assumed that investors are risk averse, it is useful to first explain the price development in an equity offering if investors were risk neutral.

Price development if investors were risk neutral

At time $t=1$, the value of a company with project, if investors were risk neutral, $V_{RN,t=1}$, and thus the share price, $P_{RN,t=1,}$ would be:

$$\begin{aligned} V_{RN,t=1} &= P_{RN,t=1} \\ &= \underline{A} + \theta_h S + N + E(\varepsilon) \\ &= \underline{A} + \theta_h S + N. \end{aligned} \qquad (2)$$

This is the case as there is one share, the original value of existing assets is $\underline{A}$, the asset is held by group h, who believes that the innovation to the value is $\theta_h S$, and the firm value at this time already includes the positive NPV from the project, N. The firm would then at $t=2$ issue $1/P_{RN,t=2}$ new shares to the existing or new investors at a price $P_{RN,t=2}$ and thus raise the 1 unit of cash, which it in needs for its investment. The firm value and share price at $t = 2$ would be:

$$V_{RN,t=2} = \underline{A} + \theta_h S + 1 + N, \qquad (3)$$

$$P_{RN,t=2} = P_{RN,t=1} = V_{RN,t=2} /(1 + 1/P_{RN,t=2})$$

$$= \underline{A} + \theta_h S + N. \qquad (4)$$

Eventually as ε is realized at $t = 3$, value and price would become:

$$V_{RN,t=3} = (\underline{A} + \theta_h S + 1 + N + \varepsilon), \qquad (5)$$

$$\begin{aligned} P_{RN,t=3} &= V_{RN,t=3} /(1 + 1/P_{RN,t=1}) \\ &= (\underline{A} + \theta_h S + 1 + N + \varepsilon) /(1+1/P_{RN,t=2}) \\ &= P_{RN,t=2} + \varepsilon/(1+1/ P_{RN,t=2}). \end{aligned} \qquad (6)$$

Finally, at $t= 4$, when A is revealed and investors see that the value of the signal was S and not $\theta_h S$, company value and stock price would become:

$$V_{RN,t=4} = V_{RN,t=3} + (1-\theta_h)S, \qquad (7)$$

$$\begin{aligned} P_{RN,t=4} &= V_{RN,t=4} /(1 + 1/P_{RN,t=2}) \\ &= (\underline{A} + S + 1 + N + \varepsilon)/(1+1/ P_{RN,t=2}) \\ &= P_{RN,t=3} + (1-\theta_h)S/(1+1/ P_{RN,t=2}). \end{aligned} \qquad (8)$$

In period 5, this value would be paid to investors as a dividend.

With risk neutral investors, there would be no cost from a rights issue in our model. In a public equity offering, on the other hand, there could be a cost or benefit (negative cost in our model) to existing shareholders, depending on whether the shares sold to new investors were under- or overvalued.

Assume now that the amount of investors who hold the company's shares increases from n to $n + m$ in a public offering, due to investment banks marketing efforts to new shareholders, where $m > 0$ (this is the case in equilibrium when investors are risk averse). In this case the company would sell a fraction $m/(n+m)$ of its shares to outsiders. As the undervaluation of these shares is $(1- \theta_h)S$, the cost (benefit) of selling undervalued (overvalued) shares to outsiders would be $(1- \theta_h)Sm/(n+m)$. In our model, the company selects the equity issuing method with the lower cost. In case of risk neutrality, this would be a rights issue if

$$(1- \theta_h)Sm/(n+m) > 0, \qquad (9)$$

i.e., if the shares were undervalued. Otherwise the company would select the public equity offering method. Let us now move to the case of risk averse investors.

Price development and cost of an equity issue when investors are risk averse

With risk averse investors, the fair value that investors assign to the company's assets at time $t=1$, $V_{RA,t=1}$, is lower than that under risk neutrality, $V_{RN,t=1}$, as investors require a reward for carrying the risk associated with the investment. The discount in the price depends on the amount of investors that carry the risk and thus is different for the two types of equity offerings. Apart from period *1*, the price development looks similar to that in the case of risk neutrality, with company value when risk averse, $V_{RA,t} \equiv V_t$ and price when risk averse, $P_{RA,t} \equiv P_t$ replacing $V_{RN,t=1}$ and $P_{RN,t=1}$ in equations 3-8.

Cost of a rights issue and the price development around a rights issue

To obtain the price after the announcement of the issue we must look at the investors' problem. At $t = 2$, *i.e.,* after the realizations of S, θ_α and θ_β the investors in group h (who hold the asset in

equilibrium) maximize (1) by deciding what percentage λ of the company's market value V_2, where V_2 already includes the 1 unit of cash from the equity issue, they wish to hold, taking the market value as given.

$$\max_{\lambda} E_2 -\exp(-\lambda(\underline{A} + \theta_h S + 1 + N + \varepsilon - V_2))$$

$$= -\exp(-(\lambda(\underline{A} + \theta_h S + 1 + N - V_2) - \tfrac{1}{2}\lambda^2\sigma^2)). \qquad (10)$$

The first order condition to the maximization problem gives:

$$\lambda = (\underline{A} + \theta_h S + 1 + N - V_2) / \sigma^2. \qquad (11)$$

Setting $n\lambda = 1$, from market clearing, we obtain:

$$V_2 = \underline{A} + \theta_h S + 1 + N - \sigma^2/n. \qquad (12)$$

Now, recognizing that the number of shares at $t=2$ is $(1+1/P_2)$, gives that the price at $t = 2$ and $t = 1$ is:

$$P_2 = P_1 = V_1 = V_2 /(1+1/P_2) = \underline{A} + \theta_h S + N - \sigma^2/n. \qquad (13)$$

Here P_2 is the price cum rights.[6] We denote the difference between V_1 and the risk neutral valuation of the assets by group h as the cost of a rights issue to existing shareholders. This is equal to the price impact of risk on the value of the existing shares:

$$C_r = \sigma^2/n. \qquad (14)$$

Let us check that the assumption (*A1*) implies that all shares are in equilibrium held by the more optimistic group. Substituting for V_2, we see that the demand by the less optimistic group, given the short sales constraint and assumption (*A1*), is:

$$\lambda' = max\{0; (\underline{A} + \theta_h S - \Delta + 1 + N - V_2) / \sigma^2\} = max\{0; (-\Delta + \sigma^2) / \sigma^2\} = 0. \quad (15)$$

Similarly, as before, in periods 3 and 4 the value and prices are:

$$V_3 = V_2 + \varepsilon, \quad (16)$$

$$P_3 = P_2 + \varepsilon/(1+1/\mathrm{P}_2), \quad (17)$$

and

$$V_4 = V_3 + (1-\theta_h)S, \quad (18)$$

$$P_4 = P_3 + (1-\theta_h)S/(1+1/\mathrm{P}_2). \quad (19)$$

Cost of a public offering

In a public equity offering, the investment bank markets the offer to new investors, thus increasing the number of investors who follow its analysts to $n + m$, where $m > 0$. As the company selects the bank whose analyst has a higher value estimate, these additional m investors, in equilibrium, also purchase their share of the new issue. Similarly, as before, using the market clearing condition that $(m+n)\lambda = 1$ in equation (11) at $t = 2$, we now obtain that the value and price at $t=2$ are:

$$V_2 = \underline{A} + \theta_h S + 1 + N - \sigma^2/(n+m), \tag{20}$$

$$P_2 = P_1 = \underline{A} + \theta_h S + N - \sigma^2/(n+m). \tag{21}$$

The cost of a general cash offer to existing investors is thus:

$$C_p = (1- \theta_h)Sm/(n+m) + \sigma^2/(n+m). \tag{22}$$

The first term represents the benefit (cost) from selling overvalued (undervalued) shares. This term comes from the fact that the company sells a fraction $m/(n+m)$ of its shares to outsiders and $(1- \theta_h)S$ is the undervaluation of these shares. The second term is the price impact, which is now smaller due to a larger number of investors ($m > 0$).

It is easy to check that assumption (*A1*) implies that also in this case the shares are held only by the investors following the more optimistic of the two analysts. Value and price development post issue is similar to the previous case.

Choice of the issuing method

Firms do a public cash offer whenever

$$NPV - C_p \geq MAX\{0, NPV - C_r\}. \tag{23}$$

They do a rights offer whenever

$$NPV - C_r \geq MAX\{0, NPV - C_p\}. \tag{24}$$

Otherwise the company chooses not to issue equity.

Value uncertainty and the choice of the issuing method

Looking at equations (23) and (24), firms do a rights offer only when $C_r < C_p$. Whether this condition holds depends firstly on the number of investors the chosen investment bank can attract, m, and secondly, firm's under- and overvaluation.[7]

Proposition 1 (Issue Frequencies): *Public offerings are more common than rights offerings. Secondly, the frequency of rights offerings increases in value uncertainty, D.*

In our model, public issues dominate rights issues, unless the shares are sufficiently undervalued. Public issues are more common than rights issues firstly, as the price impact is lower and secondly, as value uncertainty typically leads to overvaluation of shares.[8] The second result in Proposition 1 can be understood by noting that due to higher price impact, rights issues can only occur if there is large enough undervaluation. Such large enough undervaluation, on the other hand, can only occur when there is large value uncertainty.

C. Value uncertainty and stock returns around equity offerings

The main results presented below are as follows: When there is value uncertainty, and the signals are misinterpreted either too positively or too negatively, the companies with projects act opportunistically and do public equity offerings when their stocks have become overvalued (high run-up) and rights offerings when their stocks have become undervalued (lower run-up). This idea of firm's opportunistic behavior is similar to that in Korajczyk *et al.* (1991), the difference being that here the firm does not alter the timing, but rather the type of its equity offering. When value

uncertainty is high, so are also the possible magnitudes of over- and undervaluations. Because of this, for stocks with large value uncertainty, the price run-up to public offerings is larger and the long-run returns are worse. Similarly, for stocks with large value uncertainty, the price run-up to rights offers is lower and the long-run returns are better.

Proposition 2 (Public Offerings): *There is a positive run-up to public equity offerings,* $E(V_1 - V_0 \mid PO) > 0$*, and the run-up,* $E(V_1 - V_0 \mid D,PO)$*, is increasing in dispersion D. There is price pressure around public offerings, so that* $E(V_3 - V_2 \mid PO) > 0$*. The firms using public offerings have a negative long-run performance* $E(V_4 - V_3 \mid PO) < 0$*, and the expected long-run return,* $E(V_4 - V_3 \mid D,PO)$*, is decreasing in dispersion D.*

The price pressure around public equity offerings, $E(V_3 - V_2 \mid PO)$, is equal to the price impact. The price impact disappears at $t = 3$ in our model as the uncertainty related to the investment financed by the equity issue disappears (ε is revealed in period 3).[9]

Proposition 3 (Rights Offerings): *Rights offerings follow a smaller price run-up,* $E(V_1 - V_0 \mid RO) < E(V_1 - V_0 \mid PO)$*. The run-up,* $E(V_1 - V_0 \mid D,RO)$*, is decreasing in dispersion, D. There is larger price pressure around rights issues than public offerings, so that* $E(V_3 - V_2 \mid RO) > E(V_3 - V_2 \mid PO)$*. In case of rights offerings, the long-run returns are positive,* $E(V_4 - V_3 \mid D,RO) > 0$ *and increasing in D.*

II. Empirical Analysis

A. Data and sample

To test the model predictions we have collected data from the equity issues of the largest European firms. The sample used includes the relevant data for companies whose stock has been included in the Dow Jones STOXX 600 index between January 1st, 1992 and December 31st, 2006.

Total return indexes are collected from the Datastream, book value per share data is from the Worldscope and the analysts' earnings estimate data is from the I/B/E/S. The seasoned equity offerings sample is collected from Thomson SDC. The sample includes only such offerings in which the issuing company has been included in the STOXX 600 index before the offering during our sample years. We also required that the offering size is high enough.[10] Because the long-run performance is one of the main subjects of this study, only successfully completed offerings are included in our sample. Stocks are required to have dispersion data for the month before the offering month, and market capitalization and book-to-market data for the month after the issuance month to be included in the sample. The book-to-market ratio is also required to be positive. With these data availability restrictions 80 cases are excluded, resulting in a sample size for the tests regarding long-run returns of 550 equity offerings, of which 355 are public offerings and 195 rights offerings.[11] The sample period in long-run tests starts one month after the issuance month to exclude potential price impact effects and lasts 12 months.

To be included in the price run-up sample, in order to avoid selection bias favoring our predictions, we require that stock must have been in the index one year before the offering. Stocks without market capitalization and book-to-market data one year prior to the offering month are excluded. In addition the book-to-market ratio one year prior to the offering should be positive. This results in a

smaller sample size of 518 offerings, of which 316 are public and 202 rights offerings.[12] The sample period in the run-up tests is the 12 months preceding the offering month.

To calculate the dispersion in analyst estimates, we have used the Summary History data set of I/B/E/S.[13] We have used the annual earnings per share estimates for the current fiscal year. The dispersion figure in the tests is the standard deviation of the forecasts divided by the latest available book value per share, *i.e.*, the book value at the end of the fiscal year *t-1*. The dispersion level is measured at one month before the issue month, to exclude the effect of the equity offering announcement on dispersion.

[TABLE I]

Table I shows the descriptive statistics related to the offerings included in the long-run test sample. The average offer size is 767 million USD in public and 903 million USD in rights offerings. The proportional offer size in rights offerings is more than two-times larger than the proportional size in public offerings. Companies launching rights offerings are also smaller and have higher book-to-market ratios. This latter finding suggests that they are undervalued (as proposition 3 predicts), or they are different types of firms in some respect (*e.g.* distressed).

Our public offerings sample is concentrated around 1999-2002 and the rights offerings sample in the years 2001-2005. The UK, Netherlands and Germany together account for more than one half of the public offerings and the UK itself almost 40% of the public offerings sample. The main countries in the rights offering sample are France, Germany, Italy and the UK.

We calculate the long-term abnormal returns using the buy-and-hold abnormal returns method (BHAR). To evaluate whether the observed mean BHARs are statistically different from zero, we apply the basic Student t-test. Our main tests are t-tests comparing the abnormal returns of different portfolios.

The reference portfolios needed for calculating the abnormal returns for any given stock in our sample are based on sequential sort procedure. The reference portfolios are constructed from stocks that have been included in STOXX-600 index before the reference month (the month following the equity issue.)[14] These stocks need also to have market capitalization and book-to-market data for the reference month.[15] In addition book-to-market ratio is required to be positive. Companies that have launched public or rights offerings are excluded from the reference portfolio during four years surrounding their equity offering.[16] We then divide this universe to three portfolios based on the market capitalization and every one of these three portfolios is further divided into three portfolios based on the book-to-market ratios. The average holding period returns of these 9 portfolios are then used as matching returns when calculating the abnormal returns. When calculating the abnormal returns, delisted stocks are assumed to have equal return as the reference portfolio after the delisting. The chosen method should eliminate the rebalancing and new listing biases documented by Barber et al. (1999).

In addition we present test results based on index-adjusted abnormal returns. These long-term abnormal returns are also based on BHAR-method. The index used is the STOXX-600 total return index and we assume that betas of all firms are all equal to one. The sample is the same as in the reference portfolio based tests. For comparison we also present the unadjusted returns.

As one of our main interests is the effect of dispersion on the price run-up and long-run returns, we next divide our entire sample as well as the separate samples of the two types of equity issues (rights and public equity offerings) into two portfolios, based on the dispersion level at the month before the offering. We call the two thus obtained portfolios **high and low dispersion portfolios**, respectively. Note that the amount of stocks in these portfolios is somewhat lower during the months preceding issuance month, because the extra requirement that stock must have been in the index at least one year before the offering.

B. Price impact in public and rights offerings

Our model predicts that the price impact in rights offerings is higher than that in public cash offerings. Let us first investigate this issue.

Figure 1 shows the cumulative abnormal returns for a period of 100 days around public offerings and rights offerings. Visual inspection suggests that the price impact is indeed higher in rights offerings and it seems to last for at least two months. Public offerings also seem to have a small price impact of less than 1%, but this is recovered within few days.

We tested formally for the price impact by testing if the difference between the two month (one month) return after the issue and the two month (one month) return prior to issue is statistically significantly different from zero. Our results show that for rights issues these measures of price impact are statistically significantly positive at 1% level. For public cash offers, on the other hand, a similar measure of price impact had a negative sign, indicating that there is no evidence of a lasting (one or two months) price impact in the case of public offers. It turned out that for the case of public cash offers a similar measure, but for just five days around the issue was statistically significantly

positive, suggesting that there is a price impact also in the case of public offerings, but it is a shorter lived one.

The idea that a price drop prior to the equity issue is a main cost in the case of rights offerings has been presented previously in the literature, see Hansen (1988). In this paper, we argue that the price drop, which we show occurs also in Europe, is due to the price impact arising from the sale of additional shares.

[FIGURE 1]

As Figure 1 shows, the cumulative abnormal returns following public offerings are in our sample positive even after two months: The whole public offering sample has a statistically insignificant two month post-issue return of 0.1%.[17] Similar results have been found by Mikkelson and Partch (1986), however Spiess and Affleck-Graves (1995) and Tripathy and Rao (1992) find statistically significant positive returns for the first month following public offerings. In case of rights offerings, the two month post issue returns are statistically significantly positive at 1% level.

C. The frequency of rights offerings

Another issue of interest is whether the predictions stated in Proposition 1 hold. That is, the predictions that 1) public offerings are more common than rights offerings and 2) that rights offerings are more frequent amongst stocks with high value uncertainty, *i.e.,* amongst those stocks whose analysts have high dispersion in their earnings estimates. Figure 2 shows that both predictions hold in our data: First, the percentage of rights offerings is below 50% in both the high and the low dispersion portfolios. Second, the percentage of rights offerings is highest in the high dispersion portfolio, with 60% of the rights issues falling into this portfolio.

[FIGURE 2]

To test whether the difference in the proportions of rights offerings in these two portfolios is statistically significant, we use X^2–test. This test statistic is highly significant (p-value is 0.005). Secondly, we apply the Mann-Whitney-Wilcoxon test to a sample of all equity offerings with dispersion data available. This test evaluates whether the rights offerings have higher dispersion ranks compared to the dispersion ranks of the public offerings. The initial hypothesis of the test is that the ranks are divided evenly among the offering methods. This test statistics is also statistically significant at 1% level. Thus, consistent with Proposition 1, companies that select rights offerings seem to have higher dispersion than those selecting public equity offerings.

D. Long-term stock returns around public equity offerings

Figure 3 shows the cumulative abnormal returns of high and low dispersion portfolios in event time during a 26 month interval surrounding public equity offerings. Abnormal returns are calculated using index-adjustment and shown cumulative abnormal returns are based on monthly rebalancing. The graph shows that the average stock experienced a price run-up, with the high-dispersion stocks having a slightly higher price run-up than the low dispersion stocks. The post-performance part of the graph shows that the high dispersion stocks have lower post issue returns than low dispersion stocks. In fact, the entire long-run underperformance seems to be caused by the poor long-run performance of the high-dispersion stocks.

[FIGURE 3]

Price run-up

Table II shows that also the buy and hold pre-issue returns are positive for public offerings as predicted by Proposition 2. The overall sample has a pre-issue 12 month return of 10.4%, which is statistically significantly different from zero at 1% level. This result is consistent with the earlier empirical evidence. For example Tripathy and Rao (1992) and Asquith and Mullins (1986) have found similar results, although in their studies the time period that was used in the run-up tests was much shorter.

Both the high and the low dispersion portfolios have outperformed the index in the year preceding the equity issue. The high dispersion portfolio stocks have higher abnormal return before the offering than the stocks in the low dispersion portfolio if abnormal returns are calculated using the index-adjustment. The difference in the run-ups of these two portfolios is not, however, statistically significant. If the reference portfolio based abnormal returns are used, the high-dispersion portfolio has lower abnormal run-up than the low dispersion portfolio. The unadjusted median return of the high dispersion (the low dispersion) portfolio is 25.7% (29.5%).

[TABLE II]

Post-issue returns

Table III shows the one year post-offering abnormal returns for the high and the low dispersion portfolios.[18] These results are consistent with the prediction in Proposition 2, that high-dispersion stocks underperform other stocks. High dispersion portfolio has an abnormal return of -4.2%, which is not statistically significantly different from zero, however. The low dispersion portfolio has a statistically insignificant positive return of 2.8%. The difference between the high and the low dispersion portfolios' abnormal returns is statistically significant at 5% level. Thus, according our results, the underperformance following equity issues occurs only in the high dispersion portfolio.

This suggests that the findings documented in two large literatures, first related to negative long-run returns following equity offerings (see *e.g.,* Loughran and Ritter, 1995) and, second, the negative abnormal returns for stocks that have high dispersion in their analysts' earnings estimates (see *e.g.,* Johnson, 2004) are closely related. Note that this difference in returns is most significant in the case of unadjusted returns. This suggests that the high dispersion offerings are timed in periods of market wide overvaluation.

[TABLE III]

Our whole sample has an abnormal post-issue return of -0.7%, which is not statistically significantly different from zero at any conventional level. This is somewhat smaller than many earlier papers, for example Loughran and Ritter (1995), Spiess and Affleck-Graves (1995) and Jegadeesh (2000), have found, but similar as reported by Brav *et al.* (2000) and Eckbo *et al.* (2000). As Figure 1 shows, the underperformance starts roughly after two months following the equity issue.

E. Long-term stock returns around rights offerings

Figure 4 shows the cumulative abnormal returns of the high and the low dispersion portfolios in event time during a 26-month interval surrounding rights offerings. Figure 4 is constructed similarly as Figure 3. Figure 4 shows that low dispersion stocks have a price run-up and high dispersion stocks a price run-down. High-dispersion stocks overperform the index after the issuance, but the low-dispersion stocks yield no abnormal returns.

[FIGURE 4]

Price run-up

The buy and hold results related to the run-up on rights offers can be found in the Table IV. High-dispersion stocks are associated with a price run-down before the offering that is statistically significant (based on tests using the reference portfolio adjustment). The low-dispersion stocks, in contrast, have a price run-up, which is significant if index-adjustment is used. Consistent with Proposition 3, the difference in run-ups between the two dispersion classes is striking and statistically significant in all three tests presented in Table IV. The entire rights offering sample has a pre-issue abnormal return (based on reference portfolio adjustment) of -3.9%, which is not statistically significantly different from zero.

[TABLE IV]

Post-issue returns

As Table 5 shows, the entire rights offering sample has statistically insignificant long-term post-issue return of -1.8%. This result is similar to other papers, for example Burch *et al.* (2004), studying the long-term underperformance of rights offerings. The low dispersion portfolio has a statistically significant underperformance of 6.8%, whereas the high dispersion portfolio has a positive abnormal return of 3.0% (based on tests using the reference portfolio adjustment). Consistent with Proposition 3, the difference between the high and the low dispersion portfolios' post-issue abnormal returns is positive and statistically significant at 5% level.

[TABLE V]

To summarize, in case of rights offerings, our results on the run-ups provide support for the model, and the long-run post-issue returns of high dispersion stocks are positive, as predicted by the model.[19] In addition, as the model predicts, value uncertainty affects the size of the average run-up and post-issue return.

F. Proportional offer sizes

Public offerings

Another interesting question related to the idea that companies sell overvalued equity is whether the firms that we perceive as being more overvalued (those in the high dispersion portfolio) issue a larger fraction of their shares in equity issues. Table VI shows that the high dispersion companies do indeed issue a larger fraction of their shares in public equity offerings. The difference in the mean offer size between the high and the low dispersion portfolios is statistically significant at 1% level.

[TABLE 6]

Rights Offerings

For completeness, in Table 7 we document also the relative size of rights offerings in the high and the low dispersion portfolios. Similarly to the case of public cash offerings, the offerings are typically larger when dispersion is high. We cannot explain this finding with our model. The arguments presented in Footnote 7 could, however, provide one possible explanation.

[TABLE 7]

III. Conclusion

This paper has provided a theory of public cash offerings and rights offerings which is consistent with many observed patterns around equity issues. One main prediction is that there should be a price impact from the sale of additional shares in the case of rights offerings. In addition, the model predicts a positive run-up to public cash offerings, followed by poor long-run returns. It predicts a smaller run-up to rights offerings, followed by positive long-run returns. In addition, it predicts that these patterns are particularly strong for stocks that have high value uncertainty (in our model value uncertainty corresponds to dispersion in analysts' earnings forecasts). Additional predictions are that public offerings are more common than rights offerings and that the frequency of rights offerings increases in value uncertainty. Our empirical tests from the European markets, based on the equity issuing activity of the STOXX-600 stocks (largest European stocks), support all but one of these predictions: The positive post-issue returns for rights issues are found only amongst stocks with high value uncertainty.

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Appendix

Proof of Proposition 2:

Let

$$\gamma(|S|) = min\ (1-\Delta,\ \sigma^2 \mid |S|) < 1.$$

The firms doing public cash offers are those with a positive *NPV* for whom $C_p \leq C_r$.

$$C_p \leq C_r \quad \Leftrightarrow$$

$$(1- \theta_h)S - \sigma^2 \leq 0.$$

When $S > 0$, $C_p \leq C_r$ when θ_h is high enough, *i.e.,* when:

$$\theta_\beta \geq 1 - \gamma.$$

When $S < 0$, this occurs when θ_h is low enough *i.e.,*

$$\theta_\alpha \leq 1 + \gamma.$$

Note that when $\gamma = 1-\Delta$, all firms with project select public offers. Same is true when $S = 0$ (which occurs with probability zero). In the first region,

$$E(\theta_h \mid |S|,\ S > 0,\ \theta_\beta \geq 1 - \gamma) = 3/2 - \gamma/2.$$

In the second region,

$$E(\theta_h \mid |S|,\ S < 0,\ \theta_\alpha \leq 1 + \gamma) = 1/2 + \gamma/2.$$

This implies that the expected $\theta_h S$, conditional on *PO* and |S| is:

$$E[\theta_h S \mid |S|,\ PO] =$$

$$|S|/2 * (3/2 - \gamma/2) - |S|/2 * (1/2 + \gamma/2) = |S|/2(1- \gamma) > 0\ , \qquad (AP1)$$

This expectation is increasing in |S|, as $\gamma < 1$, and thus in $D = |S|\Delta$, given that Δ is constant. Now, the run-up results hold given that

$$V_1 - V_0 = \theta_h S + N - \sigma^2/(n+m),$$

and by assumption $N - \sigma^2/(n+m) > 0$.

At time 3 the price impact part of the announcement effect disappears as ε is realized implying that the value of the firm to group *h* is:

$$V_3 = \underline{A} + \theta_h S + 1 + N + \varepsilon$$

Note that

$$E_{t=2}[V_3] = \underline{A} + \theta_h S + 1 + N > V_2 = \underline{A} + \theta_h S + 1 + N - \sigma^2/(n+m).$$

Finally the average long-term underperformance (*LTUP*) is now negative and decreasing in *D* as

$$E\,[LTUP \mid |S|, PO] = E[V_4 - V_3 \mid |S|, PO]$$

$$= E[\underline{A} + S + 1 + N + \varepsilon - (\underline{A} + \theta_h S + 1 + N + \varepsilon) \mid |S|, PO]$$

$$= E[S - \theta_h S \mid |S|, PO] = E[S \mid |S|, PO] - E[\theta_h S \mid |S|, PO]$$

$$= - E[\theta_h S \mid |S|, PO] = -|S|/2(1-\gamma) < 0,$$

This is decreasing in *D,* for the same reason that (AP1) increases in $|S| = D/\Delta$.□

Proof of Proposition 3:

The firms doing rights offers are those with positive *NPV* and $C_p \geq C_r$:

When $S > 0$, this occurs when:

$$\theta_\beta \leq 1 - \gamma.$$

When $S < 0$, this occurs when

$$\theta_\alpha \geq 1 + \gamma.$$

Note that when $\gamma = 1 - \Delta$, or $S = 0$, rights issues do not occur.

In the first region, $E(\theta_h \mid |S|, S > 0, \theta_\beta \leq 1 - \gamma) = \Delta/2 + 1/2 - \gamma/2$.

In the second region, $E(\theta_h \mid |S|, S < 0, \theta_\alpha \geq 1 + \gamma) = 3/2 + \gamma/2 - \Delta/2$.

This implies that the expected $\theta_h S$, conditional on a rights issue, is:

$$E(\theta_h S \mid |S|, RO) = -|S|/2 * (1 - \Delta + \gamma) < 0,$$

which implies the result that the run-up is smaller than in the case of public equity offers. It is also easy to see that the run-up is decreasing in D, given that $\Delta < 1$ and $\gamma|S| = \sigma^2$, in the case of rights issues. The price impact result can be seen from:

$$E_{t=2}[V_3 - V_2 \mid PO] = \sigma^2/(m+n) < E_{t=2}[V_3 - V_2 \mid RO] = \sigma^2/n.$$

The average long-term underperformance is positive and increasing in D as:

$$\begin{aligned} E(LTUP) &= E[V_4 - V_3 \mid |S|, RO] \\ &= E[\underline{A} + S + 1 + N + \varepsilon - (\underline{A} + \theta_h S + 1 + N + \varepsilon) \mid |S|, RO] \\ &= E[S - \theta_h S \mid |S|, RO] = E[S \mid |S|, RO] - E(\theta_h S \mid |S|, RO) \\ &= -E(\theta_h S \mid |S|, RO) = |S|/2 * (1 - \Delta + \gamma) > 0. \end{aligned}$$

Proof of Proposition 1:

Rights issues are done by firms that have $C_r < C_p$.Using our previous results,

$$\text{Prob. } (PO \mid |S|) = (1 + \gamma)/(2-\Delta) > \text{Prob. } (RO \mid |S|) = (1 - \Delta - \gamma)/(2-\Delta).$$

When D, *i.e.*, |S| increases, γ decreases, hence

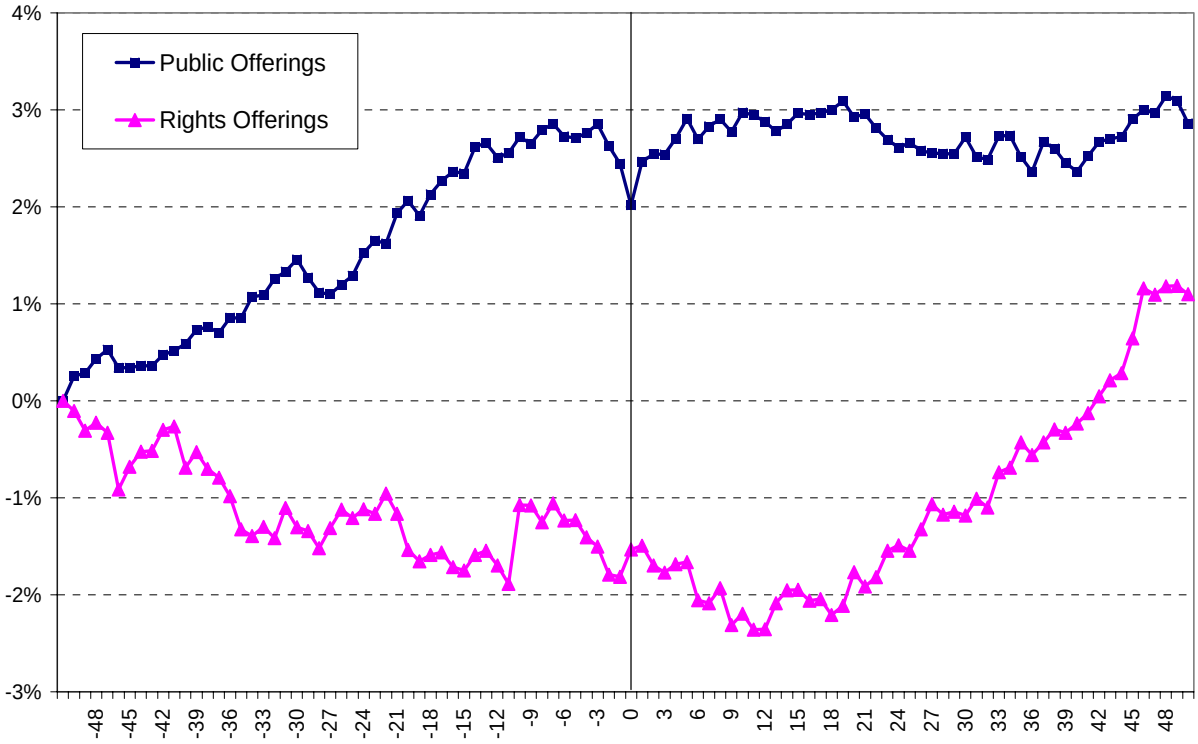
$$\text{Prob. } (RO \mid |S|) / (\text{Prob. } (PO \mid |S|) + \text{Prob. } (RO \mid |S|)) = 2(1 - \Delta - \gamma) / (2-\Delta)$$

increases. It is first zero for D such that $\gamma = 1 - \Delta$ and then strictly increasing in D for $\gamma < 1 - \Delta$ as γ is then strictly decreasing in D□

Figures and Tables

Figure 1: Price impact around equity offerings

Figure 1 shows the cumulative abnormal returns for portfolios of stocks completing public and rights offerings from 50 days prior to the issue to 50 days after the issue. Day 0 is the issuance date. The abnormal returns are index adjusted using the STOXX 600 index.



Days preceding the issue date

Issue Date

Days following the issue date

Figure 2: Percentage of rights offerings in high and low dispersion portfolios

These high and low dispersion portfolios were obtained by dividing the entire sample of equity issues (including all rights and public offerings) into two equally large samples, based on the dispersion level at the month before the offering. This figure shows the percentages of rights offerings in the two thus obtained samples.

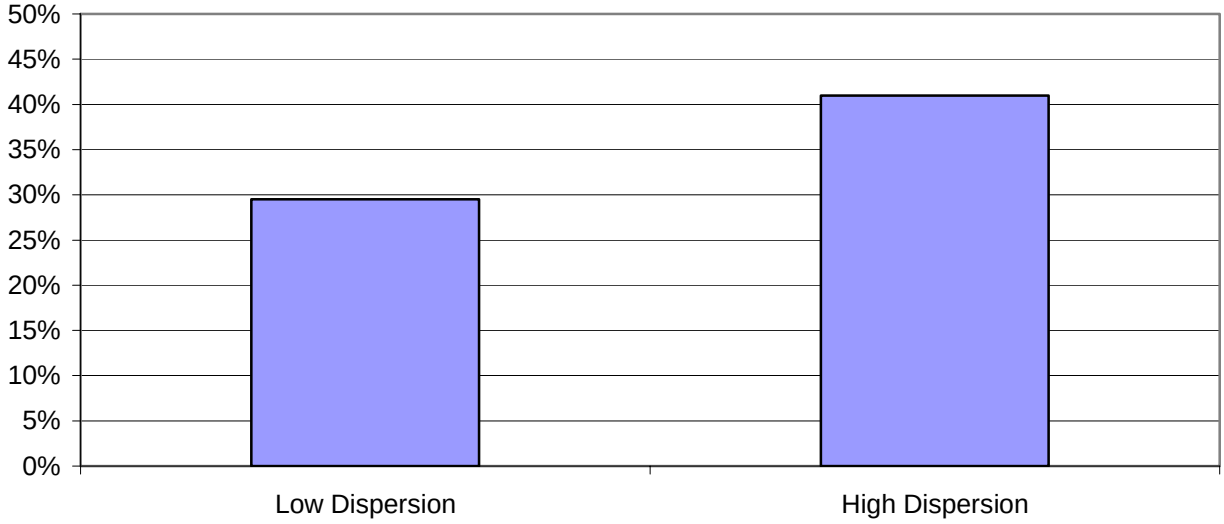
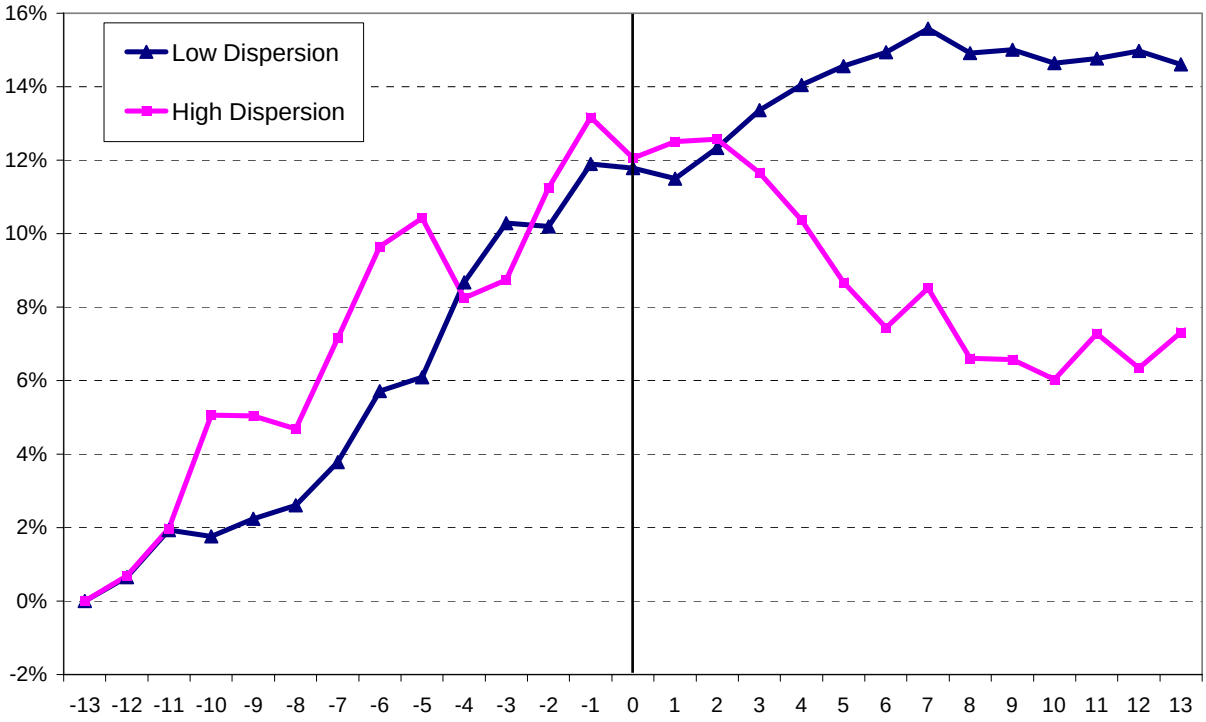


Figure 3: The cumulative abnormal returns around public offerings

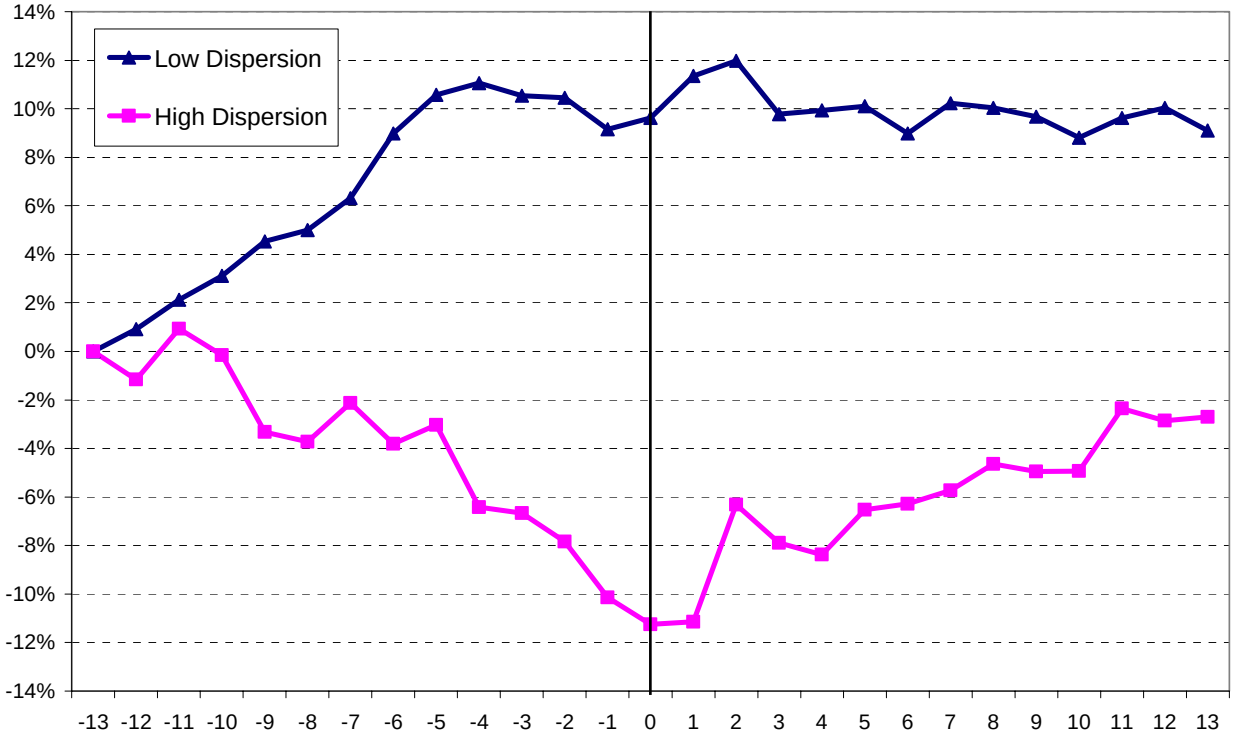
These high and low dispersion portfolios were obtained by dividing the sample of public equity offerings into two equally large samples, based on the dispersion level at the month before the offering. This figure shows the cumulative abnormal returns for the high and low dispersion portfolios during a period of 26 months surrounding the public offerings. The abnormal returns are index adjusted using the STOXX 600 index.



Months preceding the issue date | Issue Date | Months following the issue date

Figure 4: The cumulative abnormal returns around rights offerings

These high and low dispersion portfolios were obtained by dividing the sample of rights offerings into two equally large samples, based on the dispersion level at the month before the offering. This figure shows the cumulative abnormal returns for the high and low dispersion portfolios during a period of 26 months surrounding the rights offerings. The abnormal returns are index adjusted using the STOXX 600 index.



Months preceding the issue date | Issue Date | Months following the issue date

TABLE I: Descriptive statistics of the offerings and issuing companies

Descriptive statistics related to offerings used in long-run tests are shown in this table. Panel A shows statistics related to offering size and issuing firm characteristics. Panel B shows the annual division of the sample. Panel C shows the country division of the sample.

Panel A: Offering size and issuing firm characteristics

Mean values related to offering size, proportional offering size, market capitalization and book-to-market ratios are included in this table. Offering size is total proceeds of the offering in all markets combined. Proportional offering size is the offering size divided by market capitalization. Market capitalization and book-to-market figures are measured one month before the offering month.

	Primary Public Offerings	Rights Offerings
Offering size	767	903
Proportional size	15.9%	32.4%
Market Cap	8 825	6 151
Book-to-Market	0.51	0.82

Offering size and market capitalization are measured in millions of offering-time US Dollars

Panel B: Annual division

	Primary Public Offerings	Rights Offerings
1992	1.6%	2.3%
1993	3.9%	4.6%
1994	4.7%	5.0%
1995	4.7%	2.3%
1996	3.6%	4.6%
1997	8.0%	2.3%
1998	6.5%	4.1%
1999	9.1%	5.5%
2000	13.7%	5.0%
2001	8.5%	8.3%
2002	10.9%	13.3%
2003	7.8%	14.2%
2004	9.1%	18.8%
2005	7.5%	9.2%
2006 (Jan-Mar)	0.5%	0.5%
Total	100.0%	100.0%
Count	386	218

Panel C: Country division

	Primary Public Offerings	Rights Offerings
Austria	2.3%	4.6%
Belgium	0.5%	0.5%
Denmark	3.6%	1.4%
Finland	3.9%	2.3%
France	7.3%	13.3%
Germany	10.1%	14.2%
Greece	2.8%	0.5%
Ireland	2.8%	2.3%
Italy	3.6%	16.1%
Netherlands	11.4%	2.8%
Norway	3.4%	2.3%
Portugal	2.1%	6.9%
Spain	7.0%	2.3%
Sweden	0.8%	4.1%
Switzerland	2.6%	6.0%
United Kingdom	35.8%	20.6%
Total	100.0%	100.0%

TABLE II: Abnormal returns in the 12 months preceding public equity offerings

The sample of public equity offerings was divided into two equally large samples based on the dispersion in the financial analysts' earnings per share forecasts at the month preceding the offer. These portfolios are called high and low dispersion portfolios. This table reports the abnormal returns and the unadjusted returns for the entire sample, the high and the low dispersion portfolios and the difference between the last two. The reference portfolio based abnormal returns are the buy-and hold returns, in which the sample stock return is compared to the return on a portfolio of stocks in same market capitalization and book-to-market ratio class. The index-adjustment based abnormal returns are the index-adjusted buy-and hold returns. The index used is the STOXX-600 total return index.

	All	High Dispersion	Low Dispersion	**Difference**
Reference-portfolio based				
Abnormal returns	10.4%	9.8%	11.0%	**-1.3%**
t-value	3.6 ***	1.9 *	4.3 ***	**-0.2**
Index-adjustment based				
Abnormal returns	14.2%	15.5%	12.9%	**2.6%**
t-value	4.6 ***	2.8 ***	4.9 ***	**0.4**
Unadjusted buy and hold returns	27.6%	25.6%	29.5%	**-3.9%**
t-value	8.2 ***	4.3 ***	9.6 ***	**-0.6**

Statistical significance is based on basic Student t-test.*** denotes significance at 1% level, ** at 5% level, * at 10% level. The difference test is one-sided and tests of statistical significance of abnormal performance are two-sided.

TABLE III: Abnormal returns in 12 months following public equity offerings

The sample of public equity offerings was divided into two equally large samples based on the dispersion in the financial analysts' earnings per share forecasts at the month preceding the offer. These portfolios are called high and low dispersion portfolios. This table reports the abnormal returns and the unadjusted returns for the entire sample, the high and the low dispersion portfolios and the difference between the last two. The reference portfolio based abnormal returns are the buy-and hold returns, in which the sample stock return is compared to the return on a portfolio of stocks in same market capitalization and book-to-market ratio class. The index-adjustment based abnormal returns are the index-adjusted buy-and hold returns. The index used is the STOXX-600 total return index.

	All	High Dispersion	Low Dispersion	**Difference**
Reference-portfolio based				
Abnormal returns	-0.7%	-4.2%	2.8%	**-7.0%**
t-value	-0.3	-1.2	1.1	**-1.7 ****
Index-adjustment based				
Abnormal returns	0.8%	-2.0%	3.5%	**-5.5%**
t-value	0.4	-0.6	1.4	**-1.3 ***
Unadjusted buy and hold returns	10.1%	4.1%	16.1%	**-11.9%**
t-value	4.2 ***	1.0	5.9 ***	**-2.5 *****

Statistical significance is based on basic Student t-test.*** denotes significance at 1% level, ** at 5% level, * at 10% level. The difference test is one-sided and tests of statistical significance of abnormal performance are two-sided.

TABLE IV: Abnormal returns in 12 months preceding rights offerings

The sample of rights offerings was divided into two equally large samples based on the dispersion in the financial analysts' earnings per share forecasts at the month preceding the offer. These portfolios are called high and low dispersion portfolios. This table reports the abnormal returns and the unadjusted returns for the entire sample, the high and the low dispersion portfolios and the difference between the last two. The reference portfolio based abnormal returns are the buy-and hold returns, in which the sample stock return is compared to the return on a portfolio of stocks in same market capitalization and book-to-market ratio class. The index-adjustment based abnormal returns are the index-adjusted buy-and hold returns. The index used is the STOXX-600 total return index.

	All	High Dispersion	Low Dispersion	**Difference**
Reference-portfolio based				
Abnormal returns	-3.9%	-12.1%	4.4%	**-16.5%**
t-value	-1.0	-2.15 **	0.8	**-2.07 ****
Index-adjustment based				
Abnormal returns	4.4%	-4.7%	13.5%	**-18.2%**
t-value	1.0	-0.8	2.2 **	**-2.1 ****
Unadjusted buy and hold returns	18.1%	6.1%	30.2%	**-24.1%**
t-value	3.8 ***	0.9	4.4 ***	**-2.5 *****

Statistical significance is based on basic Student t-test.*** denotes significance at 1% level, ** at 5% level, * at 10% level. The difference test is one-sided and tests of statistical significance of abnormal performance are two-sided.

TABLE V: Abnormal returns in 12 months following rights offerings

The sample of rights offerings was divided into two equally large samples based on the dispersion in the financial analysts' earnings per share forecasts at the month preceding the offer. These portfolios are called high and low dispersion portfolios. This table reports the abnormal returns and the unadjusted returns for the entire sample, the high and the low dispersion portfolios and the difference between the last two. The reference portfolio based abnormal returns are the buy-and hold returns, in which the sample stock return is compared to the return on a portfolio of stocks in same market capitalization and book-to-market ratio class. The index-adjustment based abnormal returns are the index-adjusted buy-and hold returns. The index used is the STOXX-600 total return index.

	All	High Dispersion	Low Dispersion	**Difference**
Reference-portfolio based				
Abnormal returns	-1.8%	3.0%	-6.8%	**9.8%**
t-value	-0.6	0.6	-2.3 **	**1.7 ****
Index-adjustment based				
Abnormal returns	4.0%	10.6%	-2.7%	**13.3%**
t-value	1.3	2.1 **	-0.9	**2.3 ****
Unadjusted buy and hold returns	18.1%	23.3%	12.9%	**10.4%**
t-value	5.4 ***	4.2 ***	3.5 ***	**1.6 ***

Statistical significance is based on basic Student t-test.*** denotes significance at 1% level, ** at 5% level, * at 10% level. The difference test is one-sided and tests of statistical significance of abnormal performance are two-sided.

TABLE VI: Proportional offer size in public offerings

The sample of public offerings was divided into two equally large samples based on the dispersion in the financial analysts' earnings per share forecasts at the month preceding the offer. These portfolios are called high and low dispersion portfolios. This table shows the proportional offering size in the high and the low dispersion portfolios and their difference. The proportional offering size is the total principal issued to all markets combined divided by the market capitalization measured at one month before the offering month. Offerings with proportional size over 100% were given a value of 100%.

	High dispersion	Low dispersion	**Difference**
Mean	16.4%	11.7%	**4.7% *****
Median	9.2%	8.3%	

*** denotes significance at 1% level. ** at 5% level. * at 10% level.

TABLE VII: Proportional offer size in rights offerings

The sample of rights offerings was divided into two equally large samples based on the dispersion in the financial analysts' earnings per share forecasts at the month preceding the offer. These portfolios are called high and low dispersion portfolios. This table shows the proportional offering size in the high and the low dispersion portfolios and their difference. The proportional offering size is the total principal issued to all markets combined divided by the market capitalization measured at one month before the offering month. Offerings with proportional size over 100% were given a value of 100%.

	High dispersion	Low dispersion	**Difference**
Mean	31.9%	24.1%	**7.8% ****
Median	22.8%	17.6%	

*** denotes significance at 1% level. ** at 5% level. * at 10% level.

Footnotes

[1] In practice many rights issues are underwritten by an investment bank. In our setting this distinction does not matter.

[2] Using a real options approach they argue that there is a pre-issue run-up as growth options move into the money, and that managers issue equity in order to invest in these growth options. Their model predicts that the post-issue returns are low due to a decrease in firm risk, as risky growth options are converted into less risky assets in place.

[3] One can think that this occurs *e.g.* due to double taxation of interest income for corporations.

[4] In our stylized model the investment bank charges no fee for its services. Our results are robust to assuming a fee for both types of offers, assuming that the difference in the fees for the two types of offers is small enough. If the difference in fees was large, however, the first part of Proposition 1, concerning the overall frequency of the two offer types, may no longer hold.

[5] This assumption is made for simplicity. Similar results could be obtained in a more complicated model, which has uncertainty also in the existing assets, even without this assumption. It should be noted, however, that in Europe (where we test the model) the costs from short selling have been significantly higher than in the US.

[6] We assume that the rights offering subscription price is set at the existing share price, hence the rights are worthless. In a more general rights issue the company would give out $1/z$ rights to the existing investors to buy shares of the company at a price $z < P$, thus raising one unit of cash. The

number of shares after the rights have been issued is *(1+ 1/z)* and the share price, ex rights is $P^{ex} = P^{cum}/(1+1/z)$. Our results would stay the same, if were to assume z < P.

[7] In our model the company (through its investment bank) markets its shares to outsiders when it is overvalued and does not market its shares when it is undervalued. This behavior is in the interest of the company's current shareholders. In our simple model the company's management are not shareholders. It is interesting to note, however, that if they were, then they (given their unbiased estimate of the signal) would increase their holdings at the time of the rights offering and decrease their ownership at the time of the public equity offering. Because of this, their private incentives would strengthen their incentives to market the shares selectively only in public issues as the model predicts. We thank Malcolm Baker for pointing this out to us.

[8] Formally we can show that $E(\max(\theta_\alpha S,\theta_\beta S)||S|) = E(\theta_h S||S|) > 0$ and increasing in |S|. This finding, which associates dispersion to overvaluation, is consistent with the result in Diether *et al.* (2002) that high dispersion is associated with low future returns.

[9] In practice, another reason why the price impact, from the additional risk that investors bear from an equity issue, fades away, is the arrival of new investors to the market. In this case also, the risk carried by each single investor falls over time as existing investors sell part of their risk to new investors.

[10] Total proceeds in all markets combined should be at least 10 million USD and the proportional offer size should be at least 1%.

[11] To avoid selection bias, delisted stocks are included. The proceeds from selling delisted stocks at the date of delisting, are assumed to earn zero abnormal return thereafter.

[12] Run-up test period starts and ends one year later than long-run test period. The sample period for long-run tests ends at March 2006.

[13] Summary history data set includes the summary statistics calculated on the basis of all outstanding forecasts as of the third Thursday of each month.

[14] The reference month in run-up tests is the month one year before the offering

[15] The delisted stocks are included in the reference portfolio and the return of those stocks is assumed to be equal to STOXX-600 total return index after the delisting.

[16] We also excluded the secondary offerings, since our preliminary test results show that similar effects can be found using a sample of secondary offerings.

[17] These results are based on index-adjusted abnormal returns, where beta is assumed to be one for every stock.

[18] In table 3 the long run return figures presented are the 12 month returns from the end of the month following the month of the issue, due to the assumed price impact in the first one to two months time.

[19] These positive long-run returns are consistent with the finding that in some markets already the announcement returns to rights issues have been found to be positive (see Hietala and Löyttyniemi, 2000).