ERIC DUCA

The Impact of Investor Demand on Security Offerings

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De invloed van de vraag van investeerders op emissies van vermogenstitels

THESIS

to obtain the degree of Doctor from the
Erasmus University Rotterdam
by command of the
rector magnificus

Prof.dr. H.G. Schmidt

and in accordance with the decision of the Doctorate Board

The public defence shall be held on

Thursday 8 september 2011 at 13:30 hrs

by

Eric Duca
Place of birth, Malta

ERASMUS UNIVERSITEIT ROTTERDAM

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Erasmus Research Institute of Management – ERIM
The joint research institute of the Rotterdam School of Management (RSM)
and the Erasmus School of Economics (ESE) at the Erasmus University Rotterdam
Internet: http://www.erim.eur.nl

ERIM Electronic Series Portal: http://hdl.handle.net/1765/1

ERIM PhD Series in Research in Management, 240
ERIM reference number: EPS-2011-240-F&A
ISBN 978-90-5892-286-1

Design: B&T Ontwerp en advies www.b-en-t.nl

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The ink used is produced from renewable resources and alcohol free fountain solution.
Certifications for the paper and the printing production process: Recycle, EU Flower, FSC, ISO14001.
More info: http://www.haveka.nl/greening

Acknowledgements

I would like to thank all the people who have supported and encouraged me while writing this dissertation. First, I thank my promoter Abe de Jong, and supervisor Marie Dutordoir, who showed faith in me when selecting me as a PhD candidate. Abe guided this work with many useful suggestions, while Marie offered generous time and attention to this project. I thank my committee members for beneficial feedback on the papers in my dissertation. I am also grateful to seminar participants from the finance department, as well as other academics that took an interest, for providing useful feedback and suggestions that contributed to this dissertation. I appreciate the financial support of Trustfonds, which gave me the opportunity to present my work at conferences.

Besides academic ability and perseverance, completing a PhD requires a balanced perspective that places the PhD process within the broader goals in life. This approach is especially useful when days in the office start to get long, and talks are dominated by financial jargon. Luckily, my other colleagues pursuing their PhD studies at RSM not only had the financial insight that contributed to my dissertation, but also offered broader advice that kept me going during the tougher periods. Conversation with these colleagues deepened my knowledge of various cultures, and introduced new, intelligent ways of approaching life issues. These colleagues became friends, and joined a broader assembly of friends that have shared their time with me during my studies. I am truly indebted to these people, since they have helped make the past four years an enjoyable learning experience, rather than an arduous struggle.

Finally, special thanks goes to my parents and brothers, who have offered their unconditional moral support and encouragement over the past four years.

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Chapter 1

Introduction

Corporate finance decisions have traditionally been seen as being driven by a firm's fundamentals. This view considers capital structure as the result of decisions made exclusively by firms, which demand capital to finance investment opportunities. The role of investors in this process has been given limited attention, even though investors, as the suppliers of capital, represent the counterparty to corporate transactions. This dissertation consists of three empirical studies that find evidence showing that capital structure decisions are not only influenced by corporate determinants, but also by variations in investor preferences and capital available for investment. Chapters 2 and 3 use convertible debt issuance to analyze the impact of intertemporal variation in investor demand on corporate decisions, and the market reaction to these decisions. Chapter 4 provides evidence in line with the hypothesis that investors take opportunism into account when firms issue new equity. In the introduction to this dissertation I provide the context for the remaining chapters. I give particular attention to recent evidence on the influence of investor-related drivers on corporate finance decisions, and contrast this with the traditional perspective of capital structure.

1.1 Impact of the supply of capital on corporate finance decisions and security prices

In the neoclassical framework, markets are efficient and the supply of funds is perfectly elastic at a price that reflects fundamental value. In such a framework, the demand for capital is driven by investment opportunities, and capital structure is determined by firm-specific characteristics. Firms choose between debt, equity, or convertible debt financing so as to minimize contracting costs that arise due to asymmetric information, agency problems, financial distress, and tax considerations.

Under the assumption that the supply of funds is perfectly elastic, there is a limited role for managers to exploit market inefficiencies by issuing overpriced securities. A recent strand of literature, however, contends that changes in the supply of funds do have an effect on corporate finance decisions and asset prices. Baker (2009) argues that changes in the supply of capital can be caused by two factors, i.e., changes in investor tastes and changes in the funds available to investors. Baker notes that increases in the supply of capital can result in profitable financing opportunities, insofar as managers respond to these increases by opportunistically setting a higher price on their securities. Stein (1996), and Baker, Ruback, and Wurgler (2007) develop a theoretical framework for the impact of the supply of capital on corporate finance decisions.

Several papers provide empirical evidence that corporate finance decisions and security prices are indeed influenced by changes in the supply of capital. A first group of studies focuses on changes in investor tastes. Lowry (2003), Helwege and Liang (2004) and Dorn (2009) find that investor optimism drives demand for IPOs. Baker and Wurgler (2004) show that managers cater to increased investor preferences for dividend-paying firms. Manconi and Massa (2009) find that firms with more fragmented ownership have more difficulties in catering to shareholder preferences for dividend payouts. Baker, Greenwood, and Wurgler (2009) find evidence that managers choose to maintain share prices at a low level in response to investor preferences for low-priced firms. Aghion and Stein (2008) provide a theory in which managers cater to the stock market's preferences for sales growth versus profit margins. Polk and Sapienza (2009) show that firms cater to investor preferences for the level of firm investment by altering their investment policy. Baker, Ruback, and Wurgler (2007) provide a review of how market inefficiencies influence other corporate events.

A second group of studies examine the impact of the funds available for investment on corporate finance decisions and prices. Massa, Peyer, and Tong (2005) use inclusion in the S&P 500 index to estimate the impact of equity supply on security issuance and investment. Faulkender and Peterson (2006) examine the impact of access to bond markets on leverage. Leary (2009) and Lemmon and Roberts (2010) find a supply effect of bank loans and high yield bonds, respectively, on investment and financial structure.

1.2 Evidence of investor-driven corporate finance in the convertible bond market

Convertibles are bonds that can be converted into equity at the option of the investor. Convertible debt represents an important source of financing: convertible issuance by U.S. corporations amounted to $61.6 billion in 2007, compared with $71.8 billion raised from seasoned equity issues and $388.5 billion raised from straight debt issues (Securities Data Company New Issues Database). The first part of Section 1.2 reviews theories that rely on firm-specific characteristics to explain convertible bond issuance. The remaining parts explain how the unique characteristics of convertible bonds make them an ideal instrument to test for the influence of investor demand on issuance activity.

1.2.1 Traditional motivations for convertible debt issuance

The literature presents several viewpoints on why firms issue convertible debt. Green (1984) demonstrates that, due to the convexity in their payoffs, convertible bonds are useful in reducing contracting costs associated with asset substitution behavior of shareholders. Brennan and Schwartz (1988) show that convertible bonds substitute for straight debt if information asymmetry about the riskiness of the firm's assets is high, since convertibles are less sensitive to risk as a result of their option component. Convertibles reduce this risk-shifting problem by allowing bondholders to participate in any potential upside, thus lowering the potential payoffs of shareholders. In the Stein (1992) framework, firms with high financial distress costs issue convertibles as an alternative to equity to alleviate equity-related adverse selection costs. On the whole, these theories predict that convertibles are most useful for firms with high costs of attracting straight debt or equity financing. Using a security choice model that incorporates convertible debt, straight debt, and equity, Lewis, Rogalski, and Seward (1999, 2003) find empirical evidence consistent with these hypotheses.

Another implication of the theoretical convertible debt models is that, irrespective of firm-specific characteristics, convertible debt issuance should be more attractive during windows with higher economy-wide costs for attracting debt or equity financing. A number of empirical studies have therefore examined the impact of aggregate debt- and equity-related financing costs on the convertible debt issuance choice. Alexander, Stover, and Kuhnau (1979) and Henderson (2005) conclude that managers do not time convertible issues during conditions that are favorable for convertible issuance, since convertible bond prices rise after issuance. Hoffmeister, Hays, and Kelley (1987), and Mann, Moore, and Ramanlal (1999), however, do find evidence that convertible debt issuers try to time the market. Dutordoir and Van de Gucht (2007) show that firms with high costs of attracting standard financing tools time their convertible offering during periods with low debt- and equity-related financing costs. Krishnaswami and Yaman (2008) find that companies are more likely to substitute convertible debt for straight debt during periods with high economy-wide debt-related financing costs.

1.2.2 The effect of investor demand on convertible debt issuance

While there is a substantial theoretical and empirical literature on the characteristics of convertible bond issuers, only a few papers have studied convertibles from an investor perspective. Kim and Stulz (1992) show that convertible bond issuers in the U.S. took advantage of relatively higher investor demand for convertibles in the Eurobond market, caused by a temporary tax advantage, by pricing their Eurobond issues more attractively. Choi et al. (2010) document that increases in convertible arbitrage hedge funds flows have a positive impact on convertible debt issuance. Other studies find that convertibles are likely to satisfy certain investor needs that cannot be fulfilled through a combination of straight debt and equity. For instance, Ammann, Kind, and Seiz (2007) find that convertible bond returns cannot be fully explained by factors typically used to explain stock and bond returns. Eckmann, Lutz, and Sperl (2007) document that the value of a convertible reflects the interaction between its debt and equity components, rather than just their sum.

The main goal of Chapter 2 is to examine the impact of investor demand for the particular payoff structure of convertible debt on convertible bond issuance activity. Our key hypothesis is that companies cater to temporal fluctuations in investor preferences for these specific features of convertible debt. We sequentially examine the influence of investor demand on aggregate convertible bond issuance numbers, convertible bond underpricing, and convertible bond design. Our results suggest that the characteristics of convertible bonds create a clientele attracted by factors peculiar to these instruments and mostly unrelated to straight debt or equity features, thus reinforcing the notion of convertible debt as a separate asset class.

We regress quarterly U.S. convertible debt issuance volumes between January 1975 and December 2007 on lagged values of six measures for investor demand, and find that these measures are able to explain a substantial part (35.3%) of the variation in aggregate convertible issues. Our results hold after controlling for macroeconomic conditions and firm-specific characteristics and are robust to using alternative measures of convertible debt issuance volumes and investor demand. We also show that most of the proxies for time-varying investor demand for convertibles do not influence aggregate equity or straight debt issuance volumes, which corroborates our hypothesis that convertible bonds are an independent asset class catering to a specific clientele.

Having established that convertible bond issuers cater to fluctuations in investor demand, we subsequently examine whether issuers are able to obtain better prices on their offerings in periods with heightened investor demand for convertible bonds. Several earlier papers have documented that convertibles tend to be underpriced at issuance (e.g., Henderson, 2005; Chan and Chen, 2007; Loncarski, ter Horst, and Veld, 2009). We find that convertible debt underpricing is significantly lower following increases in investor demand for convertible bond offerings, suggesting that issuers opportunistically exploit windows with high investor preferences for convertible financing. Our underpricing analysis controls for macroeconomic conditions, firm-specific characteristics affecting the corporate supply of convertible securities to investors, and security design features.

Finally, we document that issuers adjust the design of their convertible bond offerings to investor preferences. We find that, ceteris paribus, issuers tend to structure their convertible debt offering to be more equity-like during periods when investors are more risk averse. One possible explanation for this result is that risk averse investors may prefer to include equity-like convertibles in their portfolio as an alternative to regular (more risky) common stock.

Overall, our findings provide strong evidence that security issuing firms are aware of changes in investor demand, and use this knowledge to optimize their issuance, pricing, and security design decisions.

1.2.3 Convertible arbitrage-related pressure on stock prices

Existing event studies on the announcement effects associated with convertible debt offerings generally focus on convertibles issued during the 1970s and 1980s. A common finding of these studies is that convertibles induce negative abnormal stock returns that are intermediate in size between the announcement effects associated with seasoned equity and straight debt offerings (Dann and Mikkelson, 1984; Mikkelson and Partch, 1986; Lewis, Rogalski, and Seward, 1999). This pattern is consistent with the signaling model of Myers and Majluf (1984), which predicts that relatively more equity-like security offerings are more likely to be perceived as a signal of firm overvaluation.

Chapter 3 is inspired by the observation that convertible bond announcement effects have sharply declined over the past decade, whereas there is no corresponding decline in equity or straight debt announcement returns. While convertible offerings announced between 1984 and 1999 induce average abnormal stock returns of −1.69%, convertibles announced in the period 2000 to 2008 are associated with average abnormal stock price declines that are more than twice as large (−4.59%).

The main hypothesis in this study is that the sharp decline in observed convertible bond announcement returns is attributable to a substantial change in the buy-side of the convertible bond market. Convertibles traditionally appealed to long-only investors looking for diversification benefits and indirect participation in equities (Lummer and Riepe, 1993). However, Choi, Getmansky, and Tookes (2009) show a dramatic increase in the importance of convertible arbitrage funds since the end of the 1990s. To exploit underpriced convertible issues, convertible bond arbitrageurs buy the convertibles and short the underlying common stock. If demand curves for stock are downward-sloping, the supply increase associated with this arbitrage-related short selling should result in a negative stock price effect.

Therefore, our key prediction is that the observed highly negative “announcement” effect of recent convertible bond issues may partly reflect temporary price pressure associated with the activities of convertible bond arbitrageurs. In line with our hypothesis, we find that the difference in announcement-period returns between convertibles issued in the period 1984 to 1999 (labeled “Traditional Investor period”) and convertibles issued in the period 2000 to September 2008 (labeled “Arbitrage period”) is no longer significant after controlling for arbitrage-induced short selling. Our findings remain intact when controlling for issuer-specific, security-specific, and macroeconomic determinants of convertible bond announcement effects.

Further analysis strengthens the arbitrage explanation for the evolution in convertible bond announcement effects. We find significant positive abnormal stock returns following Arbitrage-period convertible bond issues, as the short-selling induced price pressure is gradually absorbed by the market. In contrast, we find no evidence of such a reversal for issues made during the periods when hedge funds were less involved in purchasing convertibles.

1.3 Corporate opportunism and seasoned equity offerings

The first two studies in this thesis provide more evidence of corporate opportunism, using data on issuers of convertible debt. In the fourth chapter I examine whether investors take opportunism into account when firms issue new equity. While market timing of equity offerings is extensively documented in the literature, its effects on future equity offerings by repeat issuers are less known. Given that market timing represents a price risk for purchasers of the equity offering, I expect offerings perceived as more likely to be timed, to be issued at a greater discount to the pre-issue market price.

Seasoned equity offerings (SEOs) are on average followed by negative long-run abnormal returns (see, e.g., Loughran and Ritter, 1995; Spiess and Affleck-Graves, 1995). A popular explanation for this underperformance is that issuers are able to time the market and raise equity when the cost of capital is abnormally low. Loughran and Ritter (1995), and Baker and Wurgler (2000) view managers as being better informed than investors and are able to issue equity opportunistically when they anticipate that their share price is likely to decline. Graham and Harvey (2001) provide survey evidence in support of this view. Market timing can also be viewed in a rational framework, with firms choosing to issue equity in more favorable economic periods when asymmetric information is lower (e.g., Choe, Masulis, and Nanda, 1993; Lucas and McDonald, 1990). Another possible explanation for post-issue underperformance, suggested by Ritter (2003), is that both investors and managers are overoptimistic about the prospects of issuing firms.

In the fourth chapter, I examine the effects of past market timing on underpricing of subsequent equity offerings in the United States over the period 1980-2007. I capture possible market timing behavior based on the abnormal returns following a previous issue, and find that underpricing of equity offerings is greater if firms are more likely to have timed the market previously. The additional discount by past market timers can be seen as compensation for the perceived risk that these issuers will time the market again. I also find that the effect of past market timing is most pronounced for issuers that did not experience a change in their CEO in the period between issues. This finding is consistent with recent evidence by Baker and Xuan (2009) that the identity of the CEO matters in assessing past firm performance. I also find that underpricing is less sensitive to positive returns that follow a previous issue, than it is to negative returns. In line with prospect theory, this asymmetric effect could imply that investors are more concerned about potential losses compared with gains. An alternative interpretation of these results is that investors view a share price decline following a previous issue as market timing, but do not view a price increase as the ability of managers to successfully time profitable investment opportunities.

A corollary of the relationship between market timing and underpricing of subsequent equity offerings, is that the choice between debt and equity financing will also be influenced by past market timing. I find that firms that had timed their previous equity offering are more likely to switch to debt for subsequent financing. This suggests that past market timers anticipate the higher discounting and switch to debt in order to avoid additional dilution of share value. The higher cost of equity implies that firms' financial constraints increase if they had timed the market with previous issues, especially if they are unable to subsequently switch to debt. Finally I document that, whereas SEOs are underpriced by more if returns following previous SEOs are more negative, they are not underpriced by more if returns following previous IPOs are more negative. This suggests that investors view IPOs as being less indicative of the market timing motives of follow-on equity issuers.

Chapter 2

Do convertible bond issuers cater to investor demand?[1]

2.1 Introduction

Convertibles are bonds that can be converted into equity at the option of the investor. Convertible debt represents an important source of financing: convertible issuance by U.S. corporations amounted to $61.6 billion in 2007, compared with $71.8 billion raised from seasoned equity issues and $388.5 billion raised from straight debt issues (Securities Data Company New Issues Database).

While there is a substantial theoretical and empirical literature on the characteristics of convertible bond issuers (Green, 1984; Brennan and Kraus, 1987; Brennan and Schwartz, 1988; Stein, 1992; Lewis, Rogalski, and Seward, 1999, 2003), only few papers have studied convertibles from an investor perspective. Ammann, Kind, and Seiz (2007) find that convertible bond returns cannot be fully explained by factors typically used to explain stock and bond returns. Eckmann, Lutz, and Sperl (2007) document that the value of a convertible reflects the interaction between its debt and equity components, rather than just their sum. Thus, convertibles are likely to satisfy certain investor needs that cannot be fulfilled by means of (a combination of) straight debt and equity.

The main goal of this chapter is to examine the impact of investor demand for the particular payoff structure of convertible debt on convertible bond issuance activity. We sequentially examine the influence of investor demand on aggregate convertible bond issuance numbers, convertible bond underpricing, and convertible bond design.

Baker (2009) argues that changes in investor demand can be caused by two factors, i.e., changes in investor tastes and changes in the funds available to investors.[2] Based on this

[1] This chapter is based on De Jong, Duca, and Dutordoir (2010). It has benefited from comments by Ettore Croci, John Doukas, Mara Faccio, Bruce Grundy, Mathieu Luypaert, Elvira Sojli, Mathijs van Dijk, Chris Veld, and participants at the 2009 European Financial Management Association Meeting in Milan, the 2009 BAA Scottish Area Group Conference in Stirling, the 2009 Corporate Finance Day in Antwerp and at seminars at University of Groningen and Maastricht University. I gratefully acknowledge Trustfonds for providing financial support.

[2] In line with Baker (2009), we define investor tastes as "a broader notion of investment sentiment that includes any situation where the preferences (possibly rational) or expectations of the ultimate individual shift over time in a way that is unrelated to corporate fundamentals".

definition, we construct six proxies for investor demand for convertible instruments. To capture fluctuations in investor preferences for the option-like features of convertibles, we use the Campbell and Cochrane (1999) risk aversion measure and the Garleanu, Pedersen, and Poteshman (2009) option demand measure. To capture general investor preferences for convertibles, we include the percentage of convertible debt over-allotment options exercised, as well as abnormal stock returns around convertible bond announcements. To measure capital available for investment in convertible debt, in turn, we use flows into convertible bond mutual funds and flows into convertible arbitrage hedge funds.

We regress quarterly U.S. convertible debt issuance volumes between January 1975 and December 2007 on lagged values of these six investor demand proxies, and find that measures for investor demand are able to explain a substantial part (35.3%) of the variation in aggregate convertible issues. Our results hold after controlling for macroeconomic conditions and firm-specific characteristics and are robust to using alternative measures of convertible debt issuance volumes and investor demand. We also show that most of the proxies for time-varying investor demand for convertibles do not influence aggregate equity or straight debt issuance volumes, which corroborates our hypothesis that convertible bonds are an independent asset class catering to a specific clientele.

Having established that convertible bond issuers cater to fluctuations in investor demand, we subsequently examine whether issuers are able to obtain better prices on their offerings in periods with heightened investor demand for convertible bonds. Several earlier papers have documented that convertibles tend to be underpriced at issuance (e.g., Henderson, 2005; Chan and Chen, 2007; Loncarski, ter Horst, and Veld, 2009). We find that convertible debt underpricing is significantly lower following increases in investor demand for convertible bond offerings, suggesting that issuers opportunistically exploit windows with high investor preferences for convertible financing. Our underpricing analysis controls for macroeconomic conditions, firm-specific characteristics affecting the corporate supply of convertible securities to investors, and security design features.

Finally, we document that issuers adjust the design of their convertible bond offerings to investor preferences. We find that, ceteris paribus, issuers tend to structure their convertible debt offering to be more equity-like during periods when investors are more risk averse. One possible explanation for this result is that risk averse investors may prefer to include equity-like convertibles in their portfolio as an alternative to regular (more risky) common stock.

Overall, our findings provide strong evidence that security issuing firms are aware of changes in investor demand, and use this knowledge to optimize their issuance, pricing, and security design decisions.

Our main contributions to the literature are the following. First, we contribute to a relatively new stream of studies examining the influence of the availability of capital from investors on corporate finance actions and security prices. As pointed out by Baker (2009), corporate finance studies have traditionally focused on the corporate supply side, thereby implicitly assuming that the equilibrium demand by investors is perfectly competitive and elastic at a price that reflects the fundamental value of future cash flows. A number of recent studies show, however, that corporate finance actions can also be influenced through investor demand channels. Massa, Peyer, and Tong (2005), Faulkender and Petersen (2006), Leary (2009), and Lemmon and Roberts (2010) obtain evidence of an impact of the availability of equity or (bank) debt financing on corporate finance decisions and/or security prices. Most relevant to our study, Choi et al. (2010) document that the supply of capital from convertible bond arbitrageurs and mutual funds has a positive impact on recent convertible bond issuance volumes.[3] Our study complements Choi et al.'s work in the following ways. First, while these

[3] As argued by Baker (2009), the terms "demand" and "supply" can be assigned to investors or firms, depending on the perspective that one takes. In this chapter, we use the terminology "investor demand for convertibles" and

authors focus on the supply of capital by convertible arbitrage hedge funds and mutual funds, we examine the impact of a wide range of other measures for time-varying investor tastes for convertible debt on convertible debt issuer behavior. As such, we acknowledge Baker's (2009) statement that investor demand for securities depends both on investor tastes and on the availability of funds for investment. Second, while Choi et al. study an era in which convertible hedge funds play a very important role (i.e., from the mid-1990s onwards), we examine a much larger period spanning from 1975 to 2007. As such, we are able to show that the impact of investor demand on convertible bond issuance activity is not exclusively driven by the large influence of hedge funds over recent years. Third, we offer the additional insight that investor demand fluctuations do not only affect aggregate issuance volumes, but also convertible debt pricing and design decisions.

Our work also contributes to the literature on the impact of catering incentives on corporate finance decisions. Previous studies have shown that catering incentives shape corporate finance choices regarding the market of securities issuance (Kim and Stulz, 1992), dividend payments (Baker and Wurgler, 2004; Manconi and Massa, 2009), stock splits (Baker, Greenwood, and Wurgler, 2009), and investment levels (Polk and Sapienza, 2009). Our results suggest that the characteristics of convertible bonds create a clientele attracted by factors peculiar to these instruments and mostly unrelated to straight debt or equity features, thus reinforcing the notion of convertible debt as a separate asset class.

Finally, we contribute to the existing literature on convertible debt financing. Previous studies on convertible debt issuer motivations and/or convertible debt design mainly focus on the influence of issuer-specific (Lewis, Rogalski, and Seward, 1998, 1999, 2003; Dutordoir and Van de Gucht, 2007) or macroeconomic (Alexander and Stover, 1979; Hoffmeister, Hays, and Kelley, 1987; Mann, Moore, and Ramanlal, 1999; Krishnaswami and Yaman, 2008) determinants. Our study complements these papers by showing that, next to firm-specific and macroeconomic characteristics, temporal fluctuations in investor preferences for convertible securities also play an important role in explaining convertible debt issuance, pricing, and design.

The remainder of the chapter is structured as follows. The next section provides the testable predictions. Section 2.3 describes the data and methodology. Section 2.4 provides the empirical results, and Section 2.5 concludes the chapter.

2.2 Testable predictions

2.2.1 Impact of investor demand on convertible bond issuance

Convertibles should not be considered as a simple combination of debt and equity. The reason is that these instruments also incorporate an option component, resulting in asymmetric payoffs that cannot easily be replicated through a combination of underlying assets. In theory, investors could replicate the convertible debt payoffs by purchasing a combination of a straight bond and a call option on the underlying stock. However, only a limited fraction of convertible bond issuers have call options outstanding. Moreover, outstanding call options typically have a very short maturity (shorter than one year), while convertibles usually have a maturity in the order of 20 years (Lewis, Rogalski, and Seward, 1998). In addition, the risk profile of convertible bond issuers is typically substantially

"corporate supply of convertibles". Alternatively, Choi et al. (2010) use the terminology "investor supply of capital (for convertible investment)" and "corporate demand for convertible financing".

different from that of straight bond issuers (Lewis, Rogalski, and Seward, 1999, 2003), which could make it hard for investors to find a comparable straight bond in the market. Finally, convertibles can include a number of security design features such as soft callability that are not present in straight bonds (Korkeamaki, 2005). For these reasons, it is fair to assume that synthetically-constructed convertibles cannot fully satisfy investor demand for convertible bonds.

Our key hypothesis is that companies cater to temporal fluctuations in investor preferences for the specific features of convertible debt, by deciding to issue convertibles (instead of equity or straight debt) during periods when investor demand for the particular payoff structure of convertible debt is higher.

2.2.2 Impact of investor demand on convertible bond pricing

Chan and Chen (2007), Loncarski, ter Horst, and Veld (2009), and de Jong, Dutordoir, and Verwijmeren (2010) (among others) document that convertible bonds tend to be underpriced at issuance. Potential reasons for convertible debt underpricing include illiquidity, small issue size, and complexities associated with the valuation of hybrid securities (Lhabitant, 2002). Of course it could be questioned why a firm would ever want to issue an undervalued security in the first place. A potential explanation lies in the profile of the typical U.S. convertible debt issuer, i.e., a firm that has difficulties attracting standard (equity or debt) financing instruments (Lewis, Rogalski, and Seward, 1999, 2003).

We predict that initial convertible bond underpricing levels (i.e., offering discounts) are negatively influenced by proxies for investor demand, since convertible issuers exploit the higher demand for their offerings. Baker (2009) labels such behavior "corporate opportunism". While the impact of investor demand on convertible bond underpricing has never been formally examined in the academic literature, several business press articles provide evidence of the importance of investor demand in explaining convertible bond prices. For example:

> "*In what could be a sign of good demand, Gap Inc., the largest U.S. clothing retailer, on Wednesday cut the coupon and boosted the conversion premium on the $1 billion of seven-year convertible senior notes." Reuters (February 27, 2002).*

2.2.3 Impact of investor demand on convertible bond design

A convertible can be considered as a combination of a straight bond and a call option on the issuer's equity. An attractive feature of convertibles is that the issuer has a lot of flexibility with respect to the structure of his offering. By manipulating the different convertible debt design parameters (e.g., conversion premium, callability, maturity), the issuer can make the option component (also frequently labeled "equity component") of the convertible bond smaller or larger in size.

Previous studies (e.g., Lewis, Rogalski and Seward, 1998; Lewis and Verwijmeren, 2009) document that firm-specific and macroeconomic characteristics play an important role in explaining convertible debt design choices. We predict that the structure of convertible debt offerings may also be influenced by temporal changes in investor tastes. More particularly, during periods with stronger investor preferences for more equity- (option)-like securities, convertible debt issuers may structure their offerings to have a larger equity (or option) component. This prediction relies on the dual assumption that (i) issuers are aware of investor preferences, and (ii) issuers take these preferences into account in their design decisions. Offerings that cater to investor preferences may be sold faster and/or at a more favorable price.

2.3 Data and variable measurement

2.3.1 Data set

We obtain data for U.S. convertible bonds issued between January 1st 1975 and December 31st 2007 from the Securities Data Company New Issues Database (henceforth SDC). We use quarterly numbers of convertible debt offerings to measure aggregate convertible debt issuance (IssuesCD). We use a quarterly instead of a monthly frequency to allow for sufficient time between the observation of demand changes and the actual convertible issue. The use of a quarterly frequency is also in line with Lowry (2003) and Pastor and Veronesi (2005), who study time series of initial public offerings. We consider the number of issues a better measure than dollar volumes, since volumes may yield biased results if a small number of firms have large dollar issues. As will be shown further, our main findings remain unaltered when using dollar volumes instead of issuance numbers.

In line with Lowry (2003) and Pastor and Veronesi (2005), we deflate the number of issues by the number of firms listed on the NYSE, AMEX and NASDAQ stock exchanges at the end of the previous quarter. We construct an index for the number of listed firms (with the number of firms listed in 1975 taking the value one) and use this index as denominator to avoid having to divide by a very large number. After excluding financials (SIC codes 6000-6999) and consolidating multiple tranches of convertibles issued by the same firm, we obtain a sample of 3,497 issues corresponding to a total of $900.8 billion expressed in year-2007 USD. We follow a similar procedure to construct the number of U.S. public common equity issues (IssuesEQ) and straight debt issues (IssuesSD), thus obtaining a sample of 12,272 seasoned equity offerings and 22,284 straight debt offerings with total year-2007 dollar values of $1,613.6 billion and $6,196.7 billon, respectively. Figure 2.1 displays deflated numbers of convertible debt, seasoned equity, and straight debt issues. The pairwise Pearson correlation between the number of convertible and equity (straight debt) issues is 0.57 (0.44). Both correlations are significantly different from zero at the 1% level. These significant positive correlation numbers are consistent with the notion that convertibles have both equity-like and debt-like components.

2.3.2 Measures for investor demand for convertible debt

We construct six variables to measure time-varying investor demand for convertible securities. The first four measures capture changes in investor tastes, while the last two measures capture changes in the funds available for investment in convertibles. Whereas each proxy measures a slightly different aspect of investor demand for convertible debt, the proxies are of course related to each other. For instance, a stronger investor taste for convertible debt may result in increased flows into convertible bond funds. The use of six different proxies enables us to capture investor demand for convertibles more accurately than if we would focus on a single measure.

Our first two proxy variables measure temporal variations in investor preferences for the typical payoff pattern of convertibles. Since convertible bonds offer option-like payoffs and downside protection relative to equity (Brennan and Schwartz, 1988), we expect these securities to become more desirable in periods of heightened risk aversion. Several studies show that risk aversion varies over time (Campbell and Cochrane, 1999; Kumar and Persaud, 2002; Brandt and Wang, 2003). We construct a proxy for risk aversion (labeled RiskAversion) based on the Campbell and Cochrane (1999) habit-based model. This model relates risk aversion to surplus consumption, which is a measure of how much instantaneous consumption deviates from a slowly-moving external "habit" level. An above-habit increase in consumption is associated with a decline in risk aversion. We calibrate the model in the same way as Campbell and Cochrane, using quarterly data for real nondurables and services consumption obtained from the National Income and Product Accounts (NIPA) tables. A second proxy, OptionDemand, captures investor demand for the option-like characteristics of convertibles. Garleanu, Pedersen, and Poteshman (2009) show that the difference between implied and realized volatility on the S&P 500 index is a good proxy for option demand. We obtain implied volatilities from the Chicago Board Options Exchange Volatility Index (VXO), which measures the market's expectation of 30-day volatility as implied by S&P 100 (OEX) index options. We then compute the daily difference between the VXO implied volatility and the realized volatility on the OEX index measured over the 60 trading days prior to the VXO observation. We take the quarterly average of daily differences as our measure of option demand. Data used to compute this measure are available from the Chicago Board Options Exchange website from 1986 onwards.

Investor preferences for convertible bonds could also be driven by other factors than the typical option-like payoff structure of these instruments. For example, certain windows may be characterized by (irrational) fads during which investors prefer convertible bond financing over other investment instruments (see, e.g., Baker, 2009). We develop two proxies to measure such general (i.e., not necessarily payoff-related) investor preferences for convertible bonds. First, we include the ratio of the number of convertible debt issues for which the over-allotment option has been exercised by the issuer to the total number of convertible issues in each quarter (labeled OverAllot). Similar to issuers of common equity and straight debt, issuers of convertibles commonly incorporate an over-allotment option into their offering, which they exercise if demand for the offering exceeds the initial offering amount. The over-allotment option normally allows for an additional 15% of offering proceeds to be issued at the issuer's discretion. We obtain information on the exercise of over-allotment options from SDC. Second, in line with other studies on the impact of catering incentives on corporate finance actions (Baker and Wurgler, 2004; Baker, Greenwood, and Wurgler, 2009), we include abnormal stock returns around recent convertible debt announcements (AbnRet) as an investor demand measure. The rationale behind this variable is that more favorable announcement returns should reflect a higher investor appetite for convertible debt. We apply standard event study methodology outlined in Brown and Warner (1985) to calculate abnormal stock returns over the window (–1, 1) around the convertible debt announcement dates (obtained from SDC). We use the return over the CRSP value-weighted market index as a proxy for the market return, and estimate the market model over the window (–240, –40) relative to the announcement date of the offering.

Our final two proxies capture the amount of capital available for investment in convertible bonds. Flows into equity funds have previously been used to capture demand for equity (Cha and Lee, 2001; Baker and Wurgler, 2007). In a similar vein, we use flows into mutual funds specializing in convertible debt investments as a measure for investor demand for convertible debt. We obtain data on mutual fund flows (Mflows) from the CRSP Survivorship-Bias Free Mutual Fund Database. To identify mutual funds investing predominantly in convertible bonds, we follow Agarwal et al. (2006), who select funds that have "CVR" stated as a Strategic Insight (SI) objective. We also incorporate funds with "CV" as their Lipper Objective Code. Moreover, in line with Wermers (2000), we include funds that have at least 50% of their holdings in convertibles over their entire reporting period.[4] A total of 126 funds report their inflows over (part of) the 1975-2007 period. We use data beginning from 1986 since prior to this year the number of funds investing primarily in convertibles is very low (below ten).

Next to mutual funds specialized in convertible bonds, hedge funds have also played a very important role in the convertible debt market since the mid-1990s (Choi, Getmansky, and Tookes, 2009; Choi et al., 2010). These funds typically hold a long position in the bond to take advantage of convertible bond underpricing, and hedge this position by shorting the issuer's stock. As shown by Loncarski, ter Horst, and Veld (2009), arbitrage-related short selling results in downward stock price pressure around the convertible bond issuance date. de Jong, Dutordoir, and Verwijmeren (2010) find, however, that the negative issue-date price pressure associated with arbitrage-related short selling tends to be very short-lived, since it is caused by an uninformed supply shift that is quickly absorbed by the market. Thus, downward stock price pressure associated with hedge fund activity is not likely to be a strong deterrent of the decision to cater to these funds.

We obtain data on flows into convertible bond arbitrage hedge funds from the TASS Live and Graveyard sub-databases, which provide coverage from 1994 onwards. We select those funds that state convertible arbitrage as their primary investment category and that have a U.S.-oriented geographical focus, and convert all asset values to USD. A total of 164 funds report their inflows over (part of) the 1994-2007 period.

We measure mutual fund flows (Mflows) and hedge fund flows (Hflows) in a similar way as Choi et al. (2010). First, we calculate dollar flows for each fund using the change in total net assets over quarter t adjusted for the returns of the fund, as in Equation (1). We then aggregate flows and total net assets across funds for each quarter and divide the change in total flows by total lagged assets to obtain percentage quarterly fund flows [Equation (2)].

$$\text{Dollar Flow}_{it} = \text{Assets}_{it} - \text{Assets}_{it-1}(1 + r_{it}) \quad (1)$$

$$\text{PercentageFlows}_{t} = \frac{\sum_{i=1}^{N} \text{Dollar Flow}_{it}}{\sum_{i=1}^{N} \text{Assets}_{it-1}} \quad (2)$$

In these equations, Assets_{it} refers to total net assets of each fund in quarter t, and r_{it} is the asset return from quarter t–1 to t, calculated from the net asset value of each fund.

Panel A of Table 2.1 provides descriptive statistics for convertible issuance numbers and for each of the investor demand proxies. The largest number of offerings (86.2) occurs in the second quarter of 2003. The first quarter of 1978 is the only period without any convertible issues. In line with previous studies (Kim and Stulz, 1992; Lewis, Rogalski, and Seward, 1999, 2003), we find that convertible debt announcements induce a negative stock price effect (AbnRet of –1.4% on average). Average percentage flows into hedge funds are slightly

[4] The SI and Lipper objectives are classifications of mutual funds. "CVR" and "CV" are the categories referring to convertible bond mutual funds used by the SI and Lipper objectives, respectively.

higher than flows into mutual funds. The Dickey-Fuller unit root test results reject the null hypothesis of a unit root for all variables, except for OverAllot. However, this variable cannot grow indefinitely, since its value is bounded between zero and one by construction. The unit root test results therefore indicate that we can include all variables as such in the time-series regressions, without having to take their first differences.

Panel B presents pairwise Pearson's correlation coefficients for the investor demand proxies. The proxies tend to have rather modest correlations (always smaller than 0.43 in absolute value), which is in line with the notion that they capture different aspects of investor demand for convertibles.

2.3.3 Macroeconomic financing costs proxies

In our empirical analyses, we control for intertemporal variations in financing costs by including a number of widely-used macroeconomic variables (all obtained from Datastream). The real interest rate (Rate) serves as a proxy for bankruptcy risk, as in Krishnaswami and Yaman (2008). This variable is calculated as the difference between yields on 10-year U.S. Treasury Bonds and the inflation rate, defined as the continuously-compounded annual change in the U.S. consumer price index. Following Korajczyk and Levy (2003), we control for business conditions and expected investment opportunities by including the term spread (TermSpread), defined as the difference between yields on 10-year U.S. Treasury Bonds and 3-month U.S. Treasury Bills. Both the real interest rate and the term spread are averaged over the three months prior to the convertible bond issue date. We include the market runup (MktRunup), calculated as the return on the S&P 500 index over the quarter preceding the issue date, to control for general market conditions. To capture uncertainty about market returns, we include the annualised market return volatility (MktVolat), calculated using daily returns on the S&P 500 index over the quarter preceding the issue date. Finally, we control for investor sentiment (Sentiment), following several studies that highlight its importance in security issuance decisions (see, e.g., Lowry, 2003; Helwege and Liang, 2004). As a sentiment proxy we take the average level of the University of Michigan Consumer Sentiment Index over the three months prior to issuance.

2.4 Impact of investor demand on convertible debt issuance, pricing, and design

In this section we describe the empirical results on the impact of investor demand proxies on aggregate convertible bond issuance volumes, pricing, and design.

2.4.1 Impact of investor demand on the aggregate convertible bond issuance volumes

In the first step of our analysis we examine the importance of the six investor demand proxies in explaining aggregate convertible bond issuance fluctuations. Regressions are all estimated by means of the Newey-West technique to obtain heteroskedasticity- and autocorrelation-consistent standard errors. We include an autoregressive AR(1) parameter to correct for residual serial correlation. Table 2.2 reports the results.

In Columns (1) to (6), we separately include each of the investor demand proxies, while controlling for the macroeconomic financing costs proxies described earlier. Column (1) indicates that RiskAversion has a significant positive impact on convertible debt issuance volumes, which is in line with our prediction. To test the robustness of this result, we construct two alternative measures of risk aversion. The first measure is based on Chiu (2006), who uses the difference between flows into government bond funds and flows into equity funds as a proxy for risk aversion (a larger difference implying higher risk aversion). We identify equity and government bond mutual funds using a similar procedure as for convertible bond mutual funds. We use values for this proxy from 1982 onwards, since there are less than ten funds prior to this year. Our second alternative risk aversion measure is based on Kumar and Persaud (2002)'s hypothesis that, if risk aversion increases, investor demand will shift away from risky stocks to less risky securities, thus inducing a negative correlation between stock returns and lagged stock return volatility. Consistent with these authors, we measure risk aversion as the correlation between current returns and lagged volatility across Fama-French 48-industry portfolios. We calculate returns as monthly stock returns summed per quarter, and (annualized) volatility from monthly stock returns measured over the 12 months preceding the quarter. The coefficients of both of these alternative risk aversion proxies (untabulated) are statistically significant with the predicted sign, which further supports the notion that convertible issue volumes are positively influenced by the level of risk aversion in the economy.[5]

Columns (2), (3) and (4) show that our other three investor taste proxies (OptionDemand, OverAllot, and AbnRet) also have a significant positive impact on aggregate convertible bond issuance volumes. The results are not only statistically, but also economically significant. For example, the coefficient on OptionDemand suggests that a one-standard deviation increase in this variable leads to 4.3 additional convertible issues per quarter, and the coefficient on OverAllot indicates that a one-standard deviation increase in this variable leads to an additional 7.2 convertible bond issues per quarter.

In Columns (5) and (6), we report the impact of flows into mutual funds and hedge funds on convertible bond issuance activity. We find that the coefficients on Mflows and Hflows are both positive and significant. Thus, in line with Choi et al. (2010), we obtain evidence that convertible issuance responds to changes in the availability of investor capital. One alternative explanation is that investors increase their investments in convertible mutual funds and hedge funds when they expect a higher convertible bond issuance in the near future. To address this potential reverse causality issue, we conduct Granger causality tests with lag lengths of two quarters over the research window (starting in 1986 for Mflows and in 1994 for Hflows) (untabulated). The relation between Mflows and IssuesCD seems to be bi-directional: Mflows Granger causes IssuesCD (F-statistic for joint significance of lagged values of Mflows regressed on IssuesCD is 18.29), but we cannot rule out that flows into mutual funds are also influenced by anticipated issuance activity (F-statistic for joint significance of lagged values of IssuesCD regressed on Mflows is 5.61). On the other hand, we find strong evidence that Hflows Granger causes IssuesCD, but not vice versa (F-statistic for joint significance of lagged values of Hflows regressed on IssuesCD is 6.91, while F-statistic for joint significance of lagged values of IssuesCD regressed on Hflows is 1.62).

In Column (7), we include all investor demand proxies to assess their joint influence on convertible bond volumes. Together, the investor demand proxies account for more than one-third (35.3%) of the temporal variation in convertible bond volumes. We find that the

[5] Results of all untabulated analyses described throughout this chapter are available upon request from the corresponding author.

coefficients on OptionDemand, Overallot, and Mflows are significant with the predicted signs, while the coefficients on RiskAversion, AbnRet, and Hflows are no longer significant. Some loss in the significance of the individual proxies is expected, since all proxies are designed to capture investor demand for convertible bonds. In Column (8), we repeat this analysis while controlling for macroeconomic financing costs measures. Findings remain similar. Due to the inclusion of Hflows, the regressions in Columns (7) and (8) can only be estimated from 1994 onwards. We obtain similar results when we estimate the regressions in Columns (7) and (8) without Hflows included. With respect to the macroeconomic financing costs proxies, we find that convertible debt issuance volumes are positively influenced by equity market returns (as proxied by MktRunup), although the coefficient is only statistically significant in four out of the eight regression specifications. The finding of a positive impact of equity market conditions on aggregate convertible bond issuance volumes is in line with Hoffmeister, Hays, and Kelley (1987) and Mann, Moore, and Ramanlal (1999).

In summary, the findings reported in Table 2.2 provide support for our hypothesis that security-issuing companies cater to investor demand for convertible debt. To check whether the results in Table 2.2 may be driven by a common trend in issuance numbers and investor demand proxies (potentially causing spurious correlation), we re-estimate the regressions including a time trend variable. Results of these untabulated regressions are virtually similar to those presented in Table 2.2. The time trend variable itself is significant in only two regressions. We also examine the robustness of our findings to the use of different issuance volume measures. Results of this analysis are presented in Table 2.3. Each of the estimated coefficients in Table 2.3 is derived from a regression of an issuance measure (column) on a single investor demand proxy (row), as well as on the aggregate financing costs measures specified earlier and an AR(1) term. The table thus represents the results of 30 separate regressions. For space reasons, we only show the coefficients for the investor demand proxies.

The first column of Table 2.3 uses quarterly dollar volumes of convertible issues, obtained from SDC. All dollar values are deflated by the dollar market capitalization of the U.S. equity market at the end of the prior quarter, downloaded from Datastream. We construct an index for the equity market capitalization, with the market capitalization in 1975 taking the value one, and use this index as our denominator to avoid having to divide by a large number. The dependent variable in Column (2) is the quarterly number of convertible issues deflated by the total number of convertible, common equity and straight debt issues over the quarter. The dependent variable in Column (3) is similar, but based on dollar volumes instead of issuance numbers. The results in Columns (1) to (3) indicate that the findings on the impact of investor demand proxies reported in Table 2.3 are largely robust to using alternative measures for convertible bond issuance fluctuations.

Columns (4) and (5) provide the results of analogous regressions with quarterly numbers of seasoned common equity and straight debt issues (obtained as outlined earlier) as dependent variables. If the six demand proxies effectively capture investor demand specific to convertible bonds, we expect these proxies to have a weaker impact on equity and straight debt issue volumes than on convertible bond issue volumes. In line with this intuition, Column (4) indicates that none of the proxies for convertible debt demand have a significant impact on seasoned equity issuance, except for Mflows. When we orthogonalize Mflows with respect to flows into mutual funds specialised in common equity investments, it becomes an insignificant determinant of equity issuance volume. In Column (5), only OverAllot has a significant coefficient. When we regress the quarterly number of equity (straight debt) issues on all six of the investor demand proxies, we obtain an adjusted R^2 of 1.1% (15.1%) (untabulated), which is substantially lower than the adjusted R^2 of 35.3% obtained for an analogous regression with convertible debt issues as the dependent variable reported in

Column (7) of Table 2.2. Together, these findings suggest that the six investor demand variables capture sources of demand that are specific to convertible debt.

As a final robustness test, we analyse whether the findings on the impact of investor demand on aggregate convertible bond issuance remain intact when controlling for security issuer (i.e., "supply-side") characteristics. The literature provides two main rationales for the use of convertible debt. According to the theories of Green (1984), Brennan and Kraus (1987), and Brennan and Schwartz (1988), convertibles serve as tools to alleviate costs associated with straight debt financing. According to the model of Stein (1992), in turn, convertibles serve as instruments to mitigate equity-related adverse selection costs in the presence of high financial distress costs. On the whole, these models imply that the typical convertible bond financing candidate has high costs of attracting traditional financing instruments (Lewis, Rogalski, and Seward, 1999, 2003). Over time, characteristics of security issuers may shift towards or away from this ideal profile of convertible issuers. If these shifts in security issuer characteristics coincide with shifts in investor demand, our investor demand proxy variables may actually pick up shifts in supply-side characteristics.

To control for this possibility, we use a two-step methodology similar to the approach used by Fama and French (2001) and Baker and Wurgler (2004) in their studies of dividend issuance decisions. We first estimate a logistic regression model for the choice between convertible debt and traditional financing instruments (equity and straight debt) over the period 1975-2007, using firm characteristics as explanatory variables. The prediction errors of this model represent the propensity to issue convertible debt that cannot be explained by firm-specific features (labeled "residual propensity"). In a second step, we average residual propensities across firms for each quarter. This quarterly time series is then regressed on the investor demand proxies, as well as on macroeconomic control variables (all explanatory variables are lagged one quarter). If the investor demand variables remain significant under this alternative specification, we can conclude that our findings are not mainly driven by shifts in firm characteristics.

The first-step logistic regression has an indicator variable equal to one for convertible offerings and equal to zero for equity or straight debt offerings as dependent variable. As independent variables, we include a number of standard firm-specific financing costs proxies used in prior studies on the characteristics of convertible debt issuers (see, e.g., Lewis, Rogalski, and Seward, 1999, 2003; Krishnaswami and Yaman, 2008). We retrieve firm characteristics from the Compustat Fundamentals Annual database, and measure these variables at the fiscal year-end prior to the convertible bond announcement date, unless mentioned otherwise. The symbol "#" denotes a Compustat data item. We include the following variables: StockRunup [cumulative stock return over the window (–240, –40) relative to the announcement date]; Slack [cash and short-term investments (#1) divided by total assets (#6)]; FixedAssets [plant, property and equipment (#8) divided by total assets]; Tax [income tax (#16) divided by total assets]; MB [Market to book value, calculated as the number of shares (#25) multiplied by the share price (#199), divided by the book value of common equity (#60)]; LogAssets [natural logarithm of total assets (#6)]; Leverage [Long-term debt (#9) divided by total assets]; and AssetGrowth [Growth in total assets (#6) calculated over the year prior to the offer].

We also control for idiosyncratic and systematic firm risk using the following proxies suggested by Hoberg and Prabhala (2009): ResVolat [idiosyncratic risk, computed as the annualized standard deviation of residuals from a regression of daily excess stock returns on returns over the CRSP value-weighted market index, estimated over the window (–240, –40) relative to the offering announcement date]; and SysVolat [systematic risk, computed as the annualized standard deviation of the predicted value from a regression of daily stock returns on returns over the CRSP value-weighted market index, estimated over the window (–240, –40) relative to the offering announcement date]. Panel A of Table 2.4 presents the results of the logistic regression model. Compared to issuers of standard financing types, convertible issuers have significantly higher financial slack, leverage, growth opportunities (as proxied by AssetGrowth), and risk (as proxied by ResVolat and SysVolat), and a significantly smaller stock runup, portion of fixed assets, tax to total assets ratio, market to book value, and firm size. Overall, these results corroborate the notion that convertible bond issuers tend to have high costs of attracting equity or straight debt financing.

In Panel B, we regress the residual of the logistic regression on lagged quarterly values of the investor demand and macroeconomic financing costs proxies. Except for Hflows, all demand proxies have a significant impact on issuance volumes with the predicted sign. Similar to the findings reported in Table 2.2, the coefficients on OptionDemand, OverAllot and Mflows remain significantly positive when all investor demand variables are included in one regression equation. We can thus conclude that our findings on the impact of investor demand on aggregate convertible bond issuance volumes are largely robust to controlling for firm-specific characteristics.

2.4.2 Impact of investor demand on convertible debt pricing

Having established that investor demand positively influences aggregate convertible bond issuance, we now examine whether issuers opportunistically exploit fluctuations in investor demand to obtain lower offering discounts (i.e., smaller initial underpricing levels) on their convertible offering. In line with Chan and Chen (2007) and de Jong, Dutordoir, and Verwijmeren (2010), we adopt the following definition of convertible bond offering discounts (OD):

$$OD = \frac{TheorPrice - IssuePrice}{TheorPrice} \quad (3)$$

In Equation (3), TheorPrice refers to the theoretical price of the bond, and IssuePrice refers to actual price at which the bond is issued (obtained from SDC).

To calculate the theoretical convertible bond price, we use the Tsiveriotis and Fernandes (1998) model. Tsiveriotis and Fernandes essentially use a binomial-tree approach to model the stock price process and decompose the total value of a convertible bond into an equity component and a straight debt component. Since the straight debt part is subject to default, it needs to be discounted at a risk-adjusted rate. The residual equity-like part is default-free and can be discounted at the risk-free rate. The Tsiveriotis and Fernandes model is widely-used in other academic studies that examine convertible bond underpricing (Ammann, Kind, and Wilde, 2003; Chan and Chen, 2007; Loncarski, ter Horst, and Veld, 2009; de Jong, Dutordoir, and Verwijmeren, 2010). Zabolotnyuk, Jones, and Veld (2010) point out that the method is also popular among practitioners.

We use the following input variables in the model (all measured as of the convertible bond issue date, unless otherwise mentioned): yield on U.S. government bonds of which the maturity most closely matches the maturity of the convertible bond (obtained from CRSP); Moody's credit ratings or equivalent Standard and Poor's ratings converted to a Moody's rating [both obtained from SDC. We assign a rating of BAA2 to unrated convertibles, as in Loncarski, ter Horst, and Veld (2009)]; credit spreads of similarly-rated corporate straight debt (obtained from Datastream); conversion ratios and call schedules (obtained from SDC); dividend yield for the fiscal year preceding the announcement date [calculated as dividend per share (#26) divided by the stock price (#199)], price of the underlying stock averaged between trading days –12 and –2 (obtained from CRSP); and annualized stock return volatility calculated from daily stock returns over the window (–240, –40). We can calculate offering discounts from 1991 onwards, since credit spreads are not available on Datastream prior to this year. In total, there are 1,105 convertibles for which we have sufficient information to compute offering discounts. We find that these discounts vary substantially (maximum value of 47%, minimum value of –40%). The average offering discount is 16.7%.

To analyze the impact of investor demand on convertible bond offering discounts, we regress the OD of each convertible on the six investor demand proxies, measured at the end of the quarter prior to the convertible bond issuance date. In equilibrium, the convertible debt price should be the result of both investor demand and corporate supply. During periods with a large supply, offering discounts should be larger, ceteris paribus. As a measure for the aggregate supply of convertible bonds, we include the aggregate convertible bond issuance volume over the quarter prior to the convertible bond issuance date (VolumeCD). In addition, we include the macroeconomic financing costs measures defined earlier (each measured at the end of the quarter prior to the convertible debt issuance date). We also control for the following firm-specific characteristics suggested by the literature: StockRunup [Chan and Chen (2007) find that a higher pre-offering stock price runup is associated with lower underpricing]; StockVolat [King (1986) and Kang and Lee (1996) argue that convertibles issued by riskier companies may be more underpriced]; LogAssets (acts as a inverse measure of asymmetric information, which may lead to higher offering discounts); DivYield [acts as an inverse proxy for growth opportunities, as in Billingsley, Lamy, and Thompson (1986). Higher growth opportunities are expected to be associated with lower underpricing, since they increase the option value of a convertible]. Finally, we control for the following security design characteristics that have been shown to affect convertible debt underpricing: Dilution [number of shares issued upon conversion of the bond (obtained from SDC) divided by the total number of shares outstanding at the time of issue (obtained from CRSP). Convertibles inducing a higher level of share dilution are expected to be more underpriced (Billingsley, Lamy, and Thompson, 1986)]; Moneyness [conversion value of the convertible (obtained from SDC) divided by its investment value. The investment value denotes the value of the convertible bond under the assumption that the conversion option does not exist. King (1986), Carayannopoulos (1996), and Ammann, Kind, and Wilde (2003) find a negative relation between underpricing and the degree of moneyness of the convertible]; Maturity [as shown by Ammann, Kind, and Wilde (2003), longer-dated bonds tend to be more underpriced]; and Rating [a scale ranging from 1 for bonds rated AAA by Moody's to 15 for bonds rated B2. We assign a value of 15 to bonds rated below B2. Chan and Chen (2007) find that underpricing is higher for lower-rated bonds].

The results of the underpricing analysis are shown in Table 2.5. *t*-statistics are based on standard errors adjusted for clustering of observations within each year. The coefficients on the investor demand proxies are all significantly negative, indicating that higher investor demand indeed leads to a smaller convertible bond offering discount. The economic magnitude of the impact varies across the proxies. OverAllot has the strongest influence. A one-standard deviation increase in this demand proxy over the quarter prior to the issue (which is equivalent to a 30 percentage point increase in the number of convertible issues made using the overallotment option, relative to total issues over a quarter) leads to 2.8% less underpricing. Given that the average convertible debt issue size between 1991 and 2007 was

$280 million, this demand shock represents an average gain of approximately $7.9 million for each issuer.

With regard to the control variables, we find a positive coefficient for VolumeCD, which is significant in most of the regression specifications. This finding is in line with our expectation that convertible bond underpricing should be higher in periods with high convertible bond issuance. We also find a significant positive coefficient for Rate, and significant negative coefficients for TermSpread, MktRunup and MtkVolat. At the firm level, we find significantly higher initial underpricing for firms having more volatile returns (StockVolat), and a smaller size (LogAssets). The significantly negative coefficient for DivYield suggests that firms with many valuable growth opportunities (as proxied by low dividends) issue bonds that are more underpriced. As expected, underpricing is significantly positively influenced by Dilution, and significantly negatively influenced by Moneyness. Rating has a counterintuitive negative sign, suggesting that bonds with a higher credit rating (scale closer to one) are more underpriced.

The negative relation between the investor demand proxies and convertible debt underpricing provides direct evidence that issuers take advantage of increased investor demand to raise financing at a lower cost. In addition, the observation of a lower underpricing level during high-demand windows suggests that aggregate issuance activity seems to be unable to immediately satisfy the increased demand for convertibles.

2.4.3 Impact of investor demand on convertible debt design

In a final step of our empirical analysis, we examine the impact of temporal fluctuations in investor tastes for relatively more equity-like convertibles on the design of convertible bond offerings. We measure fluctuations in these investor preferences by means of the RiskAversion and OptionDemand proxy variables defined earlier. We predict that, during periods with higher risk aversion, investors should prefer securities with a smaller equity component, causing convertibles to be more debt-like in nature. Conversely, during periods with heightened demand for option-like securities, investors should prefer convertibles to have a larger option component. We thus expect a negative impact of RiskAversion, and a positive impact of OptionDemand on the size of the option component (or equity component) included in convertible bond offerings.[6]

We use two different measures for a convertible bond's equity component. Our first measure, labeled EquityTF, is the equity component obtained from the Tsiveriotis and Fernandes (1998) convertible bond pricing model, divided by the total value of the convertible bond. The equity component represents the difference between the theoretical price of the convertible calculated according to the Tsiveriotis-Fernandes binomial-tree algorithm (using the input parameters described earlier) and the value of an otherwise similar non-convertible straight bond. The average (median) value of EquityTF for the 1,105 convertibles for which we can calculate this component equals 52.8% (51.7%). Our second equity component measure is the convertible bond delta. Delta measures the sensitivity of the convertible bond value to its underlying common stock value. We calculate the convertible debt delta as follows:

[6] As mentioned earlier, we use the terms equity and option component interchangeably, in line with previous papers.

$$\text{Delta} = e^{-\delta T} N(d_1) = e^{-\delta T} N\left\{ \frac{\ln(\frac{S}{X}) + (r - \delta + \frac{\sigma^2}{2})T}{\sigma\sqrt{T}} \right\}, \tag{4}$$

where N(.) is the cumulative probability under a standard normal distribution, δ is the continuously-compounded dividend yield calculated as outlined earlier, S is the price of the underlying stock measured at trading day –5 prior to the issue date, X is the conversion price, r is the yield on a 10-year U.S. Treasury Bond measured on the convertible bond issue date (obtained from Datastream), σ is the annualized stock return volatility estimated from daily stock returns over trading days −240 to −40, and T is the maturity of the convertible. The average (median) delta is 79.5% (84.6%).

Both measures present the advantage that they take into account different convertible debt design features. As such, they provide a more comprehensive measure of the convertible's equity component size than single security design characteristics such as conversion premium or maturity. The Pearson correlation between both measures is 0.34 (significant at the 1% level).

In Table 2.6 we present the results of regressions of the equity component measures on RiskAversion and OptionDemand, both lagged one quarter. We also control for the aggregate financing costs measures and firm-specific characteristics specified earlier. *t*-statistics are based on standard errors adjusted for clustering of observations within each year. In Column (1), we find that RiskAversion has a significant positive influence on EquityTF.. Thus, risk aversion does have an impact on convertible debt design, but in the opposite direction of the one predicted. One possible explanation is that, during periods with heightened risk aversion, investors prefer to include equity-like convertibles in their portfolios as an alternative to (relatively more risky) common stock. Firms may cater to this preference by structuring their convertibles to have a larger equity component. Column (2) shows that OptionDemand has no significant impact. As can be seen in Columns (3) and (4), findings remain similar (albeit at lower significance levels) when we use the convertible debt delta as an alternative equity component proxy. With respect to the influence of the control variables, we find substantial differences across our two equity component measures. For example, LogAssets (StockVolat) has a significant positive (negative) impact on EquityTF, while it has a significant negative (positive) impact on Delta. These results are in line with the notion that, while EquityTF and Delta are positively correlated, these measures capture different aspects of the convertible bond design (e.g., EquityTF takes call features into account, while Delta does not). In unreported analyses, we also examine the impact of the other four investor demand proxies (i.e., OverAllot, AbnRet, Mflows, and Hflows) on convertible debt design. A priori, we expect a less significant impact for these measures. The reason is that they capture general investor preferences for convertible debt (OverAllot and AbnRet) or the availability of investor capital for convertible debt investment (Mflows and Hflows), rather than investor preferences for specific payoff patterns (as do RiskAversion and OptionDemand). In line with this intuition, we do not find a significant impact for either of these proxies.

2.5 Conclusion

We analyze whether convertible debt issuance, pricing, and design decisions are influenced by demand forces from investors. We construct six proxies to capture intertemporal variations in investor demand for convertible bond financing.

We find that convertible debt issuance volumes are significantly positively influenced by investor preferences for convertible debt, as well as by the amount of capital available for investment in this asset class. While our proxies for investor demand for convertibles have a strong impact on aggregate convertible issuance volumes, they have a substantially lower power to explain seasoned equity or straight debt offerings. This finding supports the notion that convertible bonds satisfy a specific clientele, whose needs cannot be fulfilled by means of standard financing instruments. We also obtain evidence that convertible issuers opportunistically set higher prices on their offerings during periods of heightened investor demand, and that these issuers adjust the design of their offering in response to the level of risk aversion of investors. Our empirical analyses all control for macroeconomic financing costs as well as issuer-specific ("supply") characteristics.

On the whole, our results indicate that security-issuing companies are aware of changes in the investor demand for convertible securities, and cater to increases in this demand when deciding on the security type to be issued as well as on the price and structure of the offering.

An interesting question that is left unanswered by our analysis is what drives the temporal fluctuations in investor preferences for convertible securities. We leave this question as a venue for future research.

2.6 Tables

Table 2.1: Summary statistics for convertible issues and investor demand proxies

Panel A provides descriptive statistics on convertible issues and investor demand proxies, based on quarterly observations. IssuesCD refers to the quarterly number of convertible issues. RiskAversion is a habitat-based risk aversion proxy calculated as in Campbell and Cochrane (1999). OptionDemand measures the difference between implied and realized volatilities as in Garleanu, Pedersen, and Poteshman (2009). OverAllot is the number of convertibles for which the over-allotment option is exercised relative to all convertible bond offerings in each quarter. AbnRet captures average abnormal stock returns measured over the window (–1, 1) relative to the announcement date, using standard event study methodology. Mflows measures quarterly flows into convertible mutual funds, obtained from the CRSP Survivorship-Bias Free Mutual Fund Database. Hflows measures quarterly flows into convertible arbitrage hedge funds, obtained from the TASS Live and Graveyard sub-databases. The Dickey-Fuller test has the presence of a unit root as a null hypothesis. Panel B provides pairwise Pearson's correlations between the investor demand proxies. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Panel A. Descriptive Statisitcs

		Investor Demand Proxies					
	IssuesCD	RiskAversion	OptionDemand	OverAllot	AbnRet	Mflows	Hflows
Mean	22.4	6.318	0.044	0.318	-0.014	0.015	0.020
Median	19.1	6.360	0.046	0.208	-0.014	0.005	0.021
Std. Dev.	15.8	0.512	0.027	0.300	0.013	0.063	0.046
Maximum	86.2	7.770	0.112	0.903	0.027	0.235	0.103
Minimum	0	5.064	-0.046	0.000	-0.045	-0.085	-0.125
Observations	132	132	87	87	130	88	54
Unit root: t-statistic	-5.94	-3.78	-8.77	-1.36	-4.94	-3.68	-4.14
Unit root: p-value	0.000	0.004	0.000	0.591	0.000	0.006	0.002
Period	1975-2007	1975-2007	1986-2007	1986-2007	1975-2007	1986-2007	1994-2007

Panel B. Correlations

	Investor Demand Proxies					
	RiskAversion	OptionDemand	OverAllot	AbnRet	Mflows	Hflows
RiskAversion	1					
OptionDemand	-0.02	1				
OverAllot	0.18*	0.02	1			
AbnRet	-0.12	0.19	-0.43***	1		
Mflows	-0.18*	0.19	0.11	-0.09	1	
Hflows	0.23*	0.35***	0.18	-0.01	0.42***	1

Table 2.2: Impact of time-varying investor demand proxies on convertible bond issuance

This table presents the results of regressions of quarterly convertible bond issuance numbers on investor demand proxies and aggregate financing costs measures. The dependent variable is the quarterly number of convertible bond issues, deflated by the number of firms listed on the NYSE, AMEX and NASDAQ stock exchanges at the end of the previous quarter. Investor demand variables and aggregate financing costs measures are calculated over the quarter preceding the convertible bond issue date. RiskAversion is a habitat-based risk aversion proxy calculated as in Campbell and Cochrane (1999). OptionDemand measures the difference between implied and realized volatilities as in Garleanu, Pedersen, and Poteshman (2009). OverAllot is the number of convertibles for which the over-allotment option is exercised relative to the number of convertible bond offerings in each quarter. AbnRet captures average abnormal stock returns measured over the window (–1, 1) relative to the announcement date, using standard event study methodology. Mflows measures quarterly flows into convertible mutual funds, obtained from the CRSP Survivorship-Bias Free Mutual Fund Database. Hflows measures quarterly flows into convertible arbitrage hedge funds, obtained from the TASS Live and Graveyard sub-databases. Rate refers to the quarterly average real interest rate, measured as the difference between yields on 10-year Treasury Bonds and the inflation rate. TermSpread refers to the quarterly average term premium, calculated as the difference between yields on 10-year Treasury Bonds and 3-month Treasury Bills. MktRunup captures the quarterly return on the S&P 500 Index. MktVolat is the annualized market return volatility calculated from daily returns on the S&P 500 index averaged over the quarter. Sentiment is the quarterly average level of the Michigan Consumer Sentiment Index. The starting period varies but all data range until the end of 2007. All regressions are estimated using the Newey-West technique, and include an autoregressive AR(1) parameter to correct for residual serial correlation. *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Investor Demand Proxies								
$RiskAversion_{t-1}$	6.25 *						7.22	6.78
	(1.67)						(1.29)	(0.90)
$OptionDemand_{t-1}$		164.38 **					138.36 *	265.04 **
		(2.12)					(1.75)	(2.50)
$OverAllot_{t-1}$			23.94 **				23.16 ***	32.64 ***
			(2.56)				(3.46)	(3.82)
$AbnRet_{t-1}$				129.31 *			246.76	58.08
				(1.88)			(1.38)	(0.33)
$Mflows_{t-1}$					178.98 ***		256.94 ***	253.65 ***
					(8.18)		(3.08)	(3.40)
$Hflows_{t-1}$						88.19 *	-38.33	-38.70
						(1.73)	(-1.10)	(-1.30)
Aggregate Financing Costs Measures								
$Rate_{t-1}$	1.02	-1.90	2.02	0.13	-2.96 **	-3.62 *		0.15
	(0.99)	(-0.75)	(0.71)	(0.13)	(-2.42)	(-1.94)		(0.08)
$TermSpread_{t-1}$	-0.41	-1.37	-2.95	-0.48	-0.89	0.04		-3.74 *
	(-0.30)	(-0.54)	(-1.11)	(-0.31)	(-0.69)	(0.02)		(-1.78)
$MktRunup_{t-1}$	33.89	46.85 **	22.94	37.98 *	53.65 *	39.32		59.69 *
	(1.64)	(2.08)	(0.89)	(1.86)	(1.96)	(1.02)		(2.01)
$MktVolat_{t-1}$	22.31	26.21	-1.39	29.13	36.78 *	26.88		-19.36
	(1.14)	(1.14)	(-0.06)	(1.54)	(1.68)	(0.72)		(-0.61)
$Sentiment_{t-1}$	-0.04	-0.39	-0.36	-0.08	-0.34 **	-0.30		0.06
	(-0.24)	(-1.29)	(-1.39)	(-0.44)	(-2.41)	(-0.94)		(0.22)
AR(1)	0.52 ***	0.48 ***	0.43 ***	0.58 ***	0.00	0.12		
	(7.82)	(4.67)	(4.24)	(9.54)	(0.01)	(0.69)		
Intercept	-20.10	56.19 **	48.15 *	27.08	59.45 ***	57.73 *	-34.35	-44.07
	(-0.64)	(2.04)	(1.82)	(1.61)	(3.98)	(1.84)	(-0.95)	(-0.67)
Adjusted R-squared	34.0 %	30.2 %	26.4 %	32.8 %	46.3 %	12.7 %	35.3 %	43.9 %
No. of observations	130	86	86	128	87	53	54	54
Starting period	1975	1986	1986	1975	1986	1994	1994	1994

Table 2.3: Robustness of the results to using alternative issuance measures

This table shows the robustness of the results to the use of different issuance measures. Each of the estimated coefficients is obtained from a regression of the dependent variable (column) on a single investor demand proxy (row), as well as on aggregate financing costs measures and an AR(1) term. For parsimony, only the coefficients for the demand proxies are shown. VolumeCD is the quarterly dollar volume of convertible bond issues deflated by the dollar market capitalization of the U.S. equity market at the end of the prior quarter. RelNoCD is the quarterly number of convertible issues deflated by the total number of convertible, equity and debt issues. RelVolCD is the quarterly dollar volume of convertible issues deflated by the total dollar volume of convertible, equity and debt issues. IssuesEQ and IssuesSD are the quarterly numbers of equity and straight debt issues, respectively, deflated by the number of firms listed on the NYSE, AMEX and NASDAQ stock exchanges at the end of the prior quarter. Independent variables are measured over the quarter prior to the convertible issuance date. RiskAversion is a habitat-based risk aversion proxy calculated as in Campbell and Cochrane (1999). OptionDemand measures the difference between implied and realized volatilities as in Garleanu, Pedersen, and Poteshman (2009). OverAllot is the number of convertibles for which the over-allotment option is exercised relative to all convertible bond offerings in each quarter. AbnRet captures average abnormal stock returns measured over the window (–1, 1) relative to the convertible debt announcement date. Mflows measures flows into convertible mutual funds, obtained from the CRSP Survivorship-Bias Free Mutual Fund Database. Hflows measures quarterly flows into convertible arbitrage hedge funds, obtained from the TASS Live and Graveyard sub-databases. The starting period varies but all data range until end the end of 2007. All regressions are estimated using the Newey-West technique. t-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	VolumeCD (1)	RelNoCD (2)	RelVolCD (3)	IssuesEQ (4)	IssuesSD (5)
Investor Demand Proxies					
$\text{RiskAversion}_{t-1}$	158.63 **	0.03 **	0.03 ***	-1.88	20.01
	(2.18)	(2.41)	(2.86)	(-0.17)	(1.23)
$\text{OptionDemand}_{t-1}$	2,884.54 **	0.37 **	0.46 **	130.29	215.53
	(2.56)	(2.56)	(2.22)	(1.29)	(1.28)
OverAllot_{t-1}	278.43	0.05 **	0.06 **	30.28	49.37 *
	(1.53)	(2.18)	(2.18)	(1.53)	(1.68)
AbnRet_{t-1}	2,912.49 *	0.55 *	0.26	191.01	340.90
	(1.94)	(1.97)	(0.75)	(1.05)	(1.34)
Mflows_{t-1}	2,763.11 ***	0.39 ***	0.31 ***	136.30 *	277.70
	(6.83)	(2.91)	(2.71)	(1.97)	(1.46)
Hflows_{t-1}	1,500.46 *	0.12	0.33 **	66.27	69.70
	(2.00)	(1.01)	(2.37)	(1.04)	(0.52)

Table 2.4: Propensity to issue convertible debt instead of seasoned equity or straight debt

This table presents the results of a two-step procedure used to control for the effect of firm characteristics on the decision to issue convertible debt instead of seasoned equity or straight debt. Panel A shows the results of a logistic regression analysis with an indicator variable that takes the value of one for convertible debt and zero for seasoned equity or straight debt issues as dependent variable. The independent variables are measured as of the end of the fiscal year prior to the announcement date, unless otherwise stated. # indicates a Compustat data item. StockRunup is the cumulative stock return over the window (–240, –40) relative to the announcement date. Slack is calculated as cash and short-term investments (# 1) divided by total assets (#6). FixedAssets is calculated as plant, property and equipment (#8) divided by total assets. Tax is taxes paid (#16) divided by total assets. MB refers to the market to book value and is calculated as the number of shares (#25) multiplied by the share price (#199) divided by common equity (#60). LogAssets is the natural logarithm of total assets (#6). Leverage is book leverage, measured as long-term debt (#9) divided by total assets. AssetGrowth is the percentage growth in assets over the year prior to the offering. ResVolat is the annualized standard deviation of residuals from a regression of daily excess stock returns on excess returns on the value-weighted CRSP market portfolio, estimated over the window (–240, –40) relative to the announcement date. SysVolat is the annualized standard deviation of the predicted value from a regression of daily excess stock returns on excess returns of the value-weighted CRSP market portfolio, estimated over the window (–240, –40) relative to the announcement date. The sample covers the period 1975-2007. t-statistics, estimated using Huber-White robust standard errors, are in parentheses. Panel B reports time-series models in which the dependent variable is the propensity to issue convertible debt instead of standard financing instruments, defined as the average quarterly prediction errors from the first-step logistic model. Investor demand variables and aggregate financing costs measures are calculated over the quarter preceding the convertible bond issue date. RiskAversion is a habitat-based risk aversion proxy calculated as in Campbell and Cochrane (1999). OptionDemand measures the difference between implied and realized volatilities as in Garleanu, Pedersen, and Poteshman (2009). OverAllot is the number of convertibles for which the over-allotment option is exercised relative to all convertible bond offerings in each quarter. AbnRet captures average abnormal stock returns measured over the window (-1, 1) relative to the announcement date using standard event study methodology. Mflows measures quarterly flows into convertible mutual funds, obtained from the CRSP Survivorship-Bias Free Mutual Fund Database. Hflows measures quarterly flows into convertible arbitrage hedge funds, obtained from the TASS Live and Graveyard sub-databases. Rate refers to the quarterly average real interest rate, measured as the difference between yields on 10-year Treasury Bonds and the inflation rate. TermSpread refers to the quarterly average term premium, calculated as the difference between yields on 10-year Treasury Bonds and 3-month Treasury Bills. MktRunup captures the quarterly return on the S&P 500 Index. MktVolat is the annualized market return volatility calculated from daily returns on the S&P 500 index averaged over the quarter. Sentiment is the quarterly average level of the Michigan Consumer Sentiment Index. The starting period varies but all data span until the end of 2007. The regressions in Panel B are estimated using the Newey-West technique, and include an AR(1) autoregressive parameter to correct for residual serial correlation. t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

Panel A: Stage 1 Logistic Model

	Dependent Variable = 1 if Firm Issues Convertible debt, 0 if Firm Issues Equity or Straight Debt										
Firm-Specific Characteristics	StockRunup	Slack	FixedAssets	Tax	MB	LogAssets	Leverage	AssetGrowth	ResVolat	SysVolat	Intercept
	-0.35 ***	0.56 ***	-0.87 ***	-3.33 ***	-0.01 **	-0.13 ***	0.29 **	0.03 ***	0.28 **	3.74 ***	-1.31 ***
	(-6.67)	(4.07)	(-9.91)	(-4.64)	(-2.01)	(-10.81)	(1.98)	(2.89)	(2.01)	(15.34)	(-9.83)
McFadden R-squared 6.8 %											
No. of Observations 21, 576											

Panel B: Stage 2 Propensity Model

	Dependent Variable = Propensity to Issue Convertibles Instead of Equity or Straight debt						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Investor Demand Proxies							
$RiskAversion_{t-1}$	3.53 ***						2.78
	(3.04)						(1.64)
$OptionDemand_{t-1}$		44.80 ***					34.46 ***
		(3.56)					(2.78)
$OverAllot_{t-1}$			6.45 ***				4.49 *
			(2.62)				(1.84)
$AbnRet_{t-1}$				47.79 *			0.21
				(1.73)			(0.00)
$Mflows_{t-1}$					47.74 ***		44.34 ***
					(3.38)		(2.92)
$Hflows_{t-1}$						10.00	
						(0.70)	
Aggregate Financing Costs Measures							
$Rate_{t-1}$	0.74 **	0.45	1.28	0.29	0.11	-1.40 **	0.90
	(2.14)	(0.38)	(1.09)	(0.79)	(0.17)	(-2.35)	(1.20)
$TermSpread_{t-1}$	-0.41	-1.43	-1.77 *	-0.39	-1.44 **	-0.06	-1.56 **
	(-1.13)	(-1.43)	(-1.88)	(-0.99)	(-2.47)	(-0.09)	(-2.18)
$MktRunup_{t-1}$	2.95	2.67	-4.83	5.49	-4.15	-6.73	-1.68
	(0.47)	(0.44)	(-0.68)	(0.87)	(-0.54)	(-0.66)	(-0.25)
$MktVolat_{t-1}$	-26.96 ***	-26.74 ***	-35.67 ***	-22.14 **	-28.26 ***	-28.36 **	-29.71 ***
	(-2.98)	(-3.99)	(-4.15)	(-2.36)	(-3.37)	(-2.29)	(-3.11)
$Sentiment_{t-1}$	0.02	-0.06	-0.07	0.02	-0.12 *	-0.02	-0.13
	(0.50)	(-0.65)	(-0.85)	(0.38)	(-1.67)	(-0.16)	(-1.60)
AR(1)	0.53 ***	0.63 ***	0.53 ***	0.58 ***	0.40 ***	0.31 *	0.38 ***
	(6.50)	(5.18)	(3.94)	(7.07)	(4.05)	(1.92)	(3.48)
Intercept	-22.69 ***	8.17	8.37	1.41	16.48 **	8.87	-5.80
	(-2.62)	(1.06)	(1.14)	(0.28)	(2.60)	(0.91)	(-0.42)
Adjusted R-squared	41.7 %	45.6 %	42.5 %	39.1 %	48.9 %	26.3 %	51.6 %
No. of observations	130	86	86	128	87	53	86
Starting period	1975	1986	1986	1975	1986	1994	1986

Table 2.5: The effect of investor demand on convertible debt underpricing

This table presents the results of regressions of convertible debt underpricing on investor demand proxies and control variables. The dependent variable is the percentage underpricing of each convertible debt offering as of its issuance date, calculated by comparing the issue price with the theoretical value determined using the model of Tsiveriotis and Fernandes (1998). Investor demand variables and aggregate financing costs measures are calculated over the quarter preceding the convertible bond issue date. RiskAversion is a habitat-based risk aversion proxy calculated as in Campbell and Cochrane (1999). OptionDemand measures the difference between implied and realized volatilities as in Garleanu, Pedersen, and Poteshman (2009). OverAllot is the number of convertibles for which the over-allotment option is exercised relative to all convertible bond offerings in each quarter. AbnRet captures average abnormal stock returns measured over the window (-1, 1) relative to the announcement date using standard event study methodology. Mflows measures quarterly flows into convertible mutual funds, obtained from the CRSP Survivorship-Bias Free Mutual Fund Database. Hflows measures quarterly flows into convertible arbitrage hedge funds, obtained from the TASS Live and Graveyard sub-databases. VolumeCD is the quarterly dollar volume of convertible bond issues deflated by the dollar market capitalization of the U.S. equity market at the end of the prior quarter. Rate refers to the quarterly average real interest rate, measured as the difference between yields on 10-year Treasury Bonds and the inflation rate. TermSpread refers to the quarterly average term premium, calculated as the difference between yields on 10-year Treasury Bonds and 3-month Treasury Bills. MktRunup captures the quarterly return on the S&P 500 Index. MktVolat is the annualized market return volatility calculated from daily returns on the S&P 500 index averaged over the quarter. Sentiment is the quarterly average level of the Michigan Consumer Sentiment Index. Firm-specific and issue-specific characteristics are measured as of the end of the fiscal year prior to the announcement date, unless otherwise stated (# refers to Compustat data items). StockRunup is the cumulative stock return over the window (–240, –40) relative to the announcement date. StockVolat is the annualized standard deviation of the stock return, calculated using daily returns over the window (–240, –40) relative to the announcement date. LogAssets is the natural logarithm of total assets (#6). DivYield is dividend per share (#26) divided by the stock price (#199). Dilution is defined as the number of additional shares issued upon conversion divided by the total number of shares outstanding at the time of issuance. Moneyness is the conversion value divided by the investment value. Maturity is the final maturity date of the convertible. Rating represents a scaled measure for the bond rating, ranging from 1 for bonds rated AAA by Moody's to 15 for bonds rated B2 or below. The starting period varies, but all data span until end-2007. t-statistics (calculated with standard errors robust to clustering of observations within each year) are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Investor Demand Proxies							
RiskAversion	-1.96 ***						1.50
	(-3.09)						(1.22)
OptionDemand		-55.28 ***					-29.93 ***
		(-5.13)					(-2.70)
OverAllot			-9.45 ***				-9.82 ***
			(-8.16)				(-6.17)
AbnRet				-74.23 ***			-10.49
				(-3.20)			(-0.43)
Mflows					-34.82 ***		-34.41 ***
					(-4.50)		(-3.19)
Hflows						-57.00 ***	-37.80 ***
						(-9.14)	(-6.06)

TABLE 2.5 (*continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Aggregate Financing Costs Measures							
VolumeCD	0.01 **	0.00	0.01 ***	0.00	0.01 ***	0.01 ***	0.02 ***
	(2.32)	(1.06)	(2.99)	(1.43)	(2.87)	(4.10)	(4.05)
Rate	1.64 ***	1.98 ***	0.04	1.89 ***	1.50 ***	2.15 ***	0.70 *
	(7.05)	(8.51)	(0.13)	(7.92)	(6.66)	(7.19)	(1.74)
TermSpread	-0.75 ***	-0.28	-0.10	-0.74 ***	-0.30	-0.52 **	0.49
	(-3.12)	(-1.12)	(-0.40)	(-3.10)	(-1.26)	(-2.24)	(1.64)
MktRunup	-17.57 ***	-20.93 ***	-21.56 ***	-17.58 ***	-11.82 ***	-19.15 ***	-18.46 ***
	(-4.51)	(-5.18)	(-5.36)	(-4.45)	(-3.02)	(-5.05)	(-3.94)
MktVolat	-11.07 *	-6.42	-14.21 ***	-18.61 ***	-13.30 **	-4.98	-1.26
	(-1.90)	(-1.21)	(-2.56)	(-3.31)	(-2.44)	(-0.90)	(-0.22)
Sentiment	-0.01	0.02	0.02	0.00	0.03	0.01	-0.02
	(-0.25)	(0.73)	(0.90)	(0.00)	(1.09)	(0.35)	(-0.39)
Firm-Specific Characteristics							
StockRunup	-0.58	-0.66	-0.92 **	-0.42	-0.43	-0.82 *	-0.78
	(-1.25)	(-1.43)	(-1.98)	(-0.92)	(-0.93)	(-1.71)	(-1.60)
StockVolat	16.95 ***	16.61 ***	17.98 ***	16.43 ***	16.43 ***	17.05 ***	17.44 ***
	(14.58)	(14.69)	(15.49)	(14.23)	(14.25)	(15.24)	(15.61)
LogAssets	-1.44 ***	-1.51 ***	-1.30 ***	-1.51 ***	-1.57 ***	-1.27 ***	-1.20 ***
	(-7.51)	(-8.27)	(-6.73)	(-8.04)	(-8.32)	(-6.27)	(-5.79)
DivYield	-83.95 ***	-80.19 ***	-90.99 ***	-82.00 ***	-75.14 ***	-109.15 ***	-108.40 ***
	(-4.48)	(-4.49)	(-4.77)	(-4.72)	(-4.31)	(-5.31)	(-5.19)
Issue-Specific Characteristics							
Dilution	11.73 ***	12.21 ***	11.65 ***	11.89 ***	11.98 ***	13.28 ***	13.01 ***
	(5.31)	(5.61)	(4.90)	(5.14)	(5.30)	(5.14)	(4.79)
Moneyness	-11.37 ***	-11.43 ***	-11.22 ***	-11.54 ***	-11.53 ***	-12.75 ***	-12.70 ***
	(-9.76)	(-9.89)	(-9.45)	(-9.72)	(-9.84)	(-14.19)	(-13.94)
Maturity	0.05	0.05	0.07 *	0.05	0.05	0.11 ***	0.13 ***
	(1.27)	(1.36)	(1.74)	(1.16)	(1.28)	(3.00)	(3.35)
Rating	-0.57 ***	-0.55 ***	-0.68 ***	-0.52 ***	-0.51 ***	-0.51 ***	-0.58 ***
	(-5.21)	(-5.03)	(-6.34)	(-4.79)	(-4.70)	(-5.36)	(-5.98)
Intercept	49.76 ***	35.82 ***	41.90 ***	36.13 ***	34.29 ***	32.50 ***	33.55 ***
	(10.43)	(11.31)	(13.91)	(11.15)	(11.08)	(8.10)	(3.38)
Adjusted R-squared	69.2 %	69.7 %	70.9 %	69.3 %	69.5 %	72.9 %	74.2 %
No. of Observations	1,052	1,052	1,052	1,052	1,052	932	932
Starting period	1991	1991	1991	1991	1991	1994	1994

Table 2.6: Impact of investor demand on convertible debt design

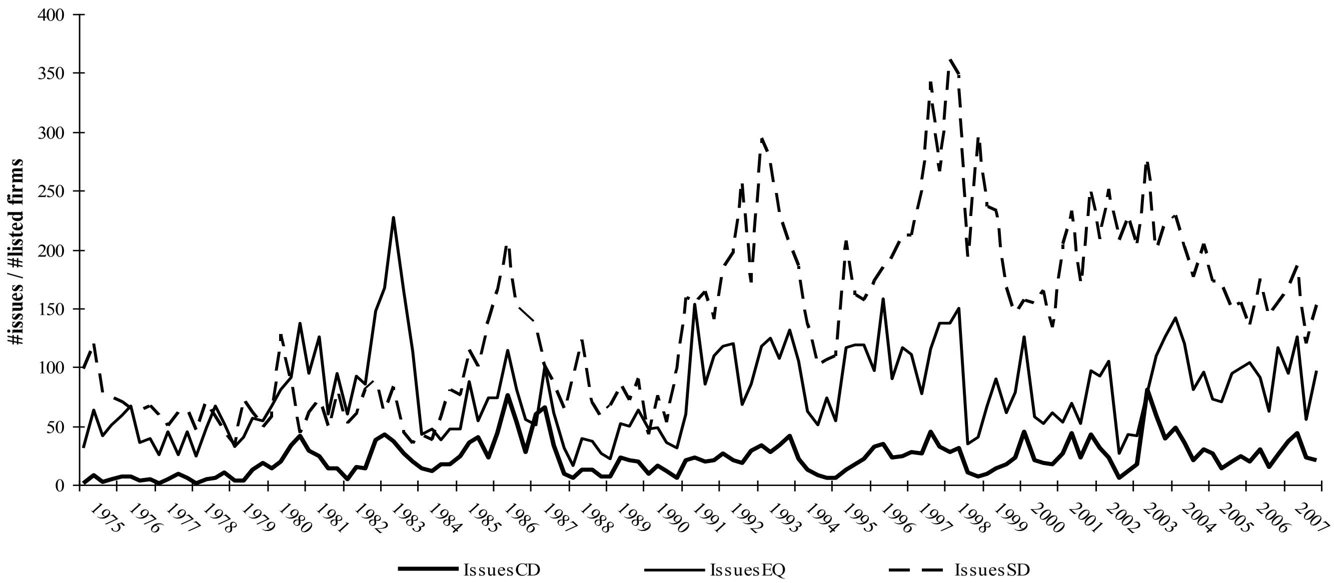
This table presents the results of regressions of convertible bond design on risk aversion and option demand proxies, firm-specific characteristics, and aggregate financing costs measures. EquityTF is the equity component obtained from the Tsiveriotis and Fernandes (1998) convertible bond pricing model, divided by the total value of the convertible bond. Delta is the sensitivity of the convertible bond value to its underlying common stock value. Aggregate financing costs measures are calculated over the quarter preceding the convertible bond issue date. RiskAversion is a habitat-based risk aversion proxy calculated as in Campbell and Cochrane (1999). OptionDemand measures the difference between implied and realized volatilities as in Garleanu, Pedersen, and Poteshman (2009). Rate refers to the quarterly average real interest rate, measured as the difference between yields on 10-year Treasury Bonds and the inflation rate. TermSpread refers to the quarterly average term premium, calculated as the difference between yields on 10-year Treasury Bonds and 3-month Treasury Bills. MktRunup captures the quarterly return on the S&P 500 Index. MktVolat is the annualized market return volatility calculated from daily returns on the S&P 500 index averaged over the quarter. Sentiment is the quarterly average level of the Michigan Consumer Sentiment Index. The following firm-specific characteristics are measured as of the end of the fiscal year prior to the issue, unless otherwise stated. # indicates a Compustat data item. StockRunup is the cumulative stock return over the window (–240, –40) relative to the announcement date. Slack is calculated as cash and short-term investments (#1) divided by total assets (# 6). FixedAssets is calculated as plant, property and equipment (#8) divided by total assets. Tax is taxes paid (#16) divided by total assets. MB refers to the market to book value and is calculated as the number of shares (#25) multiplied by the share price (#199), divided by common equity (#60). LogAssets is the natural logarithm of total assets (#6). Leverage is long-term debt (#9) divided by total assets. AssetGrowth is growth in assets over the year prior to the offering. StockVolat is the annualized standard deviation of the stock return, calculated using daily returns over the window (–240, –40) relative to the announcement date. The starting period varies but all data range until the end of 2007. *t*-statistics (calculated with standard errors robust to clustering of observations within each year) are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Dependent = EquityTF		Dependent = Delta	
	(1)	(2)	(3)	(4)
$RiskAversion_{t-1}$	2.88 ***		0.02 *	
	(2.97)		(1.70)	
$OptionDemand_{t-1}$		-2.46		0.03
		(-0.16)		(0.13)
Aggregate Financing Costs Measures				
$Rate_{t-1}$	-1.09 ***	-1.15 ***	-0.01 ***	-0.01 ***
	(-3.56)	(-3.72)	(-3.24)	(-3.60)
$TermSpread_{t-1}$	0.97 ***	0.78 ***	0.00	0.00
	(3.36)	(2.68)	(0.40)	(-0.97)
$MktRunup_{t-1}$	-15.44 ***	-14.01 ***	-0.14 **	-0.04
	(-3.10)	(-2.76)	(-2.21)	(-0.65)
$MktVolat_{t-1}$	-33.94 ***	-23.82 ***	-0.29 ***	-0.16
	(-4.36)	(-3.17)	(-2.92)	(-1.53)
$Sentiment_{t-1}$	0.08 *	0.04	0.00 ***	0.00 ***
	(1.91)	(0.99)	(5.96)	(2.97)
Firm-Specific Characteristics				
StockRunup	2.89 ***	2.78 ***	-0.01	0.00
	(5.11)	(4.94)	(-0.99)	(0.11)
Slack	-1.65	-1.33	0.01	-0.02
	(-1.12)	(-0.91)	(0.63)	(-0.94)
FixedAssets	-2.61 *	-2.81 *	-0.07 ***	-0.09 ***
	(-1.67)	(-1.77)	(-3.76)	(-3.99)
Tax	15.07	16.54 *	0.38 ***	0.44 ***
	(1.59)	(1.73)	(3.37)	(3.46)
MB	0.05	0.04	0.00	0.00
	(1.22)	(0.86)	(0.38)	(-0.77)
LogAssets	0.71 ***	0.83 ***	-0.04 ***	-0.04 ***
	(3.03)	(3.58)	(-13.85)	(-11.37)
Leverage	0.57	0.31	0.11 ***	0.09 ***
	(0.33)	(0.18)	(4.54)	(3.64)
AssetGrowth	0.02	0.01	0.00	0.00
	(0.87)	(0.60)	(1.00)	(0.92)
StockVolat	-4.10 ***	-3.49 **	0.29 ***	0.25 ***
	(-2.63)	(-2.23)	(8.39)	(6.96)
Intercept	30.92 ***	51.18 ***	0.60 ***	0.86 ***
	(3.95)	(13.24)	(6.36)	(15.94)
Adjusted R-squared	9.7 %	8.9 %	29.6 %	28.3 %
No. of Observations	956	956	1,898	1,494
Starting period	1991	1991	1980	1986

2.7 Figures

Figure 2.1: **Quarterly number of convertible debt, equity and straight debt issues**

This figure shows quarterly numbers of corporate security issues between January 1975 and December 2007. Issue data are from the Securities Data Company (SDC) New Issues Database. The number of issues is deflated by an index based on the number of public firms listed on NYSE, AMEX and NASDAQ at the end of the previous quarter. IssuesCD, IssuesEQ, and IssuesSD refer to numbers of convertible debt, seasoned equity, and straight debt issues respectively.



Chapter 3

Changes in the convertible buyer base and new issue announcement returns[7]

3.1 Introduction

Convertible bonds are hybrid securities that combine features of straight debt and equity. They resemble straight debt by paying a fixed coupon rate, and they resemble common equity by offering the possibility of conversion into stock as an alternative for receiving the nominal value in cash at the redemption date. Convertibles are a popular source of financing. Over the past 30 years, convertible debt issuance comprised approximately ten percent of total securities issuance by U.S. corporations.[8]

Existing event studies on the announcement effects associated with convertible debt offerings generally focus on convertibles issued during the 1970s and 1980s. A common finding of these studies is that convertibles induce negative abnormal stock returns that are intermediate in size between the announcement effects associated with seasoned equity and straight debt offerings (Dann and Mikkelson, 1984; Mikkelson and Partch, 1986; Lewis, Rogalski, and Seward, 1999). This pattern is consistent with the signaling model of Myers and Majluf (1984), which predicts that relatively more equity-like security offerings are more likely to be perceived as a signal of firm overvaluation.

This chapter is inspired by the observation that convertible bond announcement effects have sharply declined over the past decade, whereas there is no corresponding decline in equity or straight debt announcement returns. While convertible offerings announced between 1984 and 1999 induce average abnormal stock returns of −1.69%, convertibles announced in the period 2000 to 2008 are associated with average abnormal stock price declines that are more than twice as large (−4.59%).

[7] This Chapter is based on Duca, Dutordoir,Veld, and Verwijmeren (2010). It has benefited from comments by Stefano Bonini, Abe de Jong, Achim Himmelmann, Andreas Hoepner, Peter Roosenboom, Frederik Schlingemann, Heather Tarbert, Mathijs van Dijk, and participants at the Conference of the Scottish BAA in Glasgow (August 2010), the International Corporate Finance and Governance Symposium in Twente (October 2010), and the Campus for Finance Conference in WHU Otto-Beisheim (January 2011).

[8] That is ten percent of the total amount of convertible debt, common equity, and straight debt issued by U.S. firms (excluding financials and utilities). Source: Securities Data Company New Issues database.

We hypothesize that the sharp decline in observed convertible bond announcement returns is attributable to a substantial change in the buy-side of the convertible bond market. Convertibles traditionally appealed to long-only investors looking for diversification benefits and indirect participation in equities (Lummer and Riepe, 1993). However, Choi, Getmansky, and Tookes (2009) show a dramatic increase in the importance of convertible arbitrage funds since the end of the 1990s. To exploit underpriced convertible issues, convertible bond arbitrageurs buy the convertibles and short the underlying common stock. If demand curves for stock are downward-sloping, the supply increase associated with this arbitrage-related short selling should result in a negative stock price effect. Of course, short-selling activities take place when convertible bond arbitrageurs are actually able to buy the offerings, i.e., on convertible bond issue dates rather than on announcement dates. However, for almost all recent convertible bond offerings issuance occurs either on the announcement date or one trading date after that. The very rapid issuance of recent convertibles can be explained by the fact that most of these issues are structured as Rule 144A offerings, which allows for a very fast (often overnight) placement (Huang and Ramirez, 2010). Therefore, our key prediction is that the observed highly negative "announcement" effect of recent convertible bond issues may partly reflect temporary price pressure associated with the activities of convertible bond arbitrageurs.

To test this prediction, we collect a sample of 1,436 convertible bonds issued by U.S. corporations from the Securities Data Company's New Issues database (henceforth SDC). In line with previous studies (Choi et al., 2009, De Jong, Dutordoir, and Verwijmeren, 2010), we construct a measure for the amount of hedging-induced short selling associated with each convertible bond offering by regressing changes in monthly short interest around convertible bond issues on a number of potential firm-specific, issue-specific and time-varying determinants of arbitrageurs' interest in a given offering. The predicted value of this regression reflects the portion of the change in monthly short interest that can be attributed to short selling by convertible bond arbitrageurs (as opposed to short selling by fundamental traders).

In line with our hypothesis, we find that the difference in announcement-period returns between convertibles issued in the period 1984 to 1999 (labeled "Traditional Investor period") and convertibles issued in the period 2000 to September 2008 (labeled "Arbitrage period") is no longer significant after controlling for our constructed measure for arbitrage-induced short selling. Our findings are robust to alternative specifications of arbitrage-induced short selling, and remain intact when controlling for issuer-specific, security-specific, and macroeconomic determinants of convertible bond announcement effects.

The recent credit crisis placed serious constraints on the ability of convertible bond arbitrageurs to execute their hedging strategy. As a result, the convertible bond buyer base underwent a second important shift, from hedge funds back to long-only investors. In an article in the Financial Times of May 11, 2009, Masters (2009) writes: "*Now hedge funds play a much smaller role in the investor base, representing less than half of the buyers of new issues* (of convertible bonds) *in many cases."* In line with this comment, Hutchinson and Gallagher (2010) show a strong decline of the number of unique convertible bond arbitrage funds in the TASS database after August 2008. From an arbitrage viewpoint, we therefore expect to observe less negative abnormal returns for convertibles issued during the financial crisis. However, our event-study results indicate that the average announcement effect for convertible bonds issues between the Lehman Brothers collapse in September 2008 (which is often taken as a starting point of the crisis period) and December 2009 is almost twice as negative as in the Arbitrage period (−9.12%). Our evidence suggests that this very negative reaction can be attributed to the extremely high underpricing of crisis-period convertibles. While Arbitrage-period offerings are issued at an average discount of 15.7%, offering discounts for Post-Lehman offerings are more than twice as large (34.2% on average). Issuing highly underpriced convertibles may have been the only option for cash- and credit-constrained firms during the crisis.

To further strengthen our case for the arbitrage explanation for the evolution in convertible bond announcement effects, we also analyze post-issuance abnormal stock returns. If the observed negative announcement effects of Arbitrage-period convertibles are indeed partly attributable to hedging-induced price pressure, then we should observe a positive stock price reversal quickly after the convertible bond issue date. The reason is that, after a short time, the market should have absorbed the effect of the supply shock. Consistent with this prediction, we find significant positive abnormal stock returns following Arbitrage-period convertible bond issues, with the magnitude of the reversal significantly influenced by our constructed measure for the hedging demand associated with these offerings. Also in line with the arbitrage explanation, we find no evidence of such reversal for issues made during the Traditional Investor and Post-Lehman periods.

Our analysis provides the following two main contributions to the literature. First, our study sheds a new light on long-accepted stylized facts on the relative magnitude of security offering announcement effects, by documenting that announcement-period returns associated with recent convertible offerings are far more negative than those for equity offerings. However, we also show that part of the highly negative "announcement" return associated with Arbitrage-period convertibles is actually caused by a short-lived stock price pressure induced by short-selling activities of convertible bond buyers. Our results imply that event studies using recent convertible bond offering announcements should correct for the influence of buy-side short selling associated with announced convertible bond issues. If not, they are likely to draw wrong (i.e., overly pessimistic) conclusions on the true magnitude of the transactions' impact on firm value.[9]

Second, our study contributes to a recent stream of corporate finance articles that explicitly take the influence of investor characteristics into account. As pointed out by Baker (2009), corporate finance studies have traditionally focused on the corporate supply side, thereby implicitly considering the investor side as a black box with perfectly elastic and competitive demand. However, a number of studies find that corporate finance actions can also be influenced through investor demand channels (e.g., Faulkender and Petersen, 2006; Leary, 2009; Lemmon and Roberts, 2010). Within this stream of literature, a limited number of papers document the impact of the actions of convertible bond arbitrageurs on convertible bond issuance volumes (Choi, Getmansky, Henderson, and Tookes, 2010; De Jong, Duca, and Dutordoir, 2010) and convertible bond design (Brown, Grundy, Lewis, and Verwijmeren, 2010; De Jong, Dutordoir, and Verwijmeren, 2010). Our study compliments these papers by examining the impact of buy-side shifts on stockholder wealth effects of convertible bond issues.

The remainder of this chapter is structured as follows. The next section provides the theoretical background for our study. Section 3.3 describes the data and methodology. Section 3.4 discusses the empirical results. Section 3.5 concludes the chapter.

[9] Similarly, Mitchell, Pulvino, and Stafford (2004) show that almost half of the negative "announcement return" observed around fixed-exchange-ratio mergers is attributable to short-lived price pressure caused by the hedging transactions of merger arbitrageurs.

3.2 Theoretical background

In this section, we first briefly describe the two important shifts in the convertible bond investor base that occurred over the past decade. We then formulate our testable predictions on the impact of these shifts on the stockholder wealth effects of convertible bond offerings.

3.2.1 Shifts in the convertible bond investor base

Theoretical studies on convertible debt predict that convertibles are able to mitigate costs associated with attracting common equity and/or straight debt financing (Green, 1984; Brennan and Schwartz, 1988; Stein, 1992). Consistent with the hybrid debt-equity nature of convertible debt, event studies on the announcement effects associated with convertible debt offerings commonly find that these effects are negative and intermediate in size between the announcement effects associated with seasoned equity and straight debt offerings.[10]

The majority of these studies focus on a period in which convertible bond investors (e.g., mutual funds specialized in convertible bond investments) buy the convertibles without shorting the underlying stock. Around the beginning of the 21st century, however, the convertible bond investor base shifted from traditional long-only buyers towards convertible bond arbitrageurs (mostly hedge funds, but also institutional investors). By the beginning of the 21st century, hedge funds were purchasing up to 80% of new convertible issues (Brown et al., 2010).

The recent credit crisis, in turn, marked a substantial decline in the importance of convertible bond arbitrageurs as convertible bond investors. One of the reasons why arbitrage funds lost their grip on this market was the short sales ban affecting U.S. financial stocks between September 19, 2008 and October 8, 2008.[11] Other factors disadvantaging convertible arbitrage include widespread hedge fund redemptions, extensive deleveraging, and higher funding and borrowing costs (Credit Suisse/Tremont Hedge Index research report, May 2009).

The main goal of this chapter is to examine the impact of these two important shifts in the involvement of convertible arbitrage funds on the stock price effects of convertible bond offerings. We distinguish three periods, each with a different involvement of convertible bond arbitrageurs. It is difficult to exactly indicate when convertible bond arbitrageurs became dominant players in the convertible bond market, because hedge funds do not disclose much information on their investments. To obtain more insight into the evolution of convertible arbitrage funds over time, we search the Factiva database for news sources that mention "convertible arbitrage" or related terms over the period 1984 to 2009.[12] Figure 3.1 provides the results of this search. The graph shows a sharp rise in the number of hits from 2000 onwards. This result is in line with Choi et al. (2009), who document a dramatic increase in the total assets under management of convertible bond hedge funds at the end of the 1990s.[13] We therefore use January 2000 as a cutoff date for the start of the Arbitrage

[10] See Eckbo, Masulis, and Norli (2007) for an overview of the literature.

[11] See Beber and Pagano (2010) and Grundy, Lim, and Verwijmeren (2010) for a detailed discussion of the short sales ban.

[12] Factiva provides access to thousands of archived newspaper and magazine articles, as well as to press releases appearing on newswires.

[13] A Credit Suisse/Tremont Hedge Index research report dated May 2009 confirms that January 2000 is a reasonable cutoff date for the start of the Arbitrage period: "*Up until the year 2000, the convertible bond market*

period, in which the convertible bond investor base is dominated by convertible bond arbitrageurs, and label the previous window (from 1984 to December 1999) the Traditional Investor period.

It is also not straightforward to determine an exact date for the start of the financial crisis. As argued by Beber and Pagano (2010), the collapse of Lehman Brothers on September 15, 2008 is one of the most salient turning points in the course of events leading to the crisis. We therefore consider this date as the start of the third era, labeled “Post-Lehman” period.

3.2.2 Testable predictions

Unlike traditional long-only investors, convertible bond arbitrageurs generally short a portion of the common stock of the issuing firm to make their position invariant to small stock price movements. Their profits result from the fact that convertibles tend to be underpriced at issuance, and/or from their ability to exploit superior technology in managing convertible risk (Agarwal, Fung, Loon, and Naik, 2006).[14]

If demand curves for stock are not perfectly elastic, the increase in the supply of shares resulting from arbitrage-related short selling should induce downward stock price pressure around the convertible bond issuance date. A number of studies effectively find evidence of negative abnormal stock returns around convertible bond issue dates (Arshanapalli, Fabozzi, Switzer, and Gosselin, 2005; Loncarski, ter Horst, and Veld, 2009; De Jong, Dutordoir, and Verwijmeren, 2010).

An important feature of recent convertible bond offerings is that they are placed very rapidly (often overnight), causing their announcement and issuance to be very close. The most important reason for this rapid placement is that most recent convertibles are structured as 144A offerings. Such offerings can be sold to selected institutional investors without having to incur time-consuming activities such as road shows and SEC filings.[15] As a result of the overlap between issuance and announcement dates, the observed “announcement” effect of convertible bond issues may partly reflect price pressure associated with the shorting activities of convertible arbitrageurs. Given the different levels of involvement of this investor class over the three eras considered in our study, we thus obtain the following hypothesis:

Hypothesis 1: Arbitrage-period convertibles induce more negative announcement-period stock returns than Traditional Investor- and Post-Lehman-period convertibles.

Stock market reactions to convertible bond announcements may be influenced by the characteristics of the issuer, the convertible bond design, as well as by macroeconomic conditions at the moment of issuance (Lewis et al., 1999, 2003; Dutordoir and Van de Gucht, 2007; Krishnaswami and Yaman, 2008; Loncarski, ter Horst, and Veld, 2008). Thus, any

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was primarily driven by long-only buyers. Hedge funds entered the space in increasing numbers thereafter (...). The hedge fund influx represented a change in the buyer base.”

[14] Potential reasons for convertible debt underpricing include illiquidity, small issue size, and complexities associated with the valuation of hybrid securities (Lhabitant, 2002).

[15] One other reason why recent convertibles often have their issuance and announcement very closely together is that convertible arbitrage hedge funds tend to have a flexible, flat organization form, which enables them to decide very fast on whether they will include the convertible bond issue in their portfolio. In our empirical analysis, we include appropriate control variables for convertibles for which the announcement and issue dates coincide, as well as for 144A issues.

observed difference in the stockholder wealth effects of convertible bond offerings across the three periods may also be caused by temporal shifts in these determinants. We establish whether the differences in stockholder wealth effects across the three periods are effectively caused by temporal changes in buy-side characteristics by testing the following prediction:

Hypothesis 2: Differences in announcement-period returns between Arbitrage-period convertibles and Traditional Investor-/Post-Lehman-period convertibles disappear when controlling for arbitrage-related short selling associated with the convertible debt offering.

The arbitrage explanation for differences in stock price reactions across the three periods also yields a testable prediction on the stock price behavior shortly after the convertible bond offering. More particularly, if (part of) the negative stock price effect associated with Arbitrage-period convertibles is indeed caused by an increase in the supply of stock associated with arbitrage-related short selling, then we expect to observe a stock price reversal shortly after the issuance of these offerings. The underlying rationale is that demand curves for stock tend to be inelastic only in the short run, so stock prices should revert to their fundamental values once the market has absorbed the shock (Harris and Gurel, 1986). By contrast, in the Traditional Investor and Post-Lehman periods, there should be no such stock price reversal. We thus obtain the following hypothesis:

Hypothesis 3: Convertible offerings made during the Arbitrage period are followed by a positive stock price reversal. No such reversal takes place in the Traditional Investor and Post-Lehman periods.

3.3 Data and methodology

In this section, we first describe how we obtain the data sets of convertible, seasoned equity, and straight bond offerings. We then discuss our measure for the arbitrage-related short selling associated with convertible bond offerings, as well as the different control variables included in the analysis.

3.3.1 Convertible bond, equity, and straight bond samples

We obtain data for U.S. convertible debt, equity, and straight debt issued between January 1984 and December 2009 from the SDC Database. We exclude utilities (SIC codes 4900-4999) and financial firms (SIC codes 6000-6999), and consolidate multiple tranches of convertibles and straight debt offerings issued by the same firm on the same date. In the convertible bond sample, we only include "plain vanilla" convertible bonds (no exchangeable bonds, mandatory convertible bonds, or convertible preferred stock). In the equity sample, we only include seasoned common stock offerings made by the firm itself (no IPOs, no offerings made by existing shareholders, no preferred stock issues, no unit issues). We eliminate asset- and mortgage-backed bonds, depository notes, and bonds issued with warrants from the straight debt sample. We obtain a data set of 1,436 convertible bond issues, 4,885 equity issues, and 8,734 straight bond issues. There are 727 convertible issues in the Traditional Investor period, 645 convertible issues in the Arbitrage period, and 64 convertible issues in the Post-Lehman period.

We obtain company accounts variables from the Compustat Fundamentals Annual database, stock-price related data from the Center for Research in Security Prices (CRSP), deal-specific information from SDC, and macroeconomic data from Datastream.

3.3.2 Measure for arbitrage-related short selling

To test the arbitrage explanation for differences in convertible bond announcement returns across the three periods, we construct a measure for the amount of arbitrage-related short selling associated with each convertible bond offering. In a first step, we download monthly short interest data from the Securities Monthly file of the CRSP-Compustat merged database. These data are available from March 2003 until June 2008. To match short interest data to convertible bond issues, we apply the algorithm used by Bechmann (2004) and Choi et al. (2009). If a bond is issued before the cutoff trade date of a given month (i.e., three trading days prior to the 15^{th} of each month), we match the issue date with the short interest data filed for that month. Otherwise, we match the issue date with the short interest data for the following month. As short interest is reported bi-monthly since September 2007, we adjust the algorithm to a two-monthly frequency from that month onwards. We scale the change in monthly short interest (ΔSI) by the number of shares outstanding (SO) measured on trading day –20. We find an average (median) value of 0.019 (0.014) for the ΔSI/SO ratio, which is similar to values recorded by Choi et al. (2009) and De Jong, Dutordoir, and Verwijmeren (2010).

As argued by Choi et al. (2009), part of the observed increase in short interest around convertible bond offerings may be attributable to the short-selling actions of fundamental traders. In a second step, we therefore need to isolate the portion of the ΔSI/SO measure that can effectively be attributed to the shorting actions of convertible bond arbitrageurs. We do this by regressing ΔSI/SO on a number of potential determinants of convertible arbitrageurs' interest in that particular convertible offering. We then take the predicted value for this regression as a measure for the change in short interest caused by arbitrage-related short selling (as opposed to fundamental short selling).[16]

A priori, we expect a convertible bond arbitrageur to be more interested in issuers with more liquid shares (since high liquidity makes it easier for arbitrageurs to obtain their hedging positions), high institutional ownership (since institutional investors are more likely to lend out their shares than individual investors), volatile stock returns (since volatility positively affects the option value of the convertible, thus allowing a higher potential profit), and no dividend payouts (since dividends represent a cash outflow for short sellers). We therefore include the Amihud (2002) measure for illiquidity, the percentage of institutional ownership, the stock return volatility, and a dummy variable equal to one for convertible debt issuers that paid out a dividend in the previous fiscal year in the regression analysis. Appendix A contains detailed definitions for these variables. Next to issuer characteristics, we also expect arbitrageurs' interest in a convertible bond issue to be affected by the characteristics of the offering itself. We predict a larger increase in arbitrage-related short interest around offerings for which arbitrageurs need to short-sell a larger number of shares to hedge their positions. We therefore include the ratio of S_{arb} to shares outstanding, with S_{arb} representing the expected number of shares shorted by arbitrageurs under the assumption that

[16] Mitchell et al. (2004) apply a similar procedure to isolate the portion of changes in short interest attributable to the hedging behavior of merger arbitrageurs.

the arbitrageurs follow a delta-neutral hedging technique.[17] S_{arb} depends on the convertible bond proceeds, the conversion ratio, and the equity component size of the offerings. Appendix B provides a more detailed description of this variable. We also expect arbitrageurs to be more interested in zero-coupon convertibles. The reason is that paying no coupons makes it easier to separate the option component of the convertible from its fixed-income component, which is a technique often applied by convertible arbitrage hedge funds.

Panel A of Table 3.1 provides descriptive statistics for these potential issuer- and issue-specific hedging demand determinants for the three periods.

In the last column, we provide the results of *t*-tests for pairwise differences in the means across two periods. The letters a (b) indicate significant differences (at the 5% level) in the mean value between the Traditional Investor and the Arbitrage (Post-Lehman) period, and the letter c indicates a significant difference (at the 5% level) in the mean value between the Arbitrage and the Post-Lehman period. The Kruskal-Wallis *p*-value indicates the joint significance level of the difference in the variables across the three periods.

We find evidence of significant differences in the potential hedging demand determinants across the three periods. Most remarkably, the percentage of institutional ownership of convertible debt issuers increases substantially between the Traditional Investor and the Arbitrage period (from 41.4% to 71.5%), and the stock return volatility is almost twice as large for Post-Lehman issuers than for other issuers. It is also striking that, while approximately 7% of the convertibles issued during the first two periods have a zero-coupon structure, we find no zero-coupon offerings in the Post-Lehman period.

Panel B of Table 3.1 presents the results of a regression analysis of ΔSI/SO on the potential determinants of arbitrageurs' hedging demand. The analysis includes convertibles issued between 2003 and 2008 for which all necessary explanatory variables are available. In all regressions reported throughout the chapter, we calculate *t*-statistics using White (1980) heteroskedasticity-robust standard errors.

Next to issuer- and issue-specific features, the reported regressions also include measures for temporal variations in the importance of convertible arbitrage activities. Such variations may occur due to fluctuations in macroeconomic conditions and/or in the capital available for investments in arbitrage funds. As a first proxy for temporal fluctuations in the importance of convertible bond arbitrageurs, we include the number of news sources in Factiva that mention "convertible arbitrage" or a related term over the three months prior to issuance (CAFactiva). One limitation of this measure is that it does not control for the actual content of the news source. Since both positive and negative developments regarding arbitrage funds may be newsworthy items, CAFactiva may be high both in periods in which arbitrageurs realize high profits (i.e., the Arbitrage period) and in periods with a high failure rate among convertible arbitrage funds (i.e., the Post-Lehman era). Figure 3.1 suggests that this may indeed be the case, as the number of convertible arbitrage-related announcements remains high throughout the Post-Lehman era. In Column (2) of Panel B, we therefore include lagged capital flows into convertible arbitrage funds (CAFlows) over the quarter prior to issuance as an alternative proxy for temporal fluctuations in the activities of hedge funds. Appendix A provides a detailed description of the calculation of this variable. The CAFlows variable may be a more accurate measure than CAFactiva, but presents the disadvantage that it can only be obtained from 1994 onwards.

The R^2s of the regression specifications in Columns (1) and (2) indicate that, together, the arbitrage demand proxies are able to explain approximately 20% of the variation in short

[17] Arguably, arbitrageurs may take other Greeks (e.g., gamma, vega) into account when deciding on their hedging positions. Still, most of the convertible arbitrage strategies build on the delta-neutral hedging technique (Calamos, 2003).

interest increases around convertible bond offerings. This result is consistent with the notion that part of the increase in short interest reflects trading patterns by fundamental traders rather than arbitrageurs. The regression results suggest that the expected number of shares shorted (Sarb/SO) is the most important determinant of arbitrageurs' hedging demand. The Amihud illiquidity measure also has a significant coefficient with the predicted negative sign, while the other variables have non-significant coefficients.

In a final step, we use the coefficients of the regression in Column (1) of Table 3.1 to obtain an estimate of the arbitrage-related change in short interest for each convertible debt offering issued over the period 1984 to 2009. That is, for each observation for which we have all explanatory variables available, we multiply the value of the regression coefficients by the values of the correspondent explanatory variables. The resulting value represents the estimated change in short interest (relative to shares outstanding) caused by convertible arbitrageurs' short selling associated with that particular convertible bond.[18]

3.3.3 Control variables

Next to our hedging demand measure, we also include a number of issuer-specific variables in our analysis of convertible bond announcement returns. Appendix A provides a detailed definition of each of the control variables. All issuer characteristics included in the regression analyses are measured at fiscal year-end preceding the convertible debt announcement date, unless otherwise indicated.

Since convertibles encompass an equity component, we expect stockholder reactions to convertible debt announcements to be more negative for issuers with high equity-related financing costs. Similarly, due to the debt component embedded in convertible debt, we also expect convertible debt announcement returns to be more negative for issuers with high costs of attracting new debt financing.[19] In line with Lewis et al. (1999, 2003), we use the amount of slack capital and the pre-announcement stock runup (measured as the continuously-compounded non-market-adjusted daily stock return over trading days –60 to –2 relative to the announcement date) as proxies for the level of equity-related financing costs faced by the convertible debt issuers. When a firm with sufficient slack capital and/or a high stock runup issues equity, stockholders are more likely to infer that this firm is overvalued. We thus expect both the slack capital and the pre-announcement stock runup to have a negative impact on stockholder reactions to convertible debt announcements. To capture the level of debt-related financing costs of the convertible debt issuers, we include the ratio of taxes paid to total assets and the ratio of long-term debt to total assets. In the finance literature, it is generally assumed that firms with a higher leverage ratio and a lower tax ratio face higher costs of attracting new debt financing (see, e.g., Lewis et al., 1999, 2003). Next to these specific equity- and debt-related costs measures, we also include four control variables that act as proxies for both equity- and debt-related financing costs. The volatility of the firm's

[18] Findings remain similar when we use the coefficients in Column (2) for this purpose. The reason why we use Column (1) is that CAFactiva is available over the entire sample period, while CAFlows is only available from 1994 onwards.

[19] This prediction might seem at odds with the convertible debt rationale of Stein (1992), which states that convertibles can be used as tools to mitigate equity-related adverse selection costs. However, even though convertibles entail smaller equity-related financing costs than equity offerings, their equity component still induces an incremental increase in the level of equity-related costs of the issuing firm. Thus, *within* a convertible debt sample, we expect stockholder reactions to be more negative for issuers with high equity-related financing costs. An analogous reasoning applies for the impact of debt-related financing costs on convertible debt announcement returns.

stock expressed relative to the volatility on the S&P 500 index measures the level of asymmetric information associated with the firm, as well as the firm's riskiness. The market-to-book ratio may act as a proxy for growth opportunities (and as such be negatively associated with financing costs), but may also measure the potential for underinvestment and asymmetric information. As such, its predicted impact is unclear. Lastly, we include the ratio of fixed assets to total assets and the natural logarithm of total assets. Firms with a high proportion of fixed assets and/or a large size tend to have lower levels of asymmetric information relating to their value and risk, resulting in smaller equity- and debt-related financing costs (MacKie-Mason, 1990).

We also control for a number of issue-specific characteristics. We include the ratio of offering proceeds to total assets, since Krasker (1986) predicts that relatively larger equity(-linked) security offerings should result in more negative announcement returns. We include the delta (calculated as outlined in Appendix B) to control for the equity component size of the convertible bond issue. Following Myers and Majluf (1984), we expect relatively more equity-like convertibles to induce more negative stockholder wealth effects. We also include a 144A dummy variable to disentangle the effect of the 144A private placement of convertibles from the effect of hedging-induced short selling, and an Issue=Announcement dummy variable equal to one for convertibles for which the issue date either coincides with the announcement date or falls on the trading day after the announcement date. Convertibles for which this is the case should be associated with more negative wealth effects in the window (−1, 1), since the announcement-period returns are more likely to capture hedging-induced price pressure.[20] We also control for convertible bond offering discounts (calculated as outlined in Appendix C). Offerings with higher discounts should be received less favorably by the market, since they imply a wealth transfer from existing shareholders to convertible bondholders.

Finally, we control for a number of standard macroeconomic determinants suggested by the literature, i.e., interest rates, term spreads, market returns, and market return volatilities. In the regressions, all macroeconomic determinants are lagged one quarter. Following a similar reasoning as for the issuer-specific variables, we expect stock price reactions to convertible debt announcements to be negatively influenced by proxies for aggregate financing costs. We thus expect a negative impact of interest rates, term spreads, and market return volatilities, since these variables act as proxies for the level of debt-related financing costs in the economy as a whole (Choe, Masulis, and Nanda, 1993; Korajczyk and Levy, 2003; Krishnaswami and Yaman, 2008). In turn, we expect a positive impact of market returns, since financing costs are assumed to be lower during market booms (Choe, Masulis, and Nanda, 1993).

Table 3.2 provides descriptive statistics for these control variables, and compares their average values across the three periods.

The univariate test results indicate that Arbitrage-period issuers have a significantly larger slack and market-to-book ratio, and significantly smaller tax payments, relative stock return volatility, fixed assets, and total assets, than Traditional Investor-period issuers. With the exception of the finding on the stock return volatility, these results suggest that firms issuing convertibles during the Arbitrage period face higher external financing costs than pre-2000 issuers. Post-Lehman issuers also differ from those in the other periods on several dimensions, but the results do not provide a clear picture on the relative magnitude of their

[20] Huang and Ramirez (2010) find no differences in announcement effects between public and Rule 144A issue markets for firms issuing convertible bonds in the period 1991-2004. In contrast to this result, Carayannopoulos and Nayak (2010) find that issuers of convertible bonds under Rule 144A experience a negative stock price reaction on the announcement day, over and above any reaction associated with public issues of convertible bonds.

financing costs. On the one hand Post-Lehman issuers tend to have low tax levels and high debt levels, suggesting high debt-related financing costs, but on the other hand they tend to have low market-to-book ratios and a large firm size, which is consistent with low costs of attracting external financing.

While issue proceeds and delta are not significantly different between the Traditional Investor period and the Arbitrage period, Post-Lehman offerings are significantly smaller in size, and significantly more debt-like in nature (smaller delta). In line with Huang and Ramirez (2010), we find that the percentage of convertibles issued under Rule 144A increases dramatically in the beginning of this century. While only 9% of the Traditional Investor-period issues are made under the Rule 144A regime, the percentage of Rule 144A issues increases to 85% in the Arbitrage period. In the Post-Lehman period this percentage drops back to approximately one-third of all offerings (34%). We also find a sharp increase in the percentage of offerings for which the announcement and issue date coincide, which is likely to be linked to institutional developments in the convertible debt market (increase in the importance of 144A offerings, and increase in hedge fund involvement). Finally, we observe substantial differences in convertible bond underpricing across the three periods. Traditional Investor-period offering discounts are significantly higher than those during the Arbitrage period. However, Arbitrage-period convertibles are still substantially underpriced (average offering discount of 15.7%), thus offering ample profit potential for convertible bond arbitrageurs. Post-Lehman offerings, in turn, are offered at discounts that are more than twice as large as the underpricing levels during the Arbitrage period (average offering discount of 34.2%). One possible explanation for this finding is that, during the crisis period, issuers that cannot obtain standard financing sources (e.g., due to serious restrictions on the possibility to obtain bank debt) use convertible bonds as a last-resort financing type. The exceptionally high underpricing levels may be necessary to convince risk-averse investors to include the convertibles in their portfolios.[21,22]

We also find that most of the macroeconomic variables are significantly different across the three periods. Together, the descriptive results presented in Table 3.2 highlight the need to control for firm-specific, issue-specific, and macroeconomic financing costs measures when analyzing the source of the differences in abnormal stock returns between the three periods.

3.4 Empirical results on stockholder wealth effects of convertible bond offerings

In this section, we provide the results of our empirical tests on the validity of the arbitrage explanation for changes in the stockholder wealth effects of convertible bond announcements. We first provide event-study results on the magnitude of the announcement effects of convertible bond, equity, and straight bonds over the three time periods. We then analyse the

[21] In line with this intuition, a report by Calamos and Calamos (2008) states that convertible debt undervaluation levels were "*historically high*" as per October 2008, creating an "*incredible opportunity*" for convertible bond arbitrageurs. Of course we do realize that this text is included in a sales report for the Calamos convertible debt investment funds, and that the statements should be interpreted in this light. The "undervaluation" levels are probably also high in this period to compensate for high liquidity risk.

[22] In line with this intuition, the article "Companies return to convertibles" (Masters, Financial Times, May 11, 2009) mentions: "*The big shift came after last autumn's collapse of Lehman Brothers when bank lending dried up. Under pressure to cut their debt, many companies began looking for new sources of financing. Straight bond issues for companies with less than stellar credit ratings and those in cyclical sectors proved problematic - many would have to pay double-digit coupons and risk being rated at less than investment grade*."

impact of arbitrage-related short selling on convertible bond announcement returns, while controlling for other announcement-return determinants. We conclude by examining stock price behavior following convertible bond offerings.

3.4.1 Stockholder wealth effects of convertible, equity, and straight debt announcements

We measure abnormal stock returns by applying standard event-study methodology as outlined in Brown and Warner (1985). We use the return over the CRSP equally-weighted market index as a proxy for the market return, and estimate the market model over the window (–240, –40) relative to the announcement date. In line with most existing event studies, we measure cumulative announcement returns (CARs) over the window (−1, 1) relative to the security offering announcement date. We assume that the public announcement of convertible debt offerings happens on the filing date obtained from SDC.[23] However, this date is only available for publicly-placed convertible bond issues. For the remainder of the convertibles (754 in total), we manually look up the announcement date (identified as the date on which the offering is first mentioned) in Factiva. For equity offerings, we identify the announcement date as the filing date stated in SDC (available for virtually all of the offerings). For publicly-placed straight debt offerings, we also use the filing date. For straight debt issues for which the filing date is not available due to the fact that they are either structured as 144A offerings or privately placed (60.4% of the sample), we use the issue date obtained from SDC. Our findings remain similar when we exclude the straight debt issues for which we have no filing date available from the analysis. Table 3.3 provides the results of the event-study analysis for the three security types.

During the Traditional Investor period, we observe security offering announcement effects that are similar in magnitude to those documented in prior studies (see Eckbo et al., 2007). This is no surprise since most prior event studies on security offerings also focus on issues made prior to 2000. Consistent with *Hypothesis 1*, we find that convertible bond announcement returns are significantly more negative during the Arbitrage Period than during the Traditional Investor Period (−4.59% compared with −1.69%), while equity and straight debt announcement returns remain fairly stable. However, inconsistent with *Hypothesis 1*, we find that Post-Lehman-period convertible bond announcement effects are significantly more negative than those in the previous two periods (–9.12%). Equity announcement returns are also slightly more negative over this period (–3.21%), but the magnitude of the change is much smaller than that for convertibles. Kruskal-Wallis *p*-values confirm that there are substantial differences in abnormal stock returns around convertible bond announcements across the three periods (*p*-value for differences in convertible bond wealth effects across the three periods is smaller than 0.001), while there are no such differences for equity and bond returns.

Figure 3.2 visualizes the evolution in security offering announcement effects over our research period by plotting quarterly average shareholder wealth effects for each of the three security types. The observed patterns are similar as those discussed in the context of Table 3.3: while equity and straight debt offering announcement effects remain fairly constant (except for a decrease in equity offering announcement effects during the Post-Lehman

[23] We manually cross-checked the accuracy of the filing dates by verifying the actual announcement dates obtained from Factiva for 100 convertible bond issues. The results of this check indicate that SDC filing dates are accurate. However, some of the announcements are time-stamped after the closure of the stock market, which is why we also include day +1 in our analysis of convertible debt announcement returns.

period), convertible debt announcement returns exhibit a declining trend. Returns sharply drop as of the beginning of the Arbitrage period, and fall even further at the beginning of the Post-Lehman period.

3.4.2 Determinants of stockholder wealth effects of convertible debt announcements

In a next step of the empirical analysis, we test whether the evolutions in convertible debt announcement returns documented in Table 3.3 and Figure 3.2 can effectively be attributed to changes in the convertible bond investor base (as predicted by *Hypothesis 2*). Table 3.4 reports the results of regression specifications with the CAR over the window (−1, 1) relative to the convertible bond announcement date as dependent variable.

Model (1) only includes a dummy variable equal to one for convertibles issued during the Arbitrage period (ArbPeriod), and a dummy variable equal to one for convertibles issued during the financial crisis (PostLehmanPeriod) on the right-hand side. Both variables have significantly negative regression coefficients. The differences between the periods are large in economic terms: the abnormal return in the Arbitrage Period is almost three percentage points lower than in the Traditional Investor period, and the abnormal return in the Post-Lehman period is more than seven percentage points lower than in the Traditional Investor period.

The significantly more negative CARs during the Arbitrage and Post-Lehman periods may be attributable to shifts in issuer, issue, and/or macroeconomic characteristics across the periods. For example, as shown in Table 3.2, Arbitrage-period issuers tend to have higher costs of attracting external financing, and may therefore receive more negative stockholder reactions to their convertible bond offering announcements. In Model (2), we therefore extend the regression with the control variables specified earlier. We find that the ArbPeriod and PostLehmanPeriod dummy variables still have significantly negative effects, but that the magnitude of their coefficients is only about half as large as in Model (1). This result suggests that the more negative announcement effects induced by recent convertible bond offerings are indeed partly attributable to changes in the control variables. Consistent with this intuition, we find that the inclusion of the control variables results in a substantial increase in the adjusted R^2, from 7.40% to 10.12%.[24] CARs are significantly positively influenced by the market-to-book ratio, which is in line with results reported by De Jong, Dutordoir, and Verwijmeren (2010). In line with our expectations, we also find that abnormal returns are significantly negatively influenced by the issuer's relative volatility, the Issuance=Announcement dummy variable, the term spread, and the market return volatility.

One of the control variables included in Model (2) is a dummy variable equal to one for Rule 144A offerings. Denis and Mihov (2003) show that relatively more risky firms are more likely to opt for a Rule 144A offering. The coefficient of the Rule 144A dummy may thus be affected by an endogeneity bias if we include this variable as such in the regression analysis. Heckman (1979) demonstrates that such bias can be avoided by not only including the particular dummy variable in the regression analysis, but also including the Inverse Mills ratio. The inclusion of the Inverse Mills ratio corrects for the potential correlation between unobservable factors affecting both the decision to structure a convertible as a 144A offering

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[24] We include industry dummies based on two-digit SIC codes as additional control variables in robustness tests, and find that our results remain similar. The industry dummies have low explanatory power. In fact, we find that the adjusted R^2 slightly decreases when we include industry dummies.

and the stockholder reactions to convertible bond announcements, thus allowing us to obtain unbiased regression estimators in the abnormal return regression equation. As suggested by Heckman (1979), we first estimate a probit analysis with the 144A dummy variable as dependent variable, and with various control variables specified earlier on the right-hand side. The inverse Mills ratio (IMills) can be derived from this probit regression using the procedure outlined by Li and Prabhala (2007).

Table 3.5 reports the results of the first-stage probit analysis. The dependent variable is equal to one for 144A offerings, and equal to zero otherwise.[25] We find that Rule 144A issues are made by firms with a significantly larger slack capital and firm size and significantly smaller taxes paid and fixed assets than non-Rule 144A issues. Furthermore, they have larger offering proceeds and a larger delta. We also find a significant negative impact of the interest rate and a significant positive impact of term spreads. Overall, the probit results suggest that the choice to structure a convertible bond offering as a Rule 144A issue is non-random, although we do not find direct evidence linking this choice to the firm’s risk, as in Denis and Mihov (2003). Model (2) of Table 3.4 shows that convertible debt announcement effects are not significantly different for 144A convertibles (non-significant coefficient on the 144A dummy variable). This result corroborates results of Huang and Ramirez (2010), but goes against the results of Carayannopoulos and Nayak (2010). The coefficient on the Inverse Mills ratio is not significant either.

Hypothesis 2 implies that the differences in convertible bond announcement returns across the three periods should not longer be significant after controlling for differences in arbitrage-related short selling. In Model (3), we test this prediction by including the variable DemandArbitrage, which captures the predicted hedging demand from convertible bond arbitrageurs. DemandArbitrage is equal to the predicted increase in short interest caused by arbitrage-related activities (calculated as outlined earlier) for convertibles issued during the Arbitrage period, and equal to zero for convertibles outlined in the other two periods. Model (3) thus relies on the assumption that there is no convertible arbitrage activity at all during the Traditional Investor and Post-Lehman periods. In line with *Hypothesis 2*, we find that the effect of the ArbPeriod dummy variable is no longer significantly negative after controlling for the price pressure caused by convertible bond arbitrage activity during the Arbitrage period. DemandArbitrage itself has a highly significant, negative effect on the CAR, which is consistent with the prediction that higher short selling is associated with stronger price pressure. However, inconsistent with *Hypothesis 2*, the impact of the PostLehmanPeriod dummy variable is still significantly negative in Model (3), suggesting that the highly negative CARs registered during the crisis period cannot (entirely) be ascribed to convertible arbitrage activities.

In Model (4), we relax the assumption that there is no arbitrage-related short selling at all outside the Arbitrage period by including two additional hedging demand variables. DemandTradInvestor is equal to the expected hedging demand for convertibles issued during the Traditional Investor period, and equal to zero otherwise. DemandPostLehman is defined in an analogous way for Post-Lehman offerings. The findings for our main variables of interest, ArbPeriod and PostLehmanPeriod, remain unaltered under this alternative scenario. ArbPeriod has a non-significant regression coefficient, while the impact of PostLehmanPeriod is significantly negative. With regards to the hedging demand proxies, we again find a significant negative impact for DemandArbitrage. We also find a significantly negative coefficient for DemandTradInvestor. The latter result is consistent with the notion that even during the Traditional Investor period there was already some short-selling activity by convertible bond arbitrageurs, although the size of the coefficient is small relative to its

[25] Almost all non-144A offerings are publicly placed (only 1.08% of the convertibles are privately placed without using Rule 144A).

size in the Arbitrage period. During the Post-Lehman period, by contrast, we do not find evidence of any price pressure caused by hedging activity (coefficient of DemandPostLehman is not significant). This finding is consistent with the severe restrictions on convertible arbitrage activities during that period.

Overall, we can conclude that the regression results pertaining to the Arbitrage period are in line with *Hypothesis 2* (i.e., the differences in CARs disappear when controlling for arbitrage-related short selling), while the regression results pertaining to the Post-Lehman period are not consistent with this hypothesis. One potential explanation for the highly negative announcement returns associated with crisis-period convertibles that we did not explore so far is their high initial underpricing reported in Table 3.3. In Model (5), we therefore augment Model (4) with the offering discount of the convertible bond offerings. Due to the limited availability of some of the input variables needed to calculate underpricing, we can only estimate this regression from 1991 onwards. We exclude the Rule144A and Issue=Announcement dummy variables because there are too few observations for which these dummy variables are zero over that time span.

We find that the coefficient on the PostLehmanPeriod dummy variable is no longer statistically significant after controlling for issue-date convertible bond underpricing. Hence, the more negative announcement effects of Post-Lehman offerings (relative to Traditional Investor-period convertibles) seem to be attributable to the large underpricing of offerings in the Post-Lehman period.[26] The coefficient on the OfferingDiscount variable is significantly negative, which is consistent with the issuance of underpriced securities representing a wealth transfer from current shareholders to the buyers of the convertible securities. It could be questioned why companies issue such highly underpriced convertibles. One possible explanation is that they simply had no other choice, due to the very large difficulties in obtaining classic financing types such as bank debt during the financial crisis.

3.4.3 Stock returns following convertible bond offerings

To examine *Hypothesis 3*, we calculate CARs over the extended windows (2, 5) and (2, 10) following convertible bond issuance dates. The length of the windows is motivated by earlier studies showing that stock price reversals following arbitrage-related supply shocks tend to occur very fast (Harris and Gurel, 1986; Mitchell et al., 2004). Moreover, using longer windows would introduce too much noise in the abnormal return estimates (Wurgler and Zhuravskaya, 2002). Table 3.6 reports the results of this analysis.

Panel A provides univariate results on the stock returns following convertible offerings in the three periods. In line with our arbitrage explanation for the highly negative stock price effects observed for Arbitrage-period convertibles, we find significantly positive post-issuance stock returns for offerings made during this period. The positive abnormal stock return of 0.54% over window (2, 10) represents approximately 12% of the absolute value of the announcement-period CAR (0.54/4.59). Thus, in line with previous studies (Dhillon and Johnson, 1991; Mazzeo and Moore, 1992; Lynch and Mendenhall, 1997; De Jong, Dutordoir, and Verwijmeren, 2010), our evidence suggests that there is only a partial reversal of the

[26] The reduction in the significance of the effect of the PostLehmanPeriod dummy variable in Model (5) could also be attributable to the fact that we use a more narrow research period in this regression, due to the restrictions that the underpricing variable imposes on our sample period. We verify whether this is the case by re-running the regression in Model (4) for convertibles issued between 1991 and 2009. The untabulated results show that the Post-Lehman dummy variable is significantly negative even over this restricted window (*t*-statistic of –3.07), thus alleviating the concern that the change in its significance in Model (5) is mainly caused by a change in the research period.

negative impact of the supply shock. However, it is hard to isolate the true magnitude of the reversal of the price pressure effect due to the fact that the CAR (−1, 1) simultaneously captures the effect of the signaling content of the convertibles (which should be permanent) and the effect of price pressure resulting from arbitrage trading (which should be temporary, at least if demand curves for stock are only inelastic in the short run).

Also in line with *Hypothesis 3*, we find no evidence of a positive stock price reversal in the Traditional Investor and Post-Lehman periods. Abnormal stock returns over the window (2, 10) are even significantly negative during both periods. The finding of negative post-issuance returns is consistent with Lewis, Rogalski, and Seward (2001), who report long-run stock price underperformance following convertible debt issuance over longer investment horizons.

In Panel B, we regress post-issuance stock price returns on our measures for arbitrage-related increases in short interest.[27] We also include the Amihud illiquidity measure, since price reversals should be stronger for more illiquid stocks (Bagwell, 1992). If the positive stock price reversal following Arbitrage-period convertibles is indeed related to the supply shock caused by arbitrage-induced short selling, we expect this reversal to be stronger for convertibles attracting a higher hedging demand. In line with this prediction, we find a significant positive impact of our constructed hedging demand measure for the Arbitrage period (DemandArbitrage) on stock price reactions over windows (2, 5) and (2, 10). Also consistent with our expectations, the coefficients on the corresponding hedging demand measures for the Traditional Investor and Post-Lehman periods are not significant. Overall, the findings on stock price behavior following convertible debt issues are thus consistent with *Hypothesis 3*.

3.5 Summary and conclusions

Over the past decades, the convertible bond market has experienced a substantial shift in its buyer base. In this chapter, we show that this shift has important implications for the stockholder wealth effects registered around convertible bond announcements. We distinguish three different periods. The first period (1984-1999) is characterized by traditional investors who take long positions in convertible bonds. In the second period (2000 to September 14, 2008) the majority of convertible buyers are convertible arbitrageurs that combine a long position in convertibles with short positions in the underlying stock. In the third period (September 15, 2008 to 2009), hedge funds partly lose their grip on the convertible bond market. We find strong differences in convertible bond announcement effects between these three periods. In the Traditional Investor period, the average abnormal return is −1.69%, which is below the average abnormal return associated with a common stock issue (−2.34%). This result corresponds to findings of previous event studies, and is widely interpreted as evidence for the signaling model of Myers and Majluf (1984). In the Arbitrage period, stockholder wealth effects of convertible bond announcements decrease to −4.59%, while straight debt and equity announcement returns remain fairly constant. Our results provide two non-mutually exclusive explanations for this sharp drop in announcement effects. First, part of the negative "announcement" effect is caused by price pressure associated with arbitrage-related short selling of convertible hedge funds. Second, we find that part of the more negative announcement effect registered during the Arbitrage period can

[27] The number of observations in Panel B drops slightly compared to Panel A because data are not available for all explanatory variables.

be attributed to changes in firm-specific, security design, and macroeconomic characteristics over time.

An interesting question is why firms have continued to issue convertible securities in the Arbitrage period after managers observed the negative price effects surrounding these issues. We attempt to answer this question by examining post-issue effects, and we show that the negative price effect upon issuance in the arbitrage period partly reverses after the convertible bond offering. An additional motivation for why firms continued to sell convertibles to hedge funds is that these funds can use their expertise in short-selling to distribute equity exposure to a large number of well-diversified investors, which makes hedge funds relatively low-cost distributors of equity exposure for the firm (Brown et al., 2010).

During the financial crisis, we observe a further decrease in the abnormal returns around convertible bond announcements (−9.12%), while abnormal returns around equity announcements decrease to a much smaller extent (−3.21%) and abnormal returns around straight debt announcements remain virtually unchanged. The very negative convertible bond announcement returns are surprising given the smaller involvement of convertible arbitrage funds during this period. We find that the high underpricing of Post-Lehman convertibles plays a role in explaining the much more negative stockholder wealth effects associated with these securities.

Our results suggest that event studies on recent convertible bond announcements need to take the price pressure caused by convertible arbitrage strategies into account if they want to obtain unbiased estimates of the signaling content of convertibles. Our findings also highlight the need to control for convertible bond underpricing when analyzing stock price reactions to convertible bond announcements.

3.6 Tables

Table 3.1: Construction of our measure for arbitrage-related short selling

Panel A shows summary statistics for the potential determinants of the arbitrage-related short selling associated with a convertible bond offering. Variables are defined as outlined in Appendix A and B. The Traditional Investor period ranges from 1/1/1984 to 31/12/1999 and refers to the period before the surge in convertible arbitrage hedge funds, while the Arbitrage period ranges from 1/1/2000 to 14/9/2008 and refers to the period when convertible arbitrageurs were the predominant purchasers of convertible debt issues. The Post-Lehman period ranges from 15/9/2008 to 31/12/2009 and refers to the period following the collapse of Lehman Brothers. The Kruskal-Wallis test is used to test for the differences of the characteristics between all three sub-periods. The independent sample *t*-test (assuming unequal variances) is used to test for the equality of means across any two sub-periods. Pairs for which the difference is statistically significant at at least the 5% level are indicated by the letters a, b, or c, where a indicates a significant difference between the Traditional Investor period and the Arbitrage period, b indicates a significant difference between the Traditional Investor period and the Post-Lehman period, and c indicates a significant difference between the Arbitrage period and the Post-Lehman period. Panel B presents the results of an OLS regression analysis that estimates the arbitrage-related change in short interest over the period 01/01/2003 to 14/09/2008. The dependent variable ΔSI/SO is the change in monthly short interest divided by shares outstanding over the month around the issue date. *t*-statistics, calculated using White (1980) heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. N denotes the number of observations.

Panel A: Summary statistics for issuer- and issue-specific determinants of arbitrage-related short selling

Variable	Traditional Investor Period (N =727)			Arbitrage period (N=645)			Post-Lehman period (N=64)			Kruskal-Wallis *p*-value	*t*-test for difference in means
	Average	Median	Std. Dev.	Average	Median	Std. Dev.	Average	Median	Std. Dev.		
Amihud	0.260	0.029	1.395	0.013	0.002	0.040	0.159	0.024	0.703	0.000	a,b,c
InstitOwnership	0.414	0.406	0.229	0.715	0.752	0.217	0.754	0.808	0.231	0.000	a,b
Volatility	0.443	0.405	0.173	0.551	0.491	0.247	1.063	0.994	0.593	0.000	a,b,c
DividendPaying	37.451%			20.411%			25.609%				
S_{arb}/SO	0.169	0.130	0.165	0.103	0.089	0.069	0.145	0.095	0.296	0.000	a
ZeroCoupon	7.290%			7.878%			0.000%				

Panel B: Regression analysis of ΔSI/SO on potential determinants of arbitrage-related short selling

Variable	Parameter estimate (*t*-value) (1)	(2)
Amihud	−0.01**	−0.02*
	(−2.08)	(−1.86)
InstitOwnership	0.01	0.00
	(1.06)	(0.39)
Volatility	−0.01	0.00
	(−1.60)	(0.24)
DividendPaying	0.00	0.00
	(1.11)	(0.82)
S_{arb}/SO	0.15***	0.14***
	(8.08)	(7.35)
ZeroCoupon	0.00	0.00
	(0.09)	(0.16)
CAFactiva	−0.00	
	(−1.47)	
CAFlows		0.02
		(0.36)
Intercept	0.01	0.01
	(0.99)	(0.99)
Adj. R^2	18.72%	18.92%
R^2	20.01%	20.64%
N	440	330
Period	2003-2008	2003-2008

Table 3.2: Summary statistics for potential determinants of convertible bond announcement effects

This table provides descriptive statistics for firm-specific, issue-specific and macroeconomic variables across periods. Variables are defined as outlined in Appendix A and C. The Traditional Investor period ranges from 1/1/1984 to 31/12/1999 and refers to the period before the surge in convertible arbitrage hedge funds, while the Arbitrage period ranges from 1/1/2000 to 14/9/2008 and refers to the period when convertible arbitrageurs were the predominant purchasers of convertible debt issues. The Post-Lehman period ranges from 15/9/2008 to 31/12/2009 and refers to the period following the collapse of Lehman Brothers. The Kruskal-Wallis test is used to test for the differences of the characteristics between all three periods. The independent sample *t*-test (assuming unequal variances) is used to test for the equality of means across any two sub-periods. Pairs for which the difference is statistically significant at (at least) the 5% level are indicated by the letters a, b, or c, where a indicates a significant difference between the Traditional Investor period and the Arbitrage period, b indicates a significant difference between the Traditional Investor period and the Post-Lehman period, and c indicates a significant difference between the Arbitrage period and the Post-Lehman period. N denotes the number of observations.

Variable	Traditional Investor Period (N =727)			Arbitrage period (N=645)			Post-Lehman period (N=64)			Kruskal-Wallis *p*-value	*t*-test for difference in means
	Average	Median	Std. Dev.	Average	Median	Std. Dev.	Average	Median	Std. Dev.		
Firm characteristics											
StockRunup	0.171	0.151	0.214	0.172	0.130	0.275	0.314	0.251	0.493	0.015	b,c
Slack	0.142	0.067	0.173	0.229	0.142	0.236	0.151	0.092	0.188	0.000	a,c
Tax	0.030	0.025	0.033	0.019	0.012	0.035	0.012	0.006	0.051	0.000	a,b
LTDebt	0.214	0.201	0.167	0.214	0.207	0.183	0.283	0.284	0.194	0.000	b,c
RelVolatility	3.744	3.128	2.435	3.246	3.039	1.419	4.480	4.968	2.515	0.000	a,c
MarkettoBook	3.419	2.350	5.628	4.460	2.710	6.395	2.266	1.487	3.496	0.000	a,b,c
FixedAssets	0.334	0.290	0.217	0.250	0.165	0.228	0.332	0.219	0.274	0.000	a,c
LogAssets	5.433	5.319	1.514	4.460	2.710	6.395	6.398	6.987	1.716	0.000	a,b,c
Issue characteristics											
Proceeds	0.400	0.289	0.424	0.359	0.224	0.462	0.129	0.078	0.132	0.000	b,c
Delta	0.791	0.842	0.191	0.791	0.843	0.157	0.658	0.658	0.152	0.000	b,c
144A	9.491%			84.651%			34.375%				
Issue=Announcement	25.722%			88.372%			95.313%				
OfferingDiscount	0.215	0.219	0.090	0.157	0.150	0.131	0.342	0.340	0.102	0.000	a,b,c
Macroeconomic characteristics											
InterestRate	4.919	4.650	1.471	1.836	1.943	0.974	3.643	3.274	1.177	0.000	a,b,c
TermSpread	2.023	1.900	0.963	1.653	1.853	1.300	2.906	2.827	0.374	0.000	a,b,c
MarketRunup	0.058	0.057	0.059	0.019	0.024	0.070	0.041	0.055	0.136	0.000	a
MarketVolatility	0.132	0.130	0.036	0.160	0.159	0.059	0.312	0.353	0.105	0.000	a,b,c

Table 3.3: Univariate analysis of convertible debt, equity, and straight debt announcement effects

This table shows average and median cumulative abnormal stock returns (CARs) measured over the window (−1, 1) relative to the announcement date for samples of convertible debt, equity, and straight debt offerings. CARs are calculated using standard event-study methodology. CARsCD are the CARs of convertible debt issuers. CARsEQ are the CARs of seasoned equity issuers. CARsSD are the CARs of straight debt issuers. The Traditional Investor period ranges from 1/1/1984 to 31/12/1999 and refers to the period before the surge in convertible arbitrage hedge funds. The Arbitrage period ranges from 1/1/2000 to 14/9/2008 and refers to the period when convertible arbitrageurs were the predominant purchasers of convertible debt issues. The Post-Lehman period ranges from 15/9/2008 to 31/12/2009 and refers to the period following the collapse of Lehman Brothers. The Kruskal-Wallis test is used to test for differences between the CARs across all three sub-periods. The Patell Z-test is used to test the hypothesis that the individual CARs are equal to zero. *, **, *** indicate significance of the Patell Z-test statistic at the 10%, 5%, and 1% level, respectively. N denotes the number of observations.

Variable	Traditional Investor Period		Arbitrage period		Post-Lehman period		Kruskal-Wallis p-value
	Average	Std.Dev	Average	Std.Dev	Average	Std.Dev	
CARsCD(−1, 1)	−1.69%***	5.07%	−4.59%***	7.20%	−9.12%***	9.41%	0.00
N	727		645		64		
CARsEQ(−1, 1)	−2.34%***	6.13%	−2.67%***	7.68%	−3.21%***	11.67%	0.27
N	3,579		1,143		163		
CARsSD(−1, 1)	−0.09%*	3.67%	−0.04%	3.99%	−0.40%**	5.94%	0.06
N	5,662		2,692		380		

Table 3.4: Regression analysis of determinants of convertible debt announcement returns

This table presents the results of a regression analysis of announcement-period cumulative abnormal stock returns (CARs) of convertible offerings on a number of potential determinants. The dependent variable in the regression is the cumulative abnormal stock return measured over the window (−1, 1) relative to the announcement date, and is calculated using standard event-study methodology. ArbPeriod is a dummy variable that takes a value of one for announcements made in the Arbitrage period. PostLehmanPeriod is a dummy variable that takes a value of one for announcements made in the Post-Lehman period. InverseMills is the Inverse Mills ratio calculated from the probit regression in Table 3.5. DemandTradInvestor is equal to the estimated arbitrage-related increase in short interest relative to shares outstanding (calculated using the regression in Column (1) of Table 3.1) for issues made in the Traditional Investor period, and equal to zero for issues made during other periods. DemandArbitrage and DemandPostLehman are defined in an analogous way for issues made during the Arbitrage period and the Post-Lehman period, respectively. All other explanatory variables are defined as outlined in Appendix A and C. *t*-statistics, calculated using White (1980) heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. N denotes the number of observations.

Variable	Parameter estimate (*t*-value)				
	(1)	(2)	(3)	(4)	(5)
Period indicators					
ArbPeriod	−2.83***	−1.70**	1.51	1.45	1.09
	(−8.30)	(−2.40)	(1.53)	(1.44)	(0.88)
PostLehmanPeriod	−7.16***	−4.03***	−3.54***	−3.33**	−4.05
	(−6.25)	(−2.75)	(−2.37)	(−2.08)	(−1.49)
Firm characteristics					
StockRunup		−0.15	−0.62	−0.56	−0.51
		(−0.14)	(−0.60)	(−0.52)	(−0.37)
Slack		−1.31	−2.43	−2.44	−1.87
		(−0.86)	(−1.60)	(−1.57)	(−1.17)
Tax		2.05	3.24	1.23	−1.67
		(0.26)	(0.41)	(0.15)	(−0.18)
LTDebt		−1.46	−0.03	0.25	0.13
		(−1.09)	(−0.02)	(0.17)	(0.08)
RelVolatility		−0.37**	−0.46**	−0.55***	−0.08
		(−2.02)	(−2.43)	(−2.77)	(−0.28)
MarkettoBook		0.07*	0.02	0.02	−0.01
		(1.79)	(0.60)	(0.47)	(−0.23)
FixedAssets		0.01	0.10	−0.12	−0.66
		(0.01)	(0.08)	(−0.09)	(−0.58)
LogAssets		0.32	−0.09	0.07	0.45*
		(0.70)	(−0.20)	(0.15)	(1.87)
Issue characteristics					
Proceeds		0.19	0.34	0.88	1.72*
		(0.21)	(0.39)	(0.95)	(1.66)
Delta		−0.01	−0.70	−0.11	−1.28
		(0.00)	(−0.39)	(−0.06)	(−0.74)
144A		0.34	0.34	0.47	
		(0.58)	(0.57)	(0.77)	
InverseMills		−0.10	−0.92	−0.59	
		(−0.08)	(−0.74)	(−0.46)	
Issue=Announcement		−0.91**	−0.91**	−0.91**	−0.91**
		(−2.14)	(−2.14)	(−2.14)	(−2.14)
OfferingDiscount					−4.45*
					(−1.82)

Table 3.4 (Continued)

Macroeconomic characteristics					
$InterestRate_{t-1}$		0.39	0.56	0.54	0.72**
		(1.15)	(1.62)	(1.52)	(2.22)
$TermSpread_{t-1}$		−0.43***	−0.45***	−0.44***	−0.36*
		(−2.67)	(−2.74)	(−2.62)	(−1.91)
$MarketRunup_{t-1}$		−0.30	0.61	0.30	3.93
		(−0.10)	(0.20)	(0.09)	(0.92)
$MarketVolatility_{t-1}$		−11.98***	−13.37***	−15.04***	−11.57**
		(−2.95)	(−3.20)	(−3.49)	(−2.02)
Arbitrage-related shorting activity					
DemandTradInvestor				−8.38***	−38.88
				(−3.96)	(−1.42)
DemandArbitrage			−164.73***	−168.07***	−166.67***
			(−4.64)	(−4.67)	(−4.18)
DemandPostLehman				−7.45	43.43
				(−0.47)	(0.23)
Intercept	−1.69***	−1.16	2.79	1.45	−2.80
	(−9.11)	(−0.25)	(0.60)	(0.30)	(−0.97)
Adj. R^2	7.40%	10.12%	11.94%	12.41%	10.20%
N	1,476	1,476	1,476	1,476	788
Period	1984-2009	1984-2009	1984-2009	1984-2009	1991-2009

Table 3.5: Regression analysis of the determinants of 144A issues

This table presents the results of a probit regression with as dependent variable a dummy variable that takes the value of one for a 144A issue and zero for all other (mostly publicly-placed) convertible bond offerings. All explanatory variables are defined as outlined in Appendix A. *t*-statistics, calculated using Huber-White robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. N denotes the number of observations.

Variable	Parameter estimate (*t*-value)
Firm characteristics	
StockRunup	0.15
	(0.96)
Slack	1.24***
	(4.91)
Tax	−5.09***
	(−4.33)
LTDebt	−0.83
	(−3.26)
RelVolatility	0.27
	(1.57)
MarkettoBook	0.01
	(0.84)
FixedAssets	−1.19***
	(−6.34)
LogAssets	0.49***
	(13.91)
Issue characteristics	
Proceeds	0.57***
	(4.10)
Delta	1.66***
	(6.44)
Macroeconomic characteristics	
$InterestRate_{t-1}$	−0.30***
	(−13.48)
$TermSpread_{t-1}$	0.10***
	(3.10)
$MarketRunup_{t-1}$	0.07
	(0.12)
$MarketVolatility_{t-1}$	−0.40
	(−0.57)
Intercept	−3.77***
	(−10.09)
Adj. R^2	38.29%
N	1,476
Period	1984-2009

Table 3.6: Analysis of stock returns following convertible debt issues

This table analyses average cumulative abnormal stock returns (CARs) following convertible bond issuance, computed using standard event-study methodology. The windows are measured relative to the convertible bond issuance date. The Traditional Investor period ranges from 1/1/1984 to 31/12/1999 and refers to the period before the surge in convertible arbitrage hedge funds. The Arbitrage period ranges from 1/1/2000 to 14/9/2008 and refers to the period when convertible arbitrageurs were the predominant purchasers of convertible debt issues. The Post-Lehman period ranges from 15/9/2008 to 31/12/2009 and refers to the period following the collapse of Lehman Brothers. In Panel A, the Kruskal-Wallis test examines differences between the CARs over the three sub-periods. The Patell *Z*-test examines the hypothesis that the individual CARs are equal to zero. Panel B presents the results of a regression analysis of the CARs following convertible bond issuance on a number of potential determinants. DemandTradInvestor is equal to the estimated arbitrage-related increase in short interest relative to shares outstanding (calculated using the regression in Column (1) of Table 3.1) for issues made in the Traditional Investor period, and equal to zero for issues made during other periods. DemandArbitrage and DemandPostLehman are defined in an analogous way for issues made during the Arbitrage period and the Post-Lehman period, respectively. Explanatory variables are defined as outlined in Appendix A. *t*-statistics, estimated using White (1980) heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. N denotes the number of observations.

Panel A: Univariate analysis of abnormal stock returns following convertible bond issuance

Variable	Traditional Investor Period		Arbitrage period		Post-Lehman period		Kruskal-Wallis *p*-value
	Average	Std.Dev	Average	Std.Dev	Average	Std.Dev	
CARs(2,5)	−0.02%	5.26%	0.50%***	6.11%	−1.85%	11.52%	0.00
CARs(2,10)	−0.46%**	8.25%	0.54%***	8.79%	−3.39%*	11.49%	0.00
N	727		645		64		

Panel B: Regression analysis of abnormal stock returns following convertible bond issuance

Variable	Parameter estimate (*t*-value)	
	CARs(2,5) (1)	CARs(2,10) (2)
DemandTradInvestor	2.19	5.44
	(0.22)	(0.30)
DemandArbitrage	46.67***	58.97***
	(2.75)	(0.39)
DemandPostLehman	−33.68	−34.47
	(−0.97)	(−0.52)
Amihud	0.04	0.28
	(1.15)	(0.54)
Intercept	−0.24	−0.56
	(−0.71)	(−1.17)
Adj. R^2	0.58%	0.33%
N	1,422	1,422
Period	1984-2009	1984-2009

3.7 Figures

Figure 3.1: **Quarterly number of convertible arbitrage-related articles appearing in the Factiva database**

This figure shows the number of news sources (i.e., articles or press releases) containing any of the terms “convertible arbitrage”, “convertible debt arbitrage”, “convertible bond arbitrage”, “convertible arbitrageur”, “convertible debt arbitrageur”, “convertible bond arbitrageur”, “convertible arbitrageurs”, “convertible debt arbitrageurs”, or “convertible bond arbitrageurs” in Factiva in any given quarter over the period 1984 to 2009. To avoid double-counting, we exclude instances where the same article appears more than once.

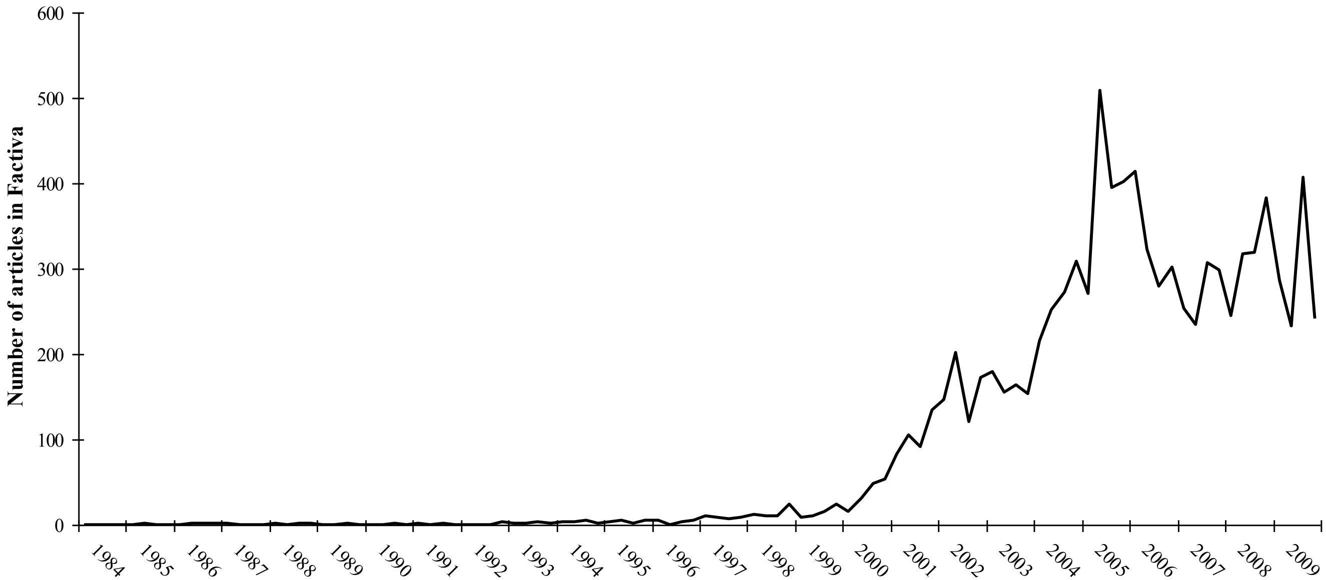
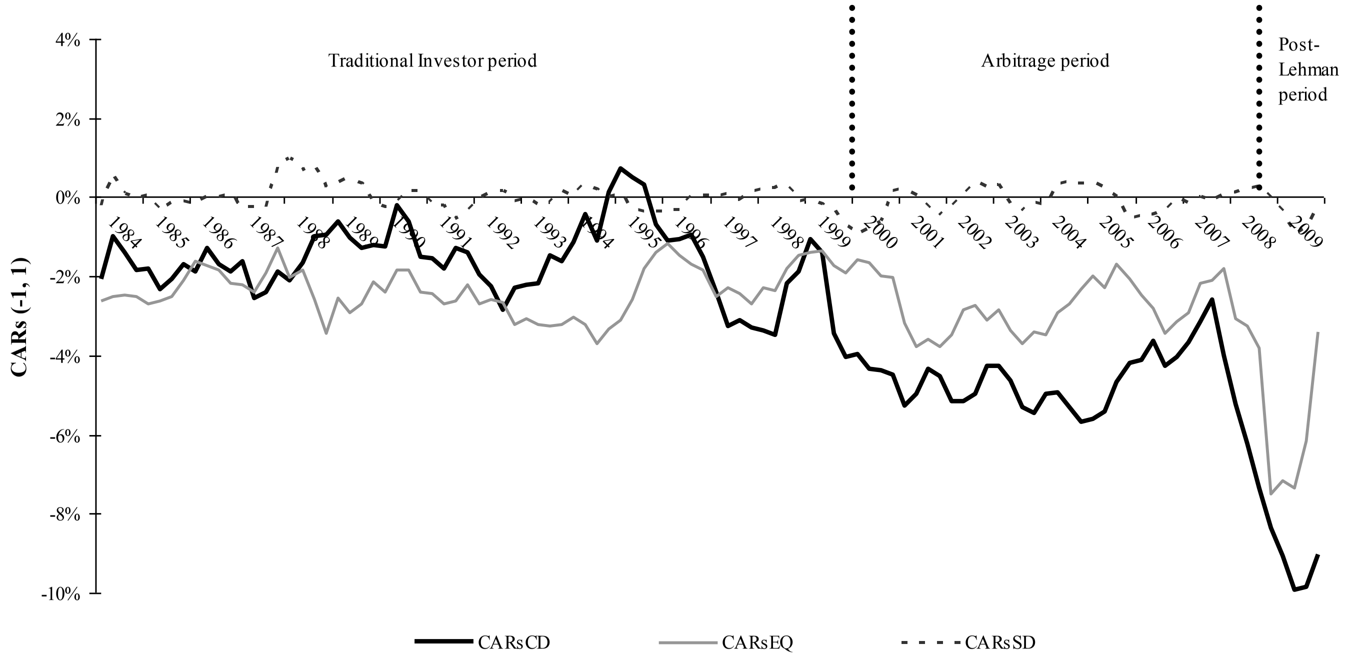


Figure 3.2: Average quarterly shareholder wealth effects of convertible, equity and straight debt announcements

This figure shows average quarterly cumulative abnormal stock returns (CARs) for security offering announcements between January 1984 and December 2009. We calculate abnormal returns for each security announcement over the window (−1, 1) relative to the announcement date using standard event-study methodology, and then average across security offering announcements made in the same quarter. We take the moving average of four quarters to smooth the time series of announcement effects. CARsCD are the CARs of convertible debt issuers. CARsEQ are the CARs of seasoned equity issuers. CARsSD are the CARs of straight debt issuers The Traditional Investor period ranges from 1/1/1984 to 31/12/1999 and refers to the period before the surge in convertible arbitrage hedge funds. The Arbitrage period ranges from 1/1/2000 to 14/9/2008 and refers to the period when convertible arbitrageurs were the predominant purchasers of convertible debt issues. The Post-Lehman period ranges from 15/9/2008 to 31/12/2009 and refers to the period following the collapse of Lehman Brothers.



3.8 Appendices

3.8.1 Appendix A: detailed description of variable calculations

Determinants of arbitrage-related short selling

Variable name	Calculation
Amihud	Amihud (2002) illiquidity measure, calculated as the ratio of the absolute value of daily stock returns divided by trading volumes averaged over the window (−120, −20) relative to the convertible bond announcement date. For expositional purposes, we multiply this ratio by 10^6.
InstitOwnership	Number of shares held by 13F institutions (obtained from Thomson Reuters), divided by the number of shares outstanding (both measured at the fiscal year-end prior to the convertible bond announcement date).
Volatility	Annualized stock return volatility, estimated from daily stock returns over the window (−240, −40) relative to the convertible bond announcement date.
DividendPaying	Dummy variable equal to one if the convertible bond issuer paid out a dividend over the previous fiscal year, which can be established through Compustat #26.
S_{arb}/SO	The number of shares that need to be shorted for arbitrageurs to obtain a delta-neutral position as of the issuance date, divided by the number of shares outstanding measured at the fiscal year-end prior to the convertible bond announcement date. S_{arb} is calculated as outlined in Appendix B.
ZeroCoupon	Dummy variable equal to one for zero-coupon convertibles.
CAFactiva	Number of news sources in Factiva mentioning "convertible arbitrage" or a related search term (as outlined in Figure 3.1), calculated over the quarter preceding the convertible bond announcement date.
CAFlows	Flows into convertible arbitrage hedge funds over the quarter prior to the convertible bond issuance quarter. We obtain data on flows into convertible bond arbitrage hedge funds from the TASS Live and Graveyard databases, which provide coverage from 1994 onwards. We select those funds that state convertible arbitrage as their primary investment category and that have a U.S.-oriented geographical focus (164 in total). We measure hedge fund flows in a similar way as Choi et al. (2010). First, we calculate dollar flows for each fund using the change in total net assets over the quarter, adjusted for the returns of the fund. We then aggregate flows and total net assets across funds for each quarter and divide the change in total flows by total lagged assets to obtain percentage quarterly fund flows.

Firm characteristics (measured at fiscal year-end preceding the convertible debt offering announcement date, unless specified otherwise; # refers to a data item in the Compustat Fundamentals Annual database).

Variable name	Calculation
StockRunup	Stock return over the window (−60, −2) relative to the announcement date.
Slack	Cash and short-term investments (#1) divided by total assets (#6).
Tax	Income taxes paid (#16) divided by total assets (#6).
LTDebt	Long-term debt (#9) divided by total assets (#6).
RelVolatility	Annualized stock return volatility, estimated from daily stock returns over the window (−240, −40) relative to the convertible bond announcement date, divided by the annualized standard deviation of the S&P 500 index (obtained from Datastream) calculated over the same period.
MarkettoBook	Market value (calculated as #25 multiplied by #199) divided by the book value of common equity (#60).
FixedAssets	Plant, property, and equipment (#8) divided by total assets (#6).
LogAssets	Natural logarithm of total assets (#6), deflated by the Consumer Price Index (obtained from Datastream).
Issue characteristics	
Variable name	Calculation
Proceeds	Relative size of the convertible bond offering, calculated as the offering proceeds divided by total assets (#6).
Delta	Sensitivity of the convertible bond value to its underlying common stock value, measured as outlined in Appendix B.
144A	Dummy variable that takes the value one for offerings made under SEC Rule 144A.
Issue=Announcement	Dummy variable that takes the value one when the issue date and announcement date coincide, or when the issue date falls one trading day after the announcement date.
OfferingDiscount	Underpricing of the convertible bond as of its issuance date, measured as outlined in Appendix C.
Aggregate financing costs measures	
Variable name	Calculation
InterestRate	Difference between yields on ten-year U.S. Treasury Bonds and the inflation rate (measured as the continuously-compounded annual change in the U.S. Consumer Price Index), averaged over the quarter prior to issuance.
TermSpread	Difference between yields on ten-year U.S. Treasury Bonds and three-month Treasury Bills, averaged over the quarter prior to issuance.
MarketRunup	Return on the S&P 500 index over the quarter prior to issuance.
MarketVolatility	Annualized market return volatility, calculated from daily returns on the S&P 500 index over the quarter prior to issuance.

3.8.2 Appendix B: calculation of number of shares expected to be shorted by arbitrageurs (Sarb)

S_{arb} represents the number of shares expected to be shorted by arbitrageurs, under the assumption that arbitrageurs follow a delta-neutral hedging strategy. In line with De Jong, Dutordoir, and Verwijmeren (2010), we calculate S_{arb} as follows:

$$S_{arb} = \frac{\text{number of convertibles issued} \times \text{face value} \times \text{delta}}{\text{conversion price}} \quad (5)$$

We calculate the number of convertibles issued by dividing the offering proceeds by the face value of the convertible (both obtained from SDC). Delta represents the sensitivity of the convertible bond value to its underlying common stock value. In line with Burlacu (2000), Dutordoir and Van de Gucht (2007), and Loncarski et al. (2009), we calculate the convertible debt delta as follows:

$$\text{Delta} = e^{-\delta T} N(d_1) = e^{-\delta T} N\left\{\frac{\ln(\frac{S}{X}) + (r - \delta + \frac{\sigma^2}{2})T}{\sigma\sqrt{T}}\right\}, \quad (6)$$

with δ the continuously-compounded dividend yield (obtained from Compustat Fundamentals Annual by dividing #26 by #199), N(.) the cumulative probability under a standard normal distribution, S the stock price on trading day −5 (obtained from CRSP), X the conversion price (obtained from SDC), r the yield on a ten-year U.S. Treasury Bond measured on the issue date (obtained from CRSP), σ the annualized stock return volatility (measured as outlined in Appendix A), and T the stated maturity of the convertible bond measured on its issuance date (obtained from SDC).[28]

3.8.3 Appendix C: calculation of convertible debt offering discounts

In line with Chan and Chen (2007) and De Jong, Dutordoir, and Verwijmeren (2010), we define the convertible debt offering discount as the difference between the bond's theoretical price and the bond's issue price, divided by the bond's theoretical price. We obtain the issue price from SDC. To calculate the theoretical convertible bond price, we use the Tsiveriotis and Fernandes (1998) model, which is widely-used in other studies on convertible bond underpricing (Ammann, Kind, and Wilde, 2003; Chan and Chen, 2007; Loncarski et al., 2009; De Jong, Dutordoir, and Verwijmeren, 2010). As pointed out by Zabolotnyuk et al. (2010), the method is also popular among practitioners.

Tsiveriotis and Fernandes (1998) use a binomial-tree approach to model the stock price process and decompose the total value of a convertible bond into an equity component and a

[28] As argued in Zabolotnyuk, Jones, and Veld (2010), a potential disadvantage of the delta is that it does not capture convertibility and callability characteristics. As such, the delta provides an incomplete measure for the equity component size of convertibles. However, the purpose of the delta measure included in the S_{arb} variable is to replicate the inputs that are actually used by arbitrageurs in their delta-neutral hedging strategy. Calamos (2003) argues that arbitrageurs base their hedging on a delta measure analogous to the one defined in Equation (6), so we conclude that it is appropriate to use this measure as an input in S_{arb}.

straight debt component. We use the following input variables in the model (all measured as of the convertible bond issue date, unless otherwise mentioned): yield on U.S. government bonds of which the maturity most closely matches the maturity of the convertible bond (obtained from CRSP); Moody's credit ratings or equivalent Standard and Poor's ratings converted to a Moody's rating (obtained from SDC);[29] credit spreads of similarly-rated corporate straight debt (obtained from Datastream);[30] conversion ratios and call schedules; dividend yield for the fiscal year preceding the announcement date, price of the underlying stock averaged between trading days –12 and –2; and annualized stock return volatility calculated from daily stock returns over the window (–240, –40).

[29] We assign a rating of Baa2 to unrated convertibles, as in Loncarski et al. (2009).

[30] Datastream discontinues the provision of credit spreads as of the end of 2008, so we construct our own credit spread estimates for convertibles issued in 2009. In 2009, 95% of our sample offerings are unrated (and thus classified as Baa2-rated offerings), while the remainder of the offerings are speculative grade. To calculate Baa2 credit spreads, we subtract the 20-year Treasury Bond rate (obtained from CRSP) from the yield on Baa-rated bonds (obtained from Bloomberg). To measure the credit spread for the (very few) speculative grade issues, we download the Barclays yield series on high-yield U.S. corporate bonds from Datastream and subtract the 20-year Treasury Bond rate from this yield. We tried using other benchmark maturities (7-, 10-, and 30-year Treasury Bond yields), but the 20-year yield results in spreads with the highest correlation and the smallest difference with the credit spreads reported by Moody's.

Chapter 4

Seasoned equity offerings and the cost of market timing[31]

4.1 Introduction

Seasoned equity offerings (SEOs) are on average followed by negative long-run abnormal returns (see, e.g., Loughran and Ritter, 1995; Spiess and Affleck-Graves, 1995). A popular explanation for this underperformance is that issuers are able to time the market and raise equity when the cost of capital is abnormally low. Loughran and Ritter (1995), and Baker and Wurgler (2000) view managers as being better informed than investors and are able to issue equity opportunistically when they anticipate that their share price is likely to decline. Graham and Harvey (2001) provide survey evidence in support of this view. Market timing can also be viewed in a rational framework, with firms choosing to issue equity in more favorable economic periods when asymmetric information is lower (e.g., Choe, Masulis, and Nanda, 1993; Lucas and McDonald, 1990). Another possible explanation for post-issue underperformance, suggested by Ritter (2003), is that both investors and managers are overoptimistic about the prospects of issuing firms.

While market timing of equity offerings is extensively documented in the literature, its effects on future equity offerings by repeat issuers are less known. Given that market timing represents a price risk for purchasers of the equity offering, I expect offerings perceived as more likely to be timed, to be issued at a greater discount to the pre-issue market price. Research has shown that seasoned equity offerings are underpriced on average, partly to compensate investors for the uncertainty regarding the value of the issuer. For instance, Corwin (2003) finds that seasoned offers were underpriced by an average of 2.2 percent between 1980 and 1998, while Altinkiliç and Hansen (2003) find an average discount of 3.2 percent over the 1990's.[32]

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[31] This Chapter is based on Duca (2010). It has benefited from comments by Abe de Jong, Marie Dutordoir, Frederik Schlingemann, Chris Veld, and seminar participants at Rotterdam School of Management.

[32] Corwin (2003) finds that underpricing represents 21.7% of total direct and indirect issue costs and results in $1.95 million in lost proceeds, while Eckbo, Masulis, and Norli, (2007) consider underpricing as the most important indirect issuance cost of SEOs.

In this chapter I examine the effects of past market timing on underpricing of subsequent equity offerings in the United States over the period 1980-2007. I capture possible market timing behavior based on the abnormal returns following a previous issue, and find that underpricing of equity offerings is greater if firms are more likely to have timed the market previously. The additional discount by past market timers can be seen as compensation for the perceived risk that these issuers will time the market again. I also find that the effect of past market timing is most pronounced for issuers that did not experience a change in their CEO in the period between issues. This finding is consistent with recent evidence by Baker and Xuan (2009) that the identity of the CEO matters in assessing past firm performance. I also find that underpricing is less sensitive to positive returns that follow a previous issue, than it is to negative returns. In line with prospect theory, this asymmetric effect could imply that investors are more concerned about potential losses than with gains. An alternative interpretation of these results is that investors view a share price decline following a previous issue as market timing, but do not view a price increase as the ability of managers to successfully time profitable investment opportunities.

In robustness tests, I control for the possible influences of short selling constraints on my results. If SEOs made by short-sale constrained issuers (i.e., stocks that are difficult to short) are also underpriced more, then the market timing effect on underpricing may be spurious. I use several measures to capture the demand and supply influences on short-sale constraints, such as short interest outstanding, institutional ownership, and the Amihud (2002) measure of illiquidity. I also examine the influences of an exogenous event, the introduction of SEC Rule 10b-21 in August 1988, which prohibited short-selling around the issue of an SEO. I find that the market timing effect on underpricing remains significant after controlling for the influences of short-sale constraints. I also perform robustness tests that use the price reaction at the SEO announcement date to capture shareholder wealth effects, instead of using underpricing as the variable of interest. I find consistent results with respect to the cost of past market timing on shareholder wealth effects.

A corollary of the relationship between market timing and underpricing of subsequent equity offerings, is that the choice between debt and equity financing will also be influenced by past market timing. I find that firms that had timed their previous equity offering are more likely to switch to debt for subsequent financing. This suggests that past market timers anticipate the higher discounting and switch to debt in order to avoid additional dilution of share value.[33] The higher cost of equity implies that firms' financial constraints increase if they had timed the market with previous issues, especially if they are unable to subsequently switch to debt.

Whereas SEOs are underpriced by more if returns following previous SEOs are more negative, they are not underpriced by more if returns following previous IPOs are more negative. This suggests that investors view IPOs as being less indicative of the market timing motives of follow-on equity issuers. Pagano, Panetta, and Zingales (1998) find motives for IPOs other than market timing, while there may also be fewer opportunities to time IPOs because these take longer to set up (Geddes, 2003), and it is harder to establish what valuations investors are willing to pay for shares that are not trading yet (Chemmanur, He, and Hu, 2009; Geddes, 2003; Ritter, 2003). In addition, a company IPO is withdrawn due to overpricing will often not get another opportunity to go public (Dunbar, 1988).

The results in this chapter provide several contributions to the literature. First, they suggest that investors take the past behavior of firms into account when evaluating their

[33] Eckbo, Masulis, and Norli (2007) note that underpricing in itself represents a wealth transfer to purchasers of the new securities, unless these are purchased entirely by current shareholders. This wealth transfer represents an indirect cost of raising equity, which decreases the marginal contribution of investment opportunities to overall shareholder wealth.

motives for market timing of subsequent equity offerings. This finding complements a growing literature that examines how investors form beliefs in financial market (see Hirschleifer and Teoh, 2003, for a review). Second, I show that there is a cost associated with timing equity issues, in the form of higher underpricing of subsequent issues. While the literature has hitherto recognized the motivations for market timing in equity offerings, the cost of such behavior has to the best of my knowledge, not been documented yet. I also show that managers who had timed previous equity issues, partly anticipate the higher underpricing of follow-on issues, and tend to switch to debt financing in order to avoid the cost of dilution or abandonment of profitable investment opportunities. This finding extends the literature on capital structure by shedding light on how past actions by firms affects the choice between equity and debt financing. A corollary is that firms' financial constraints increase if they time the market with previous issues, especially if they are unable to switch to debt. Finally, while my results provide evidence in line with the timing of seasoned equity offerings, I find no evidence that supports the market timing hypothesis in IPOs. On the other hand, my findings also support the view that IPOs and SEOs are different events, and investors do not consider the market timing of IPOs as providing a good indication of market timing intentions in subsequent equity offerings.

While studies on multiple issues of equity are relatively rare, two recent papers are most related to my study. D'Mello, Tawatnuntachai, and Taman (2003) look at repeat equity issuers and document that abnormal returns become less negative as more issues are made, with this being partly explained by a reduction in information asymmetry. I therefore control for the level of information asymmetry to ensure that the post-issue returns are not simply capturing general information asymmetry instead of market timing motives. Hovakiminan and Hutton (2010) find that the probability of seasoned equity issuers returning to the market to raise equity is positively linked to the one-year post issuance returns of the firm's previous equity issue. They attribute this to feedback from the market to the firm about the value of investment opportunities. My contribution differs in that I show a link between the returns following an SEO, which I consider as capturing market timing behavior, and underpricing of subsequent SEOs. Admittedly, it is difficult to distinguish whether returns following an issue reflect market timing by the issuer, as opposed to feedback from the market about the investment opportunities of the firm. In support of the market timing view, I find that underpricing is more sensitive to negative past returns than it is to positive past returns, a prediction in line with prospect theory. The second part of my analysis also provides support to the market timing hypothesis: I find that the returns following previous SEOs affect the choice between subsequent equity and debt financing. To some extent, conditioning on a seasoned offering being followed by either debt or equity controls for investment opportunities since funds will be raised in either case.

The remainder of the chapter is structured as follows. The next section provides literature related to underpricing, while Section 4.3 develops the testable predictions. I describe the data in Section 4.4 and present the results in Section 4.5. Section 4.6 concludes the chapter.

4.2 Background on underpricing of equity offerings

Underpricing in seasoned equity offerings (SEOs) represents lost proceeds to the issuer and is considered the most important indirect cost of raising equity (Eckbo, Masulis, and Norli, 2003). It is generally measured as the difference between the closing price on the offer day, or one day prior to the offer day, and the price that the new shares are sold for. Whereas the possible rationales for underpricing have been well documented in the IPO literature (e.g., Ljungqvist, 2007) there is relatively less literature examining underpricing in SEOs. However, most of the explanations underlying underpricing for IPOs are applicable to the SEO literature. Eckbo and Masulis (1992) report mean underpricing of 0.44% for a sample of firms over the 1963-1981 period. Corwin (2003) and Mola and Loughran (2004) examine underpricing in SEOs over the 1980s and 1990s and document an average discount of 2.2% and 3% respectively. In more recent years the discount has risen and Altinkiliç and Hansen (2003) find an average discount of 3.2% over the 1990's.

There is a large empirical and theoretic literature suggesting explanations for underpricing, more prominently for IPOs. Most of these papers rely on asymmetric information models in which either the issuer, underwriter, or investor, has more information than the other parties. The main prediction of these models is that underpricing compensates the less informed party. In the framework of Rock (1985) some investors are less informed than others, giving rise to the winner's curse problem as the less informed investors end up subscribing to the worse issues. A prediction of this model is that underpricing increases with the uncertainty of the issuer's value. Parsons and Raviv (1985) examine the perspective of the investor who has the choice of either purchasing a share with certainty in the secondary market or to subscribe to an issue. Investors with high reservation prices who are uncertain about subscription demand and the allocation of shares, drive up secondary market prices, consequently increasing underpricing. In the models of Chemmanur (1993), and Benveniste and Spindt (1989), underwriters use underpricing to induce investors into revealing their private information about their reservation price for an offering. Hanley (1993) finds evidence consistent with this hypothesis, while Bradley and Jordan (2002) find that underpricing is also related to the revelation of public information. Chemmanur (1993), Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989), propose theoretical frameworks in which firms signal their quality through higher underpricing, which ensures that future equity offerings by these firms are better received by investors. There is limited evidence to support this hypothesis, however, as shown in Mola and Loughran (2004), Garfinkel (1993), and Jegadeesh, Weinstein, and Welch (1993).

A strand of papers focuses specifically on seasoned offering, and emphasizes the importance of placement costs on underpricing. Altinkiliç and Hansen (2003) show that underwriters attract capital suppliers by last minute adjustments to the offering price, based on the demand reflected in their order book. Corwin (2003) provides evidence that price pressure impacts underpricing and that this is greater for issuers with relatively more inelastic demand curves. This setting assumes that demand curves for stocks are not perfectly elastic, with demand for an offering increasing as the issue price falls.[34] Mola and Loughran (2004) and Corwin (2003) also find evidence that underwriter pricing practices, such as offer-price rounding, impact underpricing. A final strand of literature emphasizes the role of short-sellers and manipulative trading around seasoned offerings, although the evidence is mixed. Henry and Koski (2009) find that manipulative trading increases underpricing, whereas Chemmanur, He, and Hu (2009), provide evidence that institutional trading reflects an information production role rather than manipulative trading. Further studies (e.g., Singal and Xu, 2005; Kim and Shin, 2004; Safieddine and Wilhelm, 1996) examine the consequences of the adoption of SEC Rule 10b-21 in 1988, but find contrasting results with respect to its effect on underpricing.[35]

[34] Apart from Chapter 3 of this thesis, papers that find evidence of downward sloping demand curves include Mitchell, Pulvino, and Stafford (2004), and Shleifer (1986).

[35] Rule 10b-21, adopted in August 1988, prohibited the use of shares purchased at the offering to cover short sales positions established between the initial filing and offer date. In April 1997, this rule was replaced by Rule 105 of Regulation M, which prohibited traders from covering short sales made within five days of the offering with shares obtained in the offering.

4.3 Testable predictions

4.3.1 Post issue abnormal returns and current SEO underpricing

Both seasoned equity offerings (SEOs) and to a lesser degree, initial public offerings (IPOs), are on average followed by negative long-run abnormal returns (e.g., Ritter, 2003; Loughran and Ritter, 1995; Spiess and Affleck-Graves, 1995).[36] An extensive strand of literature suggests that the post-issue underperformance is evidence of issuers timing the market to raise equity when the cost of capital is abnormally low. One version of the market timing theory assumes that managers are better informed than investors and time equity issues to coincide with periods when their equity is overvalued (see, e.g., Huang and Ritter, 2009; Baker and Wurgler, 2000; Stein, 1996; Loughran and Ritter, 1995). Graham and Harvey (2001) provide survey evidence in support of this view. Firms may also time their issues to coincide with windows of opportunity during which asymmetric information is lower and investors have a more favorable view of issuers (see, e.g., Lowry, 2003; Bayless and Chaplisky, 1996; Choe, Masulis and Nanda, 1993). In the asymmetric information models of Korajczyk, Lucas, and McDonald (1992), and Lucas and McDonald (1990), firms postpone an issue until they release positive private information, which raises their stock price. Another possible explanation for post-issue underperformance, suggested by Ritter (2003), is that both investors and managers are overoptimistic about the prospects of issuing firms. In summary, the literature on market timing documents that SEOs and IPOs on average have a negative impact on the wealth of new investors, while issuers show signs of timing their offerings to coincide with higher stock prices.[37]

In the presence of information asymmetries, investors are limited in their ability to predict the market timing motives of issuers. However, investors can infer the intentions that issuers had by observing the consequence of their actions, as captured in the post-issuance returns. A corollary is that investors view companies with more negative abnormal returns following IPOs or SEOs as more likely to time their future equity offerings. If this hypothesis holds I expect the level of underpricing in SEOs to be inversely related to the abnormal returns following previous equity issues. The risk of market timing constitutes another source of price uncertainty, complementing previous literature that relates underpricing to the uncertainty of the issuer and the demand as revealed in the underwriter's order book.

The risk of issuers timing their offering is the main price concern of potential subscribers. An equity issue is a mainly unpredictable event, and investors are assumed to update their expectations of the post-issue return distribution in a Bayesian manner, using information about returns following a similar event in the past (i.e. the previous equity issue).[38] Therefore, the magnitude of the effect that market timing risk has on underpricing depends on investors' perception about how representative the previous offering is of the current one, in terms of

[36] Eckbo, Masulis, and Norli (2007) review recent literature on equity offerings and document that 3-year buy-and-hold abnormal returns post-offering regularly exceed −10% for SEOs but are somewhat more muted for IPOs.

[37] Issuing overvalued equity to new investors results in a wealth transfer to current shareholders. As such, an overvalued issue has a positive effect on the wealth of current shareholders, unless the issuer overinvests the additional proceeds in negative net present value investments.

[38] Hirschleifer (2001) identifies the role of Bayesian updating in asset pricing, while literature reviewed by Hirschleifer and Teoh (2003) documents how investors are influenced by observing the actions of other agents, although there is inconclusive evidence on whether such behavior is fully rational. Mishra, Racine, and Schmidt (2011) find evidence that investors judge the credibility of a firm's share repurchase announcement based on its repurchase history.

indicating market timing motives. It is not clear whether market timing is seen as a general trait of a company, as opposed to it being attributable to a specific CEO, assuming that decisions about security issues are authorized by the CEO. If the identity of the CEO is more important, the signal from past issues is less informative if the CEO changes between issues. I test this hypothesis by identifying firms that experience a change in their CEO in between issues. In support of the CEO view about corporate decisions, Baker and Xuan (2009) find that investors are more likely to supply capital to CEOs who perform well, holding constant the firm performance.

If market timing incentives are similar for both SEOs and IPOs, then the returns following either event should be equally informative for investors in updating their beliefs regarding market timing of subsequent SEOs. Both SEOs and IPOs raise additional capital, so that issuance can be motivated by needs to finance profitable investment opportunities or, in contrast, opportunities to raise capital when valuations are abnormally high. On the other hand, the IPO literature suggests that investors might view IPOs as being less indicative of the market timing motives of follow-on equity issuers. Apart from raising proceeds, a company might have other benefits from going public for the first time. In addition, there may be fewer opportunities to time the market because of the time and costs of setting up the IPO, difficulty in valuation, and the risk of a failed offering. For instance, Pagano, Panetta, and Zingales (1998) find evidence of market timing of IPOs in the Italian market, but also find other benefits, such as cheaper access to bank credit. The authors also document an increased turnover in control following the IPO, which could lead to a change in market timing incentives. Geddes (2003) notes that the offering process for an IPO is more complex and lengthy than that of a secondary offering. IPOs require that documentation is set up for the first time, and involve more extensive marketing effort than subsequent SEOs.

Pricing of IPOs is also complex and usually depends on comparable firm multiples (Geddes, 2003; Ritter, 2003), whereas the price of listed securities provides a good indicator of what investors are willing to pay for seasoned offerings. As noted by Chemmanur, He, and Hu (2009), institutional investors' private information can also be partly inferred through trading volumes prior to an SEO offering, but this mechanism is not available in the case of IPOs. The importance of avoiding a failed IPO is emphasized in Dunbar (1998), who finds that only around 9% of companies with failed offerings are able to ever go public. A failed offering can be avoided if the issuer has a good indication of the demand curve for the company's shares. The uncertainty regarding the valuation of an IPO increases the risk of a failed offering, and to some extent explains why firms leave a substantial amount of money on the table by heavily discounting of the IPO.

4.3.2 Post-issue abnormal returns and capital structure

In the presence of contracting costs, the choice between equity and debt financing is one that minimizes the cost of capital. For instance, the pecking order theory emphasizes the issuance costs arising from the varying degrees of information asymmetry associated with different financing instruments. To mitigate these costs, firms should use internally generated funds, and raise external funds only if these are insufficient. Their first choice of external funding should be straight debt, while equity should only be used as a last resort. In the tradeoff theory, firms compare the costs and the benefits of debt. The costs of debt include costs related to bankruptcy and agency costs resulting from the different interests of bondholders and shareholders. The benefits of debt include the deductibility of interest expenses and the reduction of agency conflicts. This theory predicts that firms should issue equity when their leverage is above the desired target, and otherwise issue debt.

Underpricing represents an additional cost of issuing equity, since new securities are issued at below the market price. In the presence of profitable investment opportunities that can't be delayed, higher expected underpricing will cause a shift from equity to debt financing. Debt becomes a viable alternative if its issuance costs (for instance costs arising from the risk of asset substitution and bankruptcy) are lower than the investment's net present value. In severe cases of expected underpricing, or if investment opportunities are only marginally positive, the firm may abandon investment plans altogether if debt financing is not a viable substitute. Thus, past market timing may constitute a financing constraint prohibiting future fund-raising and investments. A manager can use the abnormal returns following past SEOs in the same way as investors to form expectations of underpricing of a subsequent equity offering. This behavior is consistent with the model of Noe, Rebello, and Wang (2003), where both managers and investors endogenously form expectations of prices based on past behavior, with debt emerging as the security of choice when the risk of issue failure increases. Hence, I hypothesize that firms are more likely to switch to debt if their abnormal returns following a previous SEO are more negative.

In addition, the risk of market mispricing is lower for a debt instrument than for common stock. Whereas the share price performance following past SEOs is likely to influence the perception that future SEO investors might have about the firm riskiness, this effect should be less important to investors in new debt issues. Eckbo, Masulis, and Norli, (2007) note that debt securities have a predictable contractual payment stream, while they are also protected by bankruptcy law. Debt purchasers are normally more sophisticated than equity investors and tend to scrutinize issuers more.[39] The commitment to pay interest also signals firm quality. Noe, Rebello, and Wang, (2003) provide a model in which underpricing is related to the difficulty of pricing a security, with debt emerging as the instrument that minimizes underpricing. In their model, rational agents learn from past experience how to price securities, providing further support to my hypothesis that firms switch to debt if past SEOs are followed by negative abnormal returns.

While some firms tend to switch to debt if they anticipate that an SEO will require larger underpricing, there are instances when an equity issue is still the preferable option. The most obvious case is if the share price is much higher than the issuer's underlying value, so that underpricing is not large enough to make debt an attractive alternative. In this case, the current shareholders will benefit from raising capital at a cost of equity below the true cost, while purchasers of the new issue will suffer a loss in wealth.[40] Relaxing the assumption that investments must have positive net present value, equity may be preferred to debt if managers have personal objectives and overinvest the proceeds from the issue (see, e.g., Stulz, 1990; Jensen 1986). In the presence of personal objectives, managers would prefer equity to debt since it is less restrictive and does not impose bankruptcy costs that would limit the use of the proceeds. Finally, if a firm has a multi-issue strategy, underpricing may be accepted as an immediate cost that is used to signal the quality of the issuer, which ensures that future equity offerings are better received by investors (e.g., Chemmanur, 1993; Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989).

[39] Debt issues have a minimal subscription amount that precludes smaller investors, while the illiquidity of the secondary market and restricted availability of price data also makes them unattractive to less sophisticated investors.

[40] If the new issue is purchased completely by existing shareholders, there will be no wealth transfer, so that underpricing becomes irrelevant (Eckbo, Masulis, and Norli, 2007).

4.4 Data and summary statistics

In section 4.4.1 I describe the sample of equity issues, and the construction of the variables directly related to the market timing hypothesis, underpricing and the returns following past SEOs and IPOs. In Section 4.4.2 I describe the other determinants of underpricing that I use as control variables in the underpricing regressions. In Section 4.4.3 I describe the variables that influence capital structure decisions, which I use as controls when I model the choice to issue equity.

4.4.1 Equity issues, underpricing and post-issue returns

I obtain data for U.S. Initial public offerings and seasoned equity offerings issued between January 1st 1975 and December 31st 2007 from the Securities Data Company New Issues Database (henceforth SDC). I exclude units, secondary offerings, and those made by firms having a market capitalization under $10 million as well as utilities (SIC codes 4900-4949) and financials (SIC codes 6000-6999). I condition on a SEO being preceded by another SEO or an IPO. I allow for five years to elapse after 1975, before I start my sample of follow-on issues, with the first observation occurring in 1980.[41] I also require that firms have data available in both CRSP and Compustat. My final sample consists of 2,420 SEOs, 1,402 of which follow an SEO and 1,018 following an IPO. Figure 4.1 shows the annual distribution of the number of follow-on issues.

I measure the dependent variable, underpricing, as in Altinkiliç and Hansen (2003), taking the logarithm of the ratio of the closing share price on the day prior to the offer, to the offer price. The offer price is obtained from SDC, while the closing price is obtained from CRSP. I plot the average underpricing per year in Figure 4.2. As previously documented by Mola and Loughran (2004), and Corwin (2003), underpricing exhibits an upward trend, and has averaged around 3% in recent years. The figure also shows that underpricing for equity issues that follow IPOs has become consistently above the underpricing of equity issues that follow previous SEOs. This might be because after 1990, newly listed firms became more likely to cease trading in the first 10 years after being listed, as documented by Fama and French (2004).

I capture the performance following previous SEOs or IPOs as the buy-and-hold six month or one-year abnormal returns relative to a benchmark of non-issuers matched on size, measured by the market value five days after an issue is made. I construct the benchmark portfolio based on the market value of all non issuers that have data available in CRSP, excluding financials and utilities. The benchmark return for each issuer making a SEO is the return on the equally weighted portfolio that is closest to that of the issuer. Ritter (2003) and Loughran and Ritter (1995) also use size benchmarks to calculate abnormal returns.

Figure 4.3 shows a timeline for the event study employed in my approach. Since I need one year returns following a previous SEO or IPO, I impose the condition that at least one calendar year has passed between subsequent events, and also ensure that there is no overlap with the stock runup prior to the filing date.[42] Underpricing is calculated at the issue date, which occurs on average (median) 42 (30) calendar days after the filing date.

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[41] I allow for five years to pass so that I avoid a bias arising from having (by construction) less follow-on issues in the early years of my sample, as well as a bias due to less time being allowed to pass between an IPO or SEO and subsequent equity issues.

[42] I also limit my sample to firms that re-issue within 10 years, although the results are robust to their inclusion.

4.4.2 Determinants of underpricing

I control for the following variables that have been used in other studies as determinants of underpricing:

Filing CARs: This captures the wealth effect of an SEO announcement, measured similarly to Altinkiliç and Hansen (2003), as the raw cumulative stock return over trading days -1 to +1 relative to the announcement date less the CRSP equally weighted market index return over the same period.

Abn. stock runup: The raw cumulative stock return over trading days -62 to -2 prior to the announcement date less the CRSP equally weighted market index return over the same period. As shown by Lucas and McDonald (1990), a pre-announcement stock runup can reflect lower equity-related adverse selection costs.

Residual volatility: Idiosyncratic risk, computed similarly to Hoberg and Prabhala (2009) as the annualized standard deviation of residuals from a regression of daily excess stock returns on excess returns of the value-weighted CRSP market portfolio, estimated over trading days -62 to -2 before the announcement date.

Systematic volatility: Systematic risk, computed as the annualized standard deviation of the predicted value from a regression of daily excess stock returns on excess returns of the value-weighted CRSP market portfolio, estimated over trading days -62 to -2 before the announcement date.

Ln(MV): As in Corwin (2003) I proxy for firm size by the natural logarithm of the market value measured 5 days before the announcement of the issue. Firm size is generally interpreted as capturing asset diversification and the quality of publicly available information about the firm.

Tobin's Q: This has been shown to proxy for growth opportunities (see, for e.g., Graham, 2000; Polk and Sapienza, 2009), or overvaluation (Baker, Stein, and Wurgler, 2003). Tobin's Q is calculated as the market value of equity (Compustat # 25 x # 199) + total assets (# 6) – book value of equity (# 60)/total assets.

Relative proceeds: The relative offering size is calculated as the number of shares issued dived by the number of shares outstanding. Offering size is interpreted as capturing an adverse selection effect, or the liquidity effect of price pressure associated with new shares being issued (Altinkiliç and Hansen, 2003; Corwin, 2003), which require underpricing as a 'sweetener' to lure prospective investors.

Age: Firm age. DeAngelo et al. (2010) finds that firms in the earlier stage of their lifecycle are more likely to issue equity. Age is measured as the difference, in years, between the issue date and the date that the firm first appears in the CRSP database.

Years previous: The number of years that have elapsed since the previous issue.

Ln(price): The natural logarithm of the market price measured 5 days before issue is used to control for uncertainty about firm value as in Altinkiliç and Hansen (2003), with an inverse relationship hypothesized. In addition, Corwin (2003) finds that low-priced securities tend to be more underpriced than offers of high-priced securities, due to a common practice of rounding the offer price to even dollars.

Underwriter Prestige: As in Loughran and Ritter (2004), I take prestigious underwriters as those having a ranking of 8 or higher on the Carter and Manaster (1990) 9-point scale.

SDC provides data on the underwriter of each SEO, which I match with the underwriter prestige rankings available from Jay Ritter's site.[43]

NYSE: I include a dummy variable equal to one for issuers on the New York Stock Exchange following Corwin (2003), who finds lower underpricing for these issues, which are characterized by less uncertainty.

Previous debt issue: I include a dummy variable equal to one for issuers that make a debt issue in between the current SEO and a previous equity offering.

Change CEO: A dummy variable equal to one if there was a change in the CEO since the previous issue was made, identified using Standard and Poor's Executive Compensation (ExecuComp) Database.

Panel A in Table 4.1 provides descriptive statistics for equity offerings, conditional on a firm having previously made an SEO. The sample consists of 1,402 follow-on equity offerings made by 732 firms that had a previous SEO. Around 95% of firms make no more than 4 further issues after their first SEO. Panel B presents statistics for 1,018 firms that issue equity following their IPO. The average underpricing for SEOs that follow a previous SEO is smaller than the underpricing for SEOs following an IPO. Overall, underpricing is similar to that documented by Corwin (2003), but slightly less than in Mola and Loughran (2004) and Altinkiliç and Hansen (2003), who examine a more recent period. The 6-month abnormal returns that follow a previous SEO are on average 2.6%, whereas the 12-month returns are 2.2%. Meanwhile, the 6-month abnormal returns following an IPO are -2.1%, and the 12-month returns are 21.7%.[44] The sharp increase in post-IPO returns after six months have elapsed might be due to the expiration of the lockup period that commonly occurs after 6 months. Information released at the lock up date can have a large effect on share prices. Hence, the returns in the year after issue are considered more informative about market timing than those in the first 6 months after issue. Compared to firms issuing seasoned equity for the first time, Table 4.1 indicates that firms with a prior SEO have less firm-specific risk and growth opportunities, are larger and older, and raise less proceeds. These firms are also more likely to be listed on the NYSE and to adopt a prestigious underwriter to manage their issue. Thus, firms with a previous SEO are less prone to asymmetric information problems than those issuing equity after their IPO.

4.4.3 Determinants of capital structure

I include a number of standard firm-specific variables that capture costs associated with straight debt and equity financing (see, e.g., Frank and Goyal, 2009; Lewis, Rogalski, and Seward 1999). Firm characteristics are retrieved from Compustat and measured as at the end of the fiscal year prior to the offering, unless mentioned otherwise. The symbol "#" denotes a Compustat data item:

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[43] Data for underwriter prestige between 1980 and 2007 are available on Jay Ritters's site at: http://bear.warrington.ufl.edu/ritter/ipodata.htm

[44] In the larger sample of 8,181 SEOs that are not conditioned on a previous SEO being made, the abnormal returns are -0.4% in the first 6 months, and -4.6% in the first 12 months after issue. The abnormal returns following 5,543 unconditioned IPOs are -0.1% in the first six months, and -3.1% in the first 12 months after the IPO. By comparison, Loughran and Ritter (1995) find that seasoned equity issuers underperform size-matched firms by 0.05% in the first 6 months after issue, and 6.3% in the first 12 months. They also find that IPO firms outperform the matched sample by 0.05% in the first 6 months, but underperform by 4.5% in the year after going public. Hovakimian and Hutton (2010) find that seasoned equity issuers underperform their book-to-market and size matched benchmark by 5.2% in the year after issue.

Abn. stock runup: The raw cumulative stock return over trading days -62 to -2 prior to the announcement date less the CRSP equally weighted market index return over the same period. As shown by Lucas and McDonald (1990), a pre-announcement stock runup can reflect lower equity-related adverse selection costs.

Stock volatility: Total risk, computed as the annualized standard deviation of daily stock returns over trading days -62 to -2 before the announcement date.

Slack: Cash and short-term investments (# 1) divided by total assets (# 6). Financial slack acts as a measure for adverse selection costs, as firms with higher slack could engage in wasteful use of resources.

Fixed assets: Calculated as plant, property and equipment (# 8) divided by total assets (# 6). Firms with more tangible assets are assumed to have lower financial distress costs. Asset tangibility could also be negatively associated with information asymmetry.

Ln(sales): Calculated as the natural logarithm of total sales (# 12). Larger firms are assumed to face smaller information asymmetries regarding their value and risk.

Taxes: This variable captures the tax liabilities benefit associated with issuing debt and is computed as income tax (# 16) divided by total assets.

Tobin's Q: This has been shown to proxy for growth opportunities (see, for e.g., Graham, 2000; Polk and Sapienza, 2009). Firms with higher growth opportunities face higher debt costs associated with risk shifting (Green, 1984) and underinvestment (Myers, 1977), making them more likely to issue equity instead of debt. Alternatively the Q-ratio might indicate overvaluation (Baker, Stein, and Wurgler, 2003). Tobin's Q is calculated as the market value of equity (# 25 x # 199) + total assets (# 6) – book value of equity (# 60)/total assets.

R&D expense: The expenditure on research and development (# 46) divided by total assets. Missing observations are assigned a value of 0. This variable proxies for growth opportunities.

Leverage-Target: the deviation of the market leverage from the target leverage.[45] I estimate a firm's target leverage using similar determinants of leverage as in previous research (see, for e.g., Hovakimian, Opler, and Titman, 2001; Huang and Ritter, 2009; Frank and Goyal, 2009). The firm's target leverage for firm *i* in year *t* is calculated as the fitted values from Equation (7), while the deviation from the target leverage is the actual leverage for firm *i* in year *t* minus the target leverage (*t*-statistics, clustered by firm and year, are in brackets):

$$
\begin{aligned}
\text{Market Leverage}_{it} = {} & \underset{(18.2)}{0.16}\,\text{Fixed assets}_{it-1} + \underset{(9.27)}{0.01}\,\text{LnSales}_{it-1} - \underset{(-2.05)}{0.39}\,\text{Taxes}_{it-1} \\
& - \underset{(-9.66)}{0.01}\,\text{Tobin's Q}_{it-1} - \underset{(-19.62)}{0.28}\,\text{R\&D}_{it-1} - \underset{(-8.29)}{0.17}\,\text{Capex}_{it-1} - \underset{(-10.14)}{0.15}\,\text{Cash Flow}_{it-1} \qquad (7) \\
& + \text{Industry} + \text{Year} + \upsilon_{it}
\end{aligned}
$$

Equation (7) is estimated using 129,422 firm-years over the period 1975-2007, and the adjusted R-squared is 30.9%. I retrieve firm characteristics from the Compustat Fundamentals Annual database, and omit financials (SIC codes 6000–6999), utilities (SIC codes 4900–4949), and firms with a market capitalization less than $10 million. market leverage is calculated as [book value of debt (# 9 + # 34)] divided by market value of assets [market value of equity (# 25 x # 199) + total assets (# 6) – book value of equity (# 60)];

[45] I include the deviation from the target leverage as a determinant of the choice of financing instrument, but I also include other determinants for two reasons. First, as noted by Hovakimian et al. (2001), and Leary and Roberts (2005), target leverage is estimated with error, reducing its explanatory power. In addition, firms may adjust slowly to target leverage (see, e.g., Leary and Roberts, 2005) so that other factors may be more significant in explaining the choice between debt and equity at a particular instance in time.

Fixed assets [plant, property and equipment (# 8) divided by total assets]; LnSales [the natural logarithm of sales (# 12)]; Taxes [income tax (# 16) divided by total assets]; Tobin's Q [market value of equity (# 25 x # 199) + total assets (# 6) – book value of equity (# 60)]/[total assets]; R&D is the expenditure on research and development (# 46) divided by total assets][46]; Capex [capital expenditure (# 128) divided by total assets]; Cash flow [earnings before extraordinary items (# 18) + depreciation (item 14)]/[total assets]; Industry refers to 70 dummies based on the 2 digit SIC code, and Year are annual dummies.

The estimated regression coefficients are mostly in line with those found in previous research. In line with the tradeoff theory of capital structure, larger firms and those with more collateral, as measured by fixed assets, have higher target leverage, while the negative coefficient on Taxes is unexpected. Firms with a higher Tobin's Q ratio have a smaller target leverage, although this relationship can simply be mechanical (Huang and Ritter 2009; Baker and Wurgler, 2002). R&D and Capital expenditure are both negatively related to target leverage, supporting the tradeoff hypothesis that firms with more growth opportunities face higher costs associated with debt financing due to bankruptcy, risk-shifting, or underinvestment. Cash flow is negatively related to target debt, counter to the prediction that these firms would benefit from the tax savings and lower costs of free cash flow associated with debt.

KZ index: the Kaplan and Zingales index captures financial constraints (Graham 2000; Baker, Stein, and Wurgler, 2003), and firms with higher constraints face higher costs of issuing debt, which are to some extent mitigated by the disciplinary benefit that debt brings to firms with excess cash. I expect the probability of issuing equity should be increasing in the value of KZ index since more financially constrained firms are forced to issue equity. Following Baker, Stein, and Wurgler (2003), I exclude the Tobin's Q-ratio from the index, as a high Q-ratio might indicate overvaluation and thus contaminate the index as a measure of financial constraints. Hence, the KZ index is calculated as:

$$\begin{aligned}\text{KZ Index} = &-1.002 \times \text{Cash flow} - 39.368 \times \text{Dividends} - 1.315 \times \text{Cash} \\ &+ 3.139 \times \text{Book leverage}\end{aligned} \tag{8}$$

Where: Cash flow [earnings before extraordinary items (# 18) + depreciation (item 14) divided by lagged total assets]; Dividends [cash dividends (# 21 + # 19) divided by lagged total assets]; cash [cash balances (# 1) divided by lagged total assets]; Book leverage [book value of debt (# 9 + # 34)] divided by book value of assets [book value of debt (# 9 + # 34) + stockholders' equity (# 216)].

I capture economy-wide costs of issuing debt or equity through the following *Aggregate Financing Costs Measures*, which are obtained from Datastream:

Interest rates: The real interest rate serves as a proxy for bankruptcy risk, as in Krishnaswami and Yaman (2008). This variable is calculated as the difference between yields on 10-year U.S. Treasury Bonds and the inflation rate, defined as the continuously-compounded annual change in the U.S. consumer price index.

Default premium: The default premium also captures bankruptcy risk (Korajczyk and Levy, 2003) and is defined as the difference between yields on Baa rated corporate Bonds and Aaa bonds. Both the real interest rate and the default premium are averaged over the 3 months prior to the issue date.

[46] Missing values of R&D are replaced by 0.

Market runup: Calculated as the return on the S&P 500 index over the quarter preceding the issue date, the stock market runup controls for general market conditions.

Confidence Index: I control for investor sentiment following several studies that highlight its importance in security issuance decisions (e.g., Lowry, 2003; Helwege and Liang, 2004). As a sentiment proxy I take the average level of the University of Michigan Consumer Sentiment Index over the three months prior to issuance.

4.5 Results

In Section 4.5.1 I examine the effects of past market timing on the underpricing of equity issues. I perform an analysis for equity issues occurring after previous SEOs and a separate analysis for firms issuing equity after their IPO, and contrast the results. Section 4.5.2 presents a similar analysis, but I focus on the shareholder wealth effects at the SEO announcement date, instead of on underpricing. In Section 4.5.3 I model the influences of market timing on the capital structure, while in Section 4.5.4 I test my results for robustness to measures of short-sale constraints.

4.5.1 The impact of market timing on underpricing of subsequent SEOs

My main hypothesis proposes a relationship between returns following a past SEO or IPO and underpricing of a subsequent equity offering. Hence, my sample conditions on a firm returning to the market to raise further equity, but it is possible that the choice to do so is not random. For instance, a firm's choice on whether to issue further equity can depend on insider information about expected underpricing that is not observable to the market. An example of such a situation is one where a prospective issuer has lined up a convincing road show to market the equity issue after it is announced. Information released to selective investors during the road show might not even be impounded into prices until the issue is offered for sale, when the issue price is determined. Such a case would imply a correlation between the unobservable characteristics determining the decision to issue, and the unobservable influences in the underpricing regression, resulting in a selection bias. I address this concern by applying the Heckman (1979) 2-step procedure, where in the first step I estimate a probit regression to determine the decision to issue equity, from which I obtain the Inverse Mills' ratio. This captures unobservable characteristics influencing the decision to issue. I include the Inverse Mills' ratio in the second stage regression, where I regress underpricing on the market timing proxy and control variables. Some of the variables included in the first stage influence the decision to issue equity but not underpricing, helping the identification of the underpricing equation.

Table 4.2 shows the results of the first step of the Heckman procedure for equity issues that follow previous SEOs (Columns 1 and 2) and those following IPOs (Columns 2 and 3). The first step is performed using a panel regression consisting of all firms having at least one previous SEO, but not conditioning on them issuing again. The dependent variable takes a value of one if a firm issues equity again in a given firm-year, and a value of zero for every firm-year in which it does not. All explanatory variables are lagged by one year. The first two columns in Table 4.2 indicate that the probability of issuing equity following a previous SEO is positively related to both the 6-month and 12-month returns following the previous SEO.

Hovakimian and Hutton (2010) find similar results. The other explanatory variables are generally in line with the predictions of capital structure theory. For instance, the probability of an equity issue is also positively related to the stock run-up, Tobin's Q, and R&D expenditure, variables that have been used to capture growth opportunities. Firms are also more likely to issue equity if their leverage is above their target leverage. The results in Columns (3) and (4) refer to the sample of firms having done an IPO, but without conditioning on them issuing equity again. Both the 6-month and 12-month returns following the IPO have a positive influence on the likelihood of the firm issuing equity again, while most of the other determinants have a similar effect as in the SEO sample. IPO underpricing has an insignificant impact on the likelihood of issuing equity, in contrast to the predictions of models in which underpricing is used to signal better quality firms (e.g., Chemmanur, 1993; Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989).

Having shown that the probability of issuing further equity is positively influenced by the returns following a previous SEO or IPO, I next examine repeat issuers to test the hypothesis that past market timing impacts underpricing of subsequent equity issues. Table 4.3 presents the results of the second stage Heckman procedure, using the sample of firms that had a previous SEO. The dependent variable is underpricing, while I control for several determinants of underpricing previously documented in the literature (e.g., Altinkiliç and Hansen, 2003; Corwin, 2003), as well as the Inverse Mills' ratio calculated from Table 4.2.[47] In addition, I control for the upward trend in underpricing documented in Figure 4.2 by including year dummies. The results in Column (1) suggest that past market timing has an impact on underpricing of subsequent equity issues. The significant negative coefficient for the six-month returns implies that underpricing is larger in the returns following a previous issue were more negative. In economic terms, if the returns are one standard deviation lower, underpricing increases by 0.29 percentage points. This represents 13% of the average underpricing across all SEOs. Column (2), indicates that the impact of the one-year returns on underpricing is similar, with one standard deviation lower returns resulting in higher underpricing of 0.22 percentage points (10% of the average). In the remaining analysis I report results for the one-year returns only, rather than the six-month variable.[48] I use the longer horizon for consistency with the results on issues following an IPO, for which the twelve-month period is more informative because it incorporates the expiration of the lock-up period. On the other hand, the longer horizon may be noisy due to developments not associated with market timing that occur after an issue.

With regards to the other variables in the regression, the runup in stock prices prior to the announcement has a negative impact on underpricing. This is consistent with the runup capturing growth opportunities and positive sentiment about a company. In contrast volatility, particularly that attributable to firm-specific returns, increases underpricing, in line with the hypothesis that underpricing is higher when an issuer is exposed to more asymmetric information. The positive coefficient for firm age could be due to issuers late in their lifecycle, who raise funds due to cash shortfalls instead of investment opportunities, as documented in DeAngelo, DeAngelo, and Stulz (2010). A potential explanation for the negative coefficient on *Years previous*, is that firms signal their quality by waiting longer to issue as in the models of Lucas and MacDonald (1990), and Welch (1996).[49] Underpricing is also lower for firms that are listed on the NYSE, in line with the findings or Corwin (2003),

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[47] The specification in Column (1) of Table 4.3 uses the Inverse Mills' ratio from Column (1) of Table 4.2, while the remaining specifications in Table 4.3 use the Inverse Mills' ratio from Column (2) of Table 4.2. This is in accordance with whether 6-month, or 12-month returns are the variable of interest in Table 4.3.

[48] The results are similar if the six-month returns are used.

[49] In unreported analysis I find no differential effect when I interact *Years previous* with *12 Mth. post-previous rets.*

and consistent with Mola and Loughran (2004) and Altinkiliç and Hansen (2003), who use a dummy for Nasdaq issuers. The negative coefficient for *ln(price)*, and positive coefficient for *Tick<1/4* are both evidence of offer price rounding, consistent with the findings of Mola and Loughran (2004), and Corwin (2003).

In Column (3) I devise a further test of the hypothesis that past market timing impacts subsequent SEO underpricing. This hypothesis proposes that investors use the returns following previous issues to adjust their beliefs about the intentions of the issuer, and consequently the expected returns post-issuance. If this is the case, prospect theory (Kahneman and Tversky, 1979) would suggest that investor 'value' would be more sensitive to a drop in their wealth rather than an increase, assuming investors are loss-averse.[50] In order to test this proposition, I include an interaction term to allow for a differential effect of returns following a previous SEO on underpricing. The specification in Column (3) includes the interaction term, which has a positive and significant coefficient. Adding up the coefficient of *12 Mth. post-previous rets.* and the interaction term gives a total effect (0.06) on underpricing for the returns following a previous issue, when conditioning on these being positive. In contrast the coefficient for negative returns almost doubles, increasing the impact of past market timing on underpricing.

In Column (4) I interact the 12-month returns with a dummy variable that captures whether the issuer changed its CEO since the past issue was made.[51] If the identity of the CEO is more important, the signal from past issues is less informative if the CEO changes between issues. The interaction term has an estimated coefficient that is positive and significant, lending support to this hypothesis, since the influence of past returns has a smaller impact if a company changed its CEO. The coefficient of past returns remains negative for those companies that did not change their CEO. The coefficient for the dummy Change CEO (not interacted) is negative and significant, indicating that a change in CEO, by itself, reduces underpricing of future equity issues by 0.44 percentage points. This evidence suggests that a change in CEO signals a possible improvement in prospects for a company, and is consistent with the findings of Baker and Xuan (2009).

The final column of Table 4.3 includes two additional control variables, the abnormal returns for the window (-1, 1) around the filing date of the SEO, as well as the level of underpricing of the previous issue. The sample size is smaller since I omit observations for which the filing date is unavailable. The filing date return captures investor perceptions about the reasons for a firm issuing stock, including concerns about share price overvaluation, as in the Myers and Majluf (1984) framework. The estimated coefficient for *Filing CARs* is insignificant, indicating that information from the announcement date does not influence the final price that the shares are issued at. The coefficient of *Previous underpricing* is positive, so that past underpricing has some influence on underpricing of subsequent SEOs. This could reflect firm-specific effects, such as information asymmetry, that are not captured by the other control variables in the model. Even after including these two variables, the coefficient for the 12-month returns following past SEOs continues to have a negative and significant impact on underpricing.

Next I examine the hypothesis that past market timing impacts underpricing of SEOs that follow IPOs. Table 4.4 presents the results of the second stage Heckman procedure, using the

[50] In prospect theory the value function substitutes for a utility function, and value is derived from gains and losses around a reference point, rather than from levels (of wealth, in my case).

[51] Changes in the CEO are identified using Standard and Poor's Executive Compensation (ExecuComp) Database.

sample of firms that had a previous IPO.[52] The dependent variable is underpricing, and I control for year effects in all specifications. Across all specifications, I find that returns following an IPO have no significant impact on underpricing of subsequent SEOs. These results are in contrast with those for multiple SEOs, documented in Table 4.3, and suggest that the post-IPO returns are not indicative of market timing motives in subsequent SEOs.

Turning to the other variables in Table 4.4, residual volatility has a marginally significant positive impact on underpricing, underlining the role of asymmetric information in underpricing. Tobin's Q is significantly positive across all specifications, suggests that this variable captures growth opportunities that are hard to value, or overvaluation, both of which increase price uncertainty and lead to higher underpricing. The negative coefficient for *ln(price)*, is consistent with the practice of offer price rounding, while firms listed on the NYSE have larger underpricing, which is contrary to expectations. Column (5) indicates that the level of underpricing at the IPO does not influence subsequent SEO underpricing, which is inconsistent with the signaling models discussed earlier, and in line with the results in Table 4.2.

4.5.2 The impact of market timing on the announcement effects of SEOs

In the previous section, I use underpricing at the offering date to measure the cost of past market timing on subsequent equity issues, thus placing direct focus on the purchasers of the new issue. There are several reasons why underpricing is the appropriate measure to capture these costs. For instance, in the model of Benveniste and Spindt (1989) the demand for the new issue is partly reflected in the price discount, which compensates investors for revealing their private information. Hanley (1993) finds evidence for IPOs in line with the implications of this model, while Altinkiliç and Hansen (2003) show that underwriters adjust underpricing to incorporate private information of investors as reflected in their order book.

While my primary focus is on underpricing at the offer date, theory suggests that the effects of past market timing should also to some extent be reflected in the announcement date returns, which capture shareholder wealth effects. In the Myers and Majluf (1984) framework, adverse selection costs imply that companies have an incentive to issue shares when the market price is higher than the underlying value of the company.[53] An SEO announcement may signal overvaluation and is on average accompanied by a negative share price reaction. This signal should be stronger if the firm had timed its past equity issues to coincide with overvaluation.

However, the announcement day return also incorporates other information unrelated to market timing, such as signals about unanticipated financing requirements or investment opportunities (see, e.g., Cooney and Kalay, 1993; Miller and Rock, 1985). This softer information embodies unobservable beliefs of investors, and is harder to control for. On the other hand, this information would be mostly incorporated into the share price by the time the issue is made. In addition, the announcement day reaction may be contaminated by

[52] The specification in Column (1) of Table 4.4 uses the Inverse Mills' ratio from Column (3) of Table 4.2, while the remaining specifications in Table 4.4 use the Inverse Mills' ratio from Column (4) of Table 4.2. This is in accordance with whether 6-month, or 12-month returns are the variable of interest in Table 4.4.

[53] Eckbo et al. (2007) note that unless all the new shares are sold to insiders, issuing undervalued equity dilutes the holding of current shareholders and results in a wealth transfer to purchasers of the new shares. Thus, issuers tend to wait till the market price is above the underlying value of the firm before issuing equity. Conversely, issuing overvalued equity to new investors results in a wealth transfer to current shareholders.

uninformed or passive investors. Existing shareholders also have an incentive to keep the share price high, at least until after the issue is sold, so as to extract wealth from purchasers of the new shares. On the other hand, investors buying new shares have the option not to purchase the issue unless their updated beliefs about the expected return distribution, as well as the riskiness of these shares, is incorporated into the discount.

Whereas there may be some uninformed investors holding a company's stock, the purchasers of the new shares have a greater incentive to search for information, so that they should be more informed than the average existing shareholder. Market timing should also be more of a concern for the purchasers of the new equity than for current shareholders, since current shareholders benefit if additional stock is issued when valuations are high, thus raising more funds, before the share price drops to its true value.

I examine the effects of past market timing on announcement of equity issues in Table 4.5. The dependent variable is the cumulative abnormal returns (CARs) around the window (-1, 1), surrounding the announcement of an equity issue. The first two columns present estimates for the sub-sample of equity issues that are preceded by SEOs, whereas the other two columns pertain to the sub-sample of issues that follow an IPO. The explanatory variables are similar to those used in previous studies on equity issues (e.g. D'Mello, Tawatnuntachai, and Yaman, 2003; Bayless and Chaplinsky, 1996). I exclude year dummies in all regressions, since a χ^2 test does not reject the restriction that all the year dummy variable coefficients are jointly equal to zero (*p*-value of 0.33). The Inverse Mills' ratio used in each regression is calculated using the probit model in the corresponding Column of Table 4.2.

The results in the first two columns of Table 4.5 indicate that the announcement returns are positively influenced by the returns following previous SEOs. This is evidence that market timing motives, captured by the returns following previous issues, are also incorporated in the beliefs of investors at the announcement of an issue. With regards to the firm characteristics, announcement returns are lower for riskier firms, but higher for those with a larger stock runup and Tobin's Q, suggesting that these signal growth opportunities. Announcement returns are positively related to size, as proxied by *ln(sales)*, fixed assets of the issuer, and the dummy for having issued debt in the past. Issuers that have less tax benefits of issuing debt are also better received by the market. The Inverse Mills' ratio is positive and significant in Columns (1) and (2), indicating that there is 'soft' information that is not captured by observable variables in the selection model of Table 4.2, but which influences the decision to issue equity and also affects the stock price reaction positively. In contrast, almost all of the variables in Columns (3) and (4) are not significant in explaining the stock price reaction to equity announcements that follow IPOs. The insignificance of the firm characteristics could be because the stock price already incorporates information related to these characteristics, and the announcement of a stock issue does not alter the effect that these variables have on the stock price. The low R^2 is common in studies that examine the announcement effects of SEOs, and shows that the determinants of the market reaction are not well understood.

4.5.3 The impact of market timing on capital structure

The results in the previous section show that underpricing is larger for those firms with lower returns in the year following a previous issue. In this section I test whether firms take this into account when they decide whether to issue equity or debt. Underpricing represents an additional cost of issuing equity, since new securities are issued at below the market price.

Hence I expect firms to prefer debt over equity financing if they expect larger underpricing, all else equal. I test this hypothesis by using a probit model to capture the marginal influence of returns following a previous issue, on the decision to issue equity or debt. I perform this analysis separately for SEOs and IPOs, and I condition that a firm returns to the market to issue either debt or equity. The dependent variable takes a value of one if a firm switches to debt, and zero if it issues equity.

I control for other determinants of capital structure, similar to those used in Table 4.2.[54] Panel A of Table 4.6 shows descriptive statistics for firms that switch to debt and those that stick with another equity issue, having previously made an SEO. Out of a total of 1,732 equity issues, only 593 are followed by a debt issue, compared with 1,139 that are followed by an SEO.[55] Both the average 6-month and 12-month returns following a previous SEO are lower for those firms that switch to debt. These firms have a smaller stock price runup, are less risky, and have smaller growth opportunities (as measured by *Tobin's Q* and *R&D expense*), making debt issues less prone to risk shifting costs (e.g., Green, 1984). The lower slack and larger fixed assets mitigate costs related to overinvestment and bankruptcy. Firms that switch to debt are also larger (*sales*) and older, and would consequently find it easier to switch to debt since they are more established with market participants. In fact, their leverage is above the target, suggesting that the debt issue is not done to immediately re-balance their capital structure. The coefficients estimated by the probit regression in Panel B are largely in line with the univariate analysis. The coefficients for both *6-Mth. Post-previous Rets.* and *12-Mth. Post-previous Rets.* are negative, so that a firm is more likely to switch to debt if its previous SEO was followed by lower returns. In economic terms, when the 6-month (12-month) returns are one standard deviation lower, the probability of switching to debt rises by 2.21% (2.26%). These results support the hypothesis that firms take into account expected equity issue costs that arise from past market timing, thus influencing their capital structure. A corollary is that past market timing may constitute a financing constraint prohibiting future fund-raising and investments. The evidence presented here adds to that in Huang and Ritter (2009), and Baker and Wurgler (2002), who document that market timing has long-lasting influences on capital structure.

I perform a similar analysis for equity issues that follow IPOs, as shown in Table 4.7. Out of a total of 1,033 IPOs, only 94 are followed by a debt issue. Panel A shows that the average 6-month and 12-month returns following the IPO are lower for those firms that switch to debt, but not significant in the regression analysis in Panel B. For the firm characteristics, both the univariate analysis in Panel A and the regression estimates in Panel B indicate that firms switching to debt have lower debt-related costs than those sticking with equity, in line with the findings in Table 4.6. IPO underpricing is larger for firms that issue equity after their IPO, supporting the predictions of signaling models in which underpricing is used to signal firm quality (e.g., Chemmanur, 1993; Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989).

In Table 4.8 I test whether the impact of past market timing on underpricing is robust for the sub-samples of firms that stick with equity. In columns (1) and (2) I examine the same sample of firms that stick with equity as in Panel A of Table 4.6. The results indicate that the impact of *6-Mth. Post-previous Rets.* and *12-Mth. Post-previous Rets.* on underpricing remains significantly negative for SEOs following previous SEOs. The Inverse Mills' ratio used in columns (1) and (2) are those estimated using the probit model in the corresponding

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[54] For the model I use in this section I know the precise issue date of equity or debt, which differs from that in Table 4.2, where firm-years are used in a panel setting. Thus, I can use more precise proxies for the stock runup and volatility, in line with the underpricing regressions in Tables 4.3 and 4.4.

[55] Firms switching to debt may subsequently raise equity, which is why the total number of equity issues in Panel A of Table 4.1 is larger than 1,732.

columns in Panel B of Table 4.6.[56] In columns (3) and (4) of Table 4.8 I examine the sample of firms that follow an IPO with an equity offering, taken from Table 4.7. In this case, the returns following IPOs have an insignificant impact on underpricing.

4.5.4 Underpricing and short-sale constraints

Singal and Xu (2005) find that the negative returns following an SEO are largely due to short-sale constrained stocks (i.e., stocks that are difficult to short). If SEOs made by short-sale constrained issuers are also underpriced more, then the market timing effect that I document in the previous sections, may in fact be spurious. One reason why short-sale constrained stocks can have larger underpricing is that the pre-offer price does not reflect the market's valuation because investors cannot short the stocks and impound this information into prices (especially in the period between the announcement and issue dates). On the other hand, shares that are hard to short-sell offer less opportunities for manipulative traders to influence the offer price, so that underpricing is less. In this section I introduce proxies to capture stocks that are short-sale constrained, and re-run the underpricing regressions to test if the effects of market timing remain robust.

The first proxy for short-sale constraints is short interest, scaled by the total number of shares outstanding (both measured over the quarter prior to the SEO announcement date). This captures the demand for sales for shorting purposes. Short interest data are obtained from the Securities Monthly file of the CRSP-Compustat merged database, and are available from 2003 onwards. The mean (median) number of shares that are shorted, relative to shares outstanding, is 5.60% (3.74%) in my sample. However, Asquith, Pathak, and Ritter (2005) emphasize the importance of also controlling for the supply of shares that can potentially be borrowed for shorting purposes. I capture supply effects by using the number of shares held by 13F institutions (obtained from Thomson Reuters), divided by the number of shares outstanding (both measured over the quarter prior to the SEO announcement date). Institutional investors are a measure of supply since they are more likely to lend out their shares than individual investors. The mean (median) number of shares held by institutions, relative to shares outstanding, is 51.23% (50.60%).

My third proxy for constraints is the liquidity of the shares. High liquidity makes it easier for short-sellers to obtain shares, and open short positions can be covered without creating a large adverse price impact. I use the Amihud (2002) illiquidity measure, calculated as the ratio of the absolute value of daily stock returns divided by trading volumes averaged over the window (−62, −2) relative to the SEO announcement date. As in Corwin (2003), I also control for the change in the stock price immediately prior to the issue by taking the abnormal returns over days (-6, -2) relative to the issue date. Changes in the stock price can be due to short-sellers and manipulative trading, or the result of information production. Henry and Koski (2009) find that manipulative trading increases underpricing, whereas Chemmanur, He, and Hu (2009), provide evidence that institutional trading reflects an information production role rather than manipulative trading.

As a final robustness test, I introduce a dummy variable to capture the period after SEC Rule 10b-21 was introduced in August 1988.[57] Since this rule limits short-selling, the period

[56] To estimate the correct Inverse Mills' ratio I change the dependent variable in the probit regression to one if a firm sticks with equity.

[57] Rule 10b-21 prohibited the use of shares purchased at the offering to cover short sales positions established between the initial filing and offer date. In April 1997, this rule was replaced by Rule 105 of Regulation M, which prohibited traders from covering short sales made within five days of the offering with shares obtained in the offering.

after its introduction should be one where the effects of short-sale constraints on underpricing can be separated from the effects of past market timing. Hence, if my results are not spurious, they should remain significant in the period after Rule 10b-21 was introduced. This robustness test is especially appealing since it represents an exogenous event that directly captures a change in short sale constraints common to all issuers. Several studies (e.g., Singal and Xu, 2005; Kim and Shin, 2004; Safieddine and Wilhelm, 1996) examine the consequences of the adoption of Rule 10b-21 in 1988, but find contrasting results with respect to its effect on underpricing.

I present the results of the underpricing regression including the controls for short-sale constraints, in Table 4.9.[58] In column (1) I introduce *Instit. ownership* and *Short interest*„ which enter the regression with the hypothesized sign, but are insignificant. The coefficient for the returns following a previous SEO remains significantly negative, indicating that short-selling effects have a separate influence from the market timing effects. In column (2) *Instit. ownership* becomes significant, when I omit *Short interest*, which allows the regression to be estimated from 1980 instead of 2003. In Column (3) *Amihud* has a positive coefficient, indicating that more illiquid companies underprice their issues to a larger degree. When the 5-day abnormal returns prior to an issue are positive (*Positive 5-day CARs*), the estimated coefficient implies a positive influence on underpricing. This supports models in which private information revelation prior to an offer is rewarded with larger underpricing (e.g., Hanley, 1993; Benveniste and Spindt, 1989). The dummy variable for Rule 10b-21 shows a positive coefficient when interacted with *12 Mth. post-previous rets.* in Column (4). While the effects of past market timing on underpricing are weaker after this rule was introduced, the influence of *12 Mth. post-previous rets.* remains negative (adding up the coefficients results in a net effect of -0.38). In addition a χ^2 test rejects the restriction that the sum of the two coefficients is equal to zero (*p*-value of 0.00). In Column (5) I introduce all the controls that are available after 2003, with the only change being that the coefficient for *Negative 5-day CARs*, becomes positive. A potential reason is that short-sellers manipulate prices prior to an issue to obtain shares at lower prices, even though this practice is prohibited.

4.5 Conclusions

Market timing is commonly cited as a determinant of equity issues, although the cost of timing equity offerings on future issues is not well known. In this chapter I show that offerings are issued at a greater discount to the pre-issue market price if an issuer had exhibited market timing behavior with previous offerings. I capture market timing behavior by the abnormal returns in the year following a previous issue, and find that underpricing of equity offerings is greater if abnormal returns were more negative. The additional discount by past market timers can be seen as compensation for the perceived risk that these issuers will time the market again.

The effect of past market timing is most pronounced for issuers that did not experience a change in their CEO in the period between issues, suggesting that the identity of the CEO matters in assessing past firm performance. I also find that underpricing is less sensitive to positive returns that follow a previous issue, than it is to negative returns. This asymmetric effect could imply that investors are more concerned about potential losses compared with gains, in line with prospect theory. Whereas SEOs are underpriced by more if returns

[58] In unreported results I split my sample based on the median value of several firm characteristics that D'Avolio (2002) finds to be related to short-sale constraints, such as size, market-to-book ratio, and cash flow. The effect of *12 Mth. post-previous rets.* remains significant in all sub-samples.

following previous *SEOs* are more negative, they are not underpriced by more if returns following previous *IPOs* are more negative. This suggests that investors view IPOs as being less indicative of the market timing motives of follow-on equity issuers.

Past market timing also has an influence on capital structure decisions. I find that firms that had timed their previous equity offering are more likely to switch to debt for subsequent financing. This suggests that past market timers anticipate the higher discounting and switch to debt in order to avoid additional dilution of share value. A corollary of this finding is that firms' financial constraints increase if they time the market with previous issues, especially if they are unable to subsequently switch to debt. Thus, my results have implications for the objective function that managers should maximize when considering an equity issue. In particular, the cost of raising capital in the future should be considered in tandem with the cost of a present issue.

4.6 Tables

Table 4.1: Summary statistics for follow-on seasoned equity offerings

Panel A provides descriptive statistics for equity issues that follow SEOs, while Panel B provides descriptive statistics for equity issues that follow IPOs. *SEO underpricing* is the logarithm of the ratio of the closing share price on the day prior to the offer, to the offer price. *6 Mth. post-previous rets.* (*12 Mth. post-previous rets.*) refers to the buy-and-hold returns over the 6-month (12-month) period after a previous SEO. *6 Mth. post-IPO rets*. (*12 Mth. post-IPO rets*.) refers to the buy-and-hold returns over the 6-month (12-month) period after a previous IPO. *Filing CARs* is measured as the raw cumulative stock return over trading days -1 to +1 relative to the announcement date less the CRSP equally weighted market index return over the same period. *Abn. stock runup* is the raw cumulative stock return over trading days -62 to -2 prior to the announcement date less the CRSP equally weighted market index return over the same period. *Residual volatility* is computed as the annualized standard deviation of residuals from a regression of daily excess stock returns on excess returns on the value-weighted CRSP market portfolio, estimated over trading days -62 to -2 before the announcement date. *Systematic volatility* is computed as the annualized standard deviation of the predicted value from a regression of daily excess stock returns on excess returns of the value-weighted CRSP market portfolio, estimated over trading days -62 to -2 before the announcement date. *MV* is the market value from CRSP measured 5 days before the announcement of the issue. *Tobin's Q* is calculated as the market value of equity (Compustat # 25 x # 199) + total assets (# 6) – book value of equity (# 60)/total assets. *Relative proceeds* is calculated as the number of shares issued dived by the number of shares outstanding. *Age* is measured as the difference, in years, between the issue date and the date that the firm first appears in the CRSP database. *Years previous*: is the number of years that have elapsed since the previous issue. *Price* is the market price measured 5 days before issue. *Underwriter Prestige is a* dummy equal to one for prestigious underwriters, defined as those having a ranking of 8 or higher on the Carter and Manaster (1990) 9-point scale. *NYSE* is a dummy variable for issuers on the New York Stock Exchange. *Previous debt issue* is a dummy variable for issuers that make a debt issue in between the current SEO and a previous equity offering. *Change CEO* is a dummy variable equal to one if there was a change in the CEO since the previous issue was made, identified using Standard and Poor's Executive Compensation (ExecuComp) Database. A *t*-test (χ^2 test for the binomial dummy variables) is used to test for the equality of means across sub-samples. N denotes the number of observations.

	Panel A: SEOs following an SEO (N=1,476)			*Panel B:* SEOs following an IPO (N=1,018)			Difference in means
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	
SEO underpricing	0.022	0.012	0.033	0.028	0.018	0.040	-0.01***
6 Mth. post-previous rets.	0.026	0.026	0.328				
12 Mth. post-previous rets.	0.022	0.024	0.476				
6 Mth. post-IPO rets.				-0.021	-0.020	0.364	
12 Mth. post-IPO rets.				0.217	0.203	0.553	
Filing CARs	-0.020	-0.020	0.061	-0.026	-0.028	0.073	0.01**
Abn. stock runup	0.117	0.085	0.245	0.141	0.106	0.288	-0.02**
Residual volatility	0.457	0.405	0.225	0.543	0.497	0.237	-0.09***
Systematic volatility	0.147	0.128	0.104	0.142	0.120	0.107	0.01
MV	1161.2	353.6	3189.9	406.4	138.4	1418.9	754.82***
Tobin's Q	2.115	1.575	1.819	3.390	2.281	4.800	-1.27***
Relative proceeds	0.291	0.198	0.431	0.395	0.296	0.378	-0.11***
Age	15.102	10.290	14.361	3.490	2.138	3.425	11.61***
Years previous issue	3.465	2.754	2.205	3.129	2.370	2.059	0.34***
Price	27.496	23.690	18.998	21.495	18.960	15.730	6.01***
Tick<1/4 (%)	63.600			57.589			6.01**
Underwriter prestige (%)	58.059			40.357			17.71***
NYSE (%)	43.509			13.304			30.21***
Previous debt issue (%)	18.878			7.812			11.07***
Change CEO (%)	9.914			4.017			5.89***

Table 4.2: Returns following previous equity issues and the probability of a follow-on SEO

This Table presents the results of a panel probit regression that estimates the probability of issuing equity for firms that have a prior equity offering or IPO, over the period 1975-2007. The dependent variable is one if a firm makes an issue in a firm-year and zero otherwise. *6 Mth. post-previous rets.* (*12 Mth. post-previous rets.*) refers to the buy-and-hold returns over the 6-month (12-month) period after a previous SEO. *6 Mth. post-IPO rets*. (*12 Mth. post-IPO rets*.) refers to the buy-and-hold returns over the 6-month (12-month) period after a previous IPO. All other variables are calculated over the year preceding the issue date. *Abn. stock runup* is the raw cumulative monthly stock return less the CRSP equally weighted market index return. *Stock volatility* is computed as the annualized standard deviation of monthly stock returns. *Slack* is cash and short-term investments (# 1) divided by total assets (# 6). *Fixed assets* is calculated as plant, property and equipment (# 8) divided by total assets (# 6). *Ln(sales)* is the natural logarithm of total sales (# 12). *Taxes* is computed as income tax (# 16) divided by total assets. *Tobin's Q* is calculated as the market value of equity (# 25 x # 199) + total assets (# 6) – book value of equity (# 60)/total assets. *R&D expense* is the expenditure on research and development (# 46) divided by total assets. *Leverage-Target* refers to the deviation of the market leverage from the target leverage, as calculated in Section 4.4.3. *KZ index* is the Kaplan and Zingales index of financial constraints, as calculated in Section 4.4.3. *Age* is the firm age in years, calculated using the firm first instance when the firm appears in the CRSP database. *Years previous* is the number of years that have elapsed since the previous issue. *Interest rates* refers to the quarterly average real interest rate, measured as the difference between yields on 10-year Treasury Bonds and the inflation rate. *Default premium* is defined as the difference between yields on Baa rated corporate Bonds and Aaa bonds. *Market runup* captures the return on the S&P 500 Index. *Confidence index* is the quarterly average level of the Michigan Consumer Sentiment Index. *Z*-statistics, calculated using heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Seasoned offerings		IPOs	
	(1)	(2)	(3)	(4)
Returns following previous issue				
6 Mth. post-previous rets.	0.29 ***			
	(7.92)			
12 Mth. post-previous rets.		0.27 ***		
		(9.67)		
6 Mth. post-IPO rets.			0.23 ***	
			(5.56)	
12 Mth. post-IPO rets.				0.23 ***
				(7.22)
Issuer characteristics				
Abn. stock runup	0.67 ***	0.65 ***	0.85 ***	0.85 ***
	(23.64)	(22.95)	(22.53)	(21.53)
Stock Volatility	-0.59 ***	-0.58 ***	-0.77 ***	-0.75 ***
	(-9.90)	(-9.69)	(-12.12)	(-11.49)
Slack	0.06	0.08	0.10	0.10
	(0.69)	(0.90)	(1.00)	(1.03)
Fixed assets	0.40 ***	0.41 ***	0.45 ***	0.48 ***
	(5.63)	(5.83)	(5.16)	(5.31)
Ln(Sales)	0.06 ***	0.06 ***	0.08 ***	0.08 ***
	(6.80)	(6.20)	(6.43)	(6.32)
Taxes	-0.80 **	-0.96 **	0.12	0.05
	(-2.08)	(-2.49)	(0.25)	(0.11)
Tobin's Q	0.01 *	0.01	0.03 ***	0.03 ***
	(1.93)	(1.16)	(3.88)	(3.87)
R&D expense	1.36 ***	1.37 ***	0.77 ***	0.73 ***
	(12.05)	(12.08)	(5.75)	(5.21)
Leverage-Target	0.70 ***	0.72 ***	1.07 ***	1.13 ***
	(4.94)	(5.03)	(4.85)	(5.09)
KZ index	0.02 **	0.02 **	-0.02 ***	-0.02 ***
	(2.41)	(2.38)	(-3.18)	(-2.91)
Age	0.00 ***	0.00 ***	-0.10 ***	-0.10 ***
	(-3.66)	(-3.48)	(-7.30)	(-7.36)
Years previous issue	-0.10 ***	-0.10 ***	-0.06 ***	-0.06 ***
	(-18.11)	(-17.91)	(-5.44)	(-5.16)
Previous underpricing	-0.39	-0.36		
	(-1.03)	(-0.96)		
IPO underpricing			-0.08	-0.07
			(-1.49)	(-1.28)
Aggregate Financing Costs Measures				
Interest rates	0.11	0.11	0.06	0.03
	(0.23)	(0.24)	(0.59)	(0.33)
Default premium	0.51 **	0.54 **	-0.84 **	-0.79 *
	(2.10)	(2.21)	(-2.10)	(-1.94)
Market runup	-5.99 ***	-6.11 ***	-0.20	-0.43
	(-3.83)	(-3.89)	(-0.15)	(-0.33)
Confidence Index	-0.08	-0.09	-0.04 **	-0.04 **
	(-1.25)	(-1.25)	(-2.27)	(-2.24)
Intercept	5.35	5.44	3.59 **	3.54 *
	(1.01)	(1.02)	(1.98)	(1.92)
Year dummies	Yes	Yes	Yes	Yes
Pseudo R-squared	14.98 %	15.36 %	20.72 %	21.58 %
No. of observations	23,834	23,834	13,302	13,302

Table 4.3: Returns following SEOs and underpricing of subsequent equity issues

This table presents the results of an OLS regression where the dependent variable is underpricing, using the sample of firms having made a previous SEO. The variables are explained in Table 4.1, with the exception of the following: $D_{Positive\ rets}$. is a dummy equal to one if the *12 Mth. post-previous rets* are positive. The specification in Column (1) uses the Inverse Mills' ratio from Column (1) of Table 4.2, while the remaining specifications in use the Inverse Mills' ratio from Column (2) of Table 4.2. This is in accordance with whether 6-month, or 12-month returns are the variable of interest in Table 4.3. *t*-statistics, calculated using heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Returns following previous SEO					
6 Mth. post-previous rets.	-0.87 ***				
	(-6.33)				
12 Mth. post-previous rets.		-0.46 ***	-0.88 ***	-0.52 ***	-0.46 ***
		(-7.38)	(-3.81)	(-7.04)	(-7.81)
12 Mth. post-previous rets*$D_{Positive\ rets.}$			0.75 **		
			(2.23)		
12 Mth. post-previous rets*$D_{Change\ CEO.}$				0.80 *	
				(1.88)	
Issuer characteristics					
Change CEO				-0.44 *	
				(-1.79)	
Abn. stock runup	-1.28 ***	-1.24 ***	-1.24 ***	-1.26 ***	-1.35 ***
	(-10.88)	(-14.56)	(-13.61)	(-12.85)	(-4.39)
Residual volatility	3.66 ***	3.63 ***	3.52 ***	3.63 ***	2.93 ***
	(10.83)	(10.85)	(8.95)	(11.13)	(5.01)
Systematic volatility	1.66 ***	1.66 ***	1.53 ***	1.74 ***	1.12
	(2.93)	(3.09)	(2.95)	(3.08)	(1.25)
Ln(MV)	-0.13	-0.12	-0.12	-0.13	-0.09
	(-1.61)	(-1.57)	(-1.59)	(-1.62)	(-1.23)
Tobin's Q	0.10 *	0.10	0.10	0.10 *	0.12 ***
	(1.66)	(1.62)	(1.54)	(1.69)	(3.11)
Relative proceeds	0.00	-0.01	-0.02	-0.01	0.02 **
	(0.00)	(-0.06)	(-0.11)	(-0.09)	(2.30)
Age	0.03 ***	0.02 ***	0.02 ***	0.03 ***	-0.01
	(9.06)	(8.37)	(8.23)	(8.98)	(-0.39)
Years previous	-0.02 *	-0.02 *	-0.02 *	-0.01	0.09
	(-1.72)	(-1.92)	(-1.95)	(-0.80)	(0.43)
Ln(Price)	-0.76 ***	-0.75 ***	-0.75 ***	-0.72 ***	-1.08 ***
	(-3.95)	(-3.76)	(-3.82)	(-3.71)	(-9.02)
Tick<1/4	0.11 ***	0.10 ***	0.10 ***	0.10 ***	0.25 *
	(3.56)	(3.59)	(3.43)	(3.43)	(1.95)
Underwriter prestige	0.08	0.07	0.06	0.07	0.07
	(0.33)	(0.26)	(0.23)	(0.26)	(0.21)
NYSE	-0.28 **	-0.28 **	-0.27 **	-0.28 **	-0.27
	(-2.31)	(-2.17)	(-2.10)	(-2.14)	(-1.29)
Previous debt issue	-0.07	-0.07	-0.06	-0.04	0.06
	(-0.62)	(-0.59)	(-0.53)	(-0.33)	(0.24)
Inverse Mills' ratio	0.05	0.04	0.05	0.04	0.18
	(0.37)	(0.31)	(0.42)	(0.35)	(1.39)
Filing CARs					-0.36
					(-0.70)
Previous underpricing					0.08 ***
					(5.40)
Intercept	0.94 **	0.87 **	0.83 *	0.75 **	1.93 ***
	(2.52)	(2.24)	(1.89)	(2.14)	(3.63)
Year dummies	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	24.98 %	24.68 %	24.82 %	24.79 %	24.97 %
No. of observations	1,476	1,476	1,476	1,476	871

Table 4.4: Returns following IPOs and underpricing of subsequent equity issues

This table presents the results of an OLS regression where the dependent variable is underpricing, using the sample of firms having made a previous IPO. The variables are explained in Table 4.1, with the exception of the following: $D_{Positive\ rets}$. is a dummy equal to one if the *12 Mth. post-previous rets* are positive. The specification in Column (1) uses the Inverse Mills' ratio from Column (3) of Table 4.2, while the remaining specifications in use the Inverse Mills' ratio from Column (4) of Table 4.2. This is in accordance with whether 6-month, or 12-month returns are the variable of interest in Table 4.4. *t*-statistics, calculated using heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Returns following previous SEO					
6 Mth. post-IPO rets.	-0.05				
	(-0.15)				
12 Mth. post-IPO rets.		0.28	0.84	0.31	0.42
		(1.22)	(1.42)	(1.28)	(1.58)
12 Mth. post-IPO rets*$D_{Positive\ rets.}$			-0.80		
			(-1.09)		
12 Mth. post-IPO rets*$D_{Change\ CEO.}$				-0.68	
				(-0.86)	
Issuer characteristics					
Change CEO				0.50	
				(0.74)	
Abn. stock runup	0.79	0.76	0.75	0.76	0.18
	(1.28)	(1.23)	(1.20)	(1.23)	(0.27)
Residual volatility	1.53 *	1.19	1.26	1.19	1.92 *
	(1.84)	(1.34)	(1.42)	(1.35)	(1.85)
Systematic volatility	-0.24	-0.30	-0.33	-0.30	-1.78
	(-0.18)	(-0.21)	(-0.23)	(-0.21)	(-1.06)
Ln(MV)	-0.11	-0.20	-0.20	-0.21	-0.49 **
	(-0.62)	(-1.09)	(-1.08)	(-1.12)	(-2.12)
Tobin's Q	0.15 ***	0.14 ***	0.14 ***	0.14 ***	0.15 ***
	(3.13)	(2.83)	(2.86)	(2.82)	(2.72)
Relative proceeds	0.58	0.54	0.54	0.54	-0.06
	(1.52)	(1.42)	(1.41)	(1.41)	(-1.33)
Age	0.06 *	0.05	0.05	0.05	0.16 ***
	(1.89)	(1.55)	(1.55)	(1.56)	(2.76)
Years previous	-0.02	0.01	0.01	0.00	0.00
	(-0.30)	(0.17)	(0.17)	(0.08)	(0.00)
Ln(Price)	-2.02 ***	-1.97 ***	-1.98 ***	-1.98 ***	-1.54 ***
	(-6.82)	(-6.57)	(-6.55)	(-6.58)	(-3.95)
Tick<1/4	-0.28	-0.28	-0.28	-0.29	-0.15
	(-1.22)	(-1.21)	(-1.22)	(-1.24)	(-0.55)
Underwriter prestige	-0.32	-0.22	-0.22	-0.21	-0.25
	(-1.34)	(-0.89)	(-0.90)	(-0.87)	(-0.85)
NYSE	0.77 **	0.77 *	0.77 *	0.77 *	0.90 *
	(1.97)	(1.91)	(1.90)	(1.88)	(1.81)
Previous debt issue	-0.49	-0.53	-0.53	-0.52	-0.39
	(-1.35)	(-1.38)	(-1.39)	(-1.37)	(-0.85)
Inverse Mills' ratio	0.09	0.12	0.12	0.12	-0.10
	(0.42)	(0.58)	(0.54)	(0.57)	(-0.38)
Filing CARs					0.07
					(0.03)
IPO underpricing					-0.00
					(-0.38)
Intercept	4.87 ***	5.03 ***	5.15 ***	5.11 ***	5.93 ***
	(4.13)	(4.14)	(4.17)	(4.14)	(4.27)
Year dummies	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	25.04 %	24.61 %	24.62 %	24.5 %	18.89 %
No. of observations	1,018	1,018	1,018	1,018	782

Table 4.5: SEO announcement effects and returns following previous issues

This table presents the results of an OLS regression where the dependent variable is *Filing CARs*, which captures the abnormal stock returns over the window (-1, 1) relative to the filing date. The firms in this sample have made a previous SEO (Columns 1 and 2) or IPO (Columns 3 and 4). The variables are explained in Table 4.1. The Inverse Mills' ratio used in each regression is calculated using the probit model in the corresponding Column of Table 4.2. *t*-statistics, calculated using heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Seasoned offerings		IPOs	
	(1)	(2)	(3)	(4)
Returns following previous issue				
6 Mth. post-previous rets.	0.49 *			
	(1.78)			
12 Mth. post-previous rets.		0.52 **		
		(2.15)		
6 Mth. post-IPO rets.			0.99	
			(0.98)	
12 Mth. post-IPO rets.				0.17
				(0.22)
Issuer characteristics				
Abn. stock runup	2.35 ***	2.28 ***	1.85	1.73
	(3.35)	(3.59)	(0.88)	(0.80)
Residual volatility	-3.01 **	-2.95 **	0.39	-0.63
	(-2.22)	(-2.16)	(0.14)	(-0.27)
Systematic volatility	2.19	2.11	-5.25	-5.03
	(1.56)	(1.38)	(-1.32)	(-1.31)
Slack	-0.01	0.02	0.46	0.25
	(-0.01)	(0.03)	(0.22)	(0.12)
Fixed assets	1.62 ***	1.62 ***	0.28	-0.33
	(2.66)	(2.60)	(0.19)	(-0.21)
ln(Sales)	0.25 **	0.24 **	0.53 *	0.50 *
	(2.53)	(2.29)	(1.91)	-1.76
Taxes	-9.22 *	-9.44 **	-10.55	-13.19
	(-1.93)	(-1.97)	(-1.39)	(-1.77) *
Tobin's Q	0.43 ***	0.42 ***	0.07	0.05
	(7.36)	(6.97)	(1.27)	(0.93)
R&D expense	-0.27	-0.15	3.45	3.67
	(-0.28)	(-0.16)	(0.97)	(1.02)
Leverage-Target	-0.88	-0.83	2.01	-0.13
	(-0.97)	(-0.89)	(0.83)	(-0.05)
KZ index	-0.06	-0.05	0.01	0.02
	(-0.38)	(-0.37)	(0.10)	(0.17)
Age	0.02 ***	0.02 ***	-0.03	0.00
	(2.99)	(3.07)	(-0.33)	(-0.06)
Years previous issue	-0.09	-0.06	-0.04	0.09
	(-0.99)	(-0.70)	(-0.22)	(0.50)
Previous debt issue	0.81 **	0.81 **	0.99	0.85
	(2.14)	(2.09)	(0.94)	(0.78)
Previous underpricing	0.02	0.02		
	(0.22)	(0.23)		
IPO underpricing			0.00	0.00
			(0.21)	(-0.23)
Inverse Mills' ratio	0.52 ***	0.55 ***	-0.34	-0.59
	(4.73)	(4.53)	(-0.61)	(-0.98)
Intercept	-5.32 ***	-5.46 ***	-5.03 **	-4.10 ***
	(-5.40)	(-5.36)	(-2.05)	(-1.73)
Year dummies	No	No	No	No
Adjusted R-squared	3.11 %	3.00 %	0.09 %	0.04 %
No. of observations	871	871	782	782

Table 4.6: Impact of returns following previous SEO on capital structure

Panel A provides descriptive statistics for a sample of firms with a prior SEO that subsequently issue further equity or switch to debt. Panel B shows a probit regression that estimates the probability of switching to debt for firms that have a prior equity offering, over the period 1975-2007. The dependent variable is one if a firm switches to debt and zero if it issues equity. The independent variables are explained in Table 4.2, with the exception of the following: *Abn. stock runup* is the raw cumulative stock return over trading days -62 to -2 prior to the announcement date less the CRSP equally weighted market index return over the same period. *Stock volatility* is computed as the annualized standard deviation of daily stock returns over trading days -62 to -2 before the announcement date. *Z*-statistics, calculated using heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Panel A: Descriptive statistics							*Panel B: Probit regressions*	
	Switch to debt			Stick with equity			Difference		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	in means	(1)	(2)
Returns following previous SEO									
6 Mth. Post-previous Rets.	-0.01	0.00	0.27	0.04	0.04	0.34	-0.05***	-0.31 **	
								(-2.21)	
12 Mth. Post-previous Rets.	-0.04	-0.02	0.37	0.05	0.05	0.50	-0.09***		-0.21 **
									(-2.14)
Issuer characteristics									
Abn. stock runup	0.01	0.00	0.19	0.13	0.10	0.25	-0.11***	-1.29 ***	-1.28 ***
								(-5.65)	(-5.61)
Stock Volatility	0.39	0.34	0.20	0.51	0.45	0.24	-0.12***	0.37	0.35
								(1.37)	(1.31)
Slack	0.06	0.03	0.08	0.17	0.08	0.22	-0.12***	-1.06 **	-1.05 **
								(-2.16)	(-2.14)
Fixed assets	0.44	0.42	0.24	0.33	0.27	0.24	0.10***	1.11 ***	1.12 ***
								(6.12)	(6.19)
Sales	3106.6	1287.8	4536.5	643.7	191.5	1662.2	2462.9***	0.37 ***	0.37 ***
								(10.12)	(10.14)
Taxes	0.03	0.03	0.03	0.03	0.02	0.04	0.00	1.10	1.23
								(0.70)	(0.78)
Tobin's Q	1.51	1.32	0.82	2.31	1.73	1.97	-0.79***	-0.14 **	-0.14 *
								(-1.98)	(-1.95)
R&D expense	0.01	0.00	0.02	0.07	0.00	0.14	-0.06***	-3.82 ***	-3.72 ***
								(-2.93)	(-2.86)
Leverage-Target	0.01	-0.02	0.14	-0.01	-0.03	0.13	0.02**	1.85 ***	1.84 ***
								(4.64)	(4.61)
KZ index	0.58	0.69	2.73	0.41	0.48	2.11	0.18***	-0.16 ***	-0.16 ***
								(-4.05)	(-4.00)
Age	23.18	16.12	19.65	11.63	8.15	11.42	11.54***	0.01 ***	0.01 ***
								(2.98)	(2.97)
Years previous issue	3.34	2.74	2.06	3.16	2.50	2.03	0.18*	0.02	0.02
								(1.22)	(0.99)
Previous underpricing	1.52	0.76	2.82	2.03	0.87	3.94	-0.51***	-0.34	-0.30
								(-0.26)	(-0.23)
Aggregate Financing Costs Measures									
Interest rates	3.68	3.68	2.14	3.79	3.58	2.12	-0.11	-0.17 *	-0.17 *
								(-1.90)	(-1.89)
Default premium	1.00	0.88	0.42	1.03	0.90	0.45	-0.03	0.74 *	0.71 *
								(1.82)	(1.75)
Market runup	0.04	0.04	0.07	0.04	0.04	0.06	0.00	-0.67	-0.60
								(-0.93)	(-0.84)
Confidence Index	91.69	92.33	10.98	90.03	91.77	10.96	1.66***	0.01	0.01
								(0.45)	(0.46)
Intercept								-3.98 ***	-3.97 ***
								(-3.10)	(-3.09)
Year dummies								Yes	Yes
Pseudo R-squared								35.45 %	35.57 %
No. of observations		593			1,139			1,732	1,732

Table 4.7: Impact of returns following previous IPO on capital structure

Panel A provides descriptive statistics for a sample of firms with a prior IPO that subsequently issue further equity or switch to debt. Panel B shows a probit regression that estimates the probability of switching to debt for firms that have a prior IPO, over the period 1975-2007. The dependent variable is one if a firm switches to debt and zero if it issues equity. The independent variables are explained in Table 4.2, with the exception of the following: *Abn. stock runup* is the raw cumulative stock return over trading days -62 to -2 prior to the announcement date less the CRSP equally weighted market index return over the same period. *Stock volatility* is computed as the annualized standard deviation of daily stock returns over trading days -62 to -2 before the announcement date. *Z*-statistics, calculated using heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. N denotes the number of observations.

	Panel A: Descriptive statistics							*Panel B: Probit regressions*	
	Switch to debt			Stick with equity			Difference		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	in means	(1)	(2)
Returns following previous IPO									
6 Mth. Post-IPO Rets.	-0.09	-0.09	0.27	-0.02	-0.02	0.37	-0.06**	-0.11	
								(-0.48)	
12 Mth. Post-IPO Rets.	0.09	0.10	0.41	0.21	0.20	0.53	-0.13**		-0.11
									(-0.76)
Issuer characteristics									
Abn. stock runup	0.04	0.02	0.18	0.14	0.10	0.29	-0.11***	-1.08 ***	-1.01 ***
								(-3.23)	(-2.81)
Stock Volatility	0.43	0.41	0.21	0.57	0.53	0.25	-0.15***	-0.25	-0.37
								(-0.53)	(-0.74)
Slack	0.05	0.03	0.06	0.27	0.15	0.28	-0.22***	-1.95 ***	-1.77 **
								(-2.60)	(-2.40)
Fixed assets	0.43	0.40	0.25	0.26	0.19	0.22	0.18***	0.97 ***	1.06 ***
								(2.88)	(3.07)
Sales	708.5	278.4	1434.5	194.2	60.03	500.10	514.3***	0.31 ***	0.31 ***
								(4.01)	(3.81)
Taxes	0.03	0.02	0.04	0.03	0.02	0.04	-0.01	-2.88	-2.67
								(-1.23)	(-1.16)
Tobin's Q	1.77	1.45	1.15	3.33	2.32	3.88	-1.57***	-0.08	-0.03
								(-1.01)	(-0.46)
R&D expense	0.01	0.00	0.05	0.10	0.01	0.19	-0.09***	0.52	0.47
								(0.47)	(0.48)
Leverage-Target	0.05	0.04	0.16	-0.02	-0.04	0.12	0.07**	1.59 ***	2.06 ***
								(2.60)	(3.34)
KZ index	0.52	1.08	3.24	0.05	0.11	1.82	0.47**	-0.05 **	-0.05 *
								(-2.09)	(-1.72)
Age	4.55	2.93	4.83	3.82	2.56	3.38	0.73	-0.08 **	-0.08 **
								(-1.98)	(-2.06)
Years previous issue	3.34	2.53	2.14	3.10	2.36	2.03	0.24	0.08 *	0.09 **
								(1.90)	(2.11)
IPO underpricing	4.75	2.10	9.18	14.02	5.56	31.80	-9.27***	-1.40 **	-1.41 **
								(-2.10)	(-2.01)
Aggregate Financing Costs Measures									
Interest rates	3.62	3.69	1.44	3.56	3.49	1.76	0.06	-0.35 ***	-0.37 ***
								(-2.81)	(-2.82)
Default premium	0.82	0.72	0.28	0.95	0.88	0.38	-0.14***	-1.62 **	-1.43 *
								(-2.21)	(-1.90)
Market runup	0.04	0.04	0.06	0.04	0.04	0.05	0.00	-0.97	-1.61
								(-0.62)	(-0.98)
Confidence Index	97.00	95.18	8.25	90.82	91.63	10.26	6.19***	0.05 **	0.05 **
								(2.21)	(2.22)
Intercept								-4.69 **	-5.16 **
								(-2.14)	(-2.21)
Year dummies								Yes	Yes
Pseudo R-squared								38.52 %	38.23 %
No. of observations		94			939			1,033	1,033

Table 4.8: Underpricing and returns following previous issue, after controlling for switchers

This table presents the results of an OLS regression where the dependent variable is underpricing, using the sample of firms having made a previous SEO and stick with equity (Columns 1 and 2), and those with a previous IPO that stick with equity (Columns 3 and 4). The independent variables are explained in Table 4.1. The Inverse Mills' ratio used in columns (1) and (2) are those estimated using the probit model in the corresponding columns in Panel B of Table 4.6, and the Inverse Mills' ratio used in columns (3) and (4) are those estimated using the probit model in the corresponding columns in Panel B of Table 4.7. To estimate the correct Inverse Mills' ratio I change the dependent variable in the probit regression to one if a firm sticks with equity, and zero if it switches to debt. *t*-statistics, calculated using heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Seasoned offerings		IPOs	
	(1)	(2)	(3)	(4)
Returns following previous Issue				
6 Mth. post-previous rets.	-0.75 **			
	(-2.48)			
12 Mth. post-previous rets.		-0.43 **		
		(-2.00)		
6 Mth. Post-IPO Rets.			-0.06	
			(-0.15)	
12 Mth. Post-IPO Rets.				0.39
				(1.47)
Issuer characteristics				
Abn. stock runup	-0.72	-0.68	0.75	0.81
	(-1.03)	(-0.97)	(1.08)	(1.16)
Residual volatility	3.07 ***	3.04 ***	2.13 **	1.69
	(2.69)	(2.66)	(2.18)	(1.61)
Systematic volatility	1.64	1.68	-0.08	-0.16
	(1.48)	(1.53)	(-0.06)	(-0.11)
Ln(MV)	-0.07	-0.09	-0.22	-0.27
	(-0.49)	(-0.59)	(-1.10)	(-1.29)
Tobin's Q	0.06	0.06	0.13 ***	0.12 ***
	(0.61)	(0.66)	(4.10)	(3.91)
Relative proceeds	0.07	0.05	0.11	0.10
	(0.24)	(0.17)	(0.25)	(0.22)
Age	0.03 ***	0.03 ***	-0.05	-0.06
	(2.85)	(2.80)	(-1.27)	(-1.59)
Years previous issue	-0.02	-0.02	0.10 *	0.13 **
	(-0.55)	(-0.68)	(1.69)	(2.17)
Ln(Price)	-0.94 ***	-0.92 ***	-1.76 ***	-1.79 ***
	(-3.70)	(-3.62)	(-4.64)	(-4.59)
Tick<1/4	0.08	0.07	-0.20	-0.21
	(0.42)	(0.36)	(-0.79)	(-0.80)
Underwriter prestige	-0.01	-0.02	-0.38	-0.28
	(-0.08)	(-0.11)	(-1.39)	(-1.00)
NYSE	-0.19	-0.19	0.65	0.62
	(-0.82)	(-0.82)	(1.41)	(1.30)
Inverse Mills' ratio	-0.07	-0.01	0.80	0.61
	(-0.16)	(-0.02)	(0.95)	(0.63)
Intercept	1.64 *	1.57	4.38 ***	4.72 ***
	(1.72)	(1.64)	(3.23)	(3.35)
Year dummies	Yes	Yes	Yes	Yes
Adjusted R-squared	26.34 %	26.09 %	22.98 %	22.5 %
No. of observations	1,139	1,139	939	939

Table 4.9: Underpricing and short-sale constraints

This table presents the results of an OLS regression where the dependent variable is underpricing, using the sample of firms having made a previous SEO. The variables are explained in Table 4.1, with the exception of the following: *Short interest* refers to the number of shares shorted, scaled by the total number of shares outstanding (both measured over the quarter prior to the SEO announcement date).. Short interest data are obtained from the Securities Monthly file of the CRSP-Compustat merged database. *Instit. ownership* is the number of shares held by 13F institutions (obtained from Thomson Reuters), divided by the number of shares outstanding (both measured over the quarter prior to the SEO announcement date). *Amihud* is the Amihud (2002) illiquidity measure, calculated as the ratio of the absolute value of daily stock returns divided by trading volumes averaged over the window (−62, −2) relative to the SEO announcement date. *Negative 5-day CARs* is the abnormal returns over days (-6, -2) relative to the issue date, if these are negative, and 0 otherwise. *Positive 5-day CARs* is the abnormal returns over days (-6, -2) relative to the issue date, if these are positive, and 0 otherwise. *Rule 10B* is a dummy variable to capture the period after SEC Rule 10b-21 was introduced in August 1988. The Inverse Mills' ratio is obtained from Column (2) of Table 4.2. *t*-statistics, calculated using heteroskedasticity-robust standard errors, are in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Returns following previous SEO					
12 Mth. post-previous rets.	-0.45 ***	-0.39 ***	-0.44 ***	-1.04 ***	-0.41 **
	(-2.68)	(-6.68)	(-6.58)	(-5.15)	(-2.18)
Short selling controls					
Short interest	8.06				8.84
	(1.48)				(1.46)
Instit. ownership	-0.65	-1.34 **			-0.45
	(-1.36)	(-1.97)			(-0.99)
Amihud			3.70 ***		848.11 ***
			(2.73)		(23.54)
Negative 5-day CARs			-1.32		13.33 ***
			(-1.19)		(3.64)
Positive 5-day CARs			3.65 ***		0.15
			(2.62)		(0.04)
12 Mth. post-previous rets*Rule10B				0.66 ***	
				(2.55)	
Rule 10B				1.04	
				(1.18)	
Issuer characteristics					
Abn. stock runup	0.22	-1.27 ***	-1.29 ***	-1.24 ***	-0.20
	(0.38)	(-6.30)	(-10.36)	(-15.23)	(-0.35)
Residual volatility	0.57	3.14 ***	3.54 ***	3.62 ***	0.74
	(0.45)	(24.97)	(12.17)	(11.15)	(0.40)
Systematic volatility	2.92 *	2.04 ***	1.62 **	1.67 ***	4.11 **
	(1.72)	(5.00)	(2.26)	(3.21)	(2.53)
Ln(MV)	-0.25	-0.12	-0.13	-0.13	-0.18
	(-1.49)	(-1.27)	(-1.52)	(-1.62)	(-0.99)
Tobin's Q	-0.09 **	0.09	0.09	0.11 *	-0.09 ***
	(-2.25)	(1.51)	(1.48)	(1.74)	(-2.70)
Relative proceeds	-1.95 *	-0.12	-0.04	0.00	-1.71 *
	(-1.90)	(-0.41)	(-0.35)	(0.00)	(-1.87)
Age	-0.01	0.02 ***	0.02 ***	0.02 ***	-0.01
	(-0.94)	(5.17)	(7.43)	(8.34)	(-0.93)
Years previous	0.04 **	-0.02	-0.02 *	-0.02 *	0.03 ***
	(2.18)	(-1.51)	(-1.68)	(-1.78)	(2.61)
Ln(Price)	-0.85 ***	-0.62 ***	-0.74 ***	-0.75 ***	-1.02 ***
	(-2.63)	(-2.65)	(-3.46)	(-3.73)	(-2.75)
Tick<1/4	-0.33	0.16 **	0.09 ***	0.10 ***	-0.04
	(-0.76)	(2.37)	(3.62)	(3.77)	(-0.18)
Underwriter prestige	-0.11	0.05	0.04	0.07	0.08
	(-0.22)	(0.23)	(0.15)	(0.27)	(0.17)
NYSE	0.01	-0.16 **	-0.21 **	-0.29 **	0.07
	(0.07)	(-2.17)	(-2.36)	(-2.24)	(0.47)
Previous debt issue	-1.10 ***	-0.04	-0.07	-0.06	-1.02 ***
	(-3.58)	(-0.46)	(-0.70)	(-0.53)	(-4.66)
Inverse Mills' ratio	-0.04	-0.06	0.03	0.03	0.06
	(-0.21)	(-0.62)	(0.24)	(0.28)	(0.75)
Intercept	7.49 ***	1.89 ***	0.84 **	0.90 **	6.90 ***
	(4.78)	(3.92)	(2.07)	(2.40)	(4.61)
Year dummies	No	Yes	Yes	Yes	No
Adjusted R-squared	12.79 %	22.63 %	24.63 %	24.72 %	20.71 %
No. of observations	319	1,230	1,333	1,476	319

4.7 Figures

Figure 4.1: Annual number of follow-on issues

This figure shows the average annual number of SEOs for those firms having made a prior SEO or IPO. Data on the number of issues are obtained from the Securities Data Company New Issues Database (SDC). I exclude units, secondary offerings, and those made by firms having a market capitalization under $10 million as well as utilities (SIC codes 4900-4949) and financials (SIC codes 6000-6999).

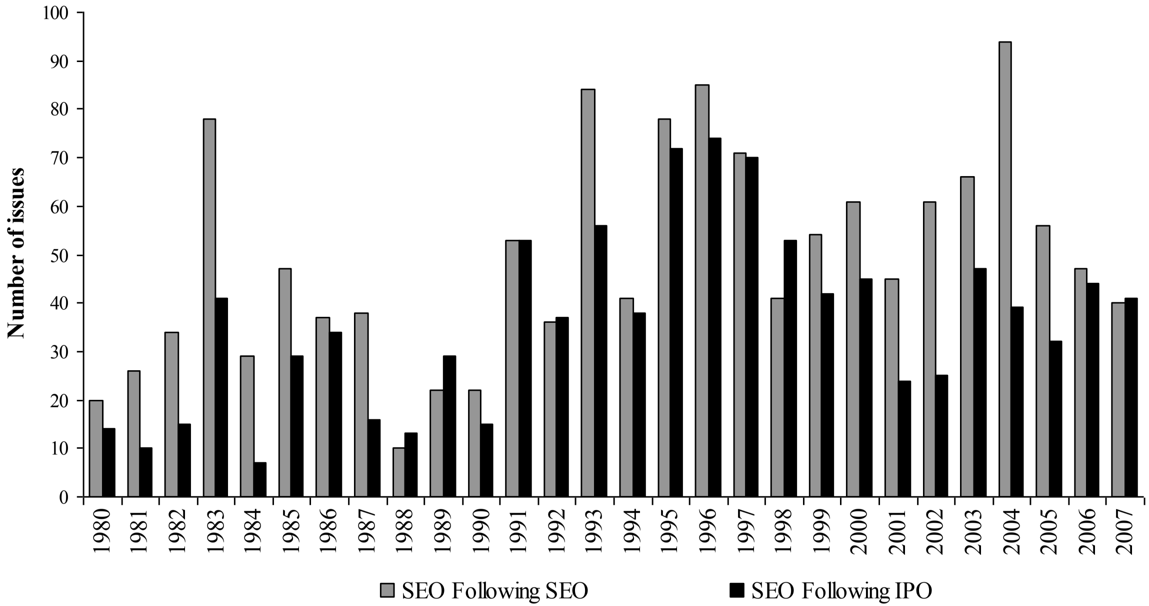


Figure 4.2: Average underpricing across issues

This figure shows the average annual underpricing for those firms having made a prior SEO or IPO. Underpricing is calculated as the logarithm of the ratio of the closing share price on the day prior to the offer, to the offer price. The offer price is obtained from SDC, and the closing price is obtained from CRSP.

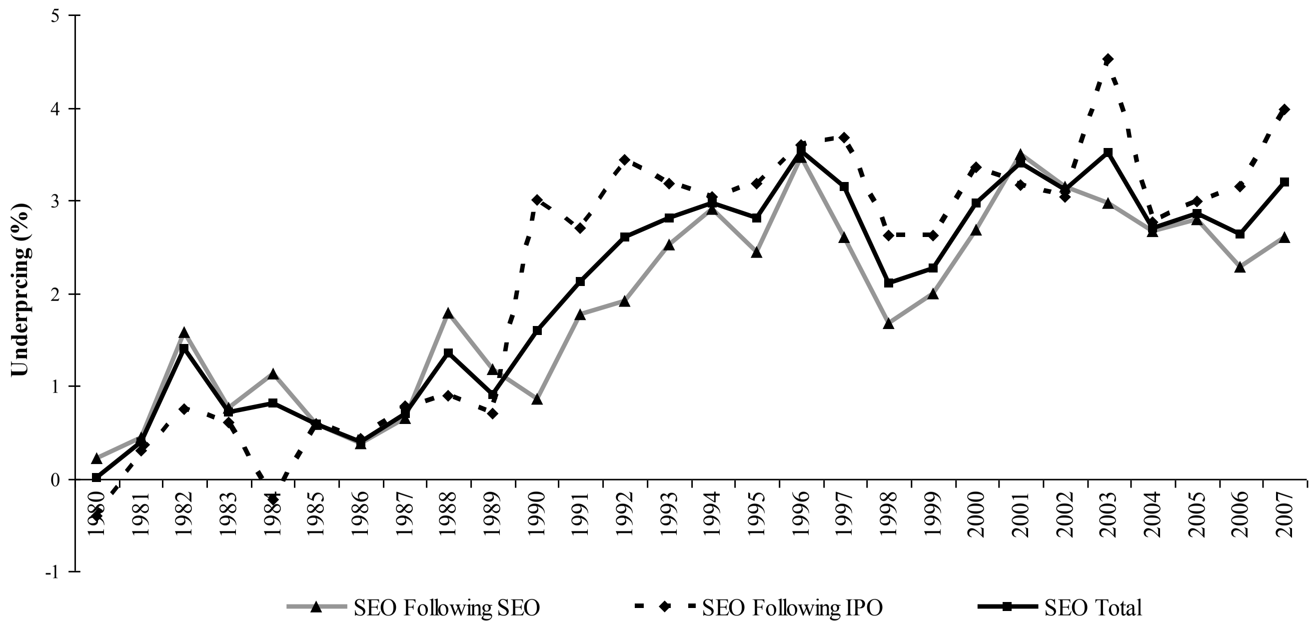
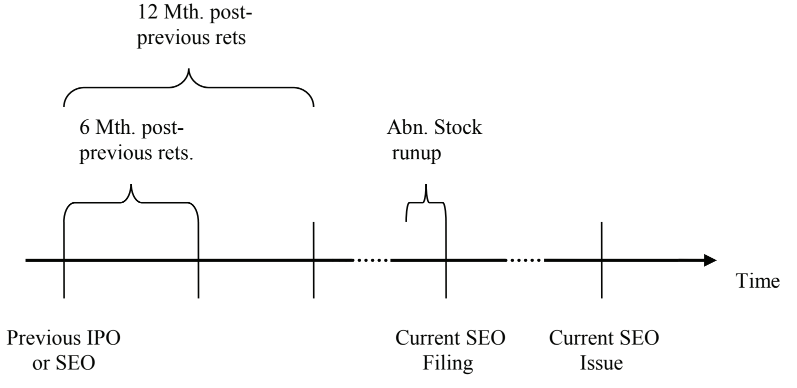


Figure 4.3: Timeline for the event study of follow-on issues

This figure shows the sequence of events for a typical firm in my sample. *6 Mth. post-previous rets.* (*12 Mth. post-previous rets.*) refers to the buy-and-hold returns over the 6-month (12-month) period after a previous SEO or IPO. *Abn. stock runup* is the raw cumulative stock return over trading days -62 to -2 prior to the announcement date less the CRSP equally weighted market index return over the same period.



Chapter 5

Summary and concluding comments

The studies in this thesis contribute to a growing stream of papers showing that capital structure decisions are not only influenced by corporate determinants, but also by fluctuations in investor tastes and capital available for investment. This is a relatively new way of looking at corporate decisions, but is also given the deserved importance in the literature (for a comprehensive survey see Baker, 2009). This view contrasts with the traditional approach in the literature that largely considered corporate decisions to be distinct from the decision process of investors. Chapters 2 and 3 use convertible debt issuance to analyze the impact of intertemporal variation in investor demand on corporate decisions, and the market reaction to these decisions. Chapter 2 shows that convertible debt issuance, pricing, and design decisions are influenced by demand forces from investors. Chapter 3 finds that a shift in the convertible bond investor base from long-only investors towards convertible arbitrage funds resulted in an increasingly negative stock price reaction, induced by short-selling pressure. Thus, the first two studies in this thesis provide more evidence of corporate opportunism, using data on issuers of convertible debt. The fourth chapter uses data from repeat issuers of equity, and provides evidence in line with the hypothesis that investors take opportunism into account when firms issue new equity. In addition, the chapter shows that firms' choice of capital structure is influenced by their past behavior.

5.1 Summary of the main findings

Chapter 2 examines whether firms cater to intertemporal fluctuations in investor demand for convertible debt by issuing more convertibles and/or opportunistically adjusting the design and pricing of their offering. We construct six proxies to capture intertemporal variations in investor demand for convertible bond financing. We find that these investor demand proxies are able to explain approximately one-third of the time-series variation in quarterly U.S. convertible debt volumes over the period 1975 to 2007. We also document that convertible issuers act opportunistically by adjusting the design of their offerings towards changes in investor tastes. In particular, issuers tend to include a larger equity component in their offering during periods with high risk aversion, thus catering to investors who would otherwise hold equities. Finally, we document that convertibles are significantly less underpriced in periods with high investor demand, even when controlling for corporate demand characteristics.

In Chapter 3 we show that a recent shift in the buyers of convertible bonds has important implications for the stockholder wealth effects around convertible bond announcements. The first period we analyze (1984-1999) is characterized by traditional investors who take long positions in convertible bonds. In the second period (2000 to September 14, 2008) the majority of convertible buyers are convertible arbitrageurs that combine a long position in convertibles with short positions in the underlying stock. We find that stockholder wealth effects around announcements in the second period are more than twice as negative as in the first period. Our results provide two explanations for this sharp drop in announcement effects. First, part of the negative announcement effect in the second period is caused by price pressure associated with arbitrage-related short selling of convertible hedge funds. Second, we find that part of the more negative announcement effect can be attributed to changes in firm-specific, security design, and macroeconomic characteristics over time. In the third period (September 15, 2008 to 2009), hedge funds partly loosen their grip on the convertible bond market, but announcement returns continue to become more negative in the wake of the post-Lehman crisis.

Chapter 4 starts with the observations that market timing is commonly cited as a determinant of equity issues, although the cost of timing equity offerings on future issues are not well known. In this study I show that seasoned equity offerings (SEOs) are issued at a greater discount to the pre-issue market price if an issuer had exhibited market timing behavior with previous offerings. The additional discount by past market timers can be seen as compensation for the perceived risk that these issuers will time the market again. The effect of past market timing is most pronounced for issuers that did not experience a change in their CEO in the period between issues, suggesting that the identity of the CEO matters in assessing past firm performance. Whereas SEOs are underpriced by more if returns following previous SEOs are more negative, they are not underpriced by more if returns following previous IPOs are more negative. This suggests that investors view IPOs as being less indicative of the market timing motives of follow-on equity issuers. Past market timing also has an influence on capital structure decisions. The results in Chapter 4 show that firms that had timed their previous equity offering are more likely to switch to debt for subsequent financing. This suggests that past market timers anticipate the higher discounting and switch to debt in order to avoid additional dilution of share value.

5.2 Implications of the findings

Chapter 2 provides evidence that corporate finance actions can be influenced through investor demand channels, rather than being solely driven by firm-specific determinants. The results in the Chapter show that firms cater to increased preference for convertible debt by issuing these securities in the primary market, while also adjusting the security design parameters, and the pricing of their offering. In particular, we obtain evidence that convertible issuers opportunistically set higher prices on their offerings during periods of heightened investor demand, and that these issuers adjust the design of their offering in response to the level of risk aversion of investors. This study adds to a growing stream of studies showing that capital structure decisions are not only influenced by corporate and macroeconomic determinants, but also by fluctuations in investor tastes and capital available for investment. It also contributes to the literature on the motivations for convertible debt offerings, which has thus far mainly focused on issuer-specific determinants. In addition, the findings support the notion that convertible bonds satisfy a specific clientele, whose needs cannot be fulfilled by means of standard financing instruments.

Chapter 3 also contributes to a recent stream of corporate finance studies that explicitly take the influence of investor characteristics into account. This study sheds provides a new perspective on long-accepted stylized facts regarding the relative magnitude of security offering announcement effects. We document that announcement-period returns associated with recent convertible offerings are far more negative than those for equity offerings, partly as a result of stock price pressure induced by short-selling activities of convertible arbitrageurs. This evidence, together with a short-term recovery in the share price after a convertible issue, suggests that the demand curve for the issuer's shares is not perfectly elastic. One of the practical implications of our results is that event studies on recent convertible bond announcements need to take the price pressure caused by convertible arbitrage strategies into account if they want to obtain unbiased estimates of the signaling content of convertibles. Our findings also highlight the need to control for convertible bond underpricing when analyzing stock price reactions to convertible bond announcements.

The study in Chapter 4 provides new insights into the interactions between firms and investors when new equity is issued. First, they suggest that investors take the past behavior of firms into account when evaluating their motives for market timing of subsequent equity offerings. This finding complements a growing literature that examines how investors form beliefs in financial markets. Second, the results show that there is a cost associated with timing equity issues, in the form of higher underpricing of subsequent issues. While past literature has acknowledged the motivations for market timing in equity offerings, the cost of such behavior has not yet been documented. Another finding is that firms that had timed previous equity issues anticipate the higher underpricing to some extent and tend to switch to debt financing to avoid the cost of dilution, or abandonment of profitable investment opportunities. This particular finding extends the literature on capital structure by shedding light on how past actions by firms affects the choice between equity and debt financing. A corollary is that firms' financial constraints increase if they time the market with previous issues, especially if they are unable to switch to debt. Finally, while the results of this Chapter provide evidence in line with the timing of seasoned equity offerings, there is no evidence that supports the market timing hypothesis in IPOs. Thus, these findings support the view that IPOs and SEOs are different events, and investors do not consider the market timing of IPOs as providing a good indication of market timing intentions in subsequent equity offerings.

5.3 Suggestions for future research

This dissertation provides empirical evidence about how corporate decisions are affected by demand forces from investors. The existing literature in this field is relatively young, and there are several opportunities for further advancement. The findings from this dissertation provide opportunities for this advancement.

Evidence from Chapter 2 supports the view that convertible bonds can be considered as a separate asset class, distinct from equities and bonds. An interesting question that is left unanswered is what drives the temporal fluctuations in investor preferences for convertible securities. In addition, the finding that issuers price on better terms when demand is higher, raises questions about why the supply of convertible bonds does not adjust to the point that such profitable opportunities disappear. Further research can address the possibility that not all firms are allowed to tap into this higher demand.

Chapter 3 documents new evidence that issuers of convertible debt during the crisis suffer a negative stock price reaction that is much larger than in earlier years. While the results of this chapter suggest that this very negative reaction can be partly attributed to the extremely high underpricing of convertibles after the collapse of Lehman Brothers, a challenge remains for future research to find other explanations underlying the reaction of investors. One suggestion is that firms raising finance during the crisis were more likely to be cash- and credit-constrained.

The results in Chapter 4 have implications for firms that raise finance through seasoned equity offerings over multiple periods. Given that I document a cost to timing these issues, future research could incorporate this cost in the objective function that managers maximize when considering an equity issue. In particular, the cost of raising capital in the future should be considered in tandem with the cost of a present issue. Another logical step for further research would be to understand how investors form beliefs when assessing the intentions of managers that are considering an equity issue.

Samenvatting (Summary in Dutch)

De studies in dit proefschrift dragen bij aan een groeiende stroom van onderzoeken, die laten zien, dat kapitaalstructuur beslissingen niet alleen beïnvloed worden door ondernemingskenmerken, maar ook door veranderingen in voorkeur van investeerders en de beschikbaarheid van kapitaal. Dit is weliswaar een relatief nieuwe manier van kijken naar ondernemingsbeslissingen, toch krijgt deze benadering de nodige aandacht in de literatuur (voor een uitgebreid overzicht zie Baker, 2009). Deze benadering staat in contrast met de traditionele benadering uit de literatuur, waarbij ondernemingsbeslissingen onafhankelijk worden geacht van het besluitvormingsproces van investeerders. De eerste twee studies in dit proefschrift geven meer bewijs van ondernemingsopportunisme met behulp van data van uitgevers van converteerbare obligaties. De laatste studie maakt gebruik van data van ondernemingen die herhaaldelijk aandelen uitgeven, de zogenaamde 'seasoned-equity offerings' (SEO). De bevindingen zijn in overeenstemming met de hypothese, dat investeerders rekening houden met opportunisme van de kant van ondernemingen die nieuwe aandelen uitgeven.

In hoofdstuk 2 onderzoeken we of bedrijven die waardepapieren uitgeven tegemoet komen aan tijdelijke schommelingen in de vraag van investeerders naar converteerbare obligaties. We veronderstellen dat de vraag van investeerders naar converteerbare obligaties kan veranderen in de tijd, als gevolg van veranderende voorkeuren en wijzigingen in beschikbare middelen voor investeringen in converteerbare obligaties. We vinden met behulp van een tijdreeks analyse, dat de determinanten van de vraag ongeveer een derde van de variantie van de kwartaalvolumes van Amerikaanse converteerbare obligaties over de periode 1975 tot 2007 kunnen verklaren. Onze bevindingen zijn robuust ook na controle voor veranderingen in de financieringsbehoefte van bedrijven naar financiering middels converteerbare obligaties. Hetgeen in overeenstemming is met de traditionele motieven vanuit de literatuur. We laten tevens zien, dat uitgevers van converteerbare obligaties zich opportunistisch gedragen, door het aanbod aan te passen aan de veranderde behoefte van de investeerders. In het bijzonder, zijn uitgevende instellingen geneigd om gedurende risicomijdende perioden een grotere component eigen vermogen toe te voegen in hun aanbod, op deze wijze cateren ze de investeerders, die anders zouden investeren in aandelen. Wij vinden ook dat emittenten hun aanbod voordeliger prijzen volgend op stijgingen van de investeerders-vraag naar converteerbare obligaties.

In hoofdstuk 3 vinden we een neerwaartse beweging in de aandelenrendementen als reactie op uitgiften van converteerbare obligaties, en we verbinden dit met een structurele verandering in het type kopers van converteerbare obligaties. Emissieaankondigingen van converteerbare obligaties leidden in de periode 1984 tot 1999 tot een gemiddeld abnormaal rendement van -1,69%, echter het negatieve aankondigingseffect over de periode 2000 tot 2008 was meer dan twee keer zo sterk (-4,59%). We veronderstellen dat deze verandering is te wijten aan een verschuiving van het type belegger, i.e. van beleggers die zelf converteerbare obligaties kopen, naar beleggers die investeren in arbitrage fondsen. Deze arbitrage fondsen kopen converteerbare obligaties en verkopen de onderliggende aandelen, waardoor een neerwaartse prijsdruk ontstaat. In overeenstemming met deze hypothese, vinden we dat de verschillen in de aankondiging rendementen tussen de traditionele investeerder-periode (1984-1999) en de arbitrage-periode (2000-september 2008) verdwijnen na een correctie voor de ‘arbitrage-short selling’. De rendementen na een aandelenemissie zijn ook in overeenstemming met met de arbitrage uitleg. De gemiddelde effecten van aankondigingen van converteerbare obligatie-emissies tijdens de recente financiële crisis zijn nog negatiever (-9,12%). Dit resultaat kan worden toegeschreven aan de ernstige onderwaardering van emissies gedurende de crisis-periode, hetgeen opweegt tegen het effect van de verminderde invloed van de arbitrage funds.

De resultaten in hoofdstuk 4 suggereren, dat wederkerende aandelenemissies (SEOs) worden uitgegeven met een grotere korting op de pre-emissie marktprijs, indien de emittent bij eerdere emmisies market timing gedrag heeft laten zien. Een robuste bevinding in de literatuur is dat SEO's worden gevolgd door negatieve lange termijn abnormale rendementen, hetgeen gezien kan worden als een bewijs van market timing. In dit onderzoek laat ik de kosten van market timing zien, gebaseerd op het idee dat beleggers bedrijven met de meest negatieve abnormale rendementen in het jaar na een SEO zullen zien, als degene die zeer waarschijnlijk de emissie hebben getimed. Deze bedrijven compenseren beleggers door een grote korting aan te bieden in een volgende SEO. Ik laat tevens zien dat emittenten een hogere onderwaardering anticiperen en daarom is de kans groter dat ze vreemd vermogen zullen uitgeven indien de rendementen bij een voorgaande SEO negatiever waren. Een gevolg van deze bevinding is dat de financiële beperkingen van emittenten toenemen indien zij bij eerdere emissies de market getimed hebben. Ik vind ook, dat het effect op onderwaardering naar aanleiding van market timing in het verleden sterker was, wanneer de CEO tussen de emissies dezelfde persoon is gebleven. Ik vind geen bewijs, dat onderwaardering gerelateerd is aan het rendement na een IPO, hetgeen suggereert dat beleggers beursintroducties minder als een indicatie beschouwen, dat deze bij toekomstige emissies de market zullen proberen te timen.

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Biography

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THE IMPACT OF INVESTOR DEMAND ON SECURITY OFFERINGS

The studies in this thesis contribute to a growing stream of papers showing that capital structure decisions are not only influenced by corporate determinants, but also by fluctuations in investor tastes and capital available for investment. This is a relatively new way of looking at corporate decisions, but is also given the deserved importance in the literature. This view contrasts with the traditional approach in the literature that largely considered corporate decisions to be distinct from the decision process of investors. Chapters 2 and 3 use convertible debt issuance to analyze the impact of intertemporal variation in investor demand on corporate decisions, and the market reaction to these decisions. Chapter 2 shows that convertible debt issuance, pricing, and design decisions are influenced by demand forces from investors. Chapter 3 finds that a shift in the convertible bond investor base from long-only investors towards convertible arbitrage funds resulted in an increasingly negative stock price reaction, induced by short-selling pressure. Thus, the first two studies in this thesis provide more evidence of corporate opportunism, using data on issuers of convertible debt. The fourth chapter uses data from repeat issuers of equity, and provides evidence in line with the hypothesis that investors take opportunism into account when firms issue new equity. In addition, the paper shows that firms' choice of capital structure is influenced by their past behavior.

Design & layout: B&T Ontwerp en advies (www.b-en-t.nl) Print: Haveka (www.haveka.nl)

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