הפקולטה לניהול ע"ש קולר
אוניברסיטת תל אביב

Coller School of Management
Tel Aviv University

Management Sciences-Finance and Accounting

Underpricing Determinants: Evidence from a Unique Corporate Bond Offering Mechanism

Thesis submitted for Doctor of Philosophy Degree

by

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November 2018

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Abstract:

I utilize a new database with unique characteristics to explore the origins of offering underpricing. The data comprises of 621 corporate bond auctions from Israel, most of which are distinctive two-stage offerings (2SO). These 2SO involve both a closed first stage only for sophisticated investors and a second stage open to retail investors. In the first stage, sophisticated investors place binding bids, entitling them to receive a pre-commitment fee (PCF). In the second stage, mainly retail investors place their bids after viewing the bids of sophisticated investors from the first stage. This database allows me to analyze different determinants for underpricing in an unexplored manner.

In the first main chapter I review the worldwide evidence of underpricing found in various offering mechanisms. In addition, I review many potential determinants for underpricing that were explored in theoretical models and concurrent empirical findings. Later in this chapter I provide details regarding the unique offering mechanism in Israel and descriptive statistics for the 621 corporate bond offerings in my sample. I conclude this chapter by showing the level of underpricing in my sample, roughly 0.5% for initial bond offerings (BIPO) and 0.25% for seasoned bond offerings (SBO), and that the underpricing in 2SO is significantly lower than regular one-stage offerings (1SO).

In the next main chapter I focus my analysis on two seminal papers on underpricing, namely Rock (1986) winner's curse and Benveniste and Spindt (1989)

information acquisition cost. Both of these papers argue that underpricing is required in order to compensate a sub-group of investors for participating in the offering. My unique setting allows me to explore these two papers in a new method. The fact that, in most offerings, underwriters bear little to no commitment and that they have almost no pricing or allocation discretion, shuts down the alternative explanation of agency or dealer risks.

Since the information about the bidding of sophisticated investors is made public before retail investors bid, these uninformed investors should not require compensation as in regular 1SO where all investors bid together, aligned with Rock (1986) predictions. I find that underpricing for 2SO is roughly 60% lower than for 1SO, even controlling for various risk proxies, supporting the notion that uninformed investors require underpricing to compensate them for the winner's curse. On the other hand, informed investors should require compensation for pre-committing in the first stage and for exposing their demand, as predicted in Benveniste and Spindt (1989). The pre-commitment fee, which is a direct compensation for these sophisticated investors, is found in my sample to be significant and amounting to about 0.45% on average.

In the last main chapter, I explore a unique determinant for underpricing which involves short selling securities before seasoned offerings. Short selling in general is considered as an important part of market efficiency, thus short selling of securities before seasoned offerings should lead to lower discount and underpricing. However, Gerard and Nanda (1993) suggested that investors might try to manipulate the pre-offer prices using short selling, thus leading to higher underpricing. I test these theories on my 220 corporate bond offerings using additional data on weekly short balances for corporate bonds. I find that there is a substantial increase in short selling

prior to the offering and a sharp decrease following the offering, similar findings to short patterns in stocks. A deeper analysis shows that this increase mainly leads to lower underpricing and almost no price reversal, thus supporting the informational short selling theory.

In the final chapter I conclude the findings in the previous three chapters. Furthermore, I present a preliminary analysis of an additional determinant for underpricing involving compensation for future illiquidity of the new securities, as predicted in Ellul and Pagano (2005).

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1. Overview and Acknowledgements

1.1 Overview

Offerings are one of the most important events in a company's life cycle, in which it sells its securities hoping to raise as much funds as possible in order to finance its activities. However, over 40 years of research (dating Ibbotson, 1975) have shown that the closing price in the offering is significantly lower than the immediate market price post-offering. This phenomenon, referred to as offering underpricing, is puzzling as to why companies sell their securities cheap and leave a considerable amount of funds on the table.

For example, initial public offering (IPO) underpricing in US market has averaged 18% between 1980 and 2013, amounting to $143 billion "left on the table". This phenomenon was not restricted just to the US market, as later papers found significant underpricing in most countries and offering mechanisms used around the world. In addition, underpricing was also evident in seasoned equity offerings (SEO), in corporate bond initial public offerings (BIPO) and seasoned bond offerings (SBO). Numerous papers modeled the determinants of underpricing, however due to the opacity of most offering mechanisms the empirical evidence was anecdotal or inconclusive.

My research uses a newly hand-collected database which provides a unique setting for testing several determinants for underpricing. This database contains 621 corporate bond offerings from Israel, of which 533 are carried out in a unique mechanism referred to as two-stage offering (2SO). In the first stage of the 2SO, sophisticated investors place binding bids for the offered securities several days

before the auction, entitling them to receive a pre-commitment fee (PCF). The bids from the first stage are publicly published and later the second stage (public stage) opens to all investors. Then, a uniform price non-discriminatory auction determines the closing price and which of the bids from the two stages would receive allocation.

This mechanism provides me with a unique testing ground of underpricing for the following reasons. First, for BIPO and SBO and for 2SO and one-stage offerings (1SO) the information dissipates at different timings, allowing me to discern among the different explanations for underpricing. Second, the pre-commitment fee creates price discrimination between sophisticated and retail investors thus allowing separating the incentives of these two groups. Third, additional data on weekly corporate bond short balances allows a finer analysis of seasoned bond offerings. All these, together with the basic difference between offering types (initial and seasoned), between 2SO and 1SO and a sizable database of offerings, create a rich research environment. Another positive feature of the data is that most offerings (roughly 92%) the underwriters act only as distributors, meaning that they have no firm-commitment and no discretion over the pricing and allocation of shares in the offering. This feature shuts down the alternative explanation of agency or dealer biases.

This dissertation is the first work done on this unique and informative offering mechanism. Generally, auctions have become rare worldwide, after losing grounds to other offering mechanisms, mainly to the bookbuilding mechanism. In the Israeli market, although bookbuilding can be used since mid-2007 (Jagannathan, Jirnyi and Sherman, 2010), auctions are still dominant, especially in this unique 2SO mechanism. Therefore, it is important to understand the main attributes of these offerings in order to explain the survival of auctions in Israel and to present another alternative to bookbuilding, fixed-price offerings or regular auctions.

Another contribution of my work stems for the fact that compared to the vast literature written on equity underpricing, corporate bond offerings were widely neglected in the literature. This is odd since it was suggested in previous papers that the underlining factors for underpricing of corporate bonds are similar to that of equity[1]. In addition, this is even more surprising when one considers the fact that the yearly worldwide corporate bond primary market is roughly six times larger than the primary equity market[2]. In this work, the unique data together with the Israeli setting of corporate bonds enable testing origins of underpricing issues that were not explored earlier in the corporate bond context.

Third, the data available in the sample enables me to study directly underpricing determinants that either were ignored or were tested with a coarse proxy, more specifically:

- The difference in information available for retail investors in 1SO versus 2SO explains the need for compensation for uninformed investors.
- From the pre-commitment fee I can measure the compensation to sophisticated investors directly and correlate it with different measures of firm's uncertainty.
- Weekly short balance data allows me to test if the short is more manipulative or informative in nature.

This dissertation is made up of 3 main chapters and a concluding chapter. Chapter 2 provides general overview of underpricing and the setting in my research.

[1] Asymmetric information in Benveniste and Spindt 1989 (pg. 359); Price pressures in Scholes 1972 (pg. 210); Gerard and Nanada 1993 do not mention this explicitly; however they argue that the manipulation result arises due to the differences between the price setting mechanisms in the secondary market and in the seasoned offering. Thus it is also relevant for corporate bond offerings

[2] Ernest & Young "Global IPO Trends 2012" and International Capital Market Association (ICMA) "Economic Importance of the Corporate Bond Markets" (March 2013). Yearly average for offerings of Non-financial firm between 2007 and 2011. In addition further approximation for SEO was required.

Specifically, Chapter 2.1 provides evidence of underpricing from around the world and from different offering mechanisms. It also covers several well researched determinants for underpricing of which some will be later deeply explored. Chapter 2.2 provides an in-depth description of the data setting focusing on the unique two-stage offering mechanisms, and illustrates descriptive statistics of the 621 offerings in my sample. Chapter 2.3 presents the underpricing and pre-commitment fees in various sub-samples and lays the ground for deeper analysis in the following chapters.

Chapter 3 dives deeper to the underpricing determinants which involve placement models in asymmetric information, namely Rock (1986) winner's curse and Benveniste and Spindt (1989) Information acquisition cost. Chapter 3.1 introduces the questions to be answered and present the main results. Chapter 3.2 provides a deeper literature review on the underlining theoretical models and previous empirical findings of placement models. Chapter 3.3 develops the four hypotheses that will later be examined. Chapter 3.4 explores the sample and describes all the relevant variables for asymmetric information. Chapter 3.5 provides the results and Chapter 3.6 concludes.

Chapter 4 examines how short selling affects the underpricing on SBO and whether the short selling is informative as predicted in previous research (Bohemer and Wu, 2012; Safieddine and Wilhelm, 1996), or is it manipulative as predicted in Gerard and Nanda (1993). Chapter 4.1 introduces the questions to be answered and present the main results. Chapter 4.2 provides a deeper literature review the two approaches to short selling, the informative and manipulative explanations. Chapter 4.3 develops the four hypotheses that will try to determine which approach dominates in my setting. Chapter 4.4 explores the sample and describes all the relevant variables

for the short incentives, mainly the weekly short balances for each corporate bond. Chapter 4.5 provides the results and Chapter 4.6 concludes.

The last chapter (Chapter 5) provides a final summary of the previous research and findings. It is important to point out that the previous underpricing determinants are not mutually exclusive or collectively exhaustive. The target of the different chapters is to analyze my setting from different viewpoints and to contribute to the specific literature for each. Other causes for underpricing undoubtedly play a role in the level of underpricing. Therefore, I add a preliminary analysis of another determinant which could be an interesting path for future research, namely compensation for future illiquidity costs (Ellul and Pagano, 2005).

1.2 Acknowledgements

In a far and distant land lived a simple peasant with his lovely wife and kids. Seven years ago, an inner voice appeared in the peasant's dream, pushing him to venture and find the coveted Scroll of Wisdom located at the top of the Ivory Tower in the Land of Tau. The peasant contemplated with this revelation for several months, as he understood the dangers in this quest and all the sacrifices he would need to make. Disregarding many who tried to discourage him, the peasant finally decided it was time. His dear wife feared of the obstacles in his path ahead but strongly supported the peasant's decision. He knew without a doubt, no matter how long or far his quest would take him, his wife will always be with him.

The peasant kissed farewell to his wife, kids and mother and embarked on his journey. He traveled light, carrying with him only the map (given by Racheli), a

laptop in the backpack and a smile on his face. His first destination was the Dungeons of Tau, a labyrinth filled with dark and damp caves crawling with various creatures on every turn, from micro bugs to treacherous snakes. On many trails you could arrive to dead-end walls or find yourself being fried from scorching rivers of lava. Luckily, the peasant stumbled upon a group of seven dwarves, Dan, Dor, Erez, Michael, Natalie, Neta and Saggi. They guided his way through complex roads, and even more importantly, they raised his spirits when anguish crept in.

After barely making it out of the Dungeons, the peasant wondered into the second stage of his journey, the Fields of Despair. This treacherous area was highly foggy, and it was hard to see what your next step should be. Shira, the peasant's guiding fairy, helped him collect the little clues along the path. Though, despair was so strong that a much stronger magic was required, a task fit for the Committee of Magic. This committee had three imperative participants, Avner the grey, the wizard from the fourth dimension, Nisan the white, the wizard from the west and Orly the purple, sorceress from the Land of the Holy. They cleared the fog and lightened the path for the peasant to pass through the Fields of Despair, arriving with immense euphoria to the Ivory Tower.

However, before reaching the top of the Ivory Tower, the peasant had to pass the final stage, climbing the Stairs of Distraction. Each step presented an intriguing and enticing alternative, whether it was innovating the world, educating the crowds, consulting the condemned, or other alluring temptations. Holding on to the vision of the scroll of wisdom had become harder each day, and there were times the peasant thought about changing his path. However, with the pictures of his family and all friends and colleagues in his head, the peasant steadily made it up step by step.

Finally, after approximately seven years, the peasant had reached the chamber on the top of the Ivory Tower. Tired and exhausted, he was in hands reach from the goal, yet he was first required to be found worthy by the Committee of Magic and the Anonymous Being. After they reviewed his journey, decisions and all the effort it took, the peasant was awarded the scroll of wisdom. And these seven years ended in a brief gesture, the peasant took the scroll and tucked it safely in his backpack. After this day, the peasant returned back to his family and old life - only to start a new and exciting quest…

This was my journey, with many ups and as many downs, but I would not have changed anything about it (maybe just a little ;-)). I convey my outmost gratitude to all the people who helped me directly or indirectly in my journey - I wouldn't have reached this scroll of wisdom without you.

2. Underpricing and Mechanism Description

2.1 Underpricing Literature Review

Underpricing is a term referring to the overwhelming evidence of security offerings that experience sharp increase in price on the first trading day (on average), suggesting that these securities were sold at a lower price than they should have been worth. This evidence was first reported over 40 years ago (Ibbotson, 1975) and ever since perplexed finance researchers as to why issuers leave a considerable amount of money on the table. Numerous papers attempted to both report the phenomenon across different countries and offering mechanisms and to find the determinants of this underpricing.

2.1.1 Underpricing evidence

Most of the underpricing evidence has been focused on equity initial public offerings (IPO) in the US. Figure 1 illustrates that although there is wide variation in the yearly underpricing (ranging from +6% to +71%), the underpricing is significantly positive with an average of 18% in the 1980 to 2013 period. The amount of money left on the table during this period is estimated at up to $143 billion.

This phenomenon was also reported in many other countries around the world. Dozens of papers showed that underpricing is a global phenomenon, and is consistently evident for a very long period. Figure 2.2 illustrates the average underpricing in various countries.

Fig 2.1 - Underpricing in the US from 1980 to 2013

The figures are yearly weighted average underpricing for US IPOs, excluding ADRs, Closed-end funds and unit offers, REITs, Banks, Partnerships and small best effort offerings. Source: Prof. Jay Ritter's website; https://site.warrington.ufl.edu/ritter/files/2015/04/IPOs2013Underpricing.pdf

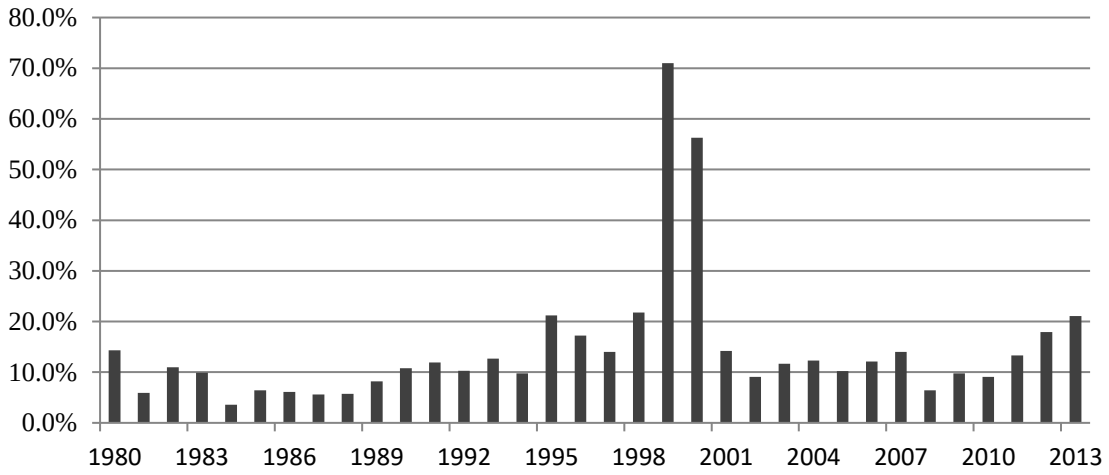
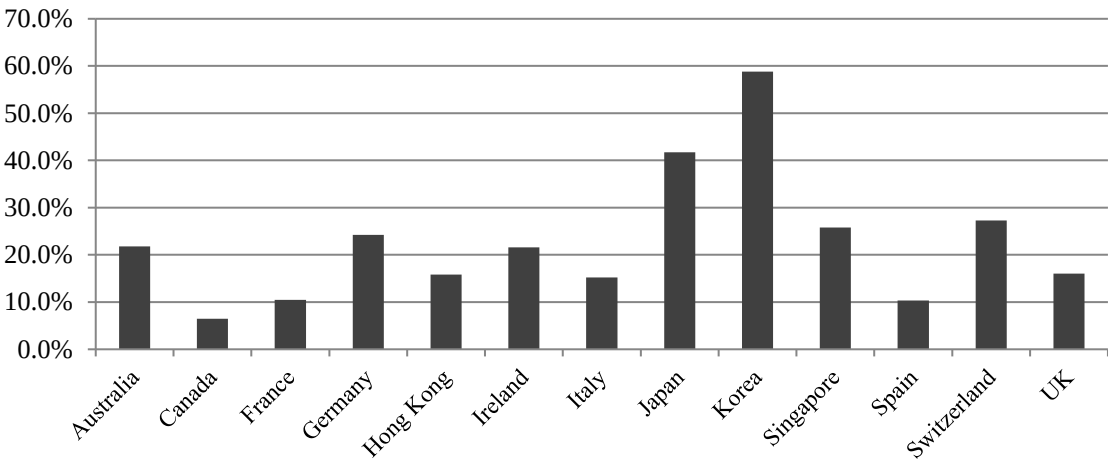


Fig 2.2 - Underpricing in various countries.

The figures are yearly weighted average underpricing for IPOs in the following countries: Australia (1562 offerings during 1976-2011), Canada (720 Offerings during 1971-2013), France (697 offerings during 1983-2010), Germany (736 during 1978-2011), Hong-Kong (1486 offerings during 1980-2013), Ireland (38 offerings during 1991-2013), Italy (312 offerings during 1985-2013), Japan (3236 offerings during 1970-2013), Singapore (609 offerings during 1973-2013), Spain (143 offerings during 1986-2013), Switzerland (164 offerings during 1983-2013) and UK (4932 offerings during 1959-2012) . Source: Prof. Jay Ritter's website:
https://site.warrington.ufl.edu/ritter/files/2015/04/IPOs2013Underpricing.pdf



Although most of past research focused on IPO underpricing, the initial trading day return was also examined in other offering types. Underpricing in seasoned equity offerings (SEO) was first reported by Smith (1977), who studied 328 SEOs in the US and showed that SEOs are underpriced by 0.82% and priced below the pre-issue close (discounted) by 0.54%. This SEO underpricing increased substantially in later periods and more recent papers document underpricing of over 2% (Corwin, 2003; Kim and Shin, 2004); although there are variations in the extent of the underpricing depending on industry and stock exchange.

Furthermore, some papers also investigated underpricing in corporate bond offerings, though evidence on this security type is scarce. Datta, Datta and Patel (1997) showed that for 50 bond initial public offerings (BIPO) in the US from 1976 to 1992 there is significant underpricing of 1.86% for speculative grade bonds; however investment grade bonds are overpriced. In a more recent paper, Cai, Helwege and Warga (2007) examine both BIPO and seasoned bond offerings (SBO) for 2975 corporate bond offering in the US from 1995 to 1999 (439 BIPOs and 2536 SBOs). They find a statistically significant underpricing of 0.37% and 0.03% for BIPO and SBO respectively, where most of the underpricing is concentrated among riskier and more opaque offerings.

A large part of the knowledge on underpricing, as was presented previously, was derived from the US setting involving mainly the bookbuilding offering method. Other offering mechanisms, mainly auctions, but also various hybrid offering mechanisms, drew more attention from the financial literature in the last several decades.

Underpricing was well examined and recorded in the regular uniform price non-discriminatory auction mechanism around the world. Although auctions were abandoned in most countries that used this mechanism for the bookbuilding method, it was shown that auctions have several favorable characteristics over the bookbuilding mechanism. Degeorge, Derrien and Womack (2010) analyze 19 IPO auctions in the US and find that they have attributes such as high elasticity, investor predictability and normal "flipping" activity, all suggest auction to be an alternative mechanism to bookbuilding. Nevertheless, they found that the underpricing in these US Auctions is 13.8% on average. Kandel, Sarig and Wohl (1999) study 27 auction IPOs from 1993 to 1996 in Israel and demonstrate that the full demand curve is fairly elastic. They also document an average 4.5% underpricing on the first trading day, attributed to new information about the elasticity of the shares introduced to the market as the results get published. Kutsuna and Smith (2004) show that Japan's introduction of bookbuilding in 1997, which quickly replaced auctions used earlier, is attributed to being less costly for large firms, and for small firms it solved an underinvestment problem for high quality firms that were reluctant to issue beforehand.

In addition, hybrid offering mechanisms, which involve a combination of bookbuilding, auction and fixed-price and which present other information schedule and timing of stages, drew more attention in the last several years. Worldwide evidence was important to examine and test the affectivity of these hybrid mechanisms as alternatives to the standard offering mechanisms. Chiang, Qian and Sherman (2009) study an offering mechanism that was previously used in Taiwan between 1995 and 2008, by examining 84 auction/fixed price hybrid equity offerings from 1995 to 2000. In the Taiwan hybrid method, first an auction trench is offered, consisting of one half of the total securities offered. The results are then published

with the ability to view the bids in the first stage. In the second stage a fixed-price trench is offered only to non-institutional investors. The underpricing in this sample is an average of 7.3%. However, in this mechanism, the auction trench is open to both institutional and individual investors (although bid size limits the participation of individuals), and they pay as they bid and are not compensated for early commitment. Moreover, the information published does not contain the actual identity of investors but only an ID number that enables distinguishing institutional from individual. Last, since in the second stage the price is already fixed, the two stages are effectively independent.

In Japan from 1989 to 1997, offering were conduct via a similar mechanism to the one in Taiwan. Kernis, Kutsuna and Smith (2007) study 321 IPOs in a hybrid mechanism where the first stage is a pay as you bid auction, and the second stage is a fixed-price offering. Yet, the Japanese hybrid offering mechanism has several distinct characteristics. First, the regulator has a very strong oversight on the pricing, amount sold, bid size, etc. Second, there are very strict participation restrictions which drive out institutional investors, such as limit of amount allocation (roughly $200,000), limiting the number of offering participations per investor per year (participating in only 4 offerings per year). Also, only the total demand and the weighted average bid is known to investors before the second stage. They find an average underpricing of 11.5% in the entire sample.

Neupane and Poshakwale (2012) and Neupane and Thapa (2013) examine an offering mechanism in India where there is concurrent bidding from different investor groups to different trenches of the offering. During the several days of the offering period, qualified, retail and non-institutional investors submit bids in the determined price range. The investors' bids are entered into systems which publish ongoing

information regarding the overall demand and the indicative demand for each subgroup of investors. They find an average underpricing of 20%, however this is combined of two different mechanisms. The first is a bookbuilding mechanism where the underwriter determines the pricing and allocation and the second is a bookbuilding mechanism where the underwriter determines only the pricing, therefore making it closer to an auction in the non-discriminatory allocation sense.

2.1.2 Underpricing Determinants

As worldwide evidence of underpricing grew, the financial literature attempted to explain this phenomenon using numerous theoretical models and concurrent empirical evidence. I will review several main determinants which were previously suggested, following the comprehensive underpricing literature reviews by Ljungqvist (2005) and by Ritter and Weltch (2002). These following underpricing reasons were originally modeled around IPOs; however most determinants can be extended to seasoned offerings (Loderer, Sheen and Kadlec, 1991; Corwin, 2003) and to corporate bond offerings (Datta, Datta and Patel, 1997; Cai, Helwege and Warga, 2007), though the level of underpricing is undoubtedly different for each type of security offering. It is important to note that the following subchapter is not intended to form a comprehensive list of all underpricing reasons, as other less central reasons do exist, but rather present the main determinants of underpricing to date.

2.1.2.1 Asymmetric Information Models

In his extensive literature review on underpricing, Ljungqvist (2005) concludes that asymmetric information models have a first order effect on underpricing. This asymmetric information could exist between investors, underwriters and issuing firm. If investors (or a sub-group of investors) are more informed about the true price or the demand for the offering, thus the issuer faces a placement problem. There are two seminal papers which modeled a subgroup of investors; the first is Rock's (1986) winner's curse and the second is Benveniste and Spindt's (1989) information acquisition cost.

Rock (1986) models a fixed price auction in which some investors are informed about the true value of an asset and some investors are uninformed. In overpriced offerings the informed investors do not bid and thus the uninformed receive the main share of overpriced securities. Conversely, in underpriced offerings informed investors bid in the auction and thus crowd out the uninformed investors. In order to mitigate the average expected loss of informed investors and incentivize them to participate, offerings should be underpriced on average. Several empirical studies find support for the predictions of this model by adjusting the average underpricing to the rationing of securities. For example, Koh and Walter (1989) and Amihud, Hauser and Kirsh (2003) showed that adjusted for rationing, uninformed investors earn underpricing close to zero.

The information acquisition model, presented in Benveniste and Spindt (1989), suggests that underpricing is required in order to induce informed investors to truthfully reveal their private information. In this type of information asymmetry, some investors are more informed about the demanded price of the offering than the

issuer and underwriter. Therefore, the issuer and underwriter need to induce informed investors to reveal their private information by compensating them via the underpricing. The notion in this model is difficult to test empirically because of the lack of specific bidding and allocation data from the bookbuilding offering mechanism. In one of the few papers that possess bidding information, Cornelli and Goldreich (2001) use proprietary data to show that limit order bids receive greater allocation than strike orders, especially when there are less bids. The winner's curse and information acquisition cost will be thoroughly analyzed in Chapter 3.

There are two other asymmetric information reasons which could also explain underpricing. The first is asymmetric information between underwriter and issuer, as the underwriter can be more informed about the demand in the issue. The underwriter acts as an agent for the issuing firm however it may have different incentives then the firm. Baron (1982) suggested that a certain level of underpricing is required in order to induce underwriters to exert effort. Empirical studies found mixed results as on one hand underwriters were found to use preferred allocation to mutual funds in underpriced offerings to gain more trading business from these funds (Reuter, 2004). However, on the other hand Muscarella and Vetsuypens (1989) found that even when underwriters hold their own IPO, their securities are just as underpriced as other issuers.

The other is asymmetric information between the issuing firm and investors, where the firm knows that it is of a high or low value, but investors do not. In this situation it might be optimal for high value firms to have a costly underpricing to signal their higher value, and "leave a good taste in investors' mouths" (Ibbotson, 1975). These firms should get more positive valuation in future SEO (Weltch, 1989) or more positive future dividend announcement response (Allen and Faulhaber, 1989).

However, there wasn't much empirical evidence for these predictions (Michaely and Shaw, 1994) and it was suggested that there are less costly ways than underpricing to signal value, such as certification of quality from reputable underwriters (Booth and Smith, 1986) or auditors (Titman and Trueman, 1986).

However, these two other asymmetric information explanations for underpricing are less relevant in the context of my sample. Underwriting and issuer conflicts are not relevant since in all offerings underwriters are considered only distributers of the securities with no discretion on pricing or allocation and in most offerings there is no firm-commitment by the underwriters to purchase securities in the offering. Signaling models that firms attempt to convey value by costly underpricing are also less relevant in my setting since in auctions the pricing is done by the investors and firms have little room for signaling.

2.1.2.2 Institutional and Ownership Determinants

Tinic (1988) and Hughes and Thakor (1992) suggested that large underpricing could prevent future litigation cost for the company if the securities drop dramatically following the offering. However, empirical evidence has found that litigation risk is the same or even higher for firms that had a higher underpricing than firm with lower underpricing (Drake and Vetsuypens, 1993; Keloharju, 1993). In my setting this determinant is not relevant since the pricing is mostly done by the investors and since there is very little evidence in Israel of litigation following offerings.

Another institutional determinant was discussed in Benveniste, Busaba and Wilhelm (1996). They argued that when underwriters commit to stabilizing prices

following the offering, they convey that these offerings are not overpriced since then stabilizing will be very costly. Rudd (1993) even argued that underpricing is a mechanical phenomenon since underwriters stabilize price when shares should have dropped, thus removing the left-hand tail of returns following offerings. Ellis, Michaely and O'hara (2000) found that the lead underwriter is always the main marker maker in the first 20 days following the offering. This determinant is also not relevant in my setting since stabilization was not allowed before 2007 and following 2007 it was hardly used. An analysis of the sample showed that there is no major difference between underpricing before and after 2007.

Last, ownership and control incentives were also suggested to influence underpricing. Brennan and Franks (1997) argued that owners use underpriced offerings to attract many investors and thus distribute the equity among the many bidders, thus retaining their control over the company. They indeed find that the more underpriced offerings are, the more discrimination there is to large bidders. This ownership reason is more relevant to equity offerings context and not to corporate bond offering since corporate bonds do not directly affect control over the company.

2.1.2.3 Seasoned Offerings Unique Determinants

Seasoned offerings have many similar aspects as IPOs that also should lead to underpricing (Loderer, Sheen and Kadlec, 1991; Corwin, 2003), however they might also have special determinants that should also be examined. One such explanations was suggested in Gerard and Nanda (1993) who showed that it might be profitable for investors to try and manipulate the pre-offer market price via short selling the securities before the offering. This will occur when they believe that they

can recover their losses in the secondary market by ordering a large quantity of securities in the primary market. This behavior would lower the pre-offer trading price below the underlining security price and the informativeness of prices, therefore increasing the underpricing. Alternatively, Chemmanur and Jiao (2011) suggested that before seasoned offerings informed investors will trade in the direction of their information, and their short selling activity will convey their negative information regarding the issuer's price. This informed trading will make the market price more informative, leading to a lower discount and underpricing. These two theories are not mutually exclusive, therefore they both can affect the discount and underpricing at the same time.

Empirical papers which studied the manipulation and information theories tested them in two different manners. On the one hand, several papers (e.g. Corwin 2013, Kim and Shin 2014, Autore 2010, Autore and Gehy 2013) tested a regulation in the US that limits the ability to cover short positions with securities in the offerings. These papers mostly found that this regulation in fact increased the discount and underpricing, suggesting it failed to limit manipulative short and limited informed short selling. On the other hand, several papers (e.g. Safieddine and Wilhelm 1996, Henry and Koski 2010, Deshmukh, Gamble and Howe 2017) examined the short positions directly. The results were mixed as the short selling either increased or decreased the discount and underpricing. I will continue to examine the manipulation and information topic in Chapter 4.

2.2 Data Setting and Descriptive Statistics

Both initial and seasoned public corporate bond offerings in Israel are held in a uniform public auction mechanism. The auctions are conducted either by a regular non-discriminatory uniform price one stage auction, or by a unique two-stage auction. In the next sub-chapters I will first explain the offering mechanisms in Israel, and secondly show descriptive statistics for all the offerings in my database.

2.2.1 The Offering Mechanisms in Israel

Both initial and seasoned public corporate bond offerings in Israel are held in a uniform public auction mechanism. In recent years most of the corporate BIPO and SBO have been carried out with a shelf prospectus, thus the company publishes a general prospectus to issue different securities with no detailed information about the offering. Later on, the company issues a short offering statement which completes the shelf prospectus, and then proceeds with the offerings. 81% of the offering in my sample were made via shelf prospectus.

In the more commonly known one-stage offering (1SO) auctions, the company offers a predetermined number of securities indiscriminately to all investors. At the start of the process, the company sets a minimum price for the offer. On the day of the offering, orders are accepted from all investors and at the end of that day, the company reports the clearing price in which the amount of securities offered equals the demand (or the minimum price if the demand is lower than the offering size). In most offerings the company also has an overallotment option to increase the offerings amount by up to 15% if the offering is oversubscribed.

However, in Israel there is a unique alternative mechanism to the regular 1SO in which the issuer is sanctioned to accept early commitments from sophisticated investors, several days before publishing the final offering document and opening the public auction. This stage will be referred to as the first stage in the two-stage offering (2SO) mechanism. Sophisticated investors are defined by The Securities Law of 1968 as all of the following: institutional investors (Mutual, provident and pension funds; Insurance companies and banks) and other qualified investors (Underwriters, stock exchange members, portfolio managers and advisors buying for their own accounts; Venture Capital funds; Corporations which are primarily engaged in capital markets activity; and corporations with book value of over 250 million NIS). The Israeli Security Authority (ISA) can also deem an investor incorporated outside of Israel as a sophisticated investor if the ISA believes that this investor "is capable of obtaining the information which it requires in order to make a decision to invest in the securities".

Before the first stage, the company hires several underwriters to contact sophisticated investors with an appeal to commit in the offering. The company usually starts a quite road show targeted to these investors, in which it provides an updated overview of the firm and information about the offering. Occasionally the company will publish to the public that it is planning to offer new securities, yet knowledge of this road show and offering details are usually kept confidential. The company provides sophisticated investors with the estimated offer size and the minimum price in which sophisticated investors can place their orders. In addition, the company informs these investors that, if eventually allocated, they would receive a fee for pre-committing, usually depicted as a percentage of the minimal offering price in the second stage. Therefore, this pre-commitment fee (PCF) is known to sophisticated

investors before placing the order, is identical to all sophisticated bidders, and is certain since it is paid out of the offering proceeds.

Since most of the initial bond offerings and all of the seasoned offerings are not marketed as firm commitment (no inventory risk for the underwriter), the role of the underwriter is limited. The underwriter does advise the company on how to structure the offering (including in setting the PCF), is responsible for arranging meetings with investors, and manages the overall process. However, in the two-stage mechanism, the company views the demand from sophisticated investors and has control on minimum price and setting the offer size. In addition, allocation is done pro-rata with no discrimination, thus the underwriter has no say on who is to be allocated. This is why underwriters are deemed and referred to in non-firm commitment offerings as distributers only.

In order to participate in the offering, sophisticated investors must submit a binding order of more than 800,000 NIS (roughly 230,000 USD). This amount can be divided into a maximum of three different price orders accumulating to the minimum required amount. Once all sophisticated investors' orders are collected, the company accepts the bids which clear the pre-determined offering size trench in the first stage, and sometimes adjusts the total number of shares to be offered. This first stage clearing price becomes the minimum price for the second stage. The received orders are not filled in the first stage, but rather transferred to the second (public) stage auction. Sophisticated investors cannot withdraw their committed order, yet they have the option to raise the order price.

Although most offerings are carried out as 2SO, there are some restrictions for using this mechanism and for the maximum fraction offered to sophisticated

investors. In offerings less than 25 million New Israeli Shekel (NIS), a first stage is not allowed. Between 25 and 200 million NIS the total amount of securities ordered from sophisticated investors can be up to 80% of the total securities offered. Furthermore, for each NIS above 200 million and below 600 million, 90% can be allocated to sophisticated investors, and 95% for every additional NIS offered over 600 million. Consequently, as will later be shown in the data section, one-stage offerings are usually smaller.

As mentioned earlier, a unique feature of the 2SO is that the orders by sophisticated investors are made known before the second stage, were mainly small investors bid. The issuer must submit a detailed description of orders placed by sophisticated investors and accepted by the firm in the first stage, classified by quantity and price. An example for this complete bidder list is provided in Appendix 1. This list is attached to the final offering report, together with other important details regarding the offering, such as total offering size, timetable for the offering, manner of placing orders, etc.

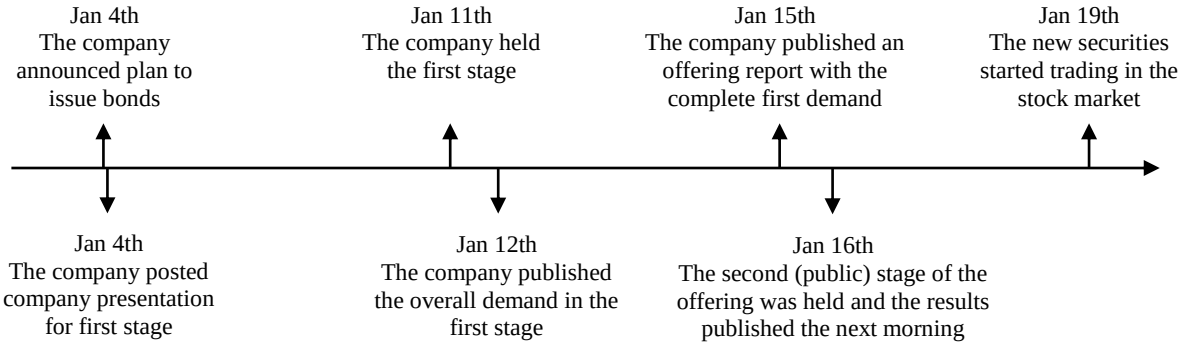
While the pre-commitment fee is the main benefit for sophisticated investors, there are two additional lesser aspects that give these investors an allocation advantage over retail investors. The first is when over-subscription occurs, sophisticated investor have priority in allocation over retail investors which ordered at the same price (sophisticated investors' orders are cleared first). The second is when both over-subscriptions occurs and the company chooses to exercise its overallotment option, the firm can decide if to allocate more shares to all investors or only to sophisticated investors those who ordered in the first stage.

This first stage has many similarities with the bookbuilding mechanism common in many other countries in order to establish a price in the offering. In both mechanisms, indications of interest and price are collected from large investors. However, in Israeli 2SO the indications of interest are binding. Furthermore, the compensation to sophisticated investors is targeted with a price discount known before the offering, and not as preferred allocation of underpriced securities as in the bookbuilding mechanism. Last, retail investors are able to view the specific orders of all sophisticated investors, whereas in bookbuilding this information is not available.

For clarification purposes, one of the offerings in the sample will be describe in detail, namely the seasoned offering of "MA Industries LTD" corporate bond series B on January 16th, 2012. A complete timeline for this offering is illustrated in Figure 2.3. "MA Industries" offered 596 million NIS (approximately $160 mil US) par value

Figure 2.3 – The timeline for MA Industries corporate bond series B offering on January 2012

This figure illustrates the timeline of the MA industries corporate bond B offering from January 16 2012. The main actions around this offering are reported: the announcement date, the first stage and the second stage.



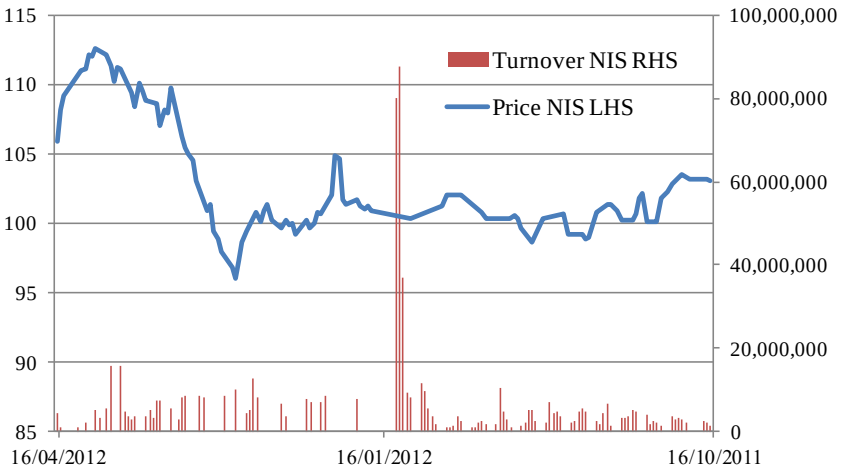
of Corporate Bond series B, which added to the existing 1,637.5 million NIS par value traded on the exchange. Series B was initially offered on December 2006 and it is inflation adjusted to the Israeli CPI. The bond has a 5.15% annual coupon paid

twice a year, and the par value is paid in 17 equal annual payments from 2020 to 2036 (duration of roughly 10.5 years). The bond is rated ilA+ by Maalot rating agency, an S&P subsidiary, equivalent to BBB+ on the US rating scale. The offering was of 596,000 units comprised of 1,000 NIS par value in each unit, with a minimum auction price of 1,010 NIS per unit. Each investor was allowed to submit up to three orders, each with a different price with increments of 1 NIS (0.099% of the total value).

The offering was conducted by 11 underwriters/distributers who received 0.25% of the gross proceeds of the offering, with the leading underwriter being Clal finance underwriters. In the first round held on January 11th, the company received 71 orders from 51 different sophisticated investors for a total of 504,427 units. These investors received a pre-commitment fee (PCF) of 0.9% from the minimum price of 1010 NIS. The complete list of bids and identity of bidders in the first stage is provided in Appendix A.

Figure 2.4 - Price and volume (in NIS) for MA Industries corporate bond series B from October 2011 to April 2012

In this figure we show the price and trading volume levels from the MA Industries Bond B series from Oct 16, 2011 to April. The blue line shows the price, with the lhs axis for reference. The red bars show the daily trading volume, with the rhs axis for reference



The full demand in the first stage was published on the morning of January 15th, and the second stage was held on January 16th trading hours. In the second stage, only an additional 9,100 units were placed at different prices, 8 orders of 8,890 units above the minimum price and two orders of 210 units at the minimum price. This brought the overall demand for this offering to 513,527 units, under-subscription of 82,473 units. The closing price was consequently the minimum price and each investor received full allocation for his order. The first stage comprised 98.2% of the total demand for the offering.

The new securities started trading on January 19th and closed on the first trading at a price of 101.09 NIS which means an underpricing of 0.09%. The "MA Industries" corporate bond B is one of the largest and most liquid bond series in the Tel-Aviv Stock Exchange (TASE), and it was part of the Tel-Bond 20 top twenty corporate bond index at that time. The volume of trade around the offering increased twelvefold from the pre-offer period. The price changes and volume around the offering are illustrated in Figure 2.4.

2.2.2 Data description

In order to analyze the offering mechanism described earlier, a large sample of offerings was gathered from the websites of the TASE (www.tase.co.il) and the registry for the Israeli Security Authority (www.magna.isa.gov.il). The total number of offerings of corporate bonds from 2001 to 2012 was 879. I exclude all 28 offerings from 2001 to 2003 for which all the documents are not accessible online. Furthermore, I exclude one additional offering from 2004 which I was not able to collect all relevant documents and one 1SO offering with a non-uniform mechanism.

Many of the remaining offerings are bundled with several other securities in the same offering. These other securities include mainly corporate bond warrants (82), equity warrants or other equity derived security (129), and some offerings with two corporate bonds offered together (14). I exclude these 225 offerings since they introduce other complexities that make the underpricing calculations more difficult and might introduce new explanatory factors. This leaves me with 621 offerings, of which 401 are bond initial public offerings (BIPO) and 220 are seasoned bond offerings (SBO).

Table 2.1 shows the number of offerings for each year during the 2004 to 2012 period. For BIPO there was a significant increase between 2004 and 2007 (before 2004 corporate bond offerings were scarce), followed with a decrease following the financial crisis of 2008 and again an increase to up to 2010. Regarding the offering mechanisms, I see that the two-stage offering is the dominant mechanism and one stage offerings comprise only 7% of BIPOs and 27% of SBOs and that the one-stage mechanism grew popular mainly during 2009 to 2011.

Table 2.1 - Number of offerings from 2004 to 2012

This table shows the number of corporate bond offerings in my sample on each year during the 2004 to 2012 period. BIPO are initial corporate bond offerings and SBO are seasoned corporate bond offerings. One-stage offerings are regular auctions and two-stage offerings are the unique offering mechanism described in detail in this chapter.

	Total	2004	2005	2006	2007	2008	2009	2010	2011	2012
BIPO										
One-stage	29	0	0	1	0	0	6	17	5	0
Two-stage	372	8	25	22	68	25	54	87	49	34
SBO										
One-stage	59	0	0	2	0	0	6	26	21	4
Two-stage	161	0	0	1	18	15	27	29	40	31

For each offering the essential data was hand collected from several different data sources. First, each company's offering documents, which include the offering report and the offering results, were downloaded from the MAYA companies' reporting platform (https://maya.tase.co.il/). The offering report contains the number of securities planned to be offered, the amount committed by sophisticated investors, the pre-commitment fee and the minimum offering price for the offering. The offering results report contains the total numbers of securities tendered for in the offering, the offering closing price and the final number of securities that were allocated by the firm. Second, the daily closing prices around corporate bonds offerings in the sample were downloaded from the Praedicta Israeli Security Data Base (PISDB). Third, information regarding the yield to maturity, duration and interest spread over the corresponding government bond was collected from the Triple-A bond information platform.

Table 2.2 reports the main characteristics of all offerings. We see that two-stage offerings are larger, roughly 4 times larger in offering size, both for BIPO and SBO. Also, two-stage offerings are less risky, measured by a lower yield spread over corresponding government bonds. These larger differences in risk will require further analysis and to be controlled for (especially in chapter 3 which examines asymmetric information's effect on underpricing). Furthermore, I observe that there are many bids for each offering, roughly 1,000 bids for BIPOs and 300 bids for SBOs. For 1SO the number of bids is higher by roughly 20-30% than the number of bids for 2SO. This fact is also predicted as the number of bids in regular auctions was found to vary substantially from very low participation to extremely high participation (Sherman, 2005).

Table 2.2 - Main characteristics of offerings by mechanism type

This tables provides descriptive statistics for the full sample of 621 offerings. BIPO are initial corporate bond offerings and SBO are seasoned corporate bond offerings. One-stage offerings are regular auctions and two-stage offerings are the unique offering mechanism described in detail in this chapter.

	Mean	STD	Min	Q1	Median	Q3	Max
BIPO							
One-stage (N=29)							
Offering Size (mil NIS)	78	52	9	49	61	99	282
Duration (Year)	4.20	1.02	1.14	3.71	4.25	4.58	6.4
Spread over govnmt	5.31%	3.49%	1.56%	3.77%	5.06%	5.80%	22.01%
Total # of bids per issue	1,089	1,000	75	524	721	1,381	4,234
Two-stage (N=372)							
Offering Size (mil NIS)	318	316	28	101	203	410	2,017
Duration (Year)	5.24	1.76	0.99	4.01	4.83	6.54	10.14
Spread over govnmt	2.83%	1.87%	0.15%	1.27%	2.39%	3.93%	9.84%
Total # of bids per issue	879	1,126	40	189	474	1,102	7,156
SBO							
One-stage (N=59)							
Offering Size (mil NIS)	80	102	8	29	51	78	623
Duration (Year)	3.82	1.63	0.89	2.73	3.67	4.60	8.11
Spread over govnmt	3.91%	2.44%	0.51%	2.02%	3.78%	4.92%	12.16%
Total # of bids per issue	365	388	1	122	264	428	1,897
Two-stage (N=161)							
Offering Size (mil NIS)	388	311	27	156	278	530	1,641
Duration (Year)	5.17	2.09	0.97	3.57	5.00	6.51	11.35
Spread over govnmt	2.50%	1.51%	0.69%	1.33%	2.00%	3.33%	6.72%
Total # of bids per issue	279	390	6	60	120	305	2,529

2.3 Underpricing in the Sample

Underpricing, both for one stage and two stage offerings, was calculated as common in the literature, the percentage increase from the offer price to the closing price on the first day the offered securities start to trade (Ritter, 1987) as follows:

$$Underpricing = \frac{P_{Close\ T+1}}{P_{Offer\_Close}} - 1 \quad (1)$$

Where P_{Offer_Close} is the offer closing price and $P_{Close\ T+1}$ is the closing price in the first day the new securities start trading on the exchange. These returns are not adjusted to the corporate bond market movements (as in Cai, Helwege and Warga, 2007) since bond begin trading promptly after the auction (2-4 days) and are traded actively enough to establish a price quickly.

The first day of trading for the additional securities offered was identified as the day in which the market value of the traded series increased in the PISDB by the offering value. This day is different from the one reported by the TASE historical data since the TASE reports the day that the firm announces the results and collection of the funds. The actual first trading starts a day or two days later, since the new securities must be transferred at the registration company and deposited in the TASE's clearing house.

Underpricing and pre-commitment fee levels are presented in Table 2.3 below. First, looking at the full sample of 621 offerings, this table shows that the underpricing is significant for both 1SO and 2SO mechanisms, at a level of +0.51% and +0.23% respectively. This level of underpricing is similar in magnitude to that found in Cai, Helwege and Warga (2007) in corporate bond offerings which have a lower rating (roughly +0.4%). It is important noting that the scale of bond rating in Israel is approximately 2-3 notches down from the US rating scale, thus the vast majority of the offerings in Israel are lower than an A rating on the US scale. The difference in underpricing of +0.28% between 1SO and 2SO is also significant and will be

Table 2.3 - Average underpricing and pre-commitment fee by offering type

This table reports the underpricing and pre-commitment fee for all the offerings in the sample. Underpricing is calculated as the change in price from the closing price in the offering to the first day the offered securities start to trade. The pre-commitment fee is the discount from the closing price sophisticated investors receive for bidding in the first stage. 1SO are the regular auctions and 2SO are the unique two-stage offerings. t-stat in reported in parentheses.

	Offering mechanism	Number of offerings	Underpricing	Pre-commitment fee
All offerings	1SO	88	0.51% (5.40)	NA
	2SO	533	0.23% (4.53)	0.53% (50.55)
Initial offerings only	1SO	29	0.77% (3.20)	NA
	2SO	372	0.28% (4.13)	0.57% (40.65)
Seasoned offerings only	1SO	59	0.39% (5.20)	NA
	2SO	161	0.11% (1.88)	0.45% (40.98)

explored in depth in the next chapter. The average pre-commitment fee in 2SO is +0.53%, and since all 2SO offering have some positive fee, it is economically and statistically significant.

The rest of Table 2.3 shows the underpricing and pre-commitment fee for the sub-groups of initial corporate bond offerings (BIPO) and seasoned bond offerings (SBO). The underpricing for initial 1SO is +0.77%, almost three times as much as the underpricing for seasoned 1SO of +0.28%, however the difference in not statistically significant due to the low number of initial 1SO and the wide variation in first day returns. For 2SO the results are similar, as the underpricing for initial 2SO (0.39%) is higher than the underpricing for seasoned 2SO (0.11%). The PCF for initial 2SO is 0.59%, which is slightly higher than the PCF of 0.48% for seasoned 2SO, but not

statistically significant. All these results will later be analyzed using different hypotheses in chapters 3 and 4.

2.4 Conclusion

In this chapter I review the underpricing phenomenon that was widely analyzed in the financial literature, both in theoretical models and empirical findings. Later I describe in detail the offerings mechanisms in Israel and present a new offering mechanism for corporate bonds that was not explored yet. This unique two-stage offering mechanism provides a novel testing ground for the underpricing determinants due to the information structure and the various other features.

The underpricing in these corporate bond offerings is significant, roughly +0.5% and +0.2% for one-stage and two-stage offerings, respectively, similar in magnitude to what previous papers have documented (Cai, Helwege and Warga, 2007). The average pre-commitment fee of +0.53% is also economically and statistically significant and illustrates the price discrimination sophisticated investors receive for pre-committing. The next chapters provide a deeper analysis on several determinants for underpricing, which could better explain the findings in this chapter.

On the next chapter (chapter 3), I explore two well-documented determinants for underpricing, the Rock (1986) winner's curse and the Benveniste and Spindt (1989) information acquisition cost. Both of these models place underpricing as a manner of compensating a group of investors for participating in the offering, either uninformed or informed investors. My unique setting allows me to separate the

compensation for potentially uninformed investors to that for informed investors, thus able to directly examine these two underpricing models.

On chapter 4, I examine a specific determinant affecting the level of underpricing in seasoned offering, namely the effect of short selling on the informativeness of prices and consequently the level of discount and underpricing. The weekly short balance for each corporate bond in Israel is reported on the stock exchange, allowing me to examine this topic.

3. Underpricing in Placement Models with Asymmetric Information

3.1 Introduction

Placement models are a main explanation for underpricing in offerings, suggesting that the underpricing is required in order to solve problems caused by the information asymmetry between informed and uninformed investors. The two most well researched seminal placement models for determinants of underpricing are undoubtedly Rock (1986) winner's curse and Benveniste and Spindt (1989) information acquisition cost. Rock (1986) argues that since uninformed investors get full allocation in overpriced offerings and get crowded out in underpriced offerings, their expected returns are negative. Therefore, in order to induce them to bid in offerings, underpricing is required to compensate them for this winner's curse. Alternatively, Benveniste and Spindt (1989) argue that underpricing is required to compensate informed investors for collecting and revealing their information, and that the book-building method allows both underpricing and preferential allocation to information-producing investors.

Numerous papers examined both the Rock (1986) paper (e.g. Koh and Walter, 1989; Michaely and Shaw, 1994, Amihud, Hauser and Kirsh, 2003) and the Benveniste and Spindt (1989) paper (e.g. Cornelli and Goldreich 2001 and 2003). However, direct analysis of these theoretical papers remained challenging due to the opacity of most widely-used offering mechanisms. In the last several years, the financial literature focused more on unique offering mechanisms from around the world which have interesting information structures and more detailed bidding data. These worldwide findings include both pre-IPO market trading of shares (e.g. Derrien

and Kecskes, 2007; Cornelli, Goldreich and Ljungqvist, 2006; Chang, Chiang, Qian and Ritter, 2017) and various hybrid offering mechanisms (e.g. Chiang, Qian and Sherman, 2009; Kernis, Kutsuna and Smith, 2007; Neupane and Poshakwale, 2012).

In this paper I study 621 corporate bond offerings in Israel between 2004 and 2012, of which 401 are initial public bond offerings (BIPO) and 220 seasoned bond offerings (SBO). Most of these offerings (533) are via a unique two stage uniform-price auctions, where first sophisticated investors bid and get a fee for pre-committing and later all investors can bid after viewing the winning bids in the first stage. The rest of the offerings (88) are regular uniform-price non-discriminatory auctions. This sample allows me to examine the concepts of the winner's curse and the information acquisition cost on a unique auction offering mechanism that potentially address these costs directly.

First, I examine whether the winner's curse, which theoretically could lead to underpricing in regular one-stage auctions, could be mitigated in two-stage auctions as the information of sophisticated investors is revealed to potentially uninformed investors. This prediction is similar to that of Schnitzlein, Shao and Sherman (2016) as they suggest that a two-stage offering, with an initial price setting trench for sophisticated investors and later a smaller public trench, could decrease underpricing. Second, the pre-commitment fee in the two-stage auction should compensate informed investors for valuing these uncertain securities and for publicly revealing the information regarding their bid price and quantity. This price discrimination provides a direct and easily quantifiable method for compensating informed investors, possibly even more direct than the widely contested preferential allocation in the book-building offering mechanism.

I find that the underpricing in 1SO is significantly higher than 2SO, even controlling for various factors and offering type selection bias. This supports the view that if some of the information regarding the pricing is truthfully revealed during the offering, uninformed investors will require much less underpricing for their information disadvantage. In addition, I find that the pre-commitment fee, which aims at compensating informed investors for revealing information, is significant and accounts for roughly 70% of the total benefit for these sophisticated investors. Furthermore, the pre-commitment fee positively correlates with various variables which proxy for the ex-ante uncertainty of the firm.

The reminder of this chapter is organized as followed: Chapter 3.2 provides a deeper literature review on the underlying theoretical models and current empirical findings and providing some context to the auction setting. In Chapter 3.3, I formulate the hypotheses to be tested by considering the implications of the theoretical concepts on the unique settings in this dissertation. Chapter 3.4 offers deeper view on the data and research design. Chapter 3.5 reviews the main findings and Chapter 3.6 concludes.

3.2 Literature Review

Placement models in offerings illustrate that underpricing is required since some of the investors are informed and some are uninformed, making the underpricing necessary in order to compensate one of these groups for participating in the offering. This literature review focuses on two seminal works in placement models in offerings (Rock, 1986; Benveniste and Spindt, 1989), the most relevant

empirical work that followed these papers and connecting these notions to the auction setting.

Rock (1986) argued that underpricing should compensate uninformed investors who participate in the offering for the winner's curse. In his work, he models a fixed price auction in which some investors are informed about the true value of the firm and some investors are uninformed, and the firm needs to determine the offering price. In overpriced offerings informed investors do not bid and thus uninformed investors receive the main share of overpriced securities, hence the winner's curse. Conversely, in underpriced offerings informed investors bid in the auction and thus crowd out the uninformed investors from receiving a large allocation in the offering. Without average underpricing, uninformed investors would earn negative returns on average when adjusting for their actual allocation. Thus underpricing is needed so that uninformed investors will at least break-even and will incentivize them to participate in the offering.

Several empirical papers study this model directly by attempting to find the theoretical returns of uninformed investors in underpriced offerings. Koh and Walter (1989) used a sample of 66 IPOs from Singapore between 1973 and 1987, to show that underpricing disappears when the rationing in the offerings is taken into account. They simulate the return from naïve bidding in offerings, a strategy fitting uninformed investors, and adjust the underpricing returns for the rationing of allocation in these offerings. The significant average underpricing of 27% drops to a non-significant 1% when adjusting the return for rationing. Amihud, Hauser and Kirsh (2003) study in a similar manner 284 IPOs in Israel from 1989 to 1993. They show that adjusted for rationing, uninformed investors earn non-positive initial returns. Both of these papers

show that offerings need to be underpriced on average in order for uninformed investors to break-even.

Alternatively, Michaely and Shaw (1994) study how an environment with potentially less information asymmetry lowers the need for underpricing offerings. They analyze offerings of Master Limited Partnerships in the US, with the unique distinction that institutional investors rarely participate in this market due to tax reasons. They find that in this setting with less investor heterogeneity, hence potentially less information asymmetry, there is no significant average underpricing. There are only a few papers that examined the winner's curse in the corporate bond context. One exception is a paper by Datta, Datta and Patel (1997) who argue that the winner's curse in corporate bond IPOs should have lower effect since institutional investor dominant the market and thus there is less potential for information asymmetry, and indeed find that there is no underpricing on average. However they find significant underpricing for non-investment grade bonds. In another example, Cai, Helwege and Warga (2007) compare bonds that were issued on the NYSE, with potentially more individual investors participation, to bonds that were offered on the dealer market, which is dominated by institutional investors. They find that there is no significant change in underpricing between these markets, suggesting that the underpricing is not compensation for individual investors. However, the NYSE proxy is very vague and the magnitude of individual investors' participation is unclear.

Although the Rock (1986) was built around fixed-price offerings, a similar notion of underpricing to compensate for the winner's curse was also suggested in regular uniform-price auctions. Jagannathan, Jirnyi and Sherman (2015) argue that if the number of bidders is high, then winning an auction following a private noisy signal implies that the signal overstated the true value of the securities. Therefore,

investors in this situation need to shave their bids accordingly in order to sufficiently account for this winner's curse, especially if obtaining a signal is costly. However, since in auctions it is very hard to account for the participation and pricing of other investors, shaving bids correctly is challenging and leads to large fluctuations in offerings demand. The authors argue that this is the main reason that auction were abandoned in almost all countries. In addition, Schnitzlein and Shao (2013) carry out and experiment with multi-unit auctions, and show that as the number of bidders increase, although bidders shave their bids relative to their signal, they fail to account in many situations for the winner's curse.

For the context of Rock's (1986) winner's curse, uniform-price auctions could also resemble fixed-price offers if they have minimum or maximum price for the offering. In maximum price offerings, when the maximum price is set low enough (as observable in Amihud, Hauser and Kirsh, 2003) it constitutes de-facto as a fixed-price offering. In auctions with a minimum price the firm sets the minimum price without knowing for certain the demand by investors. If the firm set the minimum price low enough both informed and uninformed investors bid in the auction and compete for allocation. However, if the firm set the minimum price too high, informed investors refrain from bidding in the offering and only uninformed investors bid and get fully allocated. Therefore uniform price auctions with minimum price, as all the offerings in the database, are also subject to the Rock (1986) winner's curse notion.

The information acquisition model, presented in Benveniste and Spindt (1989), stipulates that underpricing is required in order to induce informed investors to truthfully reveal their private information. In this type of information asymmetry placement model, some investors are more informed about the price of the securities than the issuer and underwriter in the offering. Therefore, the issuer and underwriter

need to induce informed investors to reveal their private information by compensating these investors via the underpricing. This compensation is required especially when obtaining this information is costly (Sherman and Titman, 2002). In the more widely common bookbuilding offering mechanism, underwriters elicit indicative bids from potentially informed investors. To induce these investors to truthfully represent their positive information, the underwriters reward them with more allocation of underpriced offerings.

The notion in this model is difficult to test empirically because of the lack of specific bidding and allocation data from most offering mechanisms. Yet on an aggregate level, Hanely (1993) finds that there is only partial adjustment (adjustment of the final offering price to the pre-road show offering price range) when there are more positive indications. This suggests that the more positive the information is, the more underpricing (money on the table) is required to induce informed investors to reveal it. In one of the few papers that possess bidding information, Cornelli and Goldreich (2001) use proprietary data on 39 offerings by a European underwriter with the full bid details and allocation data. They show that limit order bids, which provide important information regarding the perceived value of the shares, receive greater allocation in underpriced offerings than non-price limit orders, especially when there are fewer bids to derive information from. In a follow-up paper, Cornelli and Goldreich (2003) focus on how underwriters utilize the information embedded in bids in the bookbuilding process. They show that that limit orders convey important information in setting the final offering price, mainly for bids placed by repeated and large investors. This supports the Benveniste and Spindt (1989) notion that allocation in underpriced offerings is compensation for revealing information.

The Benveniste and Spindt (1989) book-building model was also constructed around a fixed-price public offering mechanism, yet the information acquisition cost concept in their paper was repeated in later work on uniform price auctions. Uniform-price auctions are very problematic when considering that information production in offering is costly; especially when free-riders might attempt to excessively over-bid and enjoy the price setting of informed investors. Several papers (Chemmanur and Liu, 2003; Sherman, 2005) argued that auctions do not compensate investors enough for producing and revealing information truthfully and thus fixed-price public offerings and book-building can induce more information production. The presence of more non-competitive free-riding investors will lower the expected return for sophisticated information-producing investors, thus the sophisticated investors will rationally need to shave their bids even more so (Jagannathan, Jirnyi and Sherman, 2015).

In the last two decades, several pre-IPO trading alternatives evolved in several countries. Companies that have their shares traded prior to the IPO promote a market price for these shares, thus potentially decreasing information asymmetry and valuation uncertainty. The first paper that studies pre-IPO trading is a work by Derrien and Kecskes (2007) who study this unique offering feature in UK offerings. In this mechanism 101 companies choose to "introduce" their shares for trading on the AIM exchange without offering shares contemporaneously, and only at a later stage 66 of them choose to offer new shares in the primary market. They test a "cost reduction hypothesis" and find that, after accounting for selection of offering mechanism, companies which first undergo introduction experience lower initial offering returns by 10% to 30% compared to regular IPOs. This suggests that introduction of pre-IPO market price mitigates some of the information asymmetry

leading to lower offering costs. In addition, in their paper they show that this introduction mechanism also allows firms to time their offering to hot markets.

Cornelli, Goldreich and Ljungqvist (2006) study the "Grey Market" pre-IPO trading in 486 European offerings. In this mechanism, during the bookbuilding process for institutional investors, independent brokers allow individual investors to trade on the forward price of the issue. Their findings show that over-optimism of individual investors in the grey market is correlated with higher underpricing and long term underperformance of the offering. However, since the published pre-offer trading price is determined by individual investors, they focus their paper on the ability to infer from these prices on the irrational opinions of these investors and not whether it reduces valuation uncertainty between individual and institutional investors.

Chang, Chiang, Qian and Ritter (2017) study the mandatory pre-IPO market trading in Taiwan between 2005 and 2011, in which firms must list and trade in Taiwan's EMS (emerging stock market) for at least 6 months before continuing with their IPO. They first show that pre-offer prices are informative, as these prices explain 77% of the variation in after market prices, especially when trading is more liquid. In addition, they show that more accurate pre-market prices are associated with more informative offering closing prices. However, since all offering are done via the same mechanism, they do not test for reduction in underpricing due to this offering mechanism. Conversely, they show that underpricing remains extremely high (55%) and attribute this to agency conflicts with IPO underwriters.

The pre-IPO markets papers mentioned above find it hard to show that these pre-offer markets mitigate asymmetric information and underpricing altogether. This

might be due to the fact that trading in these pre-IPO markets is very limited and that the market facilitated retail investors on one hand and informed investors (as companies insiders, owners, and investment banks which may have various incentives and information) on the other hand. Therefore these pre-IPO prices are far from prone to asymmetric information and miss-valuations.

Another type of unique information structure during offerings was researched in unique hybrid offering mechanisms from around the world. These papers are closest to my work as they study how a flow of information from potentially more sophisticated investors affects the offering underpricing and behavior of retail investors. Chiang, Qian and Sherman (2009) study an offering mechanism that was previously used in Taiwan between 1995 and 2008, by examining 84 auction/fixed price hybrid equity offerings from 1995 to 2000. In the Taiwan hybrid auction method, first a pay-as-you-bid auction trench is offered to both institutional and individual investors, consisting of one-half of the total securities offered. The winning bids of the auction trench are then published making the price and quantity for each bid common knowledge. In the second stage, a fixed-price trench is offered only to non-institutional investors, where the minimum price is the clearing price in the auction trench. However, the two trenches are essentially independent in the allocation, and there is little room for strategic interaction between the stages. The average underpricing in this sample of 84 auctions is 7.3%. Their evidence indicates that institutional investors are able to extract better returns, implying that they have better information and/or are more competent at bidding.

Kernis, Kutsuna and Smith (2007) study a somewhat similar auction fixed-price hybrid method used in Japan with a sample of 321 offerings between 1995 and

1997. The auction trench is very similar to that in the previous setting in Taiwan, and similar data on the winning bids is published before the second stage. The pricing of the fixed-price trench was done by the underwriters using the minimum price and weighted average price from the auction trench providing a range for the potential fixed-price. The shares in the fixed-price were allocated with the underwriter's discretion. The authors state that due to bid size limitations and information production discouragement, institutional investors mainly refrained from participating in these offerings, thus the auction trench data does not provide much information regarding the correct pricing. Neupane and Poshakwale (2012) study 306 IPOs in India during 2001 and 2010 involving a unique simultaneous offering mechanism. There are three trenches dedicated for different types of investors: Qualified institutional, Non-institutional and Retail individual. During the offering process, all investors can view on-line the aggregate demand at different prices for all group types and bid accordingly. They document that retail investors bid late in the process, closer to the offering close, and that their bids is much influenced from early institutional participation. However, they still find that retail investors act irrationally and cannot fully incorporate the information in the aggregated institutional demand.

3.3 Development of Hypotheses

As discussed earlier, according to Rock (1986) model, underpricing compensates uninformed investors for adverse selection. However, uninformed investors will require less compensation in situations where there is less information asymmetry. Indeed it was found that less compensation is required when there is more investor homogeneity (Michaely and Shaw, 1994) or if information about the pre-IPO pricing is available (Derrien and Kecskes, 2007). Therefore for 1SO, where all

investors bid together, underpricing may be required if there is need to compensate uniformed investors for participating. However, in 2SO the potentially uninformed investors view the full demand of the potentially more informed investors. The information is revealed to uninformed investors hence alleviating most of the information asymmetry. Schnitzlein, Shao and Sherman (2016) build a model and carry out an experiment showing that a hybrid auction with a public trench lowers underpricing compared to a regular one stage auction, similar to my setting.

Thus, if underpricing compensates uninformed investors for asymmetric information, as in Rock (1986), then:

H3A. Underpricing will be positive for 1SO and significantly higher than underpricing in 2SO

Several papers show that underpricing caused by asymmetric information is increasing in several proxies for the issuers' ex-ante uncertainty, such as the company's age (Ritter, 1984; Ljungqvist and Wilhelm, 2003) company's size (Ritter, 1984) or industry (Benveniste, Ljungqvist and Wilhelm, 2003). This is explained as the information asymmetry is larger the more uncertainty there is surrounding the issuer. Therefore, I expect that the ex-ante uncertainty of the issuer should affect underpricing. Yet, I expect 1SO to remain a significant factor even after controlling for all other variables. Later in this chapter I show that there are several significant differences between the firms which choose 1SO and those that adopt 2SO, mainly in their size and risk. Therefore:

H3B. 1SO mechanism is a significant factor for underpricing, even controlling for various proxies of ex-ante uncertainty

In line with Benveniste and Spindt (1989), Investors who bid in the first stage in 2SO should be compensated since they reveal their interest in the offered securities and thus give away the information they possess to the company and the general public. Therefore, the issuer must compensate these investors with a preferential price via the pre-commitment fee (PCF) for the information acquisition. Thus, my first hypothesis regarding the PCF is:

H3C. The PCF will be a significant part of the compensation sophisticated investors require for bidding in the first stage

If the securities offered are more uncertain or alternatively are more costly to value, than the inducement for sophisticated investors to produce and expose their private information must be higher, as suggested by Sherman and Titman (2002) and Sherman (2005). Similar to the notion presented earlier regarding the correlation of the underpricing to the issuer's ex-ante uncertainty, I expect that:

H3D. PCF will be positively correlated with the ex-ante uncertainty of the firm.

3.4 Data and research design

3.4.1 Descriptive statistics

In my research I examine 621 corporate bond offerings from Israel from 2004 to 2012. Of these offerings, 401 are initial bond offerings (BIPO) and 220 are seasoned bond offerings (SBO). From the 401 BIPO, 372 are via a unique two-stage offering (2SO) mechanism and 29 are regular one-stage offering (1SO) auction. From the 220 SBO, 161 are via 2SO mechanism and 59 are 1SO auction. The unique relevant features of the 2SO are mentioned earlier in this chapter, and a complete

detailed description of the mechanism is available in the Mechanism Description Chapter 2.2.1 (pgs. 23). In this subchapter I first focus my analysis on describing my sample and any potential biases between offering types that should be later accounted for. Secondly, I present in detail the costs of offering which are the dependent variables, and other relevant proxies and control variable for the winner's curse and information acquisition cost discussed earlier.

Initially (similar to Derrien and Kacskes, 2007), it is important to locate potential differences between 1SO and 2SO that could affect the results and must be accounted for later in the analysis. Descriptive statistics for the full sample of 621 offering is provided in the Table 3.1. This table examines the differences between the sample of 1SO and the sample of 2SO, examining separately SBOs in panel A and on BIPOs in panel B. The first observation I see is that 2SO mechanism dominates, especially in BIPO, as 73% of all SBO and 93% of all BIPO are via the two-stage mechanism. This popularity of the 2SO compared to the regular 1SO auction can be explained in a similar manner that describes book-building's dominance over fixed-price and discriminatory auctions around world (Sherman, 2005; Kutsuna and Smith, 2003). These previous works show that issuers prefer book-building since this offering mechanism allows for more control on information acquisition costs and less risk for investors and issuers.

Regarding the year by year comparison, Table 3.1 shows that most of the 1SO are concentrated between 2009 and 2011, both for SBO and BIPO, whereas 2SO are more spread out across the years. When comparing the industry break-down of offering companies, I see that overall the most dominant industries are financial and

Table 3.1 – Comparative statistics for all 621 offerings in the sample

This following table summarizes the sample of corporate bond offerings comparing the type of offering mechanism used (1SO or 2SO). In panel A the 220 SBO are compared and in Panel B the 401 BIPO are compared. The comparison first looks at a year by year in which the offerings occurred. Second the comparison focuses on the industry for each of the offering. Third, several offering characteristics are presented, including offering size, duration and spread for the bonds, number of total bids in the offering and ratio of new to existing securities (only for SBO). Lastly, several figures from the financial statements of issuing firms are compared; namely total asset, total capital and total revenue.

Panel A – comparative statistics for one-stage offering (1SO) and two-stage offerings (2SO) for SBO

	All SBO		One-stage SBO		Two-stage SBO	
Year and % of total						
2004	0	0%	0	0%	0	0%
2005	0	0%	0	0%	0	0%
2006	3	1%	2	3%	1	1%
2007	19	9%	0	0%	19	12%
2008	15	7%	0	0%	15	9%
2009	33	15%	6	10%	27	17%
2010	55	25%	26	44%	29	18%
2011	60	27%	21	36%	39	24%
2012	35	16%	4	8%	31	19%
Total	220		59		161	
Industry and % of total						
Financials	60	27%	7	12%	53	33%
Holding	21	10%	3	5%	18	11%
Telecommunication	9	4%	1	2%	8	5%
Real-estate	96	44%	40	68%	56	35%
Industrial	6	3%	1	2%	5	3%
Consumer Discretionary	8	4%	1	2%	7	4%
Technology	0	0%	0	0%	0	0%
Infrastructure	2	1%	2	3%	0	0%
Energy	18	8%	4	8%	14	9%
Total	220		59		161	

	All SBO	One-stage SBO	Two-stage SBO
Avg. Offering Characteristics:			
Offering Size (mil NIS)	306	80	388
New to existing securities ratio	0.73	0.45	0.84
Duration	4.81	3.82	5.17
Spread over Government	2.88%	3.91%	2.50%
Number of bids	302	371	277
Firm Characteristics (mil NIS):			
Total Assets			
Mean	53,529	4,911	71,345
Standard Deviation	94,343	8,772	104,709
Median	8,407	1,504	14,944
Total Capital			
Mean	4,020	749	5,220
Standard Deviation	6,081	822	6,707
Median	1,383	573	2,065
Total Revenues			
Mean	5,082	970	6,588
Standard Deviation	8,246	2,142	9,104
Median	1,587	504	3,680

Table 3.1 (continued)

Panel B – comparative statistics for one-stage offering (1SO) and two-stage offerings (2SO) for BIPO

	All BIPO		One-stage BIPO		Two-stage BIPO	
Year and % of total						
2004	8	2%	0	0%	8	2%
2005	25	6%	0	0%	25	7%
2006	23	6%	1	3%	22	6%
2007	68	17%	0	0%	68	18%
2008	25	6%	0	0%	25	7%
2009	60	15%	6	21%	54	15%
2010	104	26%	17	59%	87	23%
2011	54	13%	5	17%	49	13%
2012	34	8%	0	0%	34	9%
Total	401		29		372	
Industry and % of total						
Financials	108	27%	1	3%	107	29%
Holding	41	10%	3	10%	38	10%
Telecommunication	30	7%	2	7%	28	8%
Real-estate	144	36%	17	59%	127	34%
Industrial	19	5%	2	7%	17	5%
Consumer Discretionary	24	6%	2	7%	22	6%
Technology	1	0%	0	0%	1	0%
Infrastructure	7	2%	0	0%	7	2%
Energy	27	7%	2	7%	25	7%
Total	401		29		372	

	All BIPO	One-stage BIPO	Two-stage BIPO
Avg. Offering Characteristics			
Offering Size (mil NIS)	301	78	318
Duration	5.17	4.20	5.24
Spread over Government	3.00%	5.31%	2.83%
Number of bids	894	1,089	879
Firm Characteristics (mil NIS):			
Total Assets			
Mean	42,198	4,195	45,169
Standard Deviation	85,992	7,849	88,587
Median	5,047	872	5,465
Total Capital			
Mean	3,140	439	3,350
Standard Deviation	5,605	618	5,765
Median	727	144	808
Total Revenues			
Mean	3,975	864	4,218
Standard Deviation	7,069	1,464	7,274
Median	811	346	871

real-estate firms, for SBO and BIPO. However, 2SO leads in financial firms offerings whereas 1SO is dominated by real-estate firms offerings with over 60% of 2SO are real-estate firms.

The offering characteristics reveal that 2SO are significantly larger than 1SO, roughly 4 times larger on average for both SBO and BIPO. This size and risk difference affect is also reflected in the spread over government as 1SO have significantly large spreads than 2SO bonds, especially for BIPO. The duration of 2SO is higher than the duration of 1SO, which also hints on the size of companies that choose 2SO. The average number of bids for 1SO is higher than the average number of bids for 2SO, a figure more intriguing when considering that 1SO are smaller in size and in the size of offering firms. This can be explained by previous findings (Sherman, 2005) which suggests that regular one-stage auction have a very high variability in number of bidder whereas other mechanism have a more controlled bidding environment. Last and specifically for SBO, I see that the seasoned offering account for a large ratio of new securities to existing securities, especially for 2SO.

I finish the comparison by showing three figures from the financial statement of issuers known on the offering date. I again see that issuers that choose 2SO are significantly larger, approximately 11 times larger in average total assets, 8 times larger in average capital and 6 times larger in average yearly revenues. The difference in comparing the median figures is much less extreme, as the average numbers mainly for 2SO are highly skewed because of financial firms.

3.4.2 Dependent and Explanatory Variables

The main dependent variable in my research is the offering underpricing calculated as the first day of trading return compared to the offering closing price, as mentioned in the previous chapter. Another dependent variable used in this chapter is the pre-commitment fee sophisticated investors are entitled to when they bid in the

first stage in the 2SO mechanism. The pre-commitment fee variable (*Pre_Com_Fee*) is determined by the issuer and it is publicly published in the offering documents. The last dependent variable used is the total underpricing, combining the underpricing and the pre-commitment fee together. The total underpricing describes the total effective underpricing for sophisticated investors who bid in the first stage and received allocation in the offering.

In the first regression I examine if the independent dummy variable *1SO*, which identifies offerings that used the one-stage offering, is significant for the level of underpricing. In the second regression I measure what is the importance of the *Pre_Com_Fee* on the total underpricing of the offering. In the last analysis I measure how the pre-commitment fee is affected by different variables. I now list several control variables that potentially describe the difficulty of investors to value companies, thus each can contribute to the information asymmetry in the market.

Corporate bonds which are first offered to the public (*BIPO*) should be harder to value than corporate bonds that are already trading when offered (SBO), thus a dummy variable for initial offerings should capture this additional valuation difficulty. Another important means to value a new corporate bond offering is the existence of other corporate bonds of the same company already trading in the market. These existing bonds provide a good benchmark for the company's specific risks, even if they have different maturities or terms than the newly offered bond. Thus another variable to capture valuation difficulty is a dummy variable if the issuer has existing corporate bonds (*Alter_Bonds*). Shelf offering was previously found to hold some importance for the magnitude of underpricing (Kim and Shin, 2004; Autore, 2011). Since my sample is dominated by shelf-registration offerings (81% of total

offerings), I add a shelf-offering dummy variable (*Shelf_offer*) to account for any potential effects. Lastly, if the company is a bond only company without any equity trading or if the company is a foreign incorporated firm it should be harder to value, creating additional two dummy variables to account for bond-only issuer (*Bond_Only*) and foreign issuer (*Foreign*).

The next set of variables examine if the issuer is ex-ante harder to value using financial figures from the offering prospectus or the last available quarterly report before the offering. Several of the issuing firms report their financial statements in USD or EUR, therefore their figures needed to be converted to NIS using the official exchange rates on the day of the offering. The first ex-ante uncertainty variable is the log of total assets (*Log_Assets*) from the firms' balance sheet. Larger firms are potentially more stable and well-known to investors, thus making them easier to value. Second financial variable is the loan to value (*LTV*) of the issuer calculated as:

$$LTV = \frac{Total\ Assets - Equity\ Value}{Total\ Assets}$$

Firms with higher loan to value have more cash-flow volatility for both bond-holders and share-holders, making these leveraged firms potentially harder to account for this volatility. The last variable from the financial statements I use is the size of the corporate bond series (*Series_Size*), as calculated as the total number of bonds following the offering. This variable could potentially proxy for the importance for the pricing of this bond has to various investors in the market; hence their incentive to produce information is higher.

The next set of figures include several specific corporate bond features which are also available to assert if the issue is more risky thus potentially having more

information asymmetry and valuation uncertainty. Most of these variables were found in previous research as important to the underpricing level (Datta, Datta and Patel, 1997; Cai, Jiang and Lee, 2013). The first bond related variable is the corporate bond spread (*Spread*), using the corporate bond yield minus the corresponding government bond with a similar duration. For SBO the spread is calculated on the day of the offering for the existing bonds. For BIPO the spread is calculated from the first trading day of the newly offered securities. This forward looking variable for BIPO might create some concerns as the underpricing could affect the spread and not vice verse, however the change of the first trading day does not significantly change the post offering spread thus it is still a good measure for ex-ante uncertainty. The second bond related variable is the standard duration (*Duration*) of the corporate bond, as longer duration bonds are harder to value over a longer time frame. The third and last bond related variable is the rating of the corporate bonds (*Rating*) as a proxy for the riskiness of the offered bond. For this variable I use both the Maalot/S&P rating and the Midrog/Moody's where available and average those if both are available for a corporate bond. The Spread, the Duration and the Rating variables are derived from the TripleA information platform for each offering on my database. A full list of variables is attached in the appendix.

In previous underpricing research (Ljungqvist, Nanda and Singh, 2004; Cook, Jarrell and Kieschnick, 2003) the level of underpricing was found to vary between periods of increased companies issuances (hot periods) and periods of decreased companies issuances (cold periods). An additional important control variable to also account for is a year fixed effects for each year during my 2004 to 2012 sample. Last, I add an industry dummy variable *Financial* to account for potential differences for financial firms (including banks and insurance firms).

3.5 Results

I first start with testing whether the difference in offering mechanism used by firms has any affect on the offering underpricing, relating to compensation for uninformed investors (Rock, 1986) mentioned in hypotheses H3A and H3B.

The first column in Table 3.2 describes the regression of the offering underpricing to the offering mechanism. The results show that the underpricing is higher for 1SO compared to underpricing in 2SO (approximately 126% higher), supporting hypothesis H3A claim that uninformed investors in 1SO will require additional compensation to account for the winner's curse. It is important noting that the existence of a public trench in 2SO should not necessarily eliminate all underpricing, same as predicted in Schnitzlein, Shao and Sherman (2016), and since there could be other determinants for underpricing other than the winner’s curse.

The second to fourth columns in Table 3.2 add many control variables that could account for the difference in underpricing between 1SO and 2SO. The second column examines the full sample of 621 offerings, and shows how the different information related control variables affect the underpricing. It illustrates that the 1SO has the strongest statistical significance in the determinant for the offering underpricing. The affect of 1SO is even stronger once controlling for other uncertainty determinants or selection biases in the offering mechanism used, supporting hypothesis H3B.

The effect of the 1SO mechanism used remains strong both in the SBO sub-sample in the third column and in the BIPO sub-sample in the forth column. In fact, the 1SO is the only variable that is statistically significant in all columns. Other

Table 3.2 –Underpricing in offerings depending on offering mechanism

Determinants of underpricing in corporate bond offerings in Israel. The dependent variable is the first day of trading return, i.e. Underpricing. *1SO* is a dummy variable for offerings which use the one-stage offering mechanism. *BIPO* is a dummy variable for initial public bond offerings. *Bond_Only* is a dummy variable for firms that do not have any equity listed on the exchanges. *Foreign* is a dummy variable for firms which are not incorporated in Israel. *Shelf_Offer* is a dummy variable for offerings which use a shelf prospectus and not a new. *Alter_Bonds* is a dummy variable for companies which have other corporate bond series trading in the market during the issuance of new bonds. *Duration* is the standard bond duration. *Spread* is the level of bond yield over the yield of government bond with a similar duration. *Rating* is the average Maalot (S&P) and Midroog (Moodeys) corporate bond rating, if available. *Series_Size* is the number of corporate bonds which trade post-offer. *Log_Assets* is the log of total assets of the firm. *LTV* is the issuing firm's leverage ratio calculated as total assets minus capital divided by total assets. *Financial* is a dummy variable for firms which are in the financial industry. Two-tailed significance levels are shown as the 0.01 (***), 0.05 (**) and 0.10 (*) levels.

	Underpricing			
	Full Sample	Full Sample	Only SBO	Only BIPO
Intercept	0.002 ***	-0.007	-0.009	0.003
	(4.66)	(-0.05)	(-0.53)	(0.18)
1SO	0.003 **	0.005 ***	0.003 *	0.0067 **
	(2.22)	(3.35)	(1.70)	(2.53)
BIPO		0.003 **		
		(2.37)		
Bond_Only		0.001	0.002	0.001
		(0.64)	(0.82)	(0.33)
Foreign		0.000	0.003	-0.001
		(0.12)	(0.85)	(-0.27)
Shelf_Offer		0.003	0.002	0.002
		(1.50)	(0.48)	(0.91)
Alter_Bonds		-0.001	-0.004	-0.000
		(-0.89)	(-1.64)	(-0.41)
Duration		-0.000	-0.000	-0.000
		(-0.21)	(-0.27)	(-0.06)
Spread		-0.061 *	-0.042	-0.081 *
		(1.89)	(-1.07)	(-1.74)
Rating		0.000	-0.000	0.000
		(1.38)	(-0.49)	(1.26)
Log_Assets		-0.001 *	-0.000	-0.001 *
		(-1.90)	(-0.21)	(-1.84)
LTV		-0.007 **	0.007	-0.009 **
		(-1.88)	(1.39)	(-2.16)
Series_Size		0.001	0.001	0.001
		(0.96)	(0.75)	(0.85)
Financial		0.001	0.002 **	0.001
		(1.07)	(2.15)	(0.51)
Year_FE		+	+	+

notable significant variables are the dummy variable for BIPO which captures the higher underpricing for BIPO compared to SBO. The explanatory variable *Log_Assets* shows that larger firms have less underpricing, also predicted by information reasons. The Spread and LTV are significant in only BIPO but the connection to the underpricing is in the opposite direction to what I previously suggested. For fear of multicollinearity between several of the control variables, I repeated the results in different variations of these variables, yielding similar results. In addition to the control variables that should account for some of the differences between 1SO to 2SO, I made another analysis using propensity score matching. I matched the 88 1SO with 88 2SO with similar characteristics, total assets, loan to value, spread and duration. This analysis yielded similar and even somewhat stronger results than the above regression.

Hypothesis H3C suggests that if informed investors bid in the first stage and expose their interest in the offering, they will require to be compensated with preferred price. Table 3.3 reports the results for the regression of the determinants of total underpricing, comprising of the pre-commitment fee and the regular underpricing. This test examines the importance of the pre-commitment fee to the total compensation sophisticated investors receive. Column (1) shows that the pre-commitment fee is a significant part of the total underpricing, but it is not the only compensation as the intercept is positive and significant. The average pre-commitment fee is 0.53% compared to an average total underpricing of 0.76%, thus the PCF accounts for 70.1% of the total compensation.

Table 3.3 – Pre-commitment fee effect on total underpricing

Determinants of total underpricing in BIPO corporate bond offerings in Israel. The dependent variable is the Total Underpricing comprising of the regular underpricing together with the pre-commitment fee. *Pre_Com_Fee* is a variable for offerings the level of pre-commitment fee firms offer sophisticated bidders. *BIPO* is a dummy variable for initial public bond offerings. *Bond_Only* is a dummy variable for firms that do not have any equity listed on the exchanges. *Foreign* is a dummy variable for firms which are not incorporated in Israel. *Shelf_Offer* is a dummy variable for offerings which use a shelf prospectus and not a new. *Alter_Bonds* is a dummy variable for companies which have other corporate bond series trading in the market during the issuance of new bonds. *Duration* is the standard bond duration. *Spread* is the level of bond yield over the corresponding yield of government bond with a similar duration. *Rating* is the average Maalot (S&P) and Midroog (Moodeys) corporate bond rating, if available. *Series_Size* is the number of corporate bonds which trade post-offer. *Log_Assets* is the log of total assets of the issuing firm. *LTV* is the issuing firm's leverage ratio calculated as total assets minus capital divided by total assets. *Financial* is a dummy variable for firms which are in the financial industry. Two-tailed significance levels are shown as the 0.01 (***), 0.05 (**) and 0.10 (*) levels.

	Total Underpricing	
	(1)	(2)
Intercept	0.005 ***	0.009
	(4.55)	(0.56)
Pre_Com_Fee	0.402 **	0.467 *
	(1.96)	(1.69)
BIPO		0.003 **
		(2.09)
Bond_Only		0.000
		(0.13)
Foreign		-0.000
		(-0.15)
Shelf_Offer		0.003
		(1.55)
Alter_Bonds		-0.002
		(-1.25)
Duration		0.000
		(0.37)
Spread		-0.638
		(-1.38)
Rating		0.000
		(1.02)
Log_Assets		-0.001 **
		(-2.32)
LTV		-0.008 **
		(-2.18)
Series_Size		0.001
		(0.90)
Financial		0.001
		(0.68)
Year_FE		+

Table 3.4 – Ex-ante uncertainty variables effect on the pre-commitment fee

Determinants of the fee paid to sophisticated investors for pre-committing. The dependent variable is the pre-commitment fee firm offer sophisticated bidders, where column (1) is for the full sample, and columns (2) and (3) are for SBO and BIPO, respectively. *BIPO* is a dummy variable for initial public bond offerings. *Bond_Only* is a dummy variable for firms that do not have any equity listed on the exchanges. *Foreign* is a dummy variable for firms which are not incorporated in Israel. *Shelf_Offer* is a dummy variable for offerings which use a shelf prospectus and not a new. *Alter_Bonds* is a dummy variable for companies which have other corporate bond series trading in the market during the issuance of new bonds. *Duration* is the standard bond duration. *Spread* is the level of bond yield over the corresponding yield of government bond with a similar duration. *Rating* is the average Maalot (S&P) and Midroog (Moodeys) corporate bond rating, if available. *Series_Size* is the number of corporate bonds which trade post-offer. *Log_Assets* is the log of total assets of the issuing firm. *LTV* is the issuing firm's leverage ratio calculated as total assets minus capital divided by total assets. *Financial* is a dummy variable for firms which are in the financial industry. Two-tailed significance levels are shown as the 0.01 (***), 0.05 (**) and 0.10 (*) levels.

	Pre-Commitment Fee		
	Full sanple	Only SBO	Only BIPO
Intercept	0.011 ***	-0.001	0.010 ***
	(4.42)	(-0.41)	(3.53)
BIPO	0.000		
	(0.56)		
Bond_Only	-0.000 *	-0.001 **	-0.000
	(-1.71)	(-2.30)	(1.19)
Foreign	-0.000	0.000	-0.001
	(-0.94)	(0.52)	(-0.80)
Shelf_Offer	-0.001 ***	0.001	-0.001 ***
	(-3.96)	(0.96)	(-2.74)
Alter_Bonds	-0.001 ***	0.001 **	-0.001 ***
	(-2.96)	(2.06)	(-2.70)
Duration	0.000 ***	0.000 ***	0.000 ***
	(6.23)	(6.06)	(4.52)
Spread	0.045 ***	0.037 ***	0.054 ***
	(6.35)	(4.22)	(5.88)
Rating	-0.000	0.000	-0.000
	(-1.61)	(0.46)	(-0.58)
Log_Assets	-0.000 ***	-0.000	-0.000 ***
	(-4.16)	(0.73)	(-4.21)
LTV	-0.001	0.000	-0.001 *
	(-1.52)	(1.03)	(-1.81)
Series_Size	0.000	-0.000	0.000
	(0.40)	(-0.61)	(0.77)
Financial	-0.000 *	-0.001 ***	-0.000
	(-1.70)	(-2.62)	(-1.34)
Year_FE	+	+	+

In column (2), I analyze if the pre-commitment fee remains central after controlling for other various variables that could account for the total underpricing. The results show even though other proxies to ex-ante uncertainty are included, the pre-commitment fee remains an important determinant for the total underpricing. In addition, the *BIPO* and *Log_Assets* are also significant as was shown in the previous table.

Lastly, hypothesis H3D suggests that if the pre-commitment fee for sophisticated investors is the compensation for revealing information, then this fee should be associated with various measures of the uncertainty about the company. Table 3.4 reports the results of the regression of the pre-commitment fee on different ex-ante uncertainty variables, following H3D. The three variables which are significant for the pre-commitment fee in each sub-group of offerings (both SBO and BIPO) are *Duration*, *Spread* and *Alter_Bonds*. Thus, pre-commitment fee is higher for bonds which have a higher spread and higher duration, both suggesting the riskiness of the bond offered. In addition, the pre-commitment fee is lower for issued bonds which have a close benchmark for pricing, other bonds of the same company trading in the market, and for firms which are larger.

3.6 Conclusion

In this chapter I study how asymmetric information determines offering costs for companies, utilizing a new and unexplored offering mechanism for issuing corporate bonds. These costs are directly assigned to either compensating uninformed investors for the winner's curse as in Rock (1986) or compensating informed investors for revealing information as in Benveniste and Spindt (1989).

The compensation of uninformed investors should lead to positive underpricing in regular auction offering (1SO). Alternatively, in the unique two-stage offerings (2SO) mechanism the information of potentially informed investors is revealed prior to uninformed bids, thus uninformed investors should not require additional underpricing for informational reasons. However, the revelation of information by informed investors in 2SO should be accompanied with appropriate compensation.

I find that the release of bids of informed investors has some mitigating effect on the level of underpricing, as 2SO have a lower underpricing than 1SO, even when I control for various ex-ante uncertainty proxies and potential selection biases. This finding supports the hypothesis that offerings with less asymmetric information should lead to a lower underpricing compensation for uninformed investors. Furthermore, when studying the pre-commitment fee, I find that this direct compensation for revealing information is a significant part of the total compensation sophisticated investors receive, and that it is correlated with different ex-ante uncertainty proxies.

This research sheds new light on the determinants of underpricing which relate to compensation for asymmetric information. Different papers (Michaely and Shaw, 1994; Derrien and Kecskes, 2007) have shown that in settings with less information asymmetry the underpricing is lower. My findings support these previous findings showing that releasing the information of sophisticated investors has correlation with lower average underpricing. In addition, previous literature on information acquisition offering costs (Cornelli and Goldreich, 2001 and 2003) shown informed and frequent bidders in offerings must be favored in allocation for

underpriced securities. My research shows that this compensation for revealing information is provided mainly by the pre-commitment fee.

Furthermore, this research presents how a new offering mechanism can transfer the cost from a general underpricing for all investors to a directed compensation for sophisticated investors with simple price discrimination. On the one hand this 2SO mechanism offers some of the benefits that the book-building mechanism offers, such as compensation for truthfully revealing information, without the discriminatory allocation which placed book-building in much scrutiny. On the other hand, the 2SO mechanism offers other benefits of the auction method, especially the price setting by investors, but with much less variability in the success of offerings which characterizes auctions.

4. Short Selling and the Informativeness of Prices Around Seasoned Corporate Bond Offerings

4.1 Introduction

Short selling is widely viewed in the financial literature as having an imperative role in market efficiency and the information revealed by prices. Short selling will depress the prices of overvalued securities and eventually push these prices back to their fundamental value. Short selling activity is also very important as it represents well-over 20% of the overall trading volume in US stock markets (Diether, Lee and Werner, 2008; Asquith, Au and Pathak, 2006). As a result, some argued that constraining short selling would lead to inefficiencies and slower incorporation of information in prices (Miller, 1977; Diamond and Verrecchia, 1987). Numerous empirical papers examined these concepts on equity short selling data and most validated the important role short selling plays in pushing prices to their fundamental value (e.g. Boehmer, Jones and Zhang, 2008; Diether, Lee and Werner, 2009; Boehmer and Wu, 2012; Drake, Myers, Myers and Stuart, 2015 and more). The researchers' document other incentives for short selling, such as manipulation, hedging and speculation. However short selling triggered by negative information remains a chief motivation.

Compared to the plethora of academic papers on short selling of stocks, corporate bonds have been widely neglected due to lack of data availability. The exception is a paper by Asquith, Au, Covert and Pathak (2013) who possess 4 years of corporate bond borrowing data from a large depository lender in the US. They estimate that the magnitude of short trading to be roughly 19% of all corporate bond trades, a figure similar in size to that found for stocks. In addition, they examine if

corporate bond borrowing predicts future negative returns, as suggested by the informative short selling notion. They find no difference in the returns of bonds that were heavily borrowed to bonds that were not, implying that short selling is not as informative in corporate bonds as was previously found for stocks. However, their result has some limitations. The corporate bonds in their sample are thinly traded in the OTC markets, they use data on security borrowing and not actual short selling, and that there is potential selection bias associated with the depository that provided them their data. Anderson et. al (2018) revisit this previous result, and show that show bond lending predicts returns and lending scarcity will be followed by negative returns.

In this chapter, I utilize a newly hand-collected dataset of corporate bond short interests to test the economic motivation of short selling prior to seasoned bond offerings (SBO). The seasoned offering context is compelling given that the offering provides a secure way to cover short positions with discounted securities relative to the prevailing market price, making short selling very likely (Safieddine and Wilhelm, 1996; Kim and Shin, 2004). Chemmanur and Jiao (2011) model a seasoned offering with institutional investors trading in the pre-offer market. They argue that investors will trade in the direction of their private information. Thus, short sellers will push prices of overvalued stocks to their fundamental value leading to a decrease in the offering discount and underpricing. Contrary to this notion, Gerard and Nanda (1993) argue that in some cases pre-offer short selling could be manipulative. This occurs when a positively informed investor strategically hides his positive information and attempts to depress the pre-offer market price only to receive a lower closing offer price and larger allocation. This behavior potentially lowers the informativeness and increase the discount and underpricing of the offering.

The informativeness of short selling around seasoned equity offerings (SEO) has been tested extensively. Most papers which directly studied pre-offer trading and short selling interests documented a stark rise in short interest prior to the offering and a sharp drop following the offering. They also examined the effect of short selling on discount and underpricing and the permanent or temporary price changes, and arrived to the conclusion that it is mainly informative in nature (Safieddine and Wilhelm, 1996; Xu and Singal, 2005; Chemmanur, He and Hu, 2009), with the exception of Henry and Koski (2010). Other papers utilized modifications in the level of the regulation on short selling prior to the offer (rule 10b-21 that was later replaced by rule 105), showing that increases in this limitation of short selling mainly lead to higher offering discount and underpricing, suggesting it actually limited informative short selling (Safieddine and Wilhelm, 1996; Corwin, 2003; Kim and Shin, 2004; Autore and Gehy, 2013).

In my research I first examine if the short trading patterns around SBOs are similar to that previously found in SEOs. I document a stark rise in short interests in the several weeks leading to the offering. The average increase is up to sevenfold compared to the regular pre-offer levels, calculated using several different short interest measures. This increase is a slightly higher increase than previously found on SEO (Safieddine and Wilhelm, 1996; Xu and Singal, 2005), probably since these papers examined monthly short interests that might not capture the full increase in short activity. Following the offering, short interests drop quickly to the regular pre-offer levels within a week, a pattern similar to previous findings in SEOs.

Second, I analyze whether these increases in short selling prior to corporate bonds offerings have informational value, or do they incorporate other trading

incentive, as manipulative short selling. Findings show that higher short interests are correlated with lower discount and underpricing, suggesting short trading has informational value and agreeing with the predictions of Chemmanur and Jiao (2011). Furthermore, I show that the price decrease prior to the offer is mainly permanent and not associated with a temporary price drop, also suggesting that short selling is more informative in nature.

These findings add to the limited evidence on corporate bond short selling and also to our understanding of the importance of short selling on market efficiency of corporate bonds pricing. Furthermore, I contribute to the literature on short selling around seasoned equity offerings showing that informative short selling is associated with lower offering costs.

The reminder of this chapter is organized as followed: Chapter 4.2 provides a more extensive literature review on the related topics. In Chapter 4.3, I formulate the hypotheses to be tested. Chapter 4.4 offers deeper view on the data and research design. Chapter 4.5 states the findings and Chapter 4.6 concludes.

4.2 Literature Review

Empirical research on short selling mostly focused on the positive aspects of this trading activity on market efficiency and on the ability to detect overvalued securities. Bohemer and Wu (2012) studied the informational efficiency of short selling using four different measures. First they showed that on intraday patterns higher short flow leads to less pricing errors and less autocorrelation, resembling the price patterns to a more efficient random walk. Second they illustrated that higher short selling facilitates faster incorporation of public information on a monthly and annual basis. Third, following negative earnings surprises, higher short levels lead to

a reduced negative post-earnings announcement drift. Last, they find decreased short selling following extreme negative return days, implying short selling does not induce overshooting but rather market efficiency.

Boehmer, Jones and Zhang (2008) focused on the return predictability of short selling by examining flows of daily short trades executed in the US from 2000 to 2004. They show that stocks in the highest short trading quintile underperform stocks in the lowest short trading quintile by a risk-adjusted 1.16% in the 20 day period following the short trade, suggesting that short selling is informative. They add that for the most heavily shorted stocks the negative performance persists for even 60 days following the trade. Similarly, Desai, Ramesh, Thiagarajan and Balachandran (2002) examine monthly short interest in NASDAQ stocks between 1988 and 1994 to see short sellers' ability to detect overpriced securities. They show that high short interest portfolios lead to negative returns of -0.76% in the following month, and this increases up to -1.13% as short interests also increase. Jones, Reed and Waller (2016) examine a change in disclosure regime in the European Union, which requires disclosing large short positions. They document that informativeness of prices and short interests declined. Their result indicates that large short sellers are informed and there doesn't seem to be any manipulative coordination among sellers.

Short selling was also found predictive of future detrimental corporate events, thus short sellers anticipate this negative outlook and help impound future information into current prices. Drake, Myers, Myers and Stuart (2015) show that the short interest ratio aligns currents returns with earnings several years into the future, thus increasing the informativeness of prices. This effect is strongest among firms that have a weaker informational environment and over-optimism regarding future

earnings. Christophe, Ferri and Angel (2004) also examine the informativeness of short selling regarding earnings but focus on the upcoming quarterly earnings announcements. They show that there is a strong negative correlation between short selling prior to the announcement to the returns following the announcement, suggesting that short selling is informative of upcoming earnings. They also show that this short selling is not driven by firm characteristics but possibly by firm-specific information. Engelberg, Reed and Ringgenberg (2012) examined the source of the profitability of informed short sellers. They show that informed short sellers are better apt at analyzing public news and the return profitability is much higher following news days.

Karpoff and Lou (2010) find that short sellers are proficient at finding firms that misrepresent their financials. They show that almost all firms which ex-post were disciplined by the SEC for misrepresentation, had an abnormal short interest before the information of the misrepresentation became public, dating as far as 19 months prior to the exposure. Short interest is also positively correlated with the gravity of the misrepresentation. Therefore, short selling is found to have beneficiary aspects for the market since it is correlated with shorter time for detecting misrepresentation and less overpricing for uninformed investors. Not only does short selling has the ability to detect future earnings, but short selling could also deter firms from earning manipulation, as was found in Fang, Huang and Karpoff (2016). They used a pilot in the SHO regulation in which only a randomized third of the Russell 3000 firms became easier to short for a period of over 2 years. The two thirds that weren't excluded had no significant change in their discretionary accruals. However, the firms which became easier to short reduced their accruals substantially during the two years

period but increased the accruals after the pilot terminated. This shows that the presence of short selling causes firms actions to be more conservative.

Other papers emphasized the importance of short selling to market efficiency by illustrating the downside of short selling constraints both regulatory and accessibility wise, as suggested in Miller (1977). Boehmer, Jones and Zhang (2013) examined the effect of the short selling ban during the 2008 financial crisis which restricted short selling of about 800 financial stocks in the US. They show that the short ban was indeed restrictive and consequently the market quality, measured by spread and intraday volatility, deteriorated for most stocks besides the lowest quartile of firms by market cap. For these smaller stocks the market quality did not deteriorate but did not improve either. Saffi and Sigurdsson (2010) perform a broader analysis of short bans on roughly 12,600 stocks across 26 countries to see how limited lending supply and higher loan fees for borrowing securities effects the market efficiency. They show that several measures of market efficiency are positively correlated with higher availability of short selling. In an recent paper, Engelberg, Reed and Ringgenberg (2018) examine the risks in short selling, such as recalling of loans and changes in the cost of loans. They show that higher risk regarding future short selling costs is associated with less short selling, less price efficiency and lower future returns.

Albeit the widespread agreement in the financial literature on the importance of short selling as a source of information and efficiency, opposing voices indicated the dangers of short selling. The media, market participants, and politicians argued that short selling might not be informative at all but rather have a detrimental effect on the markets. Brunnermeier and Pedersen (2005) suggested that traders might try to

utilize predatory short selling to profit from the distress of others. When a large investor is required to liquidate his holdings in a stock, short sellers might attempt to join his sales and sell aggressively. This will lower the supply for liquidity especially when liquidity is needed most, and will lead to a downward overshooting of prices. Short sellers will cover their short near the end of this dip and prices will later revert as the short pressure recedes. Shkilko, Van Ness and Van Ness (2012) study these types of price reversal patterns to see whether short sellers are causing these reversals. They show that during sharp drops in prices, short sellers participate more in trading and become demanders of liquidity, thus exacerbating the decline. However they also point out that regular (long) sellers drive most of these sharp drops in prices and not short sellers.

Goldstein and Guembel (2008) show that short selling could have a negative effect on firm actions and investment allocation efficiency. In their model, a negative feedback from the financial markets might deter a firm from taking on a profitable project. Therefore a trader could in fact decrease the real fundamental value of a firm by leading a selling pressure in the markets utilizing bear raid short selling. This happens when the project did not have a high NPV to begin with, there is a large uncertainty about the project's outcomes or that firms use the market response as a gauge for the project's prospects. Grullon, Michenaud and Weston (2015) explore if the short selling regulation SHO affected firm's decisions. They show that prices for firms with less short selling restrictions fell compared to a control group, and more notably these companies' equity issues and investments decreased. Mitchell, Pulvino and Stafford (2004) examine the trading of professional investors around merger announcements. They show that a large part of the well document decrease in price of acquirers in stock mergers is contributed to merger arbitrage short selling.

In the vast literature on the importance of short selling, seasoned offering presents a unique setting for examining the informativeness of short selling on market prices, since the issuing company is selling a large number of shares in the primary market at a predetermined time and at a discounted price. This might lead to strategic trading patterns in the secondary market prior to the offering, two of which were previously suggested in the literature. The first is the informative pre-offer trading presented by Chemmanur and Jiao (2011). They model a firm that undergoes an SEO and needs to decide the offer price given the actions of informed investors, the cost of SEO failure and retail investors noisy trading. They show that for firms with more informative pre-offer market prices, the discount is expected to be lower. Also, they show that informed investors' net trading will be in the direction of their private information. Thus whenever institutional trade, both net buying and net selling, it will lead to lower discount and to post-offering returns that are in the direction of the net trading.

Conversely to informative trading, Gerard and Nanda (1993) suggested that this unique setting prior to the offering might lead to manipulative short selling. Similarly to Rock (1986), they model an SEO were the issuer must set the offer price such that uninformed investors will have zero expected profits and solve the winner's curse. The more asymmetric information among informed and uninformed investors, the lower the price is set and therefore the issuer will incur higher underpricing. The innovation in their manipulation model is that informed investors can affect the secondary market's order flow, by short selling securities pre-offer even if they have positive information regarding the firm. They showed that this will occur when investors believe that they can recover their losses in the secondary market by being allocated a large quantity of securities in the primary market. This trading behavior

will lead to less informative pre-offer market prices, exacerbate the winner's curse and increase offering discount and underpricing.

Several empirical papers tested the motivation of short selling prior to seasoned offerings. Most of these papers utilized the adoption in the US of Rule 10b-21 (that was later replaced with Rule 105) which tried to prevent this potential manipulation by restricting short selling before SEOs. However, even Gerard and Nanda (1993) suggested in their manipulation paper that the rule constraining short selling before the offering might lead to less informative market prices and higher discount and underpricing.

Corwin (2003) examines the level of underpricing before and after the adoption of Rule 10b-21. Prior to the implementation of the rule he finds no evidence that large pre-offer price drops resulted in higher underpricing, which does not corroborate manipulative short selling. However, following the rule enactment large price fluctuation led to higher underpricing, a finding suggesting that restricting short selling has made the pre-offer price less informative. Kim and Shin (2004) find similar results that the rule adoption led to higher offering underpricing. They consider large price decreases in pre-offer prior to be consistent with high degree of short selling, yet find this drops to be more permanent in nature. This leads them to argue that this rule restricted mostly informative short selling and thus led to higher offering underpricing.

Autore (2010) re-visited these previous findings by examining shelf offerings that were first excluded from the rule but later were included. He shows that these offerings also experienced raise in discount following the original change in the rule, although they were excluded from the regulation. Later when these offering were

included, there was no significant change of the level of discount. He concludes that the importance of Rule 10b-21 was over-stated in previous papers. Gehy (2013) studies the 2007 amendment to Rule 105 which restricted the short selling even more. This amendment restricted short sellers in the 5 days pre-offering window from purchasing shares in SEO at all, not only for covering purposes. He shows that this restriction increased offering discount for over-night SEOs, and attributes this to impeding potential buyers from the SEO which were not able to cover their pre-offer short.

Gustafson (2016) documents a growing trend towards accelerated over-night SEOs, from 27% in 2000-2008 to 75% over-night SEOs in 2009-2014. He argues that by doing so, firms attempt to avoid the pre-offer trading manipulation which decreases offering price. He shows that non-overnight issues have an average 2.5% decline prior to the offering, which reverses several days afterwards, and this decline is positively correlated with more inelastic demand curve and larger offerings.

Another strand of empirical papers utilizes short selling data to document the stark rise in short selling activity prior to the offering and to examine how the change in interests affects discount and underpricing. Safieddine and Wilhelm (1996) show that prior to SEOs there is significant increase in monthly short interests and open option interests, which later return to normal interest following the offering. Furthermore, they show that higher levels of short interest are associated with higher offering discount but also that regulation was able to curtail it. Xu and Singal (2005) examine both the monthly short interest and the change in Rule 10b-21 and show that this change increased the underpricing level only for short constrained firms. They argue that the rule change for short constrained firms made their prices even less

informative, consequently requiring a higher underpricing. However the rule change had little effect on short unconstrained firms, making the manipulation explanation less plausible.

Contrary to the past findings, Henry and Koski (2010) collected daily short interests and showed that they are more manipulative in nature. They documented a correlation between higher levels of short selling pre-offer and higher discount and underpricing, claiming that monthly short interest data lacks the power to find short-term investment strategies as SEO manipulation. Conversely, in a recent paper Deshmukh, Gamble and Howe (2017) find that short selling before and after SEO announcement date are informative, having predictive power on lower future operating profits and post-SEO returns. However, they do not test manipulative short selling and state that both informative and manipulative short selling can co-exist.

All these previous papers examined stock short selling trades and interests. However, due to lack of data, corporate bonds were widely neglected, although the corporate bond market is as large and important for firms as the stock market. One of the only papers that has some information about the short selling activity is the one by Asquith, Au, Covert and Pathak (2013). They possess information about corporate bond borrowing from a large depository lender in the US, during the years 2004 and 2007. They examine the magnitude of short borrowing of corporate bonds and the costs of such activity. According to their data, they estimate corporate bond short selling to be roughly 19% of all corporate bond trades, a figure similar in size to that found in stocks. In addition, they document loan fees to be between 10 to 20 basis points, also similar to stock borrowing. Lastly, and more important to my paper, they examine if corporate bond borrowing predicts future negative returns, as suggested by

the informative short selling concept. They find no difference in the returns of bonds that were heavily borrowed to bonds that were not, implying that short selling is not as informative for corporate bonds as was previously found for stocks. Anderson et. al (2018) revisit this previous finding utilizing a more comprehensive sample. They find that proxies for short-sale constraints predict negative abnormal returns. However this finding is limited to part of the firms. Similarly, Wei and Zhou (2016) find that informed trading in corporate bond does exist. However, they do not test short selling at all and focus their analysis on informed trading prior to earning announcements.

4.3 Hypotheses

Normally, short sellers need to cover their positions by buying in the open market, increasing the price while purchasing securities, consequently lowering the profitability of the short selling strategy. However, around seasoned offerings short sellers can cover their short positions with a discounted uniform price with little or no price impact. This makes short selling more likely in the period leading up to the offering (Safieddine and Wilhelm, 1996; Kim and Shin, 2004), whether the short selling is informative, manipulative or for any other reason.

It was previously found that short interests increase substantially several days prior to the offering, and dropping following the offer to regular pre-offer levels very quickly. Safieddine and Wilhelm (1996) examine monthly short interests and find that short activity rises threefold and drops following the offering. Similar numbers are found in Xu and Singal (2005). This documented increase is probably biased downwards since short selling activity is a short lived trading strategy (Diether, Lee and Werner, 2009) thus monthly data might not capture the full extent for the rise in

short selling. Henry and Koski (2010) use daily short trading data arguing that this finer data has more ability to capture short selling strategies that are considered short-lived. They document that the mean and median abnormal short trading on the offer date relative to a regular benchmark period is 6.7 and 2.8 times higher, respectively. Before using these previous findings on stocks to benchmark to my corporate bonds short selling data, it is important to make sure that in general there are no major differences in short activity patterns between stocks and corporate bonds. Asquith, Au, Covert and Pathak (2013) use corporate bond and stock borrowing data to find that overall short activity for corporate bonds are similar in magnitude of short activity for stocks. Therefore, I expect that:

H4A. Prior to the offering, there will be a substantial increase in short interests leading to the offering

H4B. Following the offering, short interests would quickly drop to normal pre-offer levels

The next couple of hypotheses involve the motivation and impact of the short selling strategy prior to the seasoned offering. Chemmanur and Jiao (2011) model a setting in which a firm goes through seasoned offering, and examine the actions of firm insiders and institutional investors. They show that if there is some probability of offering failure or high offering cost, then the issue will be discounted to the pre-offer market prices and that this discount will be correlated with the informativeness of prices. In addition, they show that institutional investors will produce information and will trade in the direction of their private information. Therefore, if investors purchase or short sell in the pre-market they will increase market informativeness and lead to a lower offering discount.

Conversely, Gerard and Nanda (1993) argue that in some situations, an informed investor might attempt to conceal his positive private information by short selling in the pre-market. This trading strategy is costly and could only be profitable if he covers his short position with a large allocation in the discounted offering price. The mechanism in which the trade is profitable is since the market prices become less informative, exacerbating the winner's curse, lowering the offering price and increasing the offering discount. Although Gerard and Nanda (1993) promote the manipulative notion, they also add that short selling could be informative and limiting this activity might lead to less efficient market prices and higher discount and underpricing. Also they argue that increasing the number of manipulators might lead to ambiguous effect on offering discount.

In practice, informative short selling might co-exist with manipulative short selling or other short selling incentives (Deshmukh, Gamble and Howe, 2017), however the consequence of the different trading strategies on the offering discount and underpricing should be different (Henry and Koski, 2010). Thus, when examining the effect of the overall changes in short interests on discount and underpricing, I attempt to see which short trading strategy dominates the market. Thus:

H4C. Higher level of informative short interest before the offering should be negatively correlated with the discount and underpricing

Both informative and manipulative short selling should create a negative price impact on the security in the pre-offer market, however the difference might be revealed following the offering. On the one hand, short selling due to negative information will adjust prices to lower fundamental value (Diamond and Verrecchia, 1987), thus leading to a more permanent price decline. On the other hand,

manipulative short selling should only have a temporary price impact and following the offering, once short selling pressures decrease, price will rebound to pre-offer levels (Gerard and Nanda, 1993; Henri and Koski, 2010). This is similar in sense to the reversal in prices caused by manipulative predatory short selling (Brunnermeier and Pedersen, 2005; Shkilko, Van Ness and Van Ness, 2012).

Therefore, I expect that:

H4D. Informative short selling will be associated with a more permanent price decline in the securities following the offering

4.4 Data

In my research, I examine 220 seasoned corporate bond offerings (SBO) from 2006 to 2012. In this subchapter, I focus my description on issues relating to the information and manipulation theories and construct the proxies that will help me discern between each other. A general overview of the data is available in the mechanism description chapter 2.2.1 (pgs. 23), covering more detailed description of the data and offering mechanism.

The most important data feature relevant to this chapter is that the Tel Aviv stock exchange publishes weekly aggregated short interest for all the traded securities, including corporate bonds. This allows me to document the short interest changes before and after the seasoned offering. For example, using the MA industries corporate bond B presented earlier in Chapter 2.2.1, the weekly short interests around the Jan 16th 2012 offering are presented in the Table 4.1.

Table 4.1. - Weekly short interests around MA Industries Jan 16th 2012 bond B offering

Line	Date	Short Interest ('000 NIS)
1	15/12/2011	1,079
2	22/12/2011	1,067
3	29/12/2011	1,213
4	05/01/2012	15,187
5	12/01/2012	136,659
6	19/01/2012	5,311
7	26/01/2012	2,299
8	02/02/2012	1,840
9	07/02/2012	1,533

As illustrated, in the several weeks before the offering (lines 1 and 2) the week-end short interest is about 1 mil NIS. On December 29th the short interest raises slightly by 20% to 1.2 mil NIS (line 3). On January 5th, 7 trading days before the offering and one day after the publishing of the upcoming offering, the short interest raise twelve-folds to 15 mil NIS (line 4). On January 12th, 2 trading days before the offering, the short interest jumps even more to a level of 135 mil NIS (line 5). This level of short interest is roughly one quarter of the total new securities issued in the offering, thus demonstrating a significant short interest outstanding. On January 19th, 3 trading days following the offering, the short interest drops dramatically by 96% to just over 5 mil NIS (line 6). Although I cannot directly match the short covering to the offering bidding, it is most probable that most of the short was covered via the offering and not via purchasing in the secondary market (cumulative trading on the 3 days following the offering amounted to 147 mil NIS). In the following weeks (lines 7 to 9) the short interest continued to decrease to the pre-offering level.

The main independent variable of interest is the magnitude of change in the short interest pre-offer for each offering, which will be calculated as followed:

$$\Delta SB = \frac{SB_{-1} - SB_{-6}}{Offer\_size}$$

Where SB_{-1} and SB_{-6} are the week-end short interests for the last reading before the offering (week -1) and for the reading 5 weeks before that (week -6), respectively. *Offer_size* is the total number of new securities offered by the firm in the offering. There is no change in the results if instead of the week -6 short interest I use week -5, week -4 or the average of short interest on week -6 to -4.

In addition to this ratio expressing the change in short interest, I use two alternative short interest changes ratios both with a different denominator. The first alternative ratio is the change in short interest divided by the total securities outstanding prior to the offering. The second alternative ratio is the change in short interest ratio divided by the average daily trading volume in a two months timeframe with a week gap prior to the offering (day –47 to day –8), similar to the widely used short interest ratio (SIR).

Following the offering, short interests are predicted to drop back to normal levels, as stated in hypothesis H4B. The drop in short interest is calculated as:

$$Drop\_SB = \frac{SB_{-1} - SB_{+1}}{Offer\_size}$$

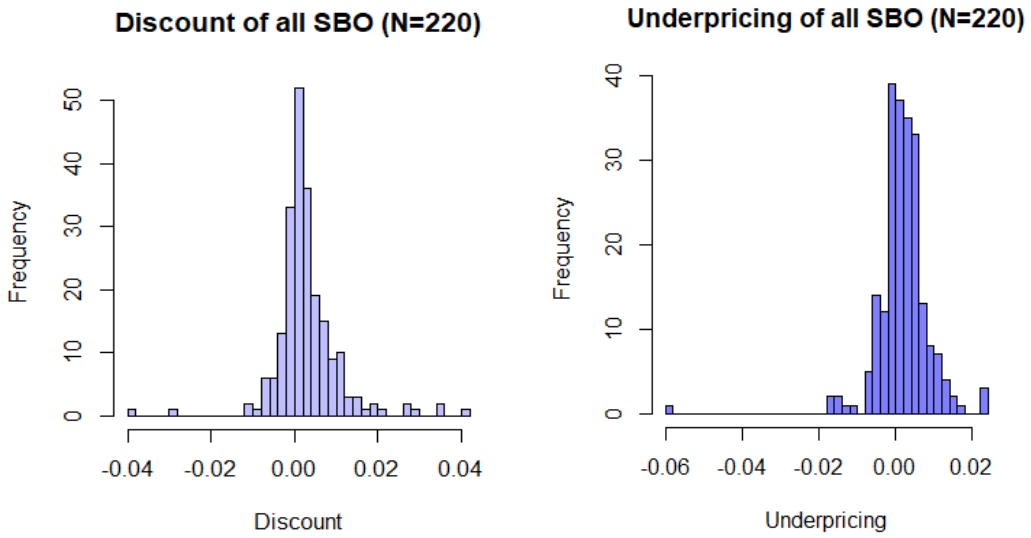
Where SB_{-1} and SB_{+1} are the week-end short interests for the last reading before the offering (week -1) and for the first week following the offering (week +1), divided by the offering size.

After documenting the changes in short selling interests, I will examine the connection between short selling and price patterns around seasoned offerings as stated in hypotheses H4C and H4D. First I calculate underpricing similar as in the previous chapter:

$$Underpricing = \left(\frac{P_{+1}}{P_{offer\_close}} - 1\right)$$

Where P_{+1} is the closing market price for the security in the first day of trading following to the offering, and P_{offer_close} is the closing price for the offering. The average underpricing across all 220 offerings is 0.185%. In addition to the underpricing, the seasoned offering context enables me to examine the price discount,

Figure 4.1 - Histograms the discount and underpricing for all seasoned corporate bond offering
This figure illustrates the histogram of returns compared to the offering closing price. The left plot shows the discount, the change in price from the closing price in the previous day to the offering closing price. The right plot shows the underpricing, the change in price from the offering closing price to the closing price of the next trading day



i.e. magnitude that the offering close price is lower than the last known pre-offer market price. Offering discount is calculated as followed:

$$Discount = -\left(\frac{P_{offer\_close}}{P_{-1}} - 1\right)$$

Where P_{offer_close} is the closing price for the offering, and P_{-1} is the closing market price for the security in the last day of trading prior to the offering. The average

discount for all 220 offerings is 0.305%. In figure 3.1 I show the distribution of discount and underpricing for all 220 offerings.

As prices adjust to fundamental value in a slightly longer time window following the offering, the permanent or temporary price drop could help distinguishing between informative and manipulative short selling. On the one hand, hypothesis H4D stipulates that if short selling is informative, than the drop in prices during the several days prior to the offering will have permanent effect. On the other hand, if short selling is mainly manipulative, than prices should rebound to the pre-short level as the temporary selling recedes (Gerard and Nanda, 1993). Therefore, the gauge for the temporary or permanent effect is calculated as:

$$Temporary = \left(\frac{P_{+6}}{P_{-1}} - 1\right)$$

Where P_{+6} is the closing market price for the security in the sixth day of trading following to the offering, and P_{-1} is the closing market price for the security in the last day of trading prior to the offering. The 6 day return captures the reversal in price, if such reversal actually exists, and I will examine whether short selling intensity prior to the offering affects this price reversal.

In my regressions of the discount and underpricing, I use several control variables to eliminate other factors that might influence the discount and underpricing. First I use the offering ratio variable to account for the ratio of new securities to the existing securities prior to the offering, as it may lead to temporary price pressures that could influence the discount and underpricing (Scholes, 1972; Corwin, 2003). This control variable is calculated as followed:

$$Offer\_ratio = \frac{New\_securities}{Existing\_securities}$$

Where new_securities is the total number of securities the firm is offering to investors, and existing_securities is the total number of securities that were already outstanding prior to the offering.

Second control variable is the duration of the bond as calculated in the triple A platform on the day of offering. The third control variable is the rating of the corporate bond series which is offered, similar to *Rating* variable mentioned in Chapter 3.4.2. The last control variable is the price changes in the 6 days leading up to the offering as in Corwin (2003). This variable is calculated as:

$$Pre\_offer\_decline = -\left(\frac{P_{-1}}{P_{-6}} - 1\right)$$

Where P_{-6} is the closing market price for the security 6 days of trading prior to the offering, and P_{-1} is the closing market price for the security in the last day of trading prior to the offering. A full list of variables is attached in the appendix

4.5 Results

I first start by documenting the average weekly short interest patterns around seasoned corporate bond offering, following hypotheses H4A and H4B. Table 4.2 provides descriptive statistics regarding the magnitude of short selling interests around offering in my sample, for all 220 SBOs. From this table it is easy to see that the average short interest on W_{-1} is economically significant and accounts for 5.5% of the total offering size, 2.6% of the total pre-offer outstanding securities and 11 times the average daily volume. Furthermore, the short interest on week -1 is as high as 67% and 24% of the total offering size and securities outstanding, respectively.

When examining the increase in short interests (ΔSB) from W_{-6} to W_{-1} it is evident that as predicted in H4A the short interests increase substantially, roughly quintupled from the regular period. The average short interest to offering size ratio, for example, increased from a level of 1.42% on week -6 to a level of 5.49% in the last reading on week -1 prior to the offering. These numbers are higher than what was previously found in Safieddine and Wilhelm (1996) and Xu and Singal (2005) and similar in magnitude to the findings in Henry and Koski (2010). As mentioned earlier, my results are collected from weekly short interest which seem to capture the

Table 4.2 - Weekly short interests around seasoned corporate bond offerings

	Mean	Std	Min	Q1	Median	Q3	Max
Short interest W_{-1} (in thousands of NIS)	22,879	44,065	0	58	4,108	22,799	270,441
Ratio of W_{-1} Short interest to:							
Offering size (%)	5.49	8.94	0	0.03	2.32	6.81	66.87
Interest outstanding pre-offer (%)	2.63	3.77	0	0.03	1.20	3.70	24.31
Average daily volume	11.92	20.66	0	0.03	4.73	13.60	189.26
ΔSB as measured with:							
Offering size (%)	4.07	7.39	-25.21	0	1.63	5.27	51.93
Interest outstanding pre-offer (%)	2.07	3.21	-1.45	0	1.05	2.91	21.86
Average daily volume	9.87	20.20	-4.79	0	2.96	11.02	189.26
Drop_SB (from W_{-1} to W_{+1}) as measured with:							
Offering size (%)	3.70	6.35	-17.60	0	1.59	4.62	35.78
Interest outstanding pre-offer (%)	1.90	3.03	-4.4	0	0.91	2.69	21.28
Average daily volume	7.87	14.11	-33.22	0	2.96	10.44	104.86

intensity of increase closer to daily flows (as in Henry and Koski, 2010) than in other papers that examined monthly short interests.

The drop in short interest from W_{-1} to W_{+1} following the offering is substantial, meaning that the higher short interest found on week -1 drop almost immediately to

pre-offer levels. For example, the average short interest to offering size ratio decreases from a level of 5.49% on the last short reading on week -1 prior to the offering to a level of 1.79% in the first reading on week +1 following the offering. The level of short interest on week +1 is almost indistinguishable from the normal level over a month prior to the offering. This indicates that most of the abnormal short activity is only prior to the offering with no permanent increase in short interests.

Figure 4.2 - Average weekly normalized short interests for all 220 offering

This figure illustrates the average weekly short interests of all 220 SBOs in the 11 week window around the SBO (which occurs between week -1 and week +1). The weekly short balances are first divided by one of the two different normalizing factors, and then averaged out across the 220 SBO. On the left plot the weekly short balances for each offering are divided by the value of the offered securities on the offering date. On the right plot the weekly short balances for each offering are divided by the average daily bond trading volume on days -47 to -8 prior to the offering

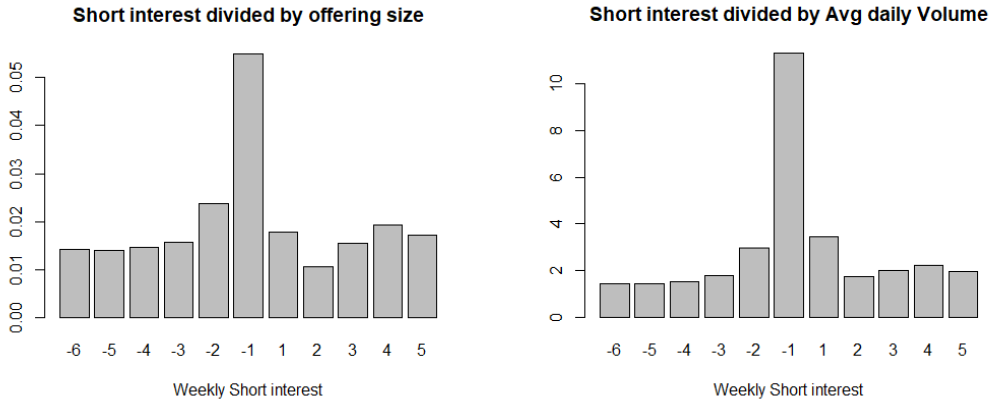


Figure 4.2 best illustrates the massive increase in short interests prior to the offerings, with an average five-fold increase from about a month prior to the offering to the last week-end reading closest to the offering, and the subsequent sharp drop following the offering.

After documenting the changes in short interests around seasoned corporate bond offerings, I move to examine if the increase in short interests is associated with

information or other type of incentive, as depicted in hypotheses H4C and H4D. The first hypothesis of the two postulates that if the short trading prior to the offering is informative, then the higher the short interest increases the lower discount and underpricing will occur in offerings.

The results of testing hypothesis H4C are presented in table 4.3, examining the correlation between the changes in short interests to the cost of the offering, both in discount and underpricing. The results show that the increase in short interest has a significant negative correlation with both discount and underpricing, with and without the control variables. This suggests that the increase in short activity was mainly due to informative short sellers as higher short balances led to lower price reactions. The increase in short interest (ΔSB) variable was also calculated by dividing the short

Table 4.3 – Effect of change in short interests on discount and underpricing

This table reports the regression result of SEO discount (models 1 and 2) and underpricing (models 3 and 4) on the short interest increase before the offering. ΔSB is the short interest increase from week -6 to week -1, divided by the number of new shares that were offered. Duration is the bonds' duration on the offering day. Offer_Ratio is the number of new securities offered to the number of existing securities. Credit_Rating is the rating of S&P, Moody's or a combination of the both where applicable. Pre_offer_decline is the decrease in prices in the 6 days prior to the offering. The t-values of the coefficients are stated in the parentheses.

	Discount		Underpricing	
	(1)	(2)	(3)	(4)
Intercept	0.004 ***	0.009 ***	0.002 ***	0.004 **
	(7.20)	(3.85)	(4.36)	(2.08)
ΔSB	-0.029 ***	-0.025 ***	-0.013 **	-0.013 *
	(-4.13)	(-3.53)	(-2.00)	(-1.88)
Duration		-0.000		0.000
		(-0.21)		(0.04)
Offer_Ratio		0.001 *		0.000
		(1.77)		(0.80)
Rating		-0.001 *		-0.000
		(-1.95)		(-0.77)
Pre_offer_decline		0.047		0.067 **
		(1.36)		(2.04)

interest increase with the total number of outstanding securities and with the average daily trading volume, yielding similar results.

Another means of testing if the short trading prior to the offering is informative is by examining the price patterns following the offerings, as mentioned in hypothesis H4D. This hypothesis suggests that if the short selling prior to the offering is driven by negative information, then the drop in prices prior to the offering will have a more permanent effect since prices adjust to a lower fundamental value. If the short is due to non-informative reasons then the decline should be temporary and prices would rebound to pre-offer levels.

Firstly, in the figure 4.3 I illustrate the 13-day price patterns around SBOs, compared to the price on day -7 prior to the offering. In the figure, day -1 is the closing price prior to the offering say, day 0 is the offering closing price and day +1 is the closing price the trading day following the offering. Several things are evident from figure 4.3 on the price pattern around seasoned corporate bond offerings. First, the market price decreases substantially in the 7 days prior to the offering by 1-2% on average. Second, the offer closing price is discounted in respect to the closing price prior to the offering (0.31% on average). Third, the price rebounds on the first day of trading following the offering, namely the underpricing (0.19% of average). Fourth, the later days following the first day the price stabilizes and doesn't show further increase. These fluctuations in prices appear to be more pronounced for 1SO than for 2SO.

Figure 4.3 –Average corporate bond price on days -7 to +6 window, all relative to day -7 price

This figure illustrates the average prices in the 14-day trading days window around all seasoned bond offerings. The prices of all 220 SBOs are normalized to one on trading day -7 before the offering. The dots show the average daily price of all offerings compared to trading day -7. Day 0 normalized price is the offering closing price compared to trading day -7 price.

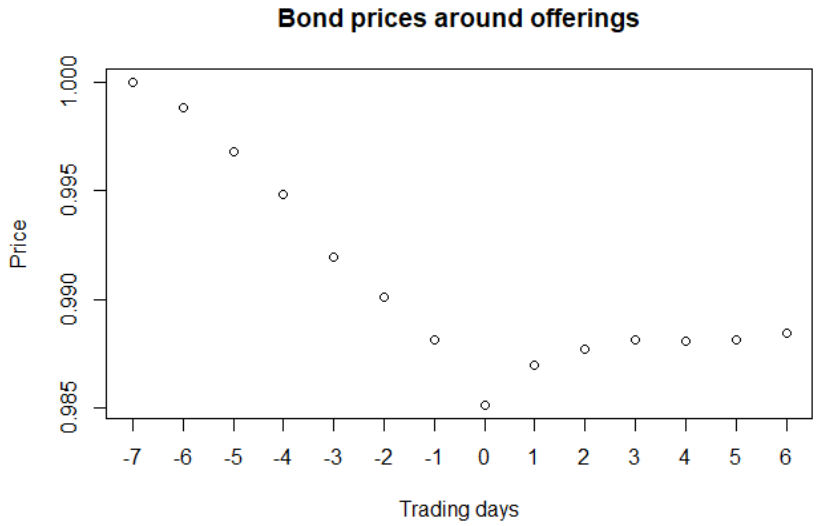


Table 4.4 – Effect of increase in short interests on temporary or permanent price drop

This table reports the regression result for the post-issue price changes, temporary variable, on short interest increase before the offering. Temporary is calculated as the return from the closing price in thr day prior to the offering to the closing price 6 days following the offering. ΔSB is the short interest increase from week -6 to week -1, divided by the number of new shares that were offered. Duration is the bonds' duration on the offering day. Offer_Ratio is the number of new securities offered to the number of existing securities. Credit_Rating is the rating of S&P, Moody's or a combination of the both where applicable. Pre_offer_decline is the decrease in prices in the 6 days prior to the offering. The t-values of the coefficients are stated in the parentheses.

	Temporary price change		
	(1)	(2)	
Intercept	-0.000	-0.011	***
	(1.54)	(-2.75)	
ΔSB	0.012	0.008	
	(0.96)	(0.67)	
Duration		0.000	
		(0.25)	
Offer_Ratio		0.001	
		(0.76)	
Credit Rating		0.001	**
		(2.27)	
Pre_offer_decline		0.036	
		(0.59)	

Secondly, table 4.4 examines if the short interest is associated with a more temporary price pattern, i.e. more short selling leads to a higher reversal in prices in the days following the offering. The coefficient to the change in short interest is positive yet statistically insignificant. This finding suggests that the a higher increase in short interests is not associated with a higher price reversal, meaning that short selling is mostly dominated by informed short selling.

4.6 Conclusion

In this chapter I first examine how short interests change around seasoned corporate bond offerings, and whether this short activity is similar to short patters around seasoned equity offerings. I find that, as expected, short selling increases substantially prior to the offering and drops instantly following the offerings, similar to seasoned offerings.

Secondly, I test whether this increase in short interests is associated with price changes that are in line with negative information short selling or with other incentives, as manipulation. I find that higher short selling is associated with lower discount and underpricing. In addition, I find that following the offerings, prices do not revert and permanently remain at a lower level. Both findings suggest that short is mainly informative and not manipulative.

The findings in this chapter add to the limited evidence on corporate bond short selling and also to our understanding of the importance of short selling on the market efficiency of corporate bonds pricing. Furthermore, I contribute to the literature on short selling around seasoned equity offerings showing that informative short selling is associated with lower offering discount and underpricing.

5. Summary and Future Research

In this concluding chapter of my dissertation I summarize the main findings and contributions of my work, both generally and specifically on the topics that were analyzed. Secondly I suggest a future research path that could extend the current contribution even more so.

5.1 Summary and Research Contribution

In Chapter 2 I present a new offering mechanism used for corporate bond offerings in Israel, namely the two-stage offering (2SO) auction mechanism. This mechanism entails a first-stage for sophisticated investors and a second-stage for mainly retail investors which bid after the demand of sophisticated investors is made public. I describe the offerings in detail and make an initial comparison to the regular one-stage (1SO) auctions. My analysis is focused on the underpricing of newly offered securities on the first trading day. My results show that 1SO have a higher average underpricing (about 0.51%) than the underpricing of 2SO (about 0.23%). This result holds for both initial corporate bond offerings (BIPO) and seasoned corporate bond offerings (SBO). In addition, the pre-commitment fee (PCF) sophisticated investors receive for pre-committing is found significant (average of 0.53%). This is, to the best of my knowledge, the first work done on this unique offering mechanism. The features of this mechanism could explain why auctions remain the main offering method in Israel where they were abandoned in most other countries, and potentially elicit an alternative to the criticized book-building method which dominates. Furthermore, I add to the limited evidence on underpricing for corporate bonds and find similar magnitude of results compared to previous papers (Cai, Helwege and Warga, 2007).

Chapter 3 focuses on asymmetric information as a main reason which could explain the difference in underpricing between the two offering mechanisms (1SO versus 2SO) and the significance of the PCF. The first placement model of Rock (1986) shows that if some investors are less informed than others, offerings should be underpriced on average in order for these uninformed investors to break even and bid in offerings. In 1SO, where potentially both informed and uninformed investors bid together, uninformed investors should require compensation for the winner's curse. However, in 2SO the information regarding the demand and pricing of sophisticated investors is made public before retail investors are allowed to bid. This revelation of information should lower the asymmetric information between informed and uninformed investors and thus lower the underpricing. I find that underpricing is lower for 2SO than underpricing for 1SO, even controlling for various firms specific features potential selection biases. This dissertation contributes to the general work on the winner's curse in offerings, and more specifically to the work on pre-offer market and unique mechanisms which potentially decrease this asymmetric information prior to or during the offering (Derrien and Kecskes, 2007; Chang, Chiang, Qian and Ritter, 2017, Chiang, Qian and Sherman, 2009; Kernis, Kutsuna and Smith, 2007; Neupane and Poshakwale, 2012).

The second placement model I examine in Chapter 3 is Benveniste and Spindt (1989) information acquisition cost. They show that informed investors require compensation for truthfully revealing their interest in an offering (mainly during road-shows of book-building offerings), especially if obtaining this information is harder. In 2SO in my sample, the compensation for informed investors is done via the PCF and not by underpricing and preferred allocation as in the book-building mechanism. The average PCF mentioned earlier (0.53%) accounts for over 70% of the total first

day profit of sophisticated investors. This PCF is increasing with various ex-ante risk variables such as smaller companies, higher duration and spread and companies with no relevant benchmark for valuation (no similar bonds and initial offerings). This chapter contributes to the literature on information acquisition cost literature showing that informed investors require compensation for revealing their information. Furthermore, it also shows that pre-set and pre-known small price discrimination could also encourage informed investors to reveal their information, a mechanism potentially fairer than discriminatory allocation.

Chapter 4 focuses on a specific determinant of underpricing for seasoned offerings, namely pre-offer short selling. On the one hand, short selling is considered as an action which makes prices closer to fundamental value and particularly could lower underpricing in seasoned offerings (Chemmanur and Jiao, 2011). On the other hand, some investors might try to manipulate pre-offer prices by short selling the securities in the market and covering the short in an underpriced price in the offering (Gerard and Nanda, 1993). In this chapter, I utilize data on weekly short balances for all corporate bonds which hold a seasoned offering to test whether short selling activity is more informative in nature, thus decreasing underpricing, or is more manipulative in nature, thus increasing underpricing.

First, I find a similar short balance patter around my 220 corporate bond offerings as was previously found on seasoned equity offerings (SEO). This pattern illustrates a stark increase in short balances prior to the offering of roughly 5-10 times higher compared to a normal short balance. Later, following the offering, short balances return to normal levels within a week or two. Second the results show that short selling activity is more informative than manipulative as seen in the post offering returns. The higher the increase in short balance prior to the offering, the

lower the underpricing and returns on the following days, both suggesting that short trades lowered the prices to fundamental value with no need for strong price reversals. These findings contribute to the literature on the importance of short selling and for the first time illustrate this importance for corporate bonds.

5.2 Future Research

As described in chapter 2.1.2 (pg. 23), numerous reasons for underpricing were presented in the financial literature. In the previous two chapters I focused on several relevant underpricing determinants, namely Rock (1986) winner's curse, Benveniste and Spindt (1989) information acquisition cost and a unique explanation for seasoned offerings involving short selling. I hypothesis how these explanations should affect underpricing in my unique setting and show whether the findings are aligned with these predictions. However, the previous two chapters are not intended to provide a full and comprehensive analysis of all the factors influencing underpricing in my sample; this is beyond the scope of my dissertation. Nevertheless, in this subchapter I present another underpricing explanation that was originated during my work, which I leave for future research.

Ellul and Pagano (2006) argued that a portion of the underpricing is compensation to investors for bearing future illiquidity risks. Their model shows that the higher the expected illiquidity and uncertainty regarding the liquidity in the post IPO market are, the higher underpricing investors will require. This uncertainty regarding future illiquidity of the offered security should be embedded in the underpricing. They mention that this concept is similar to the liquidity premium which is well covered in asset pricing literature (e.g. Amihud and Mendelson, 1986).

Using 337 fixed-price IPOs from the UK between 1998 and 2000, Ellul and Pagano show that the underpricing is correlated with several measures for expected illiquidity.

Goldreich, Hanke and Nath (2005) test the effects of future illiquidity for off- and on-the-run US treasury bonds. They find that the liquidity premium depends on the time left in the on-the-run period which experiences a higher liquidity than the off the run period, and not just the current liquidity of the treasury series. In an earlier paper, Kandel, Sarig and Wohl (1999) study Israeli regular auction IPOs and suggest that the underpricing is caused by investors learning new information about demand elasticity from the offering public results. The demand elasticity resolves uncertainty about the future liquidity, leading to higher (lower) underpricing if the demand is less (more) elastic.

Similar consequence to Ellul and Pagano's (2006) future illiquidity compensation was presented earlier for seasoned offerings' discount and underpricing. Scholes (1972) suggested that the demand curve for newly offered securities is imperative in the market's ability to absorb these newly generated securities. If the demand curve is not fully elastic, than seasoned offerings will create a downward price pressure and thus the issuer will need to offer bidders in the offering a "sweetener" or discount to prevailing market prices. Price pressures and downward sloping demand curves for securities in various economic settings have been uncovered in several empirical papers. Shleifer (1986) finds positive abnormal returns for stocks newly included into the S&P 500 Index, illustrating the price upward pressure for absorbing the additional demand. Kraus and Stoll (1972) find that block trades produce price changes which are significantly related to the size of the block and that price reversals occur for block sales.

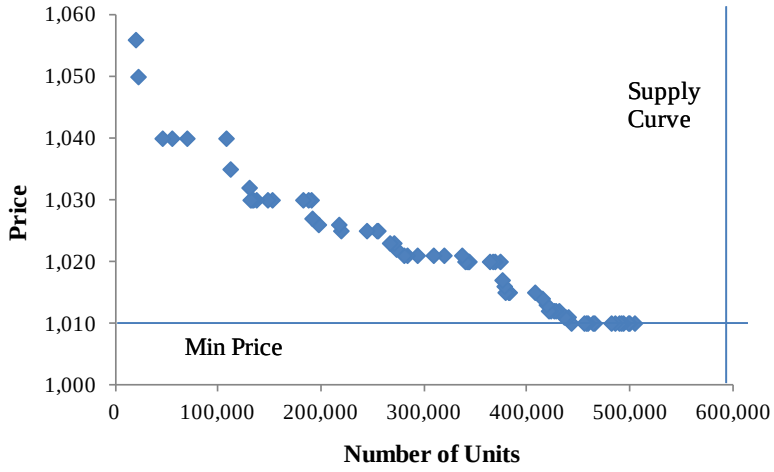
Most relevant to my seasoned offering setting, Corwin (2003) suggests that the issue of additional shares (i.e. seasoned offering) can be viewed as a sale of a very large block of new securities and the "sweetener" is reflected in the underpricing of securities. Corwin analyzes 4,454 US SEOs and shows that the price pressures theory holds illustrating that higher underpricing is positively correlated with larger offering size and with proxies of less elastic demand. Meidan (2005) also examines SEOs and finds that issuers experience significant negative returns just prior to the offering and significant positive returns straight after the offering (underpricing). He attributes this to price pressures which are temporary in nature. Intinoli and Kahle (2010) repeat these previous findings and also add that price pressures are stronger if insiders hold a large portion of the shares outstanding, which lowers the effective float and depth of the market.

My suggestion for future research involves the methodology in the work of Kandel, Sarig and Wohl (1999). In their paper, they argue that new information regarding the gross demand and future liquidity of the offered securities released in the publication of the results resolves some of the risk of illiquidity. Therefore, a higher gross elasticity for securities (calculated using the demand accepted in the closing/clearing price and the total overall demand in the offering) will lead to a lower first day return, i.e. underpricing.

In my unique corporate bond offering setting there is room to extend this analysis to a richer offering environment, since there should be different predictions for initial (BIPO) or seasoned (SBO) offerings and for 1SO and 2SO mechanisms. First, similar to Kandel, Sarig and Wohl (1999), the gross elasticity in one-stage offerings is reported once the results are published allowing to proxy for the demand

Figure 5.1 – The full demand curve from the first stage in MA Industries Bond B offering from 2012

This figure illustrates the demand curve from the first stage in the MA industries Bond B offering held in Jan 11th, 2012. The bids from the first are aggregated according to the price submitted.



elasticity. Second and even more informative, in two-stage offerings both the gross elasticity in the second stage and the full demand list (Appendix A) in the first stage are publicly reported. Figure 5.1 shows that this it creates a unique setting for testing how a demand curve determines the pricing of newly issued securities. Lastly, the timing of this new information about elasticity and its ability to affect prices in the offering or the market also lead to richer findings.

More specifically, in 1SO regular BIPO auctions, somewhat similar to those examined by Kandel, Sarig and Wohl (1999), the gross elasticity is known once the closing results are published and is incorporated in prices once the bonds start trading. Alternatively, in 2SO unique BIPO auctions the information regarding the elasticity of the demand of sophisticated investors is published before the second stage. Therefore, the information regarding the elasticity of demand and liquidity could be incorporated already in the second stage, and the gross elasticity in the second change could have an additional effect.

In 1SO regular SBO, the information regarding the gross elasticity of newly offered securities is published once the offering is completed but before the new shares start trading in the market. Thus, if new information regarding the liquidity of shares is published, then this information could be incorporated immediately in the market and not when newly issued securities start to trade. Conversely, in the SBOs with the unique 2SO, the information regarding the elasticity of the demand curve is first released in the first stage, therefore any effect should be immediately evident in the market prices of the bonds. Once the full results of the offering are released following the second stage, there could be an additional effect on market prices if there is new information in the second stage.

The variation in both the offering mechanism and the timing of demand elasticity information revealed is an excellent testing ground for the ideas set in Ellul and Pagano (2005). This appealing research topic is left for future analysis and is not part of this dissertation.

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7. Appendix

A. Complete order book in the first stage for MA Industries corporate bond B offering from January 2012

כמות (Quantity)	מחיר (Price)				LTD	MANAGEMENT	ASSETS	MAGNA
5,000	1,010						נמדר	אברהם
1,000	1,010						חברה	איילון
5,000	1,010		נוסטרו	–	בע"מ	לביטוח	אג"ח	אנליסט
2,000	1,010				נאמנות	קרן	גזית	דליה
2,000	1,010						ארזים	הדס
4,000	1,010			בע"מ	גמל	קופות	גמל	הראל
3,560	1,010				בע"מ	והשתלמות	חברה	הראל
16,440	1,010				בע"מ	לביטוח	בע"מ	יובנק
1,500	1,010						מבטחים	מנורה
5,000	1,010		נוסטרו	–	ישן	חיים ביטוח	מבטחים	מנורה
1,500	1,010		נוסטרו	–	בע"מ	החזקות	מבטחים	מנורה
2,000	1,010			בע"מ	וניהול	חיתום	הלמן	קבוצת
12,420	1,010					אלדובי	חברה	שירביט
3,000	1,010				בע"מ	לביטוח	בע"מ	אלטשולר-שחם
3,000	1,011						פיננסים	הראל
1,000	1,011		בע"מ	ערך	ובירות	מסחר	פיננסים	כלל
5,000	1,011		בע"מ	השקעות	ניהול	בטוחה	בע"מ	אלטשולר-שחם
3,000	1,012						שטוביץ	מיכאל
2,000	1,012				בע"מ		מאסטר	ספרה
3,000	1,012					פאנד	קוריפוריישן	סקיילקס
2,000	1,012				בע"מ		הון	פידליטי
2,255	1,012				בע"מ	סיכון	השקעות	פרופיוז'ן
4,000	1,013				בע"מ		ניהול	ילין-לפידות
7,000	1,014			בע"מ	גמל	קופות	בית	אי.בי.אי.
25,000	1,015				בע"מ	השקעות	אג"ח	יובנק
900	1,015					חברות	משה	עיני
3,000	1,015						עזריאלי	קבוצת
850	1,015				בע"מ		קרנות	מיטב-ניהול
2,215	1,016		תמהיל	קרנות	בע"מ	נאמנות	השקעות	פרופיוז'ן
2,000	1,017					בע"מ	ספרינט	אלומות
5,084	1,020		בע"מ	נאמנות	קרנות	ניהול	אגוד	בנק
2,000	1,020					נוסטרו	אינווסט	בסקט
3,000	1,020					בע"מ	יעוץ	דיסיליון
20,000	1,020				בע"מ	והשקעות	גלובל	ל.א.
834	1,020				בע"מ	אינווסטמנטס	קרנות	מיטב-ניהול
1,500	1,020				בע"מ	נאמנות	מאסטר	ספרה
1,500	1,020					פאנד	קוריפוריישן	סקיילקס
3,000	1,020					בע"מ	שותפות	אמטרין
17,500	1,021					מוגבלת	קפיטל	ברק
10,350	1,021			בע"מ	2006	השקעות	קפיטל	ברק
15,500	1,021			בע"מ	השקעות	ניהול	פיננסים	כלל
10,000	1,021				בע"מ	חיתום	הנפקות	לידר
3,000	1,021				בע"מ	1993	הון	פידליטי
7,555	1,021				בע"מ	סיכון	בית	מור
2,229	1,022				בע"מ	השקעות	השקעות	פרופיוז'ן
4,000	1,023					בע"מ	ניהול	פרוקסימה
11,500	1,023				בע"מ	השקעות	קרנות	איילון
1,000	1,025				בע"מ	נאמנות	מרכנתיל	בנק
10,000	1,025				בע"מ	דיסקונט	יעוץ	דיסיליון
25,000	1,025				בע"מ	והשקעות	גזית	דליה
2,000	1,025						ברטמן	א.ס.
19,800	1,026				בע"מ	השקעות	בית	אי.בי.אי.
6,000	1,026				בע"מ	השקעות	השקעות	קורדיאל
1,000	1,027					בע"מ	ASSETS	MAGNA
3,000	1,030				LTD	MANAGEMENT	בע"מ	אלטשולר-שחם
5,000	1,030						יעוץ	דיסיליון
30,000	1,030				בע"מ	והשקעות	השקעות	טיטאן
4,300	1,030					בע"מ	פיננסים	כלל
11,000	1,030				בע"מ	נגזרים	חסר	מבט
3,000	1,030					בע"מ	הארץ	נוף
1,500	1,030						השקעות	נישה
1,500	1,030						שווקים	ש.מ.
850	1,030					בע"מ	ברטמן	א.ס.
18,400	1,032				בע"מ	השקעות	הון	פידליטי
4,055	1,035				בע"מ	סיכון	שותפות	אמטרין
38,100	1,040					מוגבלת	קפיטל	ברק
14,550	1,040			בע"מ	2006	השקעות	קפיטל	ברק
9,500	1,040			בע"מ	השקעות	ניהול	פיננסים	כלל
23,500	1,040				בע"מ	נגזרים	תעודות	ק.ס.ם
2,380	1,050			בע"מ	אחזקות	סל	ברטמן	א.ס.
19,800	1,056				בע"מ	השקעות	סה"כ הזמנות	
504,427						Total number of orders		

B. Variables Definition

Name	Symbol	Short description	Calculation
Underpricing	*Underpricing*	The change in price from the offering closing price to the closing price of the first trading day	$\frac{P_{Close\ T+1}}{P_{Offer\_Close}} - 1$
Pre-commitment fee	*Pre_Com_Fee*	This fee is the fee given to sophisticated investors for participating in the first stage	The fee reported in the offering prospectus or complimentary report
Total Underpricing	*Tot_UP*	The total underpricing the both underpricing and pre-commitment fee, for only two-stage offerings	Underpricing plus the pre-commitment fee
Discount	*Discount*	The change in price from the close of the trading prior to the offering, to the offering closing price	$-\left(\frac{P_{offer\_close}}{P_{-1}} - 1\right)$
Alternative bonds	*Alter_Bonds*	A dummy variable for offering of companies which have another corporate bond trading at the time of the offering	True for offering with other bonds, False otherwise
Shelf Offering	*Shelf_Offer*	A dummy variable for offerings which are distributed via shelf offering and not a regular prospectus	True for shelf offering, False otherwise
Bond-only issuer	*Bond_Only*	A dummy variable for companies that have only bonds trading in the exchange wo any stocks	True for issuers with only traded bonds, False otherwise
Foreign company	*Foreign*	A dummy variable for companies which are incorporated outside of Israel	True for non-Israeli companies, False otherwise
Total Assets	*Log_Assets*	The total assets from the balance sheet on the last financial report prior to the offering	*Ln(Total Assets)*
Loan to Value	*LTV*	Total debt divided by total assets from the balance sheet on the last financial report prior to the offering	$\frac{Total\ Assets - Equity\ Value}{Total\ Assets}$
Series Size	*Series_Size*	The size of the corporate bond series following the offering	Total number of bonds post offering
Yield Spread	*Spread*	The spread of the corporate bond, calculated as the bond yield minus the relevant government yield	The first available spread post-offering from TripleA
Duration	*Duration*	The Macaulay duration, weighted average maturity of the corporate bond's cash flows	The first available duration post-offering from TripleA

Bond Rating	*Rating*	The Israeli corporate bond rating from the rating agencies, both if available	Maalot S&P and Midrog Moody's ratings
Financials	*Financials*	A dummy variable for companies which are from the financial sector	True for financial, False otherwise
Change in short balances	ΔSB	Change in short balance from week -6 to week -1 prior to the offering, normalized (divided) by offering size	$\frac{SB_{-1} - SB_{-6}}{Offer\_size}$
New securities to old securities	*Offer_Ratio*	The ratio between the number of new offered securities to the number of existing securities prior to the SBO	$\frac{New\_securities}{Existing\_securities}$
Drop in short balance post offering	*Drop_SB*	Change in short balance from week -1 prior to the offering to week +1 post offering, normalized (divided) by offering size	$\frac{SB_{-1} - SB_{+1}}{Offer\_size}$
Temporary change	*Temporary*	Measures the change in price from last closing price prior to the offering to the closing price 6 days post offerings	$\left(\frac{P_{+6}}{P_{-1}} - 1\right)$
Decline prior to offering	*Pre_offer_decline*	Measures the change in price from the closing price 6 days post offerings	$-\left(\frac{P_{-1}}{P_{-6}} - 1\right)$

C. List of Tables and Figures

מכיוון שהמידע אודות ההצעות של משקיעים מתוחכמים הופך פומבי בטרם משקיעים קטנים מציעים בהנפקה, אותם משקיעים שאינם מיודעים אינם זקוקים לפיצוי כפי שהיו נדרשים בהנפקה חד-שלבית בה כל המשקיעים מציעים במקביל, בהתאם לתחזיות מודל רוק (1986). כפי שחזוי, אני מוצא שתמחור החסר בהנפקות דו-שלביות הינו נמוך ב- 60% מאשר בהנפקות חד-שלביות, אפילו עם שליטה על משתנים מסבירים אחרים והבדלים במדגמים. בנוסף, משקיעים מיודעים צפויים לדרוש פיצוי על התחייבות בשלב הראשון ועל חשיפת הביקוש שלהם, כפי שצפוי במודל של בנבנישתי וספינדט (1989). עמלת ההתחייבות המוקדמת, אשר מהווה פיצוי ישיר לאותם משקיעים מתוחכמים, היא חיובית ומובהקת וברמה של 0.45% בממוצע.

בפרק העיקרי האחרון אני חוקר גורם נוסף וייחודי המשפיע על תמחור החסר, הכולל מכירות בחסר בטרם ההנפקה המשנית. באופן כללי בספרות המימונית, מכירות בחסר נמצאו כמהוות חלק מרכזי ביעילות המחירים, על כן מכירות בחסר לפני הנפקה משנית עשויות להוביל לתמחור חסר והנחה (discount) נמוכות יותר. אולם, ג'ראראד ונאנדה (1993) גרסו שמשקיעים עלולים ליצור מניפולציה של המחיר טרום-הנפקה באמצעות מכירה בחסר, ובכך יובילו לעלייה בתמחור החסר. אני בוחן את שתי תיאוריות אלו על 220 הנפקות אגרות חוב קונצרניות משניות בשימוש במידע נוסף על יתרות שורט שבועיות על אותן הנפקות. אני מוצא כי ישנה עלייה חדה ביתרות השורט לפני ההנפקה וירידה חדה מיד לאחר ההנפקה, תבנית דומה לזו שנמצאה בהנפקות מניות משניות. בניתוח מעמיק יותר העלייה בפעילות מכירות החסר מובילה לתמחור חסר נמוך יותר ולא היפוך במחיר, דבר התומך בתיאוריית המכירה בחסר אשר נובעת ממידע.

בפרק הסיכום אני כולל את הממצאים העיקריים בשלושת הפרקים העיקריים הקודמים. בנוסף, אני מציע ניתוח ראשוני של גורם נוסף שעשוי להשפיע על רמת תמחור החסר, גורם אשר מהווה פיצוי למשקיעים על אי סחירות פוטנציאלית עתידית באותם ניירות ערך המונפקים, כפי שתואר במודל של אלול ופגאנו (2005).

הגורמים לתמחור החסר: עדות ממכניזם הנפקה ייחודי של אגרות חוב קונצרניות

תקציר:

בעבודה זו אני משתמש במסד נתונים בעל מאפיינים ייחודיים על מנת לחקור את המקורות של התמחור חסר בהנפקות. המידע כולל 621 הנפקות של אגרות חוב קונצרניות מישראל, אשר מרביתן נערכות במכניזם הנפקה דו-שלביות ייחודי. בהנפקות אלו ישנו שלב ראשוני סגור למשקיעים מתוחכמים בלבד ושלב משני אשר פתוח לכלל הציבור. בשלב הראשון, משקיעים מתוחכמים מציעים הצעות מחייבות בהנפקה, דבר אשר מזכה אותם בעמלת התחייבות מוקדמת. בשלב השני בעיקר משקיעים קטנים יותר מגישים את הצעותיהם לאחר שצפו בהצעות של המשקיעים המתוחכמים מהשלב הראשון. מסד הנתונים הזה מאפשר לי לבחון את הגורמים לתמחור החסר בדרך שטרם נחקרה בספרות.

בפרק העיקרי הראשון אני סוקר את העדות חוצת היבשות של תמחור החסר אשר נמצא במגוון שיטות השקעה שונות. בנוסף, אני מתאר חלק מעשרות הגורמים האפשריים לתמחור החסר אשר נבדקו במאמרים תיאורטיים ובמחקרים אמפיריים מקבילים. בהמשך הפרק אני מתאר את סביבת ההנפה בשוק הישראלי ומספק תיאור של 621 ההנפקות של האגרות חוב הקונצרניות במדגם שלי. אני מסכם את הפרק בהצגת רמת תמחור החסר במדגם שלי, לערך 0.5% עבור הנפקות אג"ח ראשוניות ו- 0.25% עבור הנפקות אג"ח משניות, ומראה שתמחור החסר בהנפקות דו-שלביות הוא משמעותית נמוך מאשר בהנפקות חד-שלביות רגילות.

בפרק העיקרי הבא, אני ממקד את הניתוח שלי בשני מאמרים מרכזיים בנושא תמחור החסר, המודל של "קללת הזוכה" של רוק (1986) ומודל עלות רכישת המידע של בנבנישתי וספינדט (1989). שני מאמרים אלו גורסים שתמחור החסר נדרש על מנת לפצות תת-קבוצה של משקיעים על השתתפותם בהנפקה. הסביבה הייחודית שלי מאפשרת לי לבחון את שני המאמרים אלו בדרך חדשה. העובדה שבמרבית ההנפקות החתמים בהנפקה אינם נושאים בהתחייבות וכמעט שאינם משפיעים על תמחור ניירות הערך וחלוקתם בהנפקה, מונע הסבר אלטרנטיבי מרכזי של סיכוני הסוכן והסוחר.

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התמחות מימון וחשבונאות

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עבודת דוקטורט מוגשת עבור תואר "דוקטור לפילוסופיה"

על ידי

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נובמבר 2018

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