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IPO Underpricing in a Simultaneous Equations Model of Supply and Demand: Evidence from a Market of Retailers

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Abstract

This paper fulfills a great need for empirical evidence on the impacts of the supply, demand and allocation of shares on the underpricing of initial public offerings (IPOs). Exploiting a unique dataset and the institutional framework of Saudi Arabian IPOs, we construct a simultaneous equations model of supply and demand. Our evidence indicates that both curves of the market listing day supply and demand of IPOs are significantly negatively sloped with the supply curve being much steeper and above the demand curve. This is consistent with the idea that subscribers “flip” in IPOs immediately on the listing day to capture instantaneous profits. The excess demand that occurs during the subscription period becomes excess supply once the shares start floating on the listing day. Our study is the first move towards addressing the underpricing puzzle in a supply and demand context.

Key words: Initial public offerings; Supply and demand; Underpricing; Allocation

JEL Codes: G24; G32

1. Introduction

The underpricing of initial public offerings (IPOs) has been documented worldwide. The universality of the underpricing phenomenon seems at odds with both individual rationality and with the precepts of supply and demand equilibrium, which is heavily reliant on the assumption that all economic agents are rational in the market. The evidence on IPOs shows that investors purchase IPOs at the offer price and sell them on the listing day to gain positive returns. Although these initial returns vary among countries, the consensus is that IPOs reward the first day sellers. However, explanations for such a global phenomenon remain unconvincing¹.

Unfortunately, the more we study the underpricing topic, the more questions arise and the more complicated and puzzling it becomes. Ritter and Welch (2002) propose examining demand, supply, allocation of shares and other trading-related issues to solve the underpricing puzzle. The authors state “The solution to the underpricing puzzle has to lie in focusing on the setting of the offer price, where the normal interplay of supply and demand is suppressed by the underwriters” (p.1803).

The lack of sufficient disclosure on IPOs in industrial economies restricts empirical research. For example, in a paper on Australian IPOs, Lee, Taylor and Walter (1996a) were unable to empirically investigate Rock’s (1986) model of the winner’s curse. They state “The unavailability of data on allocation methods used in IPOs limits the extent of direct tests” (p.1190). In a study on 69 IPOs from the U.K, Brennan and Franks (1997) found that data on the allocation of shares and applications were only available for 13 IPOs. Thus far, scholars have recognized that Singapore provides the best disclosures of IPOs, which scholars frequently use to conduct their studies (see Koh and Walter (1989); Lee, Taylor and Walter, (1996b, 1999)).

This paper makes a significant contribution to the IPO literature. It is the first paper to models underpricing in a supply and demand framework based on real data. We utilize a unique dataset collected from Saudi Arabia that allows us to conduct experimental tests on the price

¹ In an extensive review of the IPOs underpricing literature, Ritter and Welch (2002) categorize underpricing theories into theories based on either asymmetric information such as the signaling theory, or symmetric information such as reducing the legal liability explanation. Although they introduce the modern shares allocation and trading-related theories separately, these newer theories can also be classified as theories based on asymmetric or symmetric information. Ljungqvist (2007) groups underpricing theories into four broad categories of asymmetric information, institutional, control and behavior. The very multiplicity of theories on underpricing implies that we do not actually understand this phenomenon.

movement of IPOs under a supply and demand framework. In fact, Saudi IPOs possess unique characteristics. Saudi IPOs are offered exclusively to Saudi citizens (retailers) that make some partial identification of potential subscribers (demanders) for a particular IPO feasible. In other countries, eligible subscribers are rarely identified or disclosed. Prior researches overemphasize the use of over-subscription as the only measure of demand, which is not necessarily an accurate measure. Additionally, data on the number of subscribers to each IPO in Saudi Arabia are available. Subscribers to an IPO who receive shares become the major suppliers on the listing day (Fishe, 2002; Aggarwal, 2003). In the Saudi market, 85% of the IPOs are offered solely to individuals (retailers) at a pre-announced fixed-price.

Furthermore, in our case, information about the methods used to allocate the shares and the exact number of shares allocated to the subscribers is available. In general, the data on the methods of allocation are not available. Many papers discuss the discretionary policies and the obstacles associated with obtaining the data on allocation (see for example, Lee, Taylor and Walter, 1996a; Cornelli and Goldreich, 2001; Ritter and Welch, 2002). Ljungqvist and Wilhelm (2002a) find that the transparency of the distribution of shares between retail and institutional investors varies across countries. Some countries, such as France reveal the distribution of shares, whereas others follow the U.S. in not disclosing such information. Our data on the allocation of shares are different in that we know the exact number of shares allocated to the retailers. This particular feature of our data allows us to test the supply and demand.

One might argue that Saudi Arabia is not an ideal case for studying the impact of supply and demand on underpricing, given the inefficiency and underdevelopment of its capital market. However, in this regard the underpricing of Saudi Arabian IPOs is similar to the underpricing of IPOs found around the world. The variation in the magnitude of underpricing is not limited to Saudi IPOs and is found even among the industrial economies. The IPOs in some countries such as Japanese IPOs display underpricing as high as 32.5%, whereas others such as French IPOs, display underpricing as low as 4.2%. In the U.S., Loughran and Ritter (2004) document that the IPOs were underpriced by 65% during the internet bubble and that the IPOs in China were underpriced for decades by over 200% (see Loughran, Ritter and Rydqvist, 1994 for a global review on underpricing). For example, similar to other markets we find evidence of clustering IPOs in Saudi Arabia similar to those documented in the U.S. by Ritter (1991) and in Italy by Pagano, Panetta and Zingales (1998). Additionally, the Saudi Authority restricts the insider management from trading non-offered shares for 180 days similar to the U.S.

lockup period (Field and Hanka, 2002; Aggarwal, 2003). Moreover, Saudi IPOs show the same pattern of a large trading volume during the listing day, which indicates that flipping activities similar to those in other markets are occurring (Aggarwal, 2003, Pham, Petko and Steen, 2003).

Some methodological issues must be addressed when studying underpricing. Prior authors in the literature repeatedly calculate the underpricing as the adjusted difference between the listing day's closing price and the offer price, while ignoring the opening price. We argue that this method does not allow one to view the IPO's price movement under a supply and demand framework. The IPO's opening price on its listing day has been largely ignored to the extent that we do not know much about it, although it is the price at which the real battle between buyers (demanders) and sellers (suppliers) of IPO shares commences. We understand that the closing price is the price at which the market settles and the equilibrium price is established, as suggested by Ljungqvist (2007). However, the opening price is of the same importance and, perhaps more so because it is the first post-listing adjustment. Moreover, the unusually large volume of trading that occurs on the listing day has been ignored or excluded because it is unusually high, even though it could explain much of the speculative investors' behavior and uncertainty.

Our empirical results yield a statistically significant relationship between the underpricing of the IPO and the supply and demand for its shares. We construct two simultaneous equations; one by using the opening price and the other by using the closing price. Using the opening price, we find that the pre-listing excess demand immediately converts into excess supply, which stops the price from continuing to rise. The same process must occur in all markets. Otherwise, the price has no reason to approach equilibrium. This is the shooting-up phenomenon in underpricing literature, which is widely understood but rarely mentioned. The phenomenon mainly results from the excess demand for the quantity in the pre-listing period and the investors' price expectations. Although this result is empirically proven in this paper, from a theoretical standpoint the same should occur in all markets if the IPOs are hot. Therefore, common questions in the literature such as how the quantity of shares is divided among subscribers? How is the IPO market regulated? All of these problems become different issues and their importance is related to their impact on the supply and demand for IPO shares, but not on the underpricing itself.

Afterward, we use the closing price with the volume of the listing day as the equilibrium and find that both curves are significantly negatively sloped with the supply curve being above the demand curve and steeper. Although, the negative supply curve sounds odd, it is understandable if one considers the instability of the IPO market. These negative sloped curves indicate that both supply and demand are decreasing but that the decrease in supply is faster and larger than the decrease in demand. This finding is not surprising in a market composed mainly of flippers.

The rest of the paper is organized as follows. Section 2 introduces a background on Saudi Arabian institutional settings, IPO issuance procedure, and allocation methods. Section 3 presents the data. Section 4 explains the theoretical framework and discusses the supply and demand simultaneous equations. Section 5 contains the empirical findings and we conclude in Section 6.

2. Background and IPO institutional settings

2.1 Saudi economy and stock market development

In the wake of the recent terrifying years, Saudi Arabia stands as a robust, resilient and stable economy. We are witnessing global financial crises (GFC), which are consecutively striking the country, high and rising oil prices, the threat of currency war and, more recently, the “Arab Spring”, which replaced some governments and cost the Arab nations more than US\$50 billion. Taking advantage of the rising oil prices since 2003, the Saudi economy is booming. Massive new economic cities are under construction, and newly-born banks, petrochemical companies and some industries are joining the stock market. The need for capital is calling for initial public offerings.

Saudi Arabia remains the major player in the global oil markets of current and potential future production because it contains the largest proven conventional reserves (about a quarter of the global oil reserves). Thus, the Saudi economy is hydrocarbon-based. On average, this country has produced 8.4 million barrels of oil per day in 2010, and has a capacity to reach 12 million barrels. As a result, the petroleum sector contributes to approximately 75% of the total revenues of the government, 40% of the GDP and 90% of the export earnings (Alanazi, Liu and Forster, 2011b). The downside of this heavy reliance on oil exports is that the Saudi economy lacks diversifications.

In early 1990 in an attempt to overcome the obstacle of economic diversification, the government began encouraging corporations to participate in the economy to reduce its reliance on oil, which is one of the most volatile commodities in the world². The flood of capital that came to the country with high oil prices since 2003 provides the government with the opportunity to move forward with this ambitious plan. Consequently, the Capital Market Authority (CMA) was established as an independent, legal entity to supervise and develop the Saudi capital market “Tadawul”. The foundation of the market authority was necessary to protect investors and the general public from unfair practices, achieve efficiency and transparency in securities transactions, monitor full disclosure of information related to shares and their issuers, and monitor shares trading.

Although, the roots of the Saudi stock market can be traced back in history to the 1930s, when the first joint stock company “Arab Automobile” was launched, the market was not officially regulated and the development of the market was very slow. In 2003, the number of listed companies was extended to 71, and this number can be compared to the 430 companies that are listed in the Egyptian stock exchange and the 319 companies that are listed in the Istanbul exchange. This small number of listed companies does not reflect the actual size of the Saudi economy, which joined the G20 group after the GFC. Saudi Arabia is among the top twenty largest economies in the world and is the largest economy in the Middle East (Alanazi, Liu and Forster, 2011a).

Following the establishment of the CMA, the Saudi national telecommunication company was introduced to the market through public offering. The privatization of this company, which was accompanied by a boom in the economy, was seen as the matchstick that ignited the capital market. Afterward, many IPOs followed, and the market index, which had a value of 3000 points, soared to its historical high above 20,000 points, in only three years. By the end of 2005, the capitalization of the Saudi market was over US\$650 billion, which makes it one of the largest stock markets, and lies behind the major exchange of Singapore and far ahead of that of Jakarta and Thailand. However, on the 25th of February 2006 the bubble

² In only one decade, the oil prices reached a historical low in 1998 at US\$8/barrel and a historical high in 2008 at US\$147/barrel.

exploded, the market index sharply reversed and fell back, and more than 60% of the market value was disappeared³.

Despite the collapse of the market, the policymakers' commitment to increase the number of listed companies and developing the market remain strong. Therefore, a major restructuring of the market took place in 2007. By 2010, the market was segmented into 15 industries, and 76 companies have joined the market, which is larger than the originally listed companies and indicates how hot the IPO market has been over the last 9 years.

2.2 IPO issuance procedure and allocation

Saudi IPOs are offered through a pre-announced fixed-price offering that is exclusively available to Saudi citizens⁴. Therefore, only citizens are eligible to subscribe. Cornelli and Goldreich (2001) examine a dataset of 39 equity issues composed of both SEOs and IPOs from 20 countries and find that investment bankers favor local investors. This favorable treatment given to local investors is a wealth distribution mechanism implemented by some governments. In this mechanism, investors buy low at the offer price and sell immediately at a high price on the listing day. The wealth distribution is a well-known feature in the privatization literature (see Megginson, Nash and Randenborgh, 1994).

Two different types of IPOs are offered in the Saudi market: the established IPOs and the under-establishment IPOs. The former consists of companies that have operating histories, and include family firms, joint stock companies and a few state owned enterprises. The latter are completely under-establishment companies or newly formed companies that did not exist as a single economic entity before the offering.

Any company seeking admission to the Saudi Capital Market "Tadawul" has to reveal at least three years' worth of audited accounting information (prospectus) to the public. The prospectus includes all details regarding the number of shares to be issued, the offering price, the retained ownership, the original owners of the company, the period and date of the

³ The Saudi citizens called the day when the market collapsed "the black Saturday", which has affected nearly the entire nation. Almost, every family was touched by the tragedy. For example, in February 2006 the Saudi Arabian refineries company stock was traded at a price of SAR7600/share. By June of the same year, the stock was worth only SAR760/share, which was a loss of approximately 90%.

⁴ In 2008, the Saudi regulators adopted the international book-building procedure in pricing IPOs. Therefore, the majority of our sampled IPOs are fixed-price offerings.

subscription, the minimum and maximum quantities of conditional subscriptions and the purpose of the issue.

No changes can be made during the subscription period except for the allocation. The allocation can be altered accordingly after the subscriptions end in the case of IPOs with high public demand, which usually favors individuals over institutions. Most IPOs have been offered solely to individuals (retailers), whereas a few have been offered to both individuals and institutional investors. If institutional investors are involved in the subscription, they receive preferential treatment before the subscription period starts (most companies offer institutions 70% of the deal and individuals 30%). However, the company and its investment banker retain the rights to alter this division between institutions and individuals if the number of individual subscribers exceeds a value that allows the company with the pre-conditional minimum subscription of shares to cover the whole issue.

With regard to the allocation method, the IPO specifies the minimum allocation of shares for individuals, which is guaranteed to fulfill the minimum number of the conditional subscription. Any quantity of shares remaining after the guaranteed minimum of shares is allocated among the retailers will be divided proportionally based on each individual request for the total issue of shares. If the total number of shares requested by the subscribers exceeds the total number of offered shares, the company will not guarantee the minimum allocation and will divide the shares equally among the individuals. Therefore, the allocation procedure becomes the number of offered shares divided by the number of subscribers. In Saudi Arabia, most IPOs follow this method because of the excess demand. Finally, if the number of subscribers exceeds the total offered shares, the Capital Market Authority (CMA) will decide how to allocate these shares.

This method of allocation is called the “even-handed” allocation of over-subscribed issues and guarantees fair treatment for all investors. This policy is similar to the U.K. and Singapore regulatory framework (Benveniste and Wilhelm, 1990; Benveniste and Busaba, 1997; Lee, Taylor and Walter, 1999) and is different from the discretionary policies favoring institutions over retailers that are applied in most industrial economies such as the U.S. (Hanley and Wilhelm, 1995; Aggarwal, Prabhala and Puri, 2001; Ljungqvist and Wilhelm, 2002a).

All shares must be sold or taken up by the underwriter before trading starts in the market. Formal trading cannot take place before the listing day under any circumstances. There can

be more than one subscriber in an application as families can apply jointly for a subscription (e.g. a couple with two children can submit one application for four subscribers). Because of the transaction cost (i.e., the selling fees of the allocated shares), Saudi families subscribe together, which increases their potential allocation and reduces transaction cost. This feature is linked to the Saudi culture being “collectivist” as opposed to “individualist”. Thus, some of the reasons for underpricing in Saudi Arabia can be linked to cultural factors.

The managing underwriter announces all of the information about the subscription results including the allocation of shares after the closure of the subscription period and before the listing’s day. This information includes the allocation of shares to individual subscribers. Excess capital from subscribers with no shares must be refunded before trading commences in the stock market. The first listing day for each IPO is always open to fluctuation of any size, while the fluctuations on the second day onward cannot exceed 10% in either direction. Other listed companies in the Saudi market adhere to the same policy. This distinguishing feature of the Saudi IPO market motivates both flipping and speculation behaviors on the listing day at the same time.

Short-selling is prohibited in the Saudi market for any stocks, including the IPOs, because doing so is against the “Sharia” Islamic law, which prevents selling un-owned assets. Therefore, on the listing day, initial buyers would not re-sell the shares unless they are compensated to do so. This feature also contributes to the severe underpricing that is evident in the Saudi market.

2.3 IPO market participants

A common feature distinguishing Saudi Arabian IPOs from other markets is that they are politically motivated. These includes: (1) favouring the general public small savers over institutional investors to insure a wide dispersion of shareholders and excess demand before listing; (2) aggressive advertising campaigns through T.V financial programs and newspapers designed to overcome the hesitation of public to invest in stocks; (3) facilitating the subscription process over the Internet banking, Telephone banking and the ATM; and (4) adopting a fair allocation procedure in which investors guarantee allocation and encouraged to pursue an investment strategy IPO after IPO.

It is essential to identify all parties that are involved in the IPO market to understand the Saudi IPO environment. We classify IPO parties into five categories: the legal entity that

supervises the stock market (the capital market authority); the company that is offering the shares (the IPO issuer); the investment banker who is taking the company public (the underwriter); the Saudi citizens who are being offered the shares during the subscription period (the rational general public investors) and the buyers on the listing day (the post-listing irrational participants).

These different groups have different objectives. The objectives of the market authority are to facilitate the process of the IPO to increase the efficiency and development of the stock market by increasing the number of successful listed companies and perhaps following a government agenda for distributing wealth. As stated before, the IPO market in Saudi Arabia has political motives. The goal of the IPO issuer is to maximize the proceeds of a secondary sale or to raise the required capital to start a business for start-up, under-establishment IPOs. The aim of the underwriter is to obtain the service fees from the issuer for marketing the company and insuring a full coverage. The managing underwriter and other banks in Saudi Arabia also provide brokerage services to investors. Hence, they have incentives to spread shares among a large number of investors, which increases transactions during the listing day and consequently boosts their profits (the transaction fees are fixed to SAR12 for any transaction below SAR10K).

The objective of the general public investors (flippers) is to achieve a quick profit by obtaining shares during the subscription period and selling them immediately on the listing day. We classify these people as rational investors because they buy low during the subscription period and sell high on the listing day. Although their decision to subscribe to the offered shares was not necessarily a rational decision initially because some IPOs were priced too high without fundamental reasons, the flippers were rational not to miss on a quick profit opportunity. Finally, the aim of the post-listing participants is to take advantage of the free fluctuation feature of the IPO on the listing day by buying shares from flippers and subsequently selling them to each other. We classify these people as irrational because their behavior is characterised by greed, although the winners seem very rational by not missing the unique opportunity of free fluctuation, which would not be possible afterward.

3. Data

3.1 Data sources

To identify Saudi Arabian IPOs, we inspected the Saudi Capital Market Authority (CMA) prospectuses from 2003 to 2010. A total of 76 IPOs was located. The first day closing and opening prices were gathered from the Saudi stock exchange market “Tadawul database”. Because there was a 5-to-1 stock split in the middle of 2006 for all Saudi companies, we review the unadjusted prices for the companies that went public prior to the stock split to compare their offer price with their actual first-day prices. For return adjustment purposes, the performance of the Saudi general stock market index the “Tadawul All Share Index, TASI.” is downloaded from the Tadawul website.

Data on the number of subscribers, the allocation of shares and the percentage of oversubscription for each company were collected from domestic and regional press releases. Saudi newspapers publish the results of each IPO from the first day that the company is open to subscription until the closure of the subscription period. We double check the accuracy of the data by reviewing the Argaam, Gulfbase and Alzawya databases, which contain some of these data.

3.2 Descriptive statistics

Table 1 shows descriptive statistics of the Saudi Arabian IPOs. Because of the variation in the size of the IPO, the number of offered shares by each company is positively skewed. Some IPOs have offered as many as a billion shares and some have offered only a one million shares, as shown by the maximum and minimum figures. In general, our median shows that the IPOs offered approximately 8 million shares. The maximum and minimum numbers of subscribers is 10 million and 0.315 million respectively, although the average seems to be less skewed. Approximately 15% (2.2 million people) of the Saudi population actively participated in all of the IPOs. The large demand for IPO shares (represented by the number of subscribers) and the low supply of shares (represented by the number of shares) led to the low allocation. Only 1 share was distributed to subscribers in 5 out of the 76 IPOs. The maximum allocation was 100 shares from the IPO of Alinma Bank, which offered 1.050 million shares in 2008.

The fourth variable is the time to listing, which is the delay between the closure of the subscription period and the exchange listing. We observe that the under-establishment IPOs

take longer time in general than the established IPOs because the former requires the approval of the ministry of commerce and other legal requirements. Oversubscription as measured by the ratio of the capital offered from the subscribers to the IPO gross proceeds shows similar results in other markets around the world (i.e. all hot IPOs are heavily oversubscribed with an average of 600%). The average size of the 76 IPOs as measured by the authorized capital is the median SAR310 million.

The median offer price is SAR10, which is the price of all 40 under-establishment IPOs. The variation in the price only exists within the established IPOs group with a maximum of SAR512 and a minimum of SAR10. We also, report the listing day's opening price and closing price. The opening price is higher than the closing price under all of the statistical measures. The mean opening price is SAR112, whereas the mean closing price is SAR103. Additionally, the median opening price is SAR57, whereas the median closing price is SAR51.

We also compare the IPO offer price against available listing day's quotations. The average offer price is below all quotations of the listing day. Median and other statistical measures show the same pattern. This is a distinguishing feature of hot IPOs where the low price on the listing day is higher than the IPO offer price. Another noteworthy observation is the huge variation between the IPO offer price and all listing day's prices. For example, the difference between the average offer price and the average low price is approximately SAR57. Furthermore, we note that the opening price, which is the first quotation appears on the listing day is the second largest value, just below the high of the listing day.

With regard to the fluctuations on the listing day, we also observe that the largest fluctuation occurs on the listing day is the first price jump from the offer price to the opening price (the shooting-up phenomenon). The difference in the average between the opening price and the offering price is SAR71. This difference is even larger than the difference between the high and the low of the listing day (the average difference is only SAR24.5). This has an essential implication for our analysis and understanding of the IPO price movements' behavior. The observation indicates that once the IPO's opening price appears, the fluctuation for the rest of the listing day trading hours decreases in the magnitude.

Table 1
Descriptive Statistics of 76 Saudi Arabian Initial Public Offerings from 2003 to 2010

This table reports the descriptive statistics for 76 Saudi IPOs from 2003 to 2010. Offered shares are the number of shares offered by the IPO company to the public (in millions); subscribers is the number of individuals who apply for IPO shares; subscribers allocation is the number of shares that has been allocated to individuals; delay is the number of calendar days between the end of the subscription period and the exchange listing; oversubscription is calculated as the total capital offered by all subscribers divided by the capital requested by the IPO (%); size is the IPO's authorized capital (measured in Saudi Riyal local currency SAR); the offer price is the IPO fixed-price offer (price per share) determined before the subscription and reported in the IPO's prospectus; low price is the lowest quotation of the IPO shares on the listing day; closing price is the last quotation of the IPO shares on the listing day when the exchange ends; opening price is the first quotation of the IPO shares on the listing day when the exchange starts; high price is the highest quotation of the IPO shares on the listing day.

Variable	Mean	75 th percentile	Median	25 th percentile	Maximum	Minimum
Offered shares (millions)	63	29.8	8	4.6	1050	1.2
Subscribers (millions)	2.3	2.6	1.2	0.8	10.2	0.32
Subscribers allocation	14.1	14.5	7	4	100	1
Delay	39.4	57.5	37	12	117	5
Oversubscription (%)	608	743.7	481.8	293.3	5100	74
Size (SAR millions)	2,702	1,051	310	200	63,000	80
Offer price (SAR)	41	46.5	10	10	512	10
Low price (SAR)	97.5	86	46.2	28.9	775	10.2
Closing price (SAR)	103.2	91.3	51.1	30.5	782	10
Opening price (SAR)	111.8	109.8	57	35.3	870	10.8
High price (SAR)	122	109.8	60	38	950	11.1

Note: The Saudi Riyal (SAR) currency has been pegged to the \$US since 1986 at a rate of \$US1 = SAR3.75.

4. Methodology

4.1 Measures of underpricing

We measure underpricing (the initial return on the listing day)⁵ by using the opening and the closing prices as follows:

$$R_i = \frac{(P_i - O_i)}{O_i} * 100 \quad (1)$$

where, R_i is the raw return of the IPO (percentage). To calculate this value, the difference between the IPO market price P_i on the day of the listing and the IPO offering price O_i is calculated, and the resulting value is divided by the offering price. The market price in this case is consecutively the listing day opening price and closing price.

Subsequently, we adjust the raw return with the Saudi stock market index “TASI”. Moreover, because other factors such as the transaction costs might influence this return, we adjust the underpricing for these costs as well. We follow Keloharjo (1993) and Al-Hassan, Delgado and Omran (2010) by employing the following formula:

$$AR_i = \left[\frac{(P_i - O_i - TC)}{O_i} - \left(\frac{(TASI_{it} - TASI_{i0})}{TASI_{i0}} \right) \right] * 100 \quad (2)$$

where AR_i is the IPO adjusted return (percentage); P_i is the IPO market price (the opening and closing prices consecutively); O_i is the IPO offering price; and TC is the transaction cost of the individual investors (i.e., the selling fees), which is fixed by all banks (brokers) in Saudi Arabia by SAR12 for any transaction that is below SAR10K. Thus, the transaction cost is calculated as $12/\text{allocation}$, where the allocation is the number of shares that are allocated to individual investors. $TASI_{it}$ is the value of the Saudi stock market index on the day of listing and $TASI_{i0}$ is the value of the index at the end of the subscription. We do not include the cost of capital that are confined in the subscription and not given any allocation because most people in Saudi Arabia adhere to the “Sharia” Islamic law, which opposes interest earnings. Thus, the cost of waiting is not applicable in our environment.

Thus, the average underpricing for a sample of IPOs is:

⁵ The terms underpricing and initial returns have been used interchangeably in the IPO literature.

$$\text{Average Underpricing} = \frac{\sum_{i=1}^n \text{IPO underpricing}_i}{n} \quad (3)$$

where n is the number of IPOs that are included in the sample.

4.2 Theoretical framework and models setup

4.2.1. *Asymmetric and symmetric theories*

Underpricing theories are usually divided into those that are based on asymmetric or symmetric information. Ritter and Welch (2002) discuss these theories in details and introduce the allocation of shares and other trading-related issues. Ljungqvist (2007) divides underpricing theories into four broad categories: asymmetric information, institutional, control, and behavior.

IPO underpricing is a complex function that consists of several factors in which no single theory can capture all elements and explains it on its own merits. This complexity could explain why this theoretical topic causes a fierce debate among scholars. This is the case with a low level of underpricing that does not usually exceed 10 to 20%. Therefore, it is much challenging to explain the over 200% underpricing that has occurred in the Saudi market. This extreme level rules out many of the existing theories, but it also leaves a bigger and more complicated puzzle. Underpricing literature suggests that countries that adopt fixed-price offerings have a larger degree of underpricing than those that use book-building procedures (Benveniste and Busaba, 1997; Cornelli and Goldreich, 2001). Engelen and Essen (2010) find that the level of underpricing is higher in countries with weak institutional legal frameworks.

The first theory, which is based on asymmetric information, that we consider is the Rock's (1986) theory of the winner's curse. Rock assumes that one group of investors (the informed investors) has superior knowledge over the other groups (the uninformed investors). Due to the information variation of the true value of the company, the disadvantageous, uninformed investors receive a full allocation of overpriced IPOs and only a partial allocation of the underpriced IPOs. To compensate the uninformed investors for this adverse selection dilemma, the issuer discounts the issue to guarantee the participation of the uninformed. Koh and Walter (1989) find support for the winner's curse argument based on rationing information from Singapore. They find that the returns of uninformed investors are not

significantly different from the risk-free rate of returns. Additionally, they find that rationing is stronger for underpriced IPOs than for overpriced ones.

Saudi Arabia is different from other countries in some aspects. All IPOs in this country are oversubscribed (a minimum of 74%) and the majority (approximately 91%) of our sample is substantially underpriced. Only 7 IPOs are overpriced after the results are adjusted by the market and transaction costs. We notice that rationing, which is measured by oversubscription among the overpriced IPOs is as strong as those among underpriced IPOs, which indicates that investors in Saudi Arabia blindly subscribe to new issues in the hope of a quick profit. This rationing excludes the possibility of information asymmetry at least between general public investors who are usually the major target for Saudi IPOs. Contrary to the evidence presented by Koh and Walter (1989), two overpriced IPOs in Saudi Arabia have above average rationing, and the least rationed IPO in our sample has underpricing of about 59%.

Although, we find that underpricing varies and positively correlates with the degree of rationing, which could indicate that information asymmetry between investors exists, we associate this variation to other factors such as market conditions, the expectations of allocation and profits of the investors, and preferences. Strong rationing in an even-handed policy, such as in the Saudi case, typically leads to lower allocation and increasing transaction costs, which in turn requires larger underpricing. Thus, large underpricing with strong rationing does not necessarily support Rock's theory.

Furthermore, signaling models suggest that high-quality IPOs deliberately underprice their offerings to distinguish themselves from poor-quality IPOs. The former demonstrates their quality by throwing money away and by recovering this loss in capital at a later stage through follow-on offerings (Welch, 1989). This argument is also not valid in Saudi Arabia because of the extreme over-valuation of the IPOs in this market. The aggregated gross proceeds for only 76 Saudi IPOs amount to US\$26 billion, which is larger than the proceeds of thousands of IPOs from around the world. In other words, Saudi IPOs were priced excessively high, which rules out any possibility of signaling intentions. Purnanandam and Swaminathan (2001) examine a sample of over 2000 U.S IPOs and find that, generally, IPOs are priced approximately 50% higher than comparable industry-matched, publicly listed firms.

Forty IPOs that are under examination in this study are completely under-establishment companies, which, by the time of the offering are not yet companies. The offering among

these companies is used as a mechanism to raise the capital that is required for starting operation. Although, the company has potential future growth and promising success, this does not justify the jump of the price on the listing day for some of these IPOs from SAR10 to SAR110. In other words, signaling models cannot explain a thousand percent underpricing. Instead, this severe underpricing can be explained by the fads, speculation, the lack of strong legal framework and the irrationality in the Saudi IPO market. A large body of literature associates the poor, long-run IPOs stock performance to the fads or the misevaluation of IPOs in an early stage (see among others Aggarwal and Rivoli, 1990; Ritter, 1991; and more recently, on the GCC region IPOs that include Saudi Arabia by Al-Hassan, Delgado and Omran; 2010).

Contrary to the traditional claim in the literature that underpricing is a cost sacrificing by the issuer because it is “money being left on the table”, we cannot see one convincing reason why the issuer would not be satisfied to see the price rise as much as possible. It does not make sense that capital is deliberately being left⁶. Loughran and Ritter (2002) propose a “prospect theory” that explains why issuers do not get upset about leaving money on the table. They examine the covariance between the issuers’ capital sacrifice and their overall wealth after listing. By integrating the loss with the gain, they find that issuers are wealthier than they would expect.

Another point that must be raised is the expiration of the lock-up period (usually six months), which is when the issuers will have the ability to start selling their retained shares to “cash out” without conducting any follow-on offerings. Schultz (2008) investigates the collapse of internet stock prices in the United States. He finds that the lock-up expirations and the follow on offerings made billions of dollars-worth of internet stocks available to the public. The agency theory and the “windows-of-opportunities” theory would be much more appealing in explaining the severe underpricing at earlier stages. A few studies on the Saudi IPOs operating performance document a sharp decline in the operating performance after the IPO and associate the decline to the agency theory and the owners desire to cash out (Alanazi; Liu and Forster, 2010, 2011a).

Asymmetric theories also include Welch’s (1992) cascade theory, Benveniste and Spindt’s (1989) and Benveniste and Wilhelm’s (1990) book-building theories and Baron’s (1982)

⁶ Money being left on the table contradicts the old economic saying “there is no such thing as free lunch”.

agency-based explanation. In all of these theories there is information variation among the different participants⁷. Most of these theories cannot explain the extreme underpricing in the Saudi market, even though some might be compatible with some of our findings.

Conversely, Tinic (1988) applies symmetric information and argues that underpricing is necessary to avoid any potential lawsuits in the IPO aftermarket. He argues that overpriced IPOs are more likely to be sued than underpriced ones. This argument is also not valid in our environment, which is similar to other emerging nations in that it is characterized by a weak legal framework. The IPO issuer clarifies in the distributed prospectus that the firm is not liable for any adverse price movement, and the decision of whether to buy the shares is the sole responsibility of the investors. Given the strong demand in Saudi Arabia, IPOs are offered in a “take it or leave it” manner.

4.2.2. IPO Market supply and demand

Without the traditional asymmetric and symmetric theories and given the severe underpricing in the Saudi market, we explain underpricing within the market microstructure and other trading-related issues. These issues are related to the behaviors of the investors under a supply and demand framework and how their behaviors are managed, influenced and controlled by the regulator.

Examining a finance phenomenon in a supply and demand framework is a challenge. Ross (1987) argues that fitting the theory of finance into a supply and demand framework does not provide much and that the fit would be awkward and irrelevant at best. In contrast, Wurgler and Zhuravskaya (2002) state that a detailed understanding of the practical limits of arbitrage will greatly enhance our understanding of how supply and demand forces affect the actual determinants of security prices. We believe that understanding the underpricing phenomenon requires a full analysis of how the IPO market operates and identification of the key players that influence the IPO market price.

A large body of literature suggests that the demand curve of stocks is negatively sloped. For example, Wurgler and Zhuravskaya (2002) find that stocks show a large price increase when added to the S&P 500, which implies that a less elastic demand curve exists. Gao and Ritter (2010) examine the role of marketing effort on SEOs and find that marketing flattens the

⁷ For a complete discussion on the asymmetric and symmetric theories of underpricing, the reader may refer to the artistic literature survey conducted by Ritter and Welch (2002).

demand curve and makes it more elastic than the ex-ante demand curve. Generally, securities market demand is not observable because it can originate from any agents in the market who are not under authority control such as the general public. Therefore, downward sloping demand curve studies measure the impact of events on the demand curve and measure the impact through market price movements.

On the contrary, supply is observable because it is limited by the number of outstanding shares, which the firm cannot increase without legal permission. Thus, most studies examine the demand curve by assuming a fixed supply. For example, Miller (1977) analyzes a simple model by assuming a vertical supply curve exists and demonstrates how the security price rises or falls based on the diverse opinions of the investors. Gao and Ritter (2010) fixed the supply curve for the SEOs by utilizing the total number of offered shares after the issuance. However, the assumption of fixed supply is far from a reality, and how it fits within the IPO market is unclear.

During the subscription period, the supply is fixed by the number of shares that are offered by the IPO, and a vertical, perfectly inelastic supply curve develops. Thus, the price should be entirely determined by demand, i.e., higher demand typically leads to higher prices, but no increase in the supplied quantity occurs. However, in the IPO market, the price is also fixed and does not correspond to the increasing or decreasing demand during the subscription period, which creates disequilibrium between supply and demand at the fixed offer price.

On the listing day, the scenario changes dramatically and instantaneously, and the supply of shares and the price are no longer fixed. Therefore, the IPO price is simultaneously determined by supply and demand forces. Supply can be less than the pre-listing, original supply if a holding is present, or it can exceed the original number of offered shares if a re-buying and/or re-selling occur (speculation). Also, the demand can be less or more than the subscription period demand. We observe that the average liquidity (the volume that is scaled by the offered shares) for the entire sample is 1.6, which suggests that the quantity that is supplied in the post-listing period is greater than the quantity that was originally supplied by the IPO. Yet, the underpricing is still high, which indicates an additional strong demand.

The key players on the listing day in our framework are the sellers (flippers) and buyers (speculators). In the Saudi market, IPO shares are distributed equally among retailers

(individuals), with the exception of institutional investors. This distribution creates excess demand and pre-listing rationing, which lead to the small allocation⁸. This small allocation does not encourage long-term investments, which cause most investors to flip their investments and rush to sell their shares by exploiting the sharp increase in price on the listing day.

The term ‘flipping’ describes the immediate selling of shares by the subscribers after the listing. Aggarwal (2000) documents that 60 to 70% of IPO shares are flipped on the listing day. Ritter and Welch (2002) discuss the underwriter’s conflicting views toward flipping. On the one hand, flipping establishes a liquid post-listing market and allows investors to make quick profit. On the other hand, if the post-listing demand is weak, underwriters will discourage flipping by imposing penalty bids or by excluding those flippers from future allocations. In the Saudi market, there is no such thing as a penalty bid or punishment in the form of altering allocations against flippers.

Fishe (2002) sheds light on how stock flippers affect IPO pricing and stabilization. He defines two types of participants: flippers and investors. The former turn quickly into suppliers after the listing, whereas the latter hold their shares for a longer period of time. Our framework differs from Fishe’s study in that we analyse a market in which all of the participants are flippers. As a result, there is a huge supply on the listing day that might impose downward pressure on the price.

To overcome the huge supply created by the flippers, market regulator has to create a market for the post-listing demand. One method to creating this market is to allow the stock price of the IPO on the listing day to freely fluctuate to invite buyers (i.e. greedy speculators). Cochrane (2002) finds that much of the demand for internet stocks in the U.S. originated from short-term speculators who are willing to buy shares with inflated prices in hopes of making a quick profit. While, the Saudi market regulator justifies the policy of free fluctuation by the need to establish a market price for a newly listed company, this policy actually motivates speculation. Miller (1977) explains how the prices of some companies can be driven to extreme heights in the absence of short-selling (similar to the institutional framework of the Saudi market). He defines the investors who bid the stock up as uninformed

⁸ In the literature, the pre-listing excess demand is called the artificial demand because it cannot predict the real post-listing demand or the buy-and-hold demand.

or excessively optimistic. All of the companies that are listed in the Saudi market are restricted to 10% fluctuations in either direction. By allowing the stock price of the IPO on the admission day to freely fluctuate, the regulator creates an environment in which the suppliers and demanders engage in a battle.

Most of the stabilization practices employed by the underwriters in the U.S, who are actively involved in the aftermarket, are not used in the Saudi market. For example, Aggarwal (2000) and Ellis, Michaely and O'Hara (2000) point out the role of the underwriters in price stabilization. If underwriters anticipate weak demand, they allocate up to 135% taking a naked short position such that they can have flexibility when responding to the post-listing weak demand and price. Price stabilization activities also include imposing penalty bids against brokers who flip their shares.

In contrast, if the post-listing demand is high such that in hot IPOs, the underwriters exercise the over-allotment option that allows them to sell more shares⁹. In the Saudi market, there is no over-allotment option in which the underwriters and issuers cannot sell more shares. This contributes to the extreme jump in Saudi IPOs price since no extra shares can be injected into the market to cool down the strong demand. Therefore, the number of potential floating shares is limited maximum by the number of offered shares by the IPO during the subscription.

Another point we need to consider is the allocation procedure, and how IPO shares are distributed among subscribers. Allocation methods are still not a well-understood topic because of the existing obstacles to data disclosure. Ritter and Welch (2002), Ljungqvist and Wilhelm (2002a), Koh and Walter (1989) and Lee, Taylor and Walter (1996b, 1999) all point out the challenges facing empiricists. To understand the importance of the allocation, consider for example two IPOs with the same size each offers 1 million shares. The IPO that distributes its shares among 1 million investors, and allocating 1 share to each investor is different from the one distributes its shares only among 100,000 investors with 10 shares. Furthermore, an IPO that allocates a portion of its shares to institutions (block holders) is different from the one distributes all shares to individuals. These methods of allocation influence the post-listing market liquidity and trading.

⁹ In the Saudi market, we do not know the roles of the underwriters in the post-listing period. This however, cannot rule out completely their possible involvement.

4.2.3. Initial opening price adjustment

In all oversubscribed IPOs, excess demand occurs during the subscription period, which is when the quantity of shares that are demanded by the subscribers is always larger than the shares that are offered through the IPO. However, if the offer is undersubscribed, then the IPO fails. This excess demand leads to low allocation and the wide dispersion of shares among the subscribers. At market, those subscribers become the shareholders (the major suppliers) instead of the company's original stockholders. Obviously, the suppliers have different expectations and behave differently. Some might sell immediately to take advantage of the sharp increase in the price, whereas others might hold onto their shares for the long term. The decisions of the subscribers to sell or hold are the major determinant of the market supply, demand and price.

The offering price of the IPO becomes the subscribers' reserve price. Because there is also a transaction cost involved when flippers sell their shares, which is fixed by SAR12, this cost increases the reserve price depending on the quantity of shares that investors receive. A larger allocation results in a lower transaction cost. For example, if a subscriber holds only one share, that person, has a reserve price of the IPO subscription offer price plus the selling fees of SAR12. If the subscriber holds 2 shares, the transaction cost is half that of SAR6 and so on.

Given the fair split of shares in the Saudi market, all of the subscribers have the same reserve price, which they must be compensated for upon selling a share. When trading commences, the price usually shoots up from the offer price to the opening price as is illustrated by the solid thick line in Figure 1. This sudden price increase is the first shock in the market, and mainly results from the excess demand in the pre-listing period.

The opening price has been widely ignored in the literature because there is no statistical significance difference between the closing price and the opening price when calculating the underpricing (Ritter and Welch, 2002). However, one noticeable feature of Saudi IPOs is that the opening price (average SAR111.8) is usually higher than the closing price (average SAR103.2), though we find the same outcome of the previous research (i.e. there is no statistically significant difference between these two prices). It is vital to distinguish between the two prices to identify the shapes of the supply and demand curves. We argue that although the use of the opening or closing price would not yield statistically significant results, these prices are economically and substantially different. We believe that researchers

who focus solely on significant results may miss important patterns, which may individually fall under the threshold set for tests of significance. In Appendix A1, we show the offer, reserve, opening and closing prices for 5 IPOs. Additionally, we utilize bar charts to illustrate the cross sectional price movement pattern.

We assume that the first equilibrium exists at the intersection between the opening price and the excess quantity that is demanded during the subscription period. We do not know exactly how many shares are exchanged at the opening price because this event is instantaneous. However, we know the difference between the quantity that is demanded during the subscription period and the number of offered shares, which we can use with the opening price to model the initial supply and demand equations. The excess demand is observable by all participants (i.e., buyers and sellers) before the admission; therefore, the participants hold some price expectations about the future opening price. Investors learn from experience, as suggested by Welch (1992) and by Chiang, Hirshleifer, Qian and Sherman (2011). The difference between the quantity that is demanded and the quantity that is offered at the fixed offer price represents a disequilibrium that requires a higher price to bring the situation back to normal. This factor is the oversubscription variable that has been used by nearly all of the authors in the literature to proxy the informed demand.

Furthermore, we assume that the shareholders are flippers who immediately sell their shares. In the Saudi market, it is reasonable to make this assumption given the tiny allocation that subscribers receive and the severe rationing that is in place. In 5 of the IPOs in the sample, the investors receive only 1 share and the average number of shares allocated for all of the IPOs is only 14.

An econometric model that explains market price and quantity should consist of two equations: one for supply and the other for demand. It will be a simultaneous equations model because both equations work together to determine the price and the quantity (Hill, Griffiths and Lim, 2007). We propose the following model:

Supply:

$$\begin{aligned} \text{Log (P)} = & \beta_1 + \beta_2 \text{Log (Q)} + \beta_3 \text{Log(NOS)} + \beta_4 \text{Log(RES)} \\ & + \beta_5 \text{ALLO} + \varepsilon_s \end{aligned} \quad (4)$$

Demand:

$$\text{Log}(P) = \alpha_1 + \alpha_2 \text{Log}(Q) + \alpha_3 \text{Log}(\text{Excess}) + \alpha_4 \text{MS} + \alpha_5 \text{SPE} + \alpha_5 \text{Delay} + \varepsilon_d \quad (5)$$

In this model, the two equilibrium values of price (P) and quantity (Q) are determined at the same time. These variables are called endogenous variables because their values are determined within the system that we created. They are both dependent variables and there is feedback between them¹⁰. Therefore, the dependent variables are the natural logarithm of the opening price (P) and the natural logarithm of the difference between the quantities demanded during the subscription period and the offered shares (Q). We refer to offered shares instead of outstanding shares to indicate that the subscribers can choose to hold. If all subscribers choose to hold onto their shares, there will be no supply at all, and consequently no trading will occur. We posit that the opening price, in this case, is more important than the closing price because it is a reflection of the pre-listing demand. It is possible for an IPO to open as an underpriced firm and close the same day being overpriced firm and vice versa.

A question arises as to whether the quantity (the excess-demand or shortage-supply) during the subscription period is a real or artificial demand? In our Saudi case, it is a real demand because the capital has already been offered and paid by investors during the subscription period, although the company will not access the capital or issue more shares to meet this demand. In support of this, Fishe (2002) states that if there is sufficient excess demand at the offer price to absorb the shares of flippers, the after-market price is likely to rise. Agarwal, Liu and Rhee (2008) find that the underpricing magnitude in Hong-Kong is associated with the level of demand of the pre-listing period. They divide the pre-listing demand into three categories: weak, medium and high demand. IPOs with high pre-listing demand are significantly underpriced by 58%, while the IPOs with weak demand have negative returns of -7%.

The values of the independent variables are determined outside of this system. These variables are called exogenous variables. In the supply equation, the first independent variable is the natural logarithm of the number of subscribers (NOS). On the listing day, the subscribers become the only suppliers (Fishe, 2002; Aggarwal, 2003). Therefore, we expect a negative relationship between the opening price and the number of subscribers. The reserve price (RES) composes of two components: the cost incurred by the subscribers to purchase

¹⁰ It is necessary to realize that in this model no matter which variable of price or quantity goes into the left-hand side of the equation, they are both dependent variables. In economics these models are set in this manner.

the IPO shares during the subscription period and the transaction cost (the selling fees) on the listing day. Benveniste and Spindt (1989) were the first to introduce the term ‘reserve price’ in IPO literature. This price is the conditional estimate of the aftermarket price. Thus, the reserve price restricts the supply of shares on the listing day because the subscribers require a certain amount of compensation.

The demanders also observe the reserve price, which compels them to bid higher to obtain shares. Therefore, we expect the reserve price to affect the opening price positively in that the higher the reserve price is, the higher the opening price will be. Finally, we include the allocation (ALLO) in the supply equation because allocation represents the quantity of shares held by each supplier. Therefore, the larger the allocation is, the lower the opening price should be.

In the demand equation we calculate the natural logarithm of the excess capital as the first independent variable. This variable represents the capital with no shares refunded fully to subscribers before the listing day. We expect this capital to influence the demand positively because the investors might attempt to purchase the quantity that they desired during the subscription period of the market. Of course, a larger amount of capital can enter during the trading hours. However, we do not have such information. We expect this refunded capital to affect the opening price positively.

We also include the market sentiment (MS), which is a dummy variable that takes a value of 1 if the market is a bull market between the closure of the subscription period and the listing day and 0 if it is a bear market. Although, the MS might influence both the supply and demand, we expect the impact to be stronger on the demand because the flippers (the suppliers) are more than likely to behave the same (i.e., continue to flip) under any market situation, whereas the demanders’ behavior might change based on the market situation. We do not know the exact association, but we expect a positive relationship between the market sentiment and the opening price due to stronger demand.

Additionally, we include the speculation (SPE), which measures how speculative the IPO is in the demand equation¹¹. We expect small IPOs to be more speculative than large IPOs and

¹¹ A perfect measure here would be the number of buyers (speculators) bidding to buy from the flippers and the cash capital that they are prepared to use. Unfortunately, these data do not exist. We know that the speculators exist, but we do not know who they are and what they are doing. In the Saudi market, citizens usually call the speculators the ‘big fish’ indicating that “big fish eat little fish”.

to have a higher opening price as a result. We measure speculation by scaling the IPO total turnover during the listing day by the IPO gross proceeds to control for the variation in size among the IPOs as follows:

$$\text{Speculation} = \frac{\text{Turnover}_{ipo}}{\text{Gross proceeds}_{ipo}} \quad (6)$$

where Turnover_{ipo} is the total capital traded during the listing day, and $\text{Gross proceeds}_{ipo}$ is the total amount of capital raised by the IPO.

The last variable we include in the demand equation is the delay, which is the time (number of calendar days) between the end of the subscription period and the admission date. Because under-establishment IPOs in our sample took, on average a longer time (average of 58 days) to admission than the established IPOs (average of 18 days), we include this variable to capture the differences. Thus, this continuous variable acts like a dummy variable that differentiates between the types of the IPOs. Under-establishment IPOs have distinguishing features because they are usually cheaper and the majority are smaller in size. Therefore, we expect a positive relationship between the delay and opening price.

In Figure 1, we take a closer look at the shooting-up phenomenon with the opening price. We expect the supply at the opening price to be above the demand mainly because of flipping, which stops the price from continuing to rise. Therefore, in response to the price jump, the supply increases and demand decreases in accordance with the economic laws of supply and demand. This scenario is an approximation. The actual phenomenon is much more complicated than the simplicity we are trying to make.

Figure 1: A Closer Look at the Admission of an IPO to the Stock Exchange

P on the y-axis and Q on the x-axis are the price and quantity of shares, respectively. OP is the IPO offer price; TC is the transaction cost calculated as (the SAR12 selling fees / IPO individuals' allocation); RP is the reserve price, which is equal to the IPO offering price plus the transaction cost and represents the cost that the subscribers must be compensated for upon start selling; Opening is the IPO opening price, which is the first quotation of the IPO share when the market opens and exchange begins; OSH is the number of shares offered by the IPO; QD is the quantity of shares demanded by the subscribers during the subscription period; Excess demand is the difference between the quantity demanded during the subscription period and the total shares offered by the IPO; S and D represent the supply and demand curves, respectively. The thick solid line between the offer price and the opening price represents the shooting-up phenomenon in the IPO market.

4.2.4. The cross-sectional supply and demand of IPOs

As trading continues towards the end of the listing day, we will obtain the total quantity exchanged (the volume) and the last quotation (the closing price). Figure 2 shows the movement of the supply and demand curves from the opening price to the closing price. We posit that both curves to have negative slopes that move from the opening price down towards the closing price. They both decrease, but the supply decreases at a greater and quicker rate than the demand because flippers exit the market and leave it for other interested parties. Of course, there are many other adjustments, hundreds or perhaps thousands might occur during trading hours (i.e. the high and the low of the listing day) as is shown by the stochastic price movement from the opening price to the closing price in the figure. However, we do not have data on the price movement during trading hours. Understanding the interaction between supply and demand on the first day requires a full analysis of intra-day price data, and perhaps a minute-by-minute analysis would be reasonable. For the sake of

simplicity and the lack of sufficient data, we only use the opening and closing prices to identify these slopes.

Although, a negative supply curve sounds unusual, it is not really uncommon in the underpricing topic because of the high instability and uncertainty that characterizes the market on the listing day. We refer back to the cobweb theorem of Kaldor (1934), which preceded the research on underpricing in the seventies (Ibbostong, 1975). Kaldor shows a model that is based on a time lag between supply and demand decisions in some markets in which, similar to our IPO market, the demanded quantity is observed before the price is established. Two outcomes of the cobweb model have been proposed: (i) the convergent case (stable) and (ii) the divergent case (unstable). In the convergent case, the supply curve is steeper than the demand curve, where the fluctuation decreases in magnitude. Therefore, the plot of supply and demand would look like an inward spiral as shown in our figure. Unlike our IPO case, in the divergent case, the fluctuation increases and price spirals outward.

It is vital to realize that Figure 2 is an approximation of the hot IPOs in Saudi Arabia, where most IPOs are substantially underpriced. Additionally, it is essential to understand that this analysis is a cross-sectional examination of supply and demand, and not one of time series movements from the opening to closing prices. We propose the following model to test the supply and demand using the volume equilibrium:

Supply:

$$\text{Log (P)} = \beta_1 + \beta_2 \text{Log (Q)} + \beta_3 \text{Log(NOS)} + \beta_4 \text{Log(RES)} + \beta_5 \text{ALLO} + \varepsilon_s \quad (7)$$

Demand:

$$\begin{aligned} \text{Log (P)} = & \alpha_1 + \alpha_2 \text{Log(Q)} + \alpha_3 \text{Log (Excess)} + \alpha_4 \text{MS} + \alpha_5 \text{SPE} \\ & + \alpha_5 \text{Delay} + \varepsilon_d \end{aligned} \quad (8)$$

This is the same model that we used to test the first equilibrium of the opening price and the excess demand in the pre-listing period. In the current model, we only use the volume of the listing day and the closing price. Thus, the dependent variables here are the following: 1) the natural logarithm of the difference between the closing price and the offer price (P) and 2) the natural logarithm of the volume of trade on the listing day. Ritter and Welch (2002) suggest that it is important to incorporate the IPO trading volume in the empirical work of the market microstructure because of its large magnitude on the listing day. Table 2 shows the expected

negative feedback between the endogenous variables and the expected association between the exogenous and endogenous variables.

Table 2
The Expected Association between the Endogenous and Exogenous Variables

This table shows the expected sign of the relationship between the endogenous and the exogenous variables. First, the table shows the expected negative feedback between the endogenous variables of the underpricing and the volume. Underpricing represents the difference between the listing day's closing price and the IPO offering price; volume represents the total number of shares exchanged between the market participants during the listing day. A negative association is expected between the underpricing and the volume in that large volume lowers the underpricing and high price lowers the volume. The exogenous variables are: the number of subscribers (flippers), which affects the underpricing negatively and the volume positively in accordance with the economic laws of supply and demand; the allocation (the number of shares allocated to flippers), which affects the underpricing negatively and the volume positively; the reserve price (the price incurred by flippers to purchase the IPO shares pre-listing plus the transaction cost of the selling fees on the listing day), which affects the underpricing positively and the volume negatively; the excess capital (the amount of capital fully refunded to investors pre-listing), which affects both the underpricing and the volume positively; the market sentiment (a dummy variable that takes on a value of 1 if the market is a bull market between the end of subscription period and the listing day and 0 if it is a bear market), which affects the underpricing negatively and the volume positively because we expect when the market is doing in general well that the exchange between participants becomes larger, which in turns lower the underpricing; speculation (measures the speculative degree of the IPO by scaling the turnover of the IPO on the listing day by the IPO's gross proceeds), which affects both the underpricing and the volume positively and the delay (the number of calendar days between the end of the subscription and the listing day), which affects the underpricing positively and the volume negatively because this variable captures the difference between the two types of IPOs: the under-establishment and the established ones. Because under-establishment IPOs are cheaper and generally smaller in size, we expect the delay variable to be positively associated with price and negatively with volume.

Endogenous variables	Underpricing (Closing Price)	Quantity (Volume)
Exogenous variables	(-)	(-)
Number of Subscribers	(-)	(+)
Allocation	(-)	(+)
Reserve price	(+)	(-)
Excess capital	(+)	(+)
Market sentiment	(-)	(+)
Speculation	(+)	(+)
Delay	(+)	(-)

Figure 2: An Illustration of the IPOs in Equilibrium at the Closing Price and the Volume on the Listing Day

P on the y-axis and Q on the x-axis are the price and quantity of shares, respectively. O is the pre-announced IPO fixed-price offer. OSH is the number of shares offered by the IPO. QD is the quantity of shares demanded during the subscription period. TC is the transaction cost calculated as the selling fees of SAR12 divided by the individuals' allocation. Reserve price is equal to the IPO offering price plus the transaction cost. Excess demand is the difference between the quantity of shares demanded during the subscription period and the total shares offered by the IPO. Delay is the number of calendar days between the end of subscription and the listing day. Re-selling area is the area where the number of shares exchanged during the listing day exceeds the original number of shares offered by the IPO. OP is the opening price, which is the first quotation of the IPO share when the exchange begins. The thick solid line between the offer price and the opening price represents the shooting-up phenomenon in the IPO market. HP and LP represent the highest and lowest quotations, respectively that appear during the listing day. CP is the closing price, which is the last quotation of the IPO shares on the listing day. Volume represents the total number of shares exchanged between the buyers and sellers during the listing day. The stochastic price movement illustrates the price movements of the IPO stock during the listing day.

5. Empirical evidence

5.1 Underpricing

Panel A of Table 3 reports the underpricing for 76 Saudi IPOs using the market listing day opening price. We separately report the raw and adjusted returns. Consistent with the global evidence on underpricing, Saudi IPOs are significantly underpriced, but at a much larger magnitude than other markets. The average IPO's first-day raw and adjusted returns are 297% and 285%, respectively. Additionally, the median reveals the same observations of large raw and adjusted underpricing of 134% and 123%, respectively, which is very large for IPOs that were originally offered at high prices. Our overall result on large magnitude underpricing is consistent with that of Al-Hassan, Delgado and Omran (2010), who report 290% underpricing for 47 IPOs in the GCC region¹².

The aggregated amount of capital that was left on the table in the Saudi market is approximately US\$43 billion. Loughran and Ritter (2001, 2004) report that the underpricing of IPOs in the U.S. was the highest during the internet bubble, which had an average of 65% and an aggregate amount of US\$66 billion left on the table. Nineteen IPOs in their sample were underpriced by more than 300%. Ritter (2011) reports that IPOs in the Chinese market were extremely underpriced by more than 200%, on average. Engelen and Essen (2010) find that the level of underpricing is higher in countries with weak institutional legal frameworks. Our evidence from Saudi IPOs is consistent with this view.

In Panel B, we report underpricing by using the market listing day closing price. The results are slightly different and lower, and they show an adjusted underpricing of 253%. It is clear that the underpricing that results from using the opening price is higher than from using the closing price. Although the difference is not statistically significant, the variations under all statistical measures are economically and substantially large. Fifty-one IPOs of the 76 (approximately 67%) follow this pattern, and 8 IPOs close at the same price with which they opened.

We also differentiate between the underpricing of large and small IPOs and of old and new IPOs. We find that, on average, established, old IPOs are underpriced by 63%, whereas new

¹² The GCC is the Gulf Cooperation Council, which assembles Saudi Arabia, Kuwait, Qatar, Bahrain, United Arab Emirates, and Oman.

IPOs are underpriced by 423.5%. Similarly, large IPOs have an adjusted return of 149%, whereas small IPOs have a return of 357%. Although the measures of size and age are consistent with Beatty and Ritter's (1986) explanation of the ex-ante uncertainty, our interpretation of this finding is different. We believe that because large IPOs have a potential for a greater supply of shares and liquidity in the post listing market, these IPOs tend to be less underpriced. In other words, the number of floating shares for large IPOs is larger than for small IPOs. Likewise, old IPOs were initially offered at higher prices than new IPOs, and thus, we anticipated that any variation observed in this study would follow the laws of supply and demand. In Appendix A2, we list all IPOs by their dates of issuance, and we report the gross proceeds for each IPO with their raw and adjusted-underpricing by using the closing price.

Table 3
Underpricing for 76 Saudi Initial Public Offerings from 2003 to 2010

The sample is 76 Saudi IPOs went public between 2003 and 2010. The raw underpricing is calculated by taking the difference between the IPO market price on the listing day and the IPO offer price and divided by the offer price as in Eq.1. The adjusted return is the IPO raw return adjusted with the Saudi market “TASI” return and for the transaction cost as in Eq.2. Panel A shows various statistics for the full sample of 76 Saudi IPOs using the market listing day opening price. Panel B shows various statistics using the market listing day closing price. *t*-Statistic that the mean return equals zero.

Panel A: Underpricing using Opening Price								
Underpricing	Mean	25 th percentile	Median	75 th percentile	Maximum	Minimum	Std.dev	<i>t</i> -Statistic
Raw return %	296.8	42	133.6	395.6	1400	-7.3	347	(7.5)***
Adjusted return %	284.96	33.1	122.7	378.44	1374.39	-101.46	343	(7.1)***
Panel B: Underpricing using Closing Price								
Underpricing	Mean	25 th percentile	Median	75 th percentile	Maximum	Minimum	Std.dev	<i>t</i> -Statistic
Raw return %	264.5	35.2	118	336	1770	-17.6	347	(6.5)***
Adjusted return %	252.64	33.26	116.46	328.53	1737.56	-80.63	343.3	(6.3)***

*** Significant at the 1 % level.

5.2 Initial supply and demand curves

Table 4 reports the 2SLS estimates of the initial supply and demand for IPO shares. At the opening price, the supply curve is above the demand curve and positively sloped. This finding indicates that the pre-IPO excess demand converts immediately into excess supply mainly because of the flippers who rush to sell their shares. Consequently, the demand will decrease in response to the sharp price increase. Previous scholars have always assumed that the demand curve is negatively sloped in response to the IPO price jump (Ritter and Welch, 2002; Fische, 2002). In this paper, we empirically prove this assumption.

Examining the supply side of the system, we find that all of the variables are giving the expected signs to a significant degree. The number of subscribers (flippers) and the quantity of shares that each subscriber holds before the exchange begins (the allocation) are both negatively associated with the opening price. This result is expected according to the economic laws of supply and demand (i.e., large supply leads to a low price and low supply leads to a high price). If an IPO has a large number of flippers and those flippers hold large quantities of shares, the expected opening price should be low. In contrast, the reserve price is positively associated with the opening price. As hypothesized, the reserve price of Benveniste and Spindt (1989) restricts the supply side because of the compensation that the shareholders require. Therefore, the higher the reserve price, the higher the expected opening price should be.

With respect to the demand side of the system, we find that the capital refunded to the disappointed shareholders with no allocation in the pre-listing period is positively linked with the opening price. The larger this pool of capital was, the higher the opening price would be. Market sentiment is unexpectedly negatively associated with the opening price. This indicates that if the market was a bull market between the closure of the subscription period and the admission day, the opening price would be lower. As we suggested before, sellers are expected to behave in the same manner (continue to flip), regardless of the market situation, whereas the buyers might be influenced by the market sentiment. Our result suggests that those IPOs went public during a bull market have achieved a lower opening price than those went public during a bear market. We also observe that the opening price is positively associated with the speculation variable, which indicates as anticipated that the speculative IPOs showed higher opening prices than other IPOs. Finally, the delay to listing variable suggests that the IPOs that took longer waiting period to be admitted showed higher opening

prices. As indicated before, while this result is in line with Beatty and Ritter's (1986) ex-anti uncertainty explanation, our interpretation of this is different. We link this to the fact that under-establishment IPOs were priced initially lower than old IPOs. Consequently they show larger underpricing. Thus, the delay variable reflects the variation between the two types of IPOs in that new IPOs have higher opening price than old IPOs.

The system has strong explanatory power for both equations of supply and demand at 52% and 72%, respectively. Similar results (not reported) are obtained using various combinations of the model. We also use (results are not reported) the natural logarithm of the difference between the opening price and the offer price as the dependent variable, instead of the opening price alone and obtain similar results and association between variables.

Table 4
2SLS Simultaneous Equations of IPO Supply and Demand

The sample consists of 76 Saudi IPOs issued from 2003 to 2010. The table reports the estimates of the supply and demand for the IPO using the opening price adjustment. We use the following simultaneous equations:

Supply:

$$\text{Log (P)} = \beta_1 + \beta_2 \text{Log (Q)} + \beta_3 \text{Log(NOS)} + \beta_4 \text{Log(RES)} + \beta_5 \text{ALLO} + \varepsilon_s$$

Demand:

$$\text{Log (P)} = \alpha_1 + \alpha_2 \text{Log(Q)} + \alpha_3 \text{Log (Excess)} + \alpha_4 \text{MS} + \alpha_5 \text{SPE} + \alpha_6 \text{Delay} + \varepsilon_d$$

The dependent variables are the natural logarithm of the opening price and the quantity of excess demand in the pre-listing period. The supply side of the system has three independent variables: the natural logarithm of the number of subscribers, the number of shares held by each subscriber (allocation) and the reserve price, which is the IPO offering price plus the transaction cost. In the demand side of the system, the independent variables are the natural logarithm of the excess capital, which is the capital with no allocation that has been fully refunded to the subscribers in the pre-listing period; the market sentiment dummy variable, which takes on a value of 1 if the market is a bull market from the end of the subscription period to the listing day and 0 if it is a bear market; speculation, which measures how speculative the IPO is by scaling the total turnover of the IPO shares on the listing day by the IPO gross proceeds; and the delay to listing, which is the number of calendar days between the closure of the subscription period and the admission to the stock exchange.

2SLS estimates for the supply of IPO shares			
Variable	Coefficient	<i>t</i> -Stat	<i>p</i> -Value
Intercept	(1.44)**	2.07	0.04
Quantity	0.14	1.45	0.15
Number of Subscribers	(-0.26)**	-2.37	0.01
Allocation	(-0.01)**	-2.59	0.01
Reserve Price	(0.78)***	8.26	0.00
<i>f</i> -Stat	(21.43)***		
Adjusted R ²	52%		
2SLS estimates for the demand of IPO shares			
Variable	Coefficient	<i>t</i> -Stat	<i>p</i> -Value
Intercept	-0.29	-0.53	0.59
Quantity	(-1.01)***	-12.12	0.00
Excess capital	(1.05)***	11.67	0.00
Market sentiment	(-0.25)***	-4.49	0.00
Speculation	(0.01)***	3.09	0.00
Delay	(0.01)***	5.52	0.00
<i>f</i> -Stat	(38)***		
Adjusted R ²	72%		

*, **, *** Significant at the 10, 5 and 1 % levels, respectively.

5.3 Supply and demand curves using the closing price

In Table 5, we report the 2SLS estimates of the supply and demand equations using the closing price adjustment with the IPO volume on the listing day. The intercept of the supply equation in model 1 is 5.4 (significant at the 1% level), which is higher than the demand equation intercept of 0.76. This finding suggests that the supply curve is above the demand curve. The intercepts for both equations are different from the ones we observed while using the opening price, which indicates that both curves shift during the trading hours. All of the other models from 1 to 5 suggest the same observation; the supply curve is above the demand curve. Furthermore, when we swap the price and quantity in models 4 and 5 by moving the volume to the left-hand side of the equations, we obtain similar results. In model 5, the supply curve is above the demand curve ($6.3 > 2$).

The slopes of both the supply and demand curves are significantly negative, with the supply curve being steeper than the demand curve. For example, in the first model, the slope of the supply is -0.56, whereas the slope of the demand is -0.72. The variation is much larger in the other models, except for model 2 which shows positive supply curve, but insignificant. This finding is consistent with our conjecture that the supply decreases at a quicker and greater rate than the demand. We interpret this result by conjecturing that the flippers are exiting the market, but that other interested parties are entering (perhaps speculators exploiting the freely fluctuating price of the listing day). Moreover, this finding suggests that, although the demand is decreasing, it is still strong enough to resist the price pressure caused by the sellers. If this is not true, then we expect a sharp decrease in the price, as the IPOs may become overpriced and the IPO's market price should fall below the offer price. This is not the case in our hot IPOs in which the average low price of the listing day is higher than the average initial IPO offer price.

We now investigate the exogenous variables and their individual impacts on and interactions with the supply and demand. We notice that the number of subscribers and the allocation are both insignificant. However, as expected, they both have negative impacts on the closing price. In models 4 and 5, when we replace the left-hand side of the system with the volume, we find that the allocation is significantly positive, which suggests that when the allocation is large, the quantity supplied in the market (volume) is large. In turn, the large quantity supplied would negatively affect the price. We need to keep in mind that this is a simultaneous one, in which both the price and quantity variables affect each other. Therefore,

we can understand the parts that we could not understand in one side by using the other side. The reserve price is positive, which suggests that a higher (offering price and transaction cost) require a higher closing price. When we examine their impact on the volume in models 4 and 5, the signs became negative as we expected because of the compensation required on these expensive IPOs.

In the demand side of the system, the excess capital returned to investors is positively linked to both the closing price and volume variables. A large amount of capital refunded to subscribers increases the demand for IPO shares at market. Hence, the closing price should be higher. Additionally, the volume and the power of exchange will be larger when the refunded capital is large. In the same vein, the speculation variable suggests that those speculative IPOs have achieved higher closing prices and have enjoyed larger volumes. The market sentiment provides negative, but insignificant signs in all of the models. Finally, the delay to listing is positive, which indicates that under-establishment IPOs have higher closing prices. The system can be confusing when we examine the supply and the demand and how they interact with each other. To better understand our structural system, we explore the reduced form estimates of the system in the next section.

Table 5
2SLS Simultaneous Equations of IPO Supply and Demand

The sample is composed of 76 Saudi IPOs issued from 2003 to 2010. The table reports the estimates of the supply and demand for the IPO using the last adjustment of the closing price and the volume of the listing day. The dependent variables are the natural logarithm of the difference between the closing price and the offer price and the IPO volume on the listing day. The supply side of the system has three independent variables: the natural logarithm of the number of subscribers; the allocation, which is the number of shares held by each subscriber; and the reserve price, which is the IPO offer price plus the transaction cost. In the demand side of the system, the independent variables are the natural logarithm of the excess capital, which is the capital with no allocation that has been fully refunded to the subscribers in the pre-listing period; the market sentiment; which is a dummy variable that takes on a value of 1 if the market is a bull market from the closure of the subscription period to the listing day and 0 if it is a bear market; the speculation, which measures how speculative the IPO is by scaling the total turnover of the IPO shares on the listing day by the IPO gross proceeds; and the delay, which is the number of calendar days between the end of the subscription period and the listing day. Models 1, 2 and 3 are estimated as in Eq. 7 and 8. In models 4 and 5, the volume for the same system transformed into the left-hand side and the price transformed into the right-hand side.

2SLS Estimates for Supply of IPO Shares						
Model	1	2	3		4	5
Variable				Variable		
Intercept	5.35	2.06	3.46	Intercept	6.27	6.27
<i>t</i> -Stat	(2.9)***	0.06	(2.15)**	<i>t</i> -Stat	(4.93)***	(4.93)***
Quantity	-0.56	0.06	-0.38	Price	-0.43	-0.43
<i>t</i> -Stat	(-2.23)***	0.21	(-1.89)*	<i>t</i> -Stat	(-2.18)**	(-2.18)**
Number of				Number of		
Subscribers	-0.09	-0.33		Subscribers	0.23	0.23
<i>t</i> -Stat	-0.42	-1.24		<i>t</i> -Stat	1.15	1.15
Allocation	0.01	-0.01		Allocation	0.02	0.02
<i>t</i> -Stat	0.75	-0.96		<i>t</i> -Stat	(4.67)***	(4.67)***
Reserve Price	0.41	0.70	0.46	Reserve Price	-0.17	-0.17
<i>t</i> -Stat	(1.88)*	(2.70)***	(2.22)**	<i>t</i> -Stat	-0.79	-0.79
<i>f</i> -Stat	(6.31)***	(4.34)***	(9.07)***	<i>f</i> -Stat	(15.5)***	(15.52)***
Adjusted-R ²	25%	13%	29%	Adjusted-R ²	47%	47%

2SLS Estimates for Demand of IPO Shares						
Model	1	2	3		4	5
Variable				Variable		
Intercept	0.76	1.11	3.26	Intercept	1.66	2
<i>t</i> -Stat	0.49	0.80	(2.6)**	<i>t</i> -Stat	0.95	1.14
Quantity	-0.72	-0.63	-0.81	Price	-1.08	-1.3
<i>t</i> -Stat	(-4.92)***	(-4.10)***	(-3.34)***	<i>t</i> -Stat	(-5.12)***	(-4.38)***
Excess capital	0.60	0.51	0.32	Excess capital	0.73	0.72
<i>t</i> -Stat	(3.81)***	(3.35)***	(2.21)**	<i>t</i> -Stat	(3.78)***	(3.67)***
Market sentiment	-0.04	-0.08	0.02	Market sentiment	0.05	-0.02
<i>t</i> -Stat	-0.25	-0.49	0.12	<i>t</i> -Stat	0.26	-0.11
Speculation	0.04	0.03		Speculation	0.04	0.05
<i>t</i> -Stat	(2.96)***	(2.98)***		<i>t</i> -Stat	(3.16)***	(3.07)***
Delay	0.00			Delay	0	
<i>t</i> -Stat	1.05			<i>t</i> -Stat	0.71	
<i>f</i> -Stat	(7.52)***	(6.57)***	(5.36)***	<i>f</i> -Stat	(8.26)***	(7.52)***
Adjusted-R ²	31%	33%	15%	Adjusted-R ²	26%	-6%

*, **, *** Significant at the 10, 5 and 1% respectively.

5.4 Reduced form estimates

In Table 6, we report the impacts of the exogenous variables on the quantity exchanged during the listing day (volume) and the closing price (P). Looking first at the volume in Panel A, we find that all of the coefficients provide the expected signs of the relationship, with the exception of the refunded capital, which is insignificant. The market sentiment is positively significant, indicating that the quantity exchanged is larger during a bull market. Of course, when the market is doing well, the match between buyers and sellers becomes stronger, which increase the volume. Additionally, speculative IPOs have stronger trading volumes than the other IPOs. The shares of some IPOs in the sample have been exchanged six times more than the original number of shares offered by the IPO, suggests that the stock is highly liquid. The average liquidity for the entire sample (the volume scaled by the outstanding shares) is 1.6. This result confirms our conjecture that new-comers participate in the post-listing period.

The number of subscribers (flippers) and the quantity of shares that they hold (allocation) both positively affect the trading volume, as one would expect according to the economic laws of supply and demand. An IPO with 100 potential suppliers in the post-listing period is different from one with 1000 potential suppliers. Moreover, the reserve price is negatively associated with the trading volume. We proposed that the shares of expensive IPOs are more difficult to trade because of the higher compensation that their shareholders require. The last variable is the delay, which indicates that IPOs that took longer time to be admitted (the under-establishment IPOs) have experienced a lower trading volume because they are usually smaller in size. The model has a strong explanatory power of 53%.

Now, we examine the impact of the same exogenous variables on the closing price. Excess capital is insignificant, but provides a positive sign, as expected. Thus, the larger the amount of refunded capital, the higher the expected closing price will be on the listing day. The market sentiment is significant and switches from positive (with the volume (Panel A)) to negative (with the closing price (Panel B)). Recall that the market sentiment positively affects the volume. In turn, this effect should lower the closing price. Now, after we started looking at the reduced forms, we are able make sense of the association between the variables in our simultaneous system.

Furthermore, we observe that the number of subscribers and the allocation both switch signs. These two variables positively affect the quantity exchanged (the volume) because of the existence of a larger number of suppliers and the quantity to be supplied. Thus, we expect their impact on the price to be negative. The larger the number of market participants and the quantity of shares held by each supplier, the lower the market price should be.

Moreover, the reserve price is significantly positive and switches sign, which indicates that the higher the IPO offer price and the transaction cost are, the higher the required market price will be. This implication is related to the premium that the subscribers must be paid for their shares to start selling in the post-listing period. This finding suggests that no matter what the offering price is, as long as there is excess demand in the pre-listing period and there are interested parties on the listing day, the post-listing price will be higher. Additionally, speculative IPOs and IPOs with longer times to listing (the under-establishment IPOs) have significantly higher closing prices. The model has a strong explanatory power of 39%.

Table 6
Cross-Sectional OLS Reduced Form Estimates of the Supply and Demand System

The sample is composed of 76 Saudi IPOs issued from 2003 to 2010. The table reports the reduced form estimates of the supply and demand system using the closing price adjustment. The reduced form equations express the endogenous variables price and quantity, in terms of the exogenous variables, the intercept and the error term as follows:

$$\text{Log (Q)} = \pi_{11} + \pi_{21} \text{Log (Excess)} + \pi_{31} \text{MS} + \pi_{41} \text{SPE} + \pi_{51} \text{Log(NOS)} \\ + \pi_{61} \text{Log (RES)} + \pi_{71} \text{ALLO} + \pi_{81} \text{Delay} + \nu_1$$

$$\text{Log (P)} = \pi_{12} + \pi_{22} \text{Log (Excess)} + \pi_{32} \text{MS} + \pi_{42} \text{SPE} + \pi_{52} \text{Log(NOS)} \\ + \pi_{62} \text{Log (RES)} + \pi_{72} \text{ALLO} + \pi_{82} \text{Delay} + \nu_2$$

Panel A: Reduced form for quantity of shares

Variable	Coefficient	<i>t</i> -Stat	<i>p</i> -Value
Intercept	(5.53)***	3.95	0.00
Excess Capital	-0.01	-0.04	0.88
Market Sentiment	(0.31)**	2.61	0.01
Speculation	(0.2)**	2.46	0.01
Number of Subscribers	(0.34)*	1.72	0.08
Reserve	(-0.51)**	-2.39	0.01
Allocation	(0.02)***	5.34	0.00
Delay	(-0.01)***	-2.91	0.00
<i>f</i> -Stat	(13.23)***		
Adj- R ²	53%		

Panel B: Reduced form for price of shares

Variable	Coefficient	<i>t</i> -Stat	<i>p</i> -Value
Intercept	-2.18	-1.34	0.19
Excess Capital	0.28	1.42	0.16
Market Sentiment	(-0.23)*	-1.73	0.08
Speculation	(0.02)**	1.87	0.06
Number of Subscribers	-1.17	-0.65	0.51
Reserve	(1.11)***	4.15	0.00
Allocation	-0.00	-0.86	0.39
Delay	(0.01)***	4.15	0.00
<i>f</i> -Stat	(7.15)***		
Adj-R ²	39%		

*, **, *** Significant at the 10, 5 and 1% levels, respectively.

6. Conclusion and future research

This paper examines the underpricing phenomenon under a supply and demand framework using 76 Saudi IPOs issued from 2003 to 2010. The IPOs in this sample are significantly underpriced, with an adjusted-underpricing of 253%. This large figure mainly results from the unique institutional framework adopted by the market regulators. The institutional framework drives severe demand during the subscription period and aggressive speculation during the listing day.

Given this background, overwhelmingly the main thrust of the paper was to demonstrate that it is feasible to model first-day trading of IPO shares in a demand and supply model, and given current data availability to estimate those equations. The focus, therefore, is not so much on the results of the estimation but to demonstrate the feasibility of such estimation. In this context it is important to temper any conclusions that can be drawn from the estimation of the model with the realisation that the modelling is made possible because of the special nature of the Saudi Arabian data. In interpreting the estimates it is assumed that the special nature of the data allows the estimation but does not create results that are entirely specific to the Saudi Arabian market. The major characteristic of the data that allows the modelling and estimation is argued to be relatively innocuous in this respect – that all subscribers have to receive shares and in equal proportions. This yields enormous information about demand (especially before market trading) and supply (during first day market trading).

Nonetheless, the results of the first system indicate that the first adjustment in the IPO market occurs at the opening price, where the pre-IPO excess demand converts instantaneously into excess supply. The implications of this are not restricted to Saudi Arabia but are relevant to understanding the underpricing phenomenon worldwide. Quite possibly this immediate conversion always occur if the IPOs are ‘hot’ and show extreme price jumps. Otherwise, the price would continue to rise and never approach equilibrium. As the market absorbs the opening price information, the price rises, falls or fluctuates under the forces of supply and demand, moving between the high and the low of the listing day. The results indicate that the demand curve is negatively sloped, as expected but that the supply curve is also negatively sloped. The supply remains above the demand curve and is much steeper as well. This finding suggests that the

supply decreases at a greater and at a faster rate than the demand mainly because the flippers are exiting the market.

The findings in this paper have other implications, including underpricing being primarily related to the supply and demand. This implication suggests that everything proposed in the literature has a direct or indirect link to the supply and demand. Therefore, underpricing is not a question of the variation in the magnitude of underpricing among or the explanatory power of particular theories regarding the underpricing observed in particular markets. Rather, the question is how the underpricing phenomenon is managed and governed in a particular market. Given that underpricing is a global phenomenon, the reasons causing it must be common as well, regardless of the magnitude. Underpricing primarily depends on how regulatory body controls the supply and demand of IPO shares. This process begins in the subscription period, continues until the listing day, and may even last afterwards for a longer period of time.

In the post-listing market, regulators also greatly influence the supply and demand. In the Saudi market given the huge supply expected on the listing day, the regulator successfully creates market demand on the listing day by giving the IPOs the ability to freely fluctuate their prices. This unique feature attracts speculation. Therefore, the variations in the magnitude of underpricing are related to the variations in regulations among countries. Moreover, as the underpricing of IPOs changes over time (even within the same country), this variation will be linked to the change in the regulations and the change in the investors' behaviors over time. In turn, these changes will affect the supply and demand and as a consequence the underpricing. Thus, underpricing is higher during the hot years and decreases in other periods.

Future research will see demand and supply models of a more sophisticated form than is currently possible. One reason will almost certainly be that more useful data will become available but, more importantly there will be new ways of using the data that are currently available. Such models also contain the possibility of employing data across several jurisdictions, the principles of demand and supply being universal.

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