

# **A Joint Experimental Analysis of the Dutch Auction, Book Building and Competitive IPO Pricing Methods**

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## **Abstract**

We examine the differences of three IPO pricing methods jointly: book building, employed worldwide, the Dutch clock auction, routinely cited as an alternative to book building, and the competitive IPO, a recent innovation, tested in a few offers in Europe. We employ experiments with South American subjects who are bank professionals or business students. The main result is the characterization of book building as a pricing method that mostly benefits the investor at the expense of the issuer and the selling shareholders. The competitive IPO, on the other hand, was the method that gave the best results for the issuer and selling shareholders, at the expense of investors. The competitive IPO, however, showed more dispersion of initial returns and evidence of the "bait-and-switch" strategy, which may be disguised in book building offers but is clearly exposed in the competitive IPO. Issuers could benefit from regulation or private contracting that favor the competitive IPO if its procedure discourages "baiting-and-switching". Moving towards the competitive IPO may not be in the interest of underwriters and their clients.

Keywords: auction, book building, experiment, competitive IPO

EFM Classification Codes: 230, 320, 330

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## **Abstract**

We examine the differences of three IPO pricing methods jointly: book building, employed worldwide, the Dutch clock auction, routinely cited as an alternative to book building, and the competitive IPO, a recent innovation, tested in a few offers in Europe. We employ experiments with South American subjects who are bank professionals or business students. The main result is the characterization of book building as a pricing method that mostly benefits the investor at the expense of the issuer and the selling shareholders. The competitive IPO, on the other hand, was the method that gave the best results for the issuer and selling shareholders, at the expense of investors. The competitive IPO, however, showed more dispersion of initial returns and evidence of the "bait-and-switch" strategy, which may be disguised in book building offers but is clearly exposed in the competitive IPO. Issuers could benefit from regulation or private contracting that favor the competitive IPO if its procedure discourages "baiting-and-switching". Moving towards the competitive IPO may not be in the interest of underwriters and their clients.

## **1. Introduction**

There is a growing interest in the experimental analysis of the pricing methods for initial public offerings of equity (IPOs). Biais et al. (2002), Trauten and Langer (2008), Zhang (2006, 2009) and Bonini and Voloshyna (2009) present theoretical and empirical experimental analyses about the usual methods and propose alternatives to mitigate the problems of book building, the most common method. We test three pricing methods jointly under the same simulated environment: book building, the Dutch clock auction, and the competitive IPO, a relatively new method. The competitive IPO is a two stage decision process that separates the decision to hire an advising bank to structure the offer from that of

hiring another bank to sell the offer by means of a competitive bid. The competitive IPO aims to avoid the "bait-and-switch" problem in which an underwriter may pressure for a lower offer price after it is hired by the issuers. Bonini and Voloshyna (2009) perform a similar analysis but they compare the new Ausubel (2004) auction method to more conventional auctions and book building to the competitive IPO method separately. We compare three methods jointly, employ the same environment to analyze all the three methods, employ more subjects per method and include bank professionals as subjects. Trauten and Langer (2008) and Zhang (2006, 2009) compare the fixed price method to an auction.

Setting the price is one of the key issues in an IPO because there is no price history and often no clear price reference. The usual methods to set the price in many countries are the book building or an auction. Around the world, financial institutions, possibly investment banks, carry out the pricing process in a competitive underwriting market where each institution obviously keeps the information about the intentions of their customers private. Thus, it is very difficult to conduct natural experimental studies with real data, unless local laws mandate that some of this information is disclosed or non-replicable case studies are carried out using private and non-identified data.

With no access to the actual pricing data and process, the alternative is to simulate it. We investigate the implications of different IPO pricing methods by means of controlled experiments in a simulated stock-offering environment, taking a closer look at the return levels, dispersion and the unveiling of information. Smith (1976) stressed the robustness and the importance of experimental techniques for the understanding of economic phenomena as well as a primary tool to test and explore empirical predictions to be verified in the real world.

Benveniste and Spindt (1989) proposed the environment of information generation that supports our experiments where investment banks collect information about the investment intentions of their clients, define the offering price based upon it, and allocate the available

shares. The disclosure of information by informed investors reduces information asymmetry in this model.

The different sources of revenue for investment banks lead to possible conflicts of interest (Michaely and Womack, 1999; Ljungqvist et al., 2006; Reuter, 2006). For example, the lead underwriter has incentives to raise the offer price because its fees are tied to the total offer amount. In contrast, the same underwriter allocates shares to its prime clients and may reduce the offer price for their benefit, increasing their chance of greater gains in the secondary market.

The lead underwriter controls the entire allocation process in the book building. It receives the price and quantity bids, determines the price and discretionarily allocates the offer among investors. Cornelli and Goldreich (2001) examined stock offerings in twenty different countries and found evidence that the lead underwriter allocates more shares to investors whose bids contain more information (quantity, price, different levels of quantity and price). The pricing process should be better when investors provide more information. On the other hand, Jenkinson and Jones (2004) found no relationship between the amount of information in the bids, the number of shares allocated to the investor, and the first day returns using European IPO data. They also note that long-term investors get more of the new shares than the so-called flippers.

Dimovski and Brooks (2004) doubt the importance of the pricing and trading role of underwriters because their evidence suggest that their participation does not contribute to price discovery in Australian IPOs between 1994 and 1999. IPOs with no participation of financial intermediaries exhibited lower first-day initial returns. Lowry and Schwert (2004) reach similar conclusions and suggest that financial intermediaries do not aggregate either public or private information to the offer price.

The next section reviews IPO pricing methods. Section 3 describes the experimental design and the procedures of each pricing mechanism used in this study. Section 4 contains a discussion of the results and section 5 concludes.

## **2. Pricing methods**

Wilhelm (2005) maintains that keeping their reputation is one of the reasons that may prevent abuses by the underwriters conducting a book building in IPO valuations. Book building overcame technological problems by bringing investors together. However, the lead underwriter still exercises its discretion. Wilhelm (2005) supports book building and is skeptical of alternative methods because there are no strong precedents that justify its replacement.

Benveniste and Wilhelm (1997), Ljungqvist and Wilhelm (2002) and Sherman (2000, 2005) stress that a key feature of book building is the ability of underwriters to reward investors that reveal their opinion about the true value of the company. Investors that include more information in their bid, such as quantity and price, receive greater allocations (Jagannathan and Sherman, 2005). There may be more information production and more rewards to institutional investors with book building. Cornelli and Goldreich (2003) and Ljungqvist (2007) sustain that book building is the best pricing method for IPOs because it is a more effective information discovery procedure.

Benveniste and Busaba (1997) suggested that book building results in a better price discovery than fixed price offers, even though it may also be associated to greater price dispersion. Their findings are consistent with those of Benveniste and Wilhelm (1990) in different regulatory environments. Busaba and Chang (2010), in contrast, do not support the superiority of book building over fixed pricing in regards to the trading of the new shares in the secondary market. Book building may significantly influence the behavior of the new

stock prices in the secondary market and the compensation of lead underwriters (Bartling and Park, 2010).

The disadvantages of book building led many authors to advocate its replacement by one of the existing kinds of auction (Spatt and Srivastava, 1991; Degeorge et al., 2008; Lowry et al., 2010). The auction was supported by Derrien and Womack (2003) and Derrien (2005), who compared it to the fixed price and book building offer-pricing procedures in France. Zhang (2009) sustains that the uniform price auction method is superior to the fixed price auction. There is also evidence that a clock auction is more efficient than a sealed bid auction (Sherstyuk, 2009). Wilson (1979) asserts that the auction of fractions of assets (stocks, for example) presents the problem of the potential collusion between investors and the consequent undervaluation of the asset, leading to higher initial returns. Biais and Faugeron-Crouzet (2002) found that pricing is better when the auction technique resembles the book building.

The uniform price method is the most common in auctions of multiple items. Each buyer states the price they wish to pay for a certain quantity of the goods under auction. Once all the bids are placed, the auctioneer allocates to the higher bidder first, with any remaining goods going to the second highest bidder and so on until there are no goods. The uniform price paid by all bidders is the lowest winning bid.

Ausubel (2004) proposed an alternative methodology for auctions that could be employed in stock offerings. The auctioneer announces a price and bidders indicate the quantities they are willing to buy at such price. The auctioneer then announces successively higher prices until the quantity of goods offered clears. Bonini and Voloshyna (2009) compared the Ausubel (2004) auction to conventional auctions and concluded that it conducted to less undervaluation than in the uniform clock auction.

Wilhelm (2005), conversely, rejected many of the book building criticisms and listed a series of problems with the other pricing methods, considering, in particular, the technological possibilities for their implementation. Book building may not be the ideal pricing method but it solved the problem of aligning bids in various locations around the world and provided a channel for the flow of information among potential investors.

Ljungqvist et al. (2003) assert that the benefits of book building are even more salient when it is carried out by US banks or when offers are sold to US investors. Jenkinson and Jones (2009b), however, conduct a survey of institutional investors regarding new stock offerings and doubt the ability to produce information of the method. Jagannathan and Sherman (2005, 2006) concede that auctions were abandoned in many markets, recognize the advantages of book building and discuss how to reduce some of its flaws, especially those relating to its lack of transparency. They note that the main problem of the auction is that its sole criterion for allocation is the price. Trauten and Langer (2008) employ experiments and sustain that there is room for the underwriters discretionary power in the allocation of IPO shares.

There is a growing interest in a new pricing method called competitive IPO that derives from book building. Its modifications reduce the problems stemming from potential conflicts of interest of the lead underwriters. The offer structuring and selling tasks are split between different banks in a competitive IPO. Jenkinson and Jones (2009a) describe this innovative process, which was used in a few offers in Belgium, France, Greece, and Britain. They argue that one of its key advantages is that it is not a major departure from book building. Book building is the dominant method around the world and the auction is the usual alternative method employed to reduce the discretionary power of banks. Yet, the adoption of auctions significantly changes the way offers are currently carried out. The competitive IPO retains

many of the qualities of book building and promotes small changes to control potential conflicts of interest.

The competitive IPO changes the incentive structure of underwriters. The first step is the selection of a bank to be the advisor to the issuer who will conduct its formal procedures. The advisory bank selects the bank that will coordinate the selling effort after the road show and prior to the pricing date. Banks that compete to sell the offer submit bids for the proposed preliminary price range of the offer as in the traditional book building. The difference is that the choice of the selling bank is made later in the process. Additionally, the compensation of the selling bank depends on the pricing of the offer, which may not be less than a value related to the preliminary range proposed. This procedure reduces the incentives that banks may have to bait-and-switch, competing for the mandate to sell by offering high price ranges and, after hired, setting lower prices to potentially benefit investors. In the traditional book building, the bank proposes a price to the issuer, but during the course of the offering, and on the pricing day, may reduce this value substantially.

The issuer has the power to hire whichever bank they like with book building, however, once selected, the bank will have a great deal of influence over the offering, given the high costs the issuer would incur if they decide to replace the bank. In a competitive IPO, the issuer may establish that there will be no fee if the price is set below a certain level or the fee may decrease proportionally to the price.

The competitive IPO received attention because of its potentially better price discovery may reduce the losses of issuers and of selling shareholders. However, Sherman and Titman (2002) warn that greater offer price accuracy leads to greater initial returns due to the larger number of investors needed. The track record of the competitive IPO is fairly recent. The debate over which method is better to set prices in initial public offerings depends on what

one considers to be good or bad. Greater underpricing is good to short term investors and bad to issuers and vice versa.

### **3. Experiment design**

Bonini and Voloshyna (2009), to the best of our knowledge, have been the only authors to employ experiments to analyze the competitive IPO so far. Besides the subjects, which are more numerous and include professionals, the main change we introduce relative to their work is the way we perform the comparisons of the pricing methods. They compared book building to the competitive IPO in a setting and the clock auction to the Ausubel auction in a different setting but did not perform a joint analysis of these methods.

We compared the uniform clock auction or Dutch auction, recently used in the Google IPO, book building and the competitive IPO in the same environment and with parameters from a single structure, enabling us to compare them jointly. All the experiment sessions were designed and conducted with the Zurich Toolbox for Readymade Economic Experiments (Fischbacher, 2007). The experiment sessions that produced our data were preceded by a series of pilot tests and sessions. The beginning of each session was preceded by three rounds of trial IPOs that allowed the participants practice the rules of the experiment. Data from these trial rounds were excluded from the analysis. Each session was made up of twenty-four rounds. Each round represents an IPO.

Participants in the experiment were selected from undergraduate students and graduate business students in a large public South American university whose full time MBA is ranked in the top one hundred in the world by The Financial Times newspaper and among employees of a large financial conglomerate ranked among the top three in Latin America that also acts as an IPO underwriter. We believe that we need to disclose that subjects are from South America but we do not make any claims that South American subjects would perform differently or similarly to those elsewhere. All subjects had previous exposure to financial

concepts. Each session included between nine and eleven participants. There was a total of nine sessions in the whole experiment, each comprising twenty-four rounds (IPOs) and thus we collected simulated data for 216 (nine times twenty-four) IPOs, seventy-two (three sessions) for each of the simulated pricing methods (Dutch auction, book building and competitive IPO). Each session lasted sixty to eighty minutes. Eighty-seven different subjects participated in the experiment and each one participated in only one session, no matter which pricing method was simulated.

Table 1 provides some details about the subjects and their performance. Fifty-six percent of the participants were professionals and only sixteen percent were females. The experience of professionals in years was three times longer than those of students and they were ten years older than students on average. Eighty-four percent declared some previous exposure to the stock market. We tested if the performance of professionals and students were different for each pricing method and found no statistically significant results. These results are not reported in Table 1 but are available from the authors.

[TABLE 1 HERE]

We follow the informational structure of Kagel and Levin (1986, 1999). Assume that shares have a true value  $\mathbf{V}$ , which is the closing market price on the first trading day, a random variable drawn from a uniform distribution in the  $[10, 110]$  range before each round. Participants are not aware of the value of  $\mathbf{V}$ . An adjustment factor  $\mathbf{a}$  in  $[0.8, 1.2]$  is then picked randomly. The value  $\mathbf{mid} = \mathbf{V} \times \mathbf{a}$  is the reference to build the price range with upper limit within  $[0.95 \times \mathbf{mid}, 1.3 \times \mathbf{mid}]$  and lower limit within  $[0.70 \times \mathbf{mid}, 0.95 \times \mathbf{mid}]$ , randomly drawn. The upper and lower limits are drawn from these ranges randomly. These ranges are used in the clock auction and in the book building sessions. Each participant  $i$  receives a private signal  $S_i$  about the value  $\mathbf{V}$ . The values of  $S_i$  for each participant are extracted independently from a uniform distribution defined in the  $[\mathbf{V}-\mathbf{e}, \mathbf{V}+\mathbf{e}]$  range. This

signal represents the private valuation each investor receives about the investment decision from their advisor and simulates both pessimistic and optimistic outlooks about the issue. The parameter  $e$  replicates the inaccuracy of the assessment that each investor receives and is also drawn randomly. Participants know only their own signals.

The experiment reflects two major characteristics of IPOs: high uncertainty and the establishment of a community of experienced investors. The group of investors (participants) in each session is the same, forming a community, as it happens in the actual frequent interactions between banks and institutional investors. These investors interact continuously with their banks through their orders. Participants are divided into groups of investors in the case of the competitive IPO because it is important to isolate the community of clients of the same bank in this procedure. We offer more details ahead.

A portion of the participants in the experiment had little financial market expertise but all received a financial reward as an incentive. Each subject received at least \$5, enough to recruit participants, and could earn, depending on their performance, as much as \$25. We follow Smith (1976) on the importance of control in experiments through the setting of a compensation system for the participants. The actions of each subject in the experiment will hopefully be motivated by the prospect of actual monetary gain (Smith and Walker, 1993). Participants do not compete for points or just for being the "winners". Their individual performance is reflected in the amount of money each one receives at the end of each session.

We designed procedures to capture as much of the characteristics of each pricing method as possible without losing the parsimony that allowed their simulation in a controlled environment. Each participant received 500 units of the experiment currency at the beginning of each session. Profits and losses were recorded for each session round. One stock offering traded in each round consisting of thirty identical items (shares). Participants received their individual private information about the offering price ( $S_i$ ), representing their particular

advisory system, and the preliminary price range for the offering, representing the preliminary information gathered by banks in real world. The offer would be cancelled if there was no demand for all shares. The profit (or loss) recorded in each round is equal to the positive (negative) difference between the market price ( $V$ ) and the price paid by the investor, multiplied by the amount he or she received in the allocation procedure. The total profit or loss at the end of a session is equal to the sum of the profit or loss in each one of its rounds.

### *3.1. Dutch auction design*

Participants inform the quantity of shares they want to buy considering the prices that are suggested by the virtual auctioneer, which fall in time during the round in proportion to the actual price level  $V$ . This procedure is necessary to prevent small decreases in the price level, which could lead to very time consuming rounds. Thus, price variation is a percentage of  $V$  and not a currency unit value because  $V$  lies in the relatively wide [10, 110] range. The auction (round) ends when the sum of the quantities demanded at a given price is greater or equal the quantity offered. The allocation is then done (fractionally if necessary) among those participants who have made quantity bids at the state price before the interruption. This method is mostly mechanical and is the least problematic to simulate.

### *3.2. Book building design*

Each investor may inform the quantity of shares she or he is willing to buy and the maximum unit price she or he is willing to pay for them in each offer (round). The book is built and the clearing price to all allocated investors is the lowest bid informed when at the time a bid clears the thirty stocks in the offer. The allocation is made among those that bid at or above the clearing price in proportion to the quantities they demanded as in step four below. In book building, all investors belong to the same group, which means that all investors are clients of one bank, unlike in the competitive IPO, described in the following item. The step by step book building procedure is:

Step 1:  $V$  is drawn and investors have access to private value  $S_i$ .

Step 2: The preliminary price range is set around  $V$ .

Step 3: Participants inform their demands, building the book.

Step 4: The allocation is made when  $\sum q \geq Q$  at the lowest bid price made. Each allocated investor receives  $k \times q$  shares, where  $k=Q/\sum q$ ,  $Q$  is the quantity offered and  $\sum q$  is the sum of individual demands.

### *3.3. Competitive IPO design*

Price formation in the competitive IPO is similar to that in the book building. The difference is the insertion of a preliminary step before the submission and processing of bids. Investors are divided into groups of three participants each. Each group represents the set of customers of one bank. Groups are formed randomly at the beginning of the session and remain the same throughout the twenty-four rounds (IPOs) in the session. Participants do not know who their fellow group members are and cannot communicate among themselves, whether or not they belong to the same group.

In the first stage, each participant receives the private signal  $S_i$  and informs the unit price that she or he would pay for the offer. The mean bid price for the members of each group (clients of the same bank) is obtained. The group that submitted the highest average price will be benefited in the allocation of shares. This emulates the preference given to the clients of the bank that offered the higher preliminary price, representing greater information disclosure about the true value of the stock. The preliminary price range is obtained with the highest price average and disclosed to all participants. In the next stage, subjects bid following the same rules as in the book building. Besides the preliminary price range (the same to all) and the private signal about the price (one for each and the same as in the previous stage), subjects are informed if their bank was the winner, which may result in allocation preference.

The allocation procedure is also somewhat different relative to that employed in the book building. Clients of the winning bank (the group with the higher average bid in the first stage) are given preference in the allocation. Their portion is greater than that of the clients of the other banks (groups). Clients of the winning bank are not certain of receiving allocations as well as clients of the other banks are not barred from allocations. The difference will reside only in the proportion of the allocation. The original allocations to the clients of the winning bank, if allocated, are multiplied by a factor  $f$  in the open (1, 2) range, while the clients of other banks, if allocated, will have their allocations reduced by a factor of  $2-f$ .

#### **4. Results and discussion**

Figure 1 depicts three scatter plots of the prices resulting from the offer according to each one of the three methods and of the true value ( $V$ ) that corresponds to the market value of the stock at the end of the first trading day, randomly picked at the beginning of each session. A visual inspection of the charts in Figure 1 suggests that book building results in higher initial returns (underpricing), while competitive IPO may even result in overpricing.

Table 2 confirms this observation in its Panel A but Panel B shows that the initial returns in the auction were higher only when the last twelve rounds, out of the twenty-four in each session, are considered. Price dispersion was larger in the competitive IPO for all sessions and for the auction for the last twelve sessions. Book building also presented the maximum initial return in a single offering while the overall minimum occurred under the competitive IPO. The auction had the highest minimum initial return.

Table 3 portrays mean difference statistics. There is no significant difference between the auction and book building. Initial returns are significantly larger with book building and the auction relative to the competitive IPO. The competitive IPO led to a much larger number of negative initial returns than the other two pricing methods. Investors perform much worse when the competitive IPO is employed. After some practice, it seems that investors fared

better with the auction. The competitive IPO aimed to reduce pricing uncertainty but its greater standard deviation of initial returns and incidence of negative returns in our experiment does not suggest that it will reach this goal.

[FIGURE 1 HERE]

[TABLE 2 HERE]

[TABLE 3 HERE]

Figure 2 shows the round by round evolution of initial returns per method. The greater concentration of positive initial returns with book building and of negative initial returns with the competitive IPO is clearly visible. There are more positive initial returns in the early rounds of book building while negative initial returns were more concentrated in the middle rounds of competitive IPO. There was no discernable pattern under the Dutch auction. Table 2 shows that the average of initial returns in book building in the last twelve rounds, when participants had sufficient time to develop their strategies, are lower than in the initial rounds, while they are greater in the last twelve rounds for the other two methods. The increase in returns as the rounds progress could indicate that the experience of participants leads to the development of winning strategies. However, the opposite trend in book building does not warrant this conclusion and may imply that we could see even lower returns in book building if the number of rounds was greater.

[FIGURE 2 HERE]

Figure 3 portrays private signals ( $S_i$ ) relative to bids. The maximum bid permitted was 150, thus the scale of the chart, because it might have been necessary to limit investors whose bids deviate significantly from their signals in the competitive IPO. This possibility was not controlled by Bonini and Voloshyna (2009) who did not impose restrictions on this behavior with the competitive IPO. The dispersion of bids is also greater under the competitive IPO.

Perhaps its more complex rules led to a greater differentiation in the strategies followed by the subjects.

[FIGURE 3 HERE]

Table 4 presents the differences between the bids and the private signal ( $S_i$ ) received by each investor in the book building and the competitive IPO sessions. The results indicate that the competitive IPO is more likely to result in bids greater than the price signaled in the private information. A visual inspection of Figure 3 supports this statement. Table 5 shows the bid premium relative to the midpoint of the preliminary price range. The largest adjustment took place with the Dutch auction, which was the only method showing a positive adjustment that was significantly larger than the other two methods in the last twelve rounds. The average price adjustment was significantly negative in the competitive IPO relative to the other two pricing methods.

[TABLE 4 HERE]

[TABLE 5 HERE]

The subjects clearly employed the bait-and-switch strategy in the competitive IPO. The initial high bids served only to obtain the preliminary price range to increase their chances of being selected as the winning bank. However, subjects offered lower prices when asked to provide the actual bid, which were still higher than with other methods. Book building was the only method in which returns went down after the subjects could learn about the process and had time to develop strategies. In the Dutch auction, on the other hand, returns increased, which could be related to the findings of Kagel and Levin (1986) regarding the incidence of the winner's curse in auctions. Even though these authors documented that agents learn and avoid incurring into the winner's curse by means of participation in subsequent auctions.

## **5. Conclusions**

In our comparisons of book building, the Dutch auction, and the competitive IPO we conclude that book building may be the IPO pricing method that most benefits bidding investors at the expense of the issuing firm and selling shareholders. The competitive IPO, in contrast, provided the best results for the issuing firm and selling shareholders, at the expense of investors. These results are in line with those of Bonini and Voloshyna (2009). It must be noted, nonetheless, that the competitive IPO showed greater dispersion in price formation, which somewhat goes against the motivation for its conception. We still found evidence of the use the bait-and-switch strategy in the competitive IPO suggesting that it is important to create rules that discourage this practice. Bait-and-switch may be better disguised with book building but competitive IPOs clearly expose it because the competition for mandates is an explicit part of the offering procedure. Book building exhibited greater price formation stability, lower dispersion of initial returns and average deviation around the true offering price. This finding confirms the argument of Sherman and Titman (2002) that accuracy in the offer pricing leads to larger initial returns.

Larger offer prices relative to the true value of the firm are better for the issuer and selling shareholders. Investors benefit from the opposite. Methods that lead to better price discovery are certainly in the interests of the issuer and selling shareholders and may contribute to noise reduction in this market. Reforms along those lines are not in the interest of underwriters, however (Green, 2007). Issuers could induce reforms taking into account the worldwide phenomena of underpricing in the short run. One can argue that the experiment does not lead to realistic conclusions, questioning the principle of parallelism, and thus the extensibility of the results. However, without actual data available for inspection or analysis to support the difference between laboratory data and real world data, this kind of grumble is mere speculation (Smith, 1980, 1982).

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**Table 1**  
Subject Characteristics

	Students	Professionals	All
Quantity	38	49	87
Average age in years	25.8	35.7	31.3
Number of females	11	3	14
Number of males	27	46	73
Subjects with stock market experience	25	48	73
Professional experience in years	3.1	10.7	7.3
Initial return - auction	-0.64%	1.00%	0.46%
Initial return - book building	0.61%	2.77%	1.33%
Initial return - competitive IPO	-5.21%	-6.41%	-6.01%
Overall initial return	-1.61%	-1.16%	-1.41%

**Table 2**  
Descriptive initial return statistics

Panel A – Initial Returns – All Rounds				
	Auction	Book building	Competitive IPO	All
Mean	0.46%	1.33%	-6.01%	-1.41%
Median	0.38%	0.92%	-5.12%	-1.53%
Standard Deviation	8.22%	8.59%	10.45%	9.67%
Maximum	19.04%	25.14%	17.32%	25.14%
Minimum	-13.38%	-17.75%	-44.99%	-44.99%
# Positive	37	41	16	94
# Negative	35	31	56	122

Panel B – Initial Returns – Last 12 Rounds				
	Auction	Book building	Competitive IPO	All
Mean	1.62%	-0.12%	-4.67%	-1.06%
Median	1.89%	0.62%	-5.02%	-1.74%
Standard Deviation	9.39%	7.95%	8.60%	8.99%
Maximum	19.04%	15.66%	14.32%	19.04%
Minimum	-13.38%	-17.75%	-31.87%	-31.87%
# Positive	20	19	8	51
# Negative	16	17	28	57

**Table 3**  
Mean initial return differences

<b>Panel A – All Rounds</b>		
	<i>t</i> test ( <i>t</i> statistic)	Wilcoxon test ( <i>v</i> statistic)
Auction vs. Book building	-0.62	-0.48
Book building vs. Competitive IPO	4.61**	4.05**
Auction vs. Competitive IPO	4.13**	3.85**

<b>Panel B – Last 12 Rounds</b>		
	<i>t</i> test ( <i>t</i> statistic)	Wilcoxon test ( <i>v</i> statistic)
Auction vs. Book building	0.85	0.79
Book building vs. Competitive IPO	2.33**	2.38**
Auction vs. Competitive IPO	2.96**	2.47**

Significance at 10% and 5% denoted by \* and \*\*, respectively.

**Table 4**  
Information Revelation: Bid Premium over Private Price Signal

<b>Panel A – All Rounds</b>			
	Book building	Competitive IPO	Difference <i>t</i> test
Mean	-8.11%	4.53%	-6.24**
Median	-2.36%	0.07%	
Standard Deviation	28.70%	46.21%	

<b>Panel B – Last 12 Rounds</b>			
	Book building	Competitive IPO	Difference <i>t</i> test
Mean	-6.75%	3.20%	-4.14**
Median	-1.41%	0.05%	
Standard Deviation	30.25%	33.66%	

Significance at 10% and 5% denoted by \* and \*\*, respectively.

**Table 5**  
Final Price Position

Panel A – All Rounds			
	Auction	Book building	Competitive IPO
Mean	2.26%	-0.22%	-34.21%
Standard Deviation	11.00%	8.32%	17.68%
Maximum	33.37%	17.72%	-7.03%
Minimum	-25.42%	-18.99%	-84.00%
	<i>t</i> test ( <i>t</i> statistic)	Wilcoxon test ( <i>v</i> statistic)	
Auction vs. Book building	1.52	1.04	
Book building vs. Competitive IPO	14.76***	7.37***	
Auction vs. Competitive IPO	14.86***	7.34***	

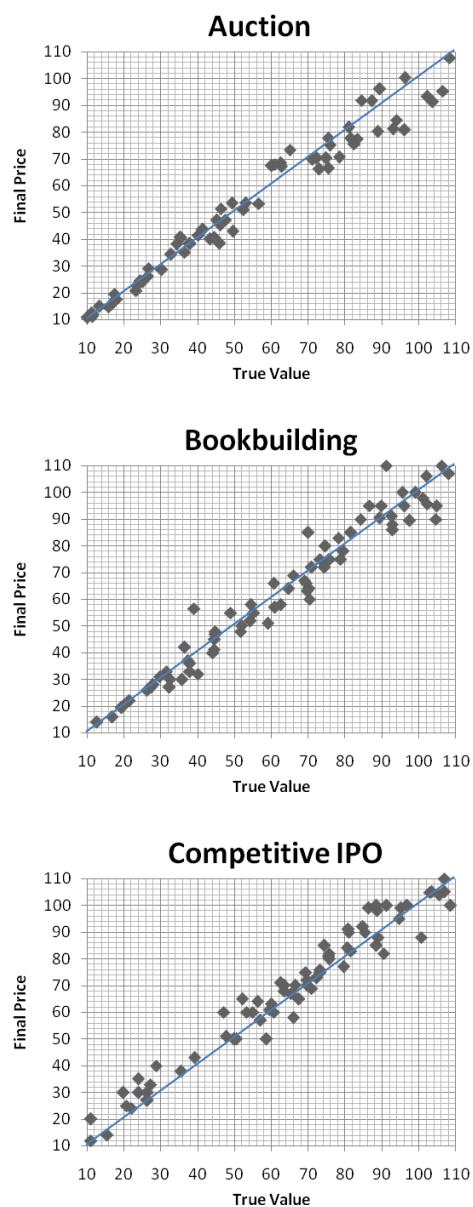
  

Panel B – Last 12 Rounds			
	Auction	Book building	Competitive IPO
Mean	3.91%	-0.57%	-35.39%
Standard Deviation	9.23%	8.61%	18.16%
Maximum	33.37%	17.72%	-7.17%
Minimum	-11.20%	-18.99%	-84.00%
	<i>t</i> test ( <i>t</i> statistic)	Wilcoxon test ( <i>v</i> statistic)	
Auction vs. Book building	2.13**	1.70*	
Book building vs. Competitive IPO	10.39***	5.22***	
Auction vs. Competitive IPO	11.58***	5.22***	

Significance at 10% and 5% denoted by \* and \*\*, respectively.

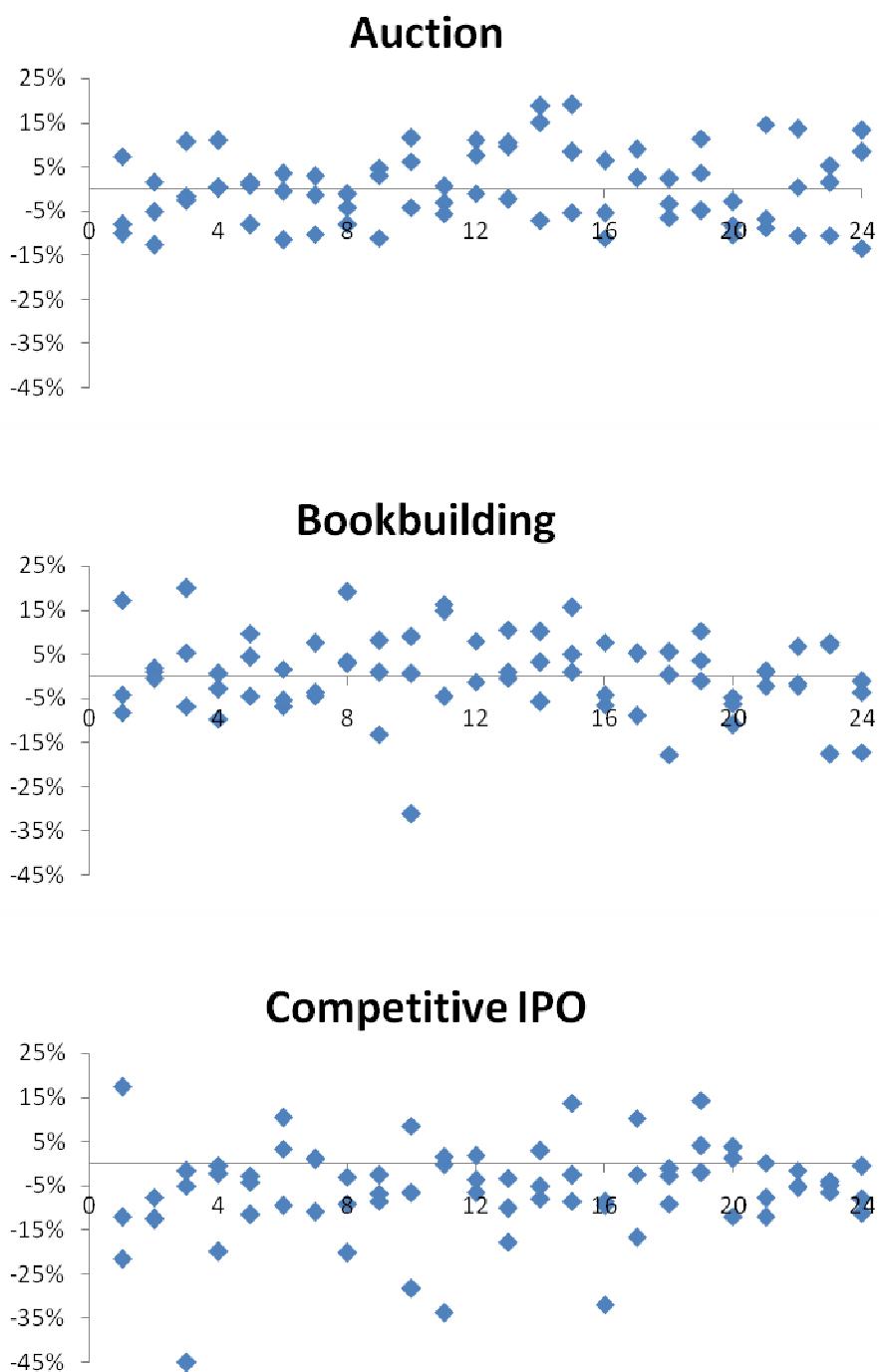
**Figure 1**

Scatter plot with final prices and true values



**Figure 2**

Initial returns from the first to the twenty-fourth round



**Figure 3**

Scatter plot of private signals ( $S_i$ ) and bids

