Underpricing, Bookbuilding and Competitive IPO: an Experimental Analysis

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Abstract

The investigations in the beginning of the 2000s of the IPO practices following dot.com bubble have spurred hot debates among regulators as well as academics about the issuing methods most widely adopted. The discussion about the superiority of one or another traditional IPO mechanism in controlling the underpricing is still largely open, although practitioners have started actively developing and implementing novel mechanisms.
In 2004 two large IPOs have been conducted through non-traditional methods: Dutch auction (Google) and a pioneering method named "competitive IPO" (Pages Jaunes).
The present paper investigates the investors' behavior in competitive IPO, in particular, we stipulate that this method increases competition not only among banks but also among investors resulting in more information revelation and less underpricing compared to traditional bookbuilding. We adopt an experimental methodology approach to deal with the lack of reliable field data.
Our results show that in competitive IPO investors consistently reveal more information compared to traditional bookbuilding, and for experienced investors the difference in information revelation between the two mechanisms becomes even more pronounced. The underpricing (and its volatility) is also significantly lower for the newly introduced methodology.

1. Introduction

The investigations in the beginning of the 2000s of the IPO practices following dot.com bubble have revealed the dark side of investment banking and resulted in fines of hundreds of millions for top investment banks and hot debates among regulators as well as academics about the issuing methodologies commonly in place. This discussion about the superiority of one or another traditional IPO mechanism in controlling the underpricing is still largely open (Biais et al, 2002; Derrien and Womack, 2003; Ritter, 2003; Sherman, 2005). Differently, practitioners have taken a different road starting to develop and test innovative mechanisms.

A notable example of this behavior has been the 2004 mega-offerings of Google and PagesJaunes, which went public through non-traditional methods: Google, the path-breaking internet search engine, has chosen a modified Dutch auction with certain degree of control over bids, while, on the other hand, PagesJaunes, the French telephone directories business, has employed a pioneering method (which lately has been named "competitive IPO") designed by Dresdner Kleinwort Wasserstein, its financial advisor.

While Dutch Auction is a relatively well-known methodology (already adopted, though on a small scale, in France and Israel among others), competitive IPO is a novel mechanism blending traditional bookbuilding and auctions in an innovative way. Under this mechanism an "auction" stage is introduced before the appointment of bookrunners. The issuer performs a contest among investment banks interested in securing for themselves a bookrunner mandate, in which each participating bank must submit the indicative price range based on preliminary marketing and collected investors' interests. The bank(s) with the highest (or middle, if the issuer is concerned more with price accuracy than with the proceeds) price ranges win the bookrunner mandates, and eventually IPO proceeds in the standard way. Another important feature of competitive IPO is the adoption of a "no-fee"

threat: the mandate winners do not obtain their fees if the final price ends up being below the lower end of the price range. The novelty of this method, aimed at increasing pre-marketing competition among investment banks, derives from the combination of late bookrunner appointment and no-fee threat, which aligns the incentives of the issuer and the bookrunners (though decreasing drastically the profits of the latter).

The introduction of competitive IPO was not welcomed by most investment banks with some hurrying to state that "it's a cretinous waste of time" or that the new method pushes up pressure on the analysts covering the participating banks (Wilson, 2005). However, new floats have followed in 2005, adopting this procedure: Inmarsat (the UK-based mobile satellite company), Telenet (Belgian cable company), EFG International (Swiss private bank), Eutelsat (French satellite company). The average first-day price jump for these companies was 7.26% and the first-week change -1.38% while the comparable numbers for European IPOs the same year were 29.5% and 25.4% respectively[1].

The present paper aims providing some evidence on investors' behavior in a competitive IPO. In particular, we stipulate that this methodology increases competition not only among banks but also among investors, resulting in more information revelation and less underpricing compared to traditional bookbuilding. For this purpose we adopt an experimental methodology approach, which has proven to be a useful tool when no field data are available. The paper proceeds as follows. Section 2 discusses competitive IPO on the case of PagesJaunes and formulates the research hypotheses. Section 3 develops the experimental design. Results of the experiments are reported in Section 4. Section 5 concludes.

2. Competitive IPO

PagesJaunes (PJ), the French telephone directories business, went public in July 2004 using for the first time an IPO approach developed by Dresdner Kleinwort Wasserstein

[1] Data are from Dealogic, investment banking data provider (www.dealogic.com).

(DrKW). Since then, this pioneering methodology, referred to as "competitive IPO", was applied again in 2005 in four additional IPOs. The new approach is meant to eliminate the drawbacks of traditional IPOs caused by the presence of conflicts of interests by banks, limited competition between banks and weak monitoring of the issuing process by the issuer.

The novelty of the competitive IPO lies in three aspects. First, the preparation of IPO is decoupled from execution. PJ hired DrKW as financial advisor who prepared the company for the IPO and closely monitored the entire issuing process while the selected banks carried the offering (i.e. engaged in pre-marketing, collected investors' interests and allocated the shares). Second, the competition between banks is sustained throughout the process. Usually, in France, the bookrunner positions are assigned six months (or even a year) before the launch of IPO; in the PJ case, the banks learnt about their syndicate roles only two weeks before pricing. Third, a "punishing" fee scheme is introduced: if the final price is set outside the price range, underwriting fees are not paid.

Next, we highlight key points of competitive IPO, using as an example PagesJaunes case, and discuss their possible impact on the underwriters and investors.

2.1 Competitive IPO: Case of PagesJaunes

The issuing process has started with selecting a financial advisor (DrKW) who had to prepare the offering but not to execute it. The aim was that by not participating in the profits from the share allocations the financial advisor would not be involved in potential conflicts of interests. Bringing in the financial advisor, in this case, could be thought of as acquiring the financial expertise generally missing in new issuers expertise. The financial advisor organized a beauty contest among interested banks and short-listed several banks as potential syndicate members based on the proposals submitted by the participants. The proposals

contained the banks' views on market sentiment, potential demand, offering structure, valuation and other relevant offering details.

The short-listed banks were informed that their syndicate roles (bookrunner or non-book position) would be assigned only after a pre-marketing stage. Each bank received a list of investors to contact (the accounts highlighted as important in the beauty parade) and had to send to DrKW daily reports. After collecting investors' feedback the banks would submit price range proposals, and the financial advisor would present the issuer the conclusions about the price range and syndicate composition. The issuer would then take the decision about the final price range and appoint the banks with the mid price-ranges as bookrunners, and others as Joint-Lead Managers[2].

The going-public would then proceed in the usual way: road shows were launched followed by building the book. In order to maintain banks' selling effort, fees were split in two: a base fee and an incentive fee. The base fee would be paid only in the case the final price would fall within or above the price range. The half of the incentive fee is paid automatically if the price is in the upper tier of the price range.

The PagesJaunes' listing was completed successfully with a final price set at a significant premium compared to market comparables and was followed by a very stable aftermarket.

2.2 The effect of the competition on the underwriters and investors

The implementation of such an innovative IPO methodology has become possible as a result of the introduction of an additional agent in the usual process: the financial advisor (FA), in this case DrKW. The advisor role is to provide expertise and perform thorough monitoring of the entire process. Not being involved in shares allocation implies that FA is

[2] For the issuer the price accuracy was of key importance, and, thus, the bookrunner's positions were filled in by the banks with average valuations of the issue.

not exposed to usual conflicts of interests and, therefore, the FA's incentives are aligned with those of the issuer and these two actors can be considered as one agent, or the "expert issuer".

Two other features of competitive IPO eliminate (or at least significantly mitigate) the conflict of interest between the issuer and the underwriter: the late appointment of bookrunner(s) and the threat of not getting the fees. The combination of these characteristics creates competition among investment banks, which are encouraged to submit aggressive but realistic enough price estimates in order not to lose their fees. Indeed, if there were only a "late appointment" component without the "no-fees" punishment, the banks would propose overoptimistic price ranges in order to win the mandate and later on to set the price below the price range without adding any additional efficiency to the placement process. Allocation discretion would still be in place but hardly it could compensate zero-fees. On the other hand, having the fee threat in place - but no competition - would guarantee the selected underwriters' efforts to get the final price inside the range, but would delete the incentive to push the price range up. As a result, the final price would be set far from the highest level possible. Having both components in place aligns the incentives of the issuer and its underwriter to maximize the proceeds from going public.

With this methodology the issuer and the FA are supposedly aligning underwriters and issuers incentives. Yet, very few information is available about the investors (in particular, institutional investors) behavior, which is aimed at pushing the price as much towards the bottom end as possible. Some questions then arise: will investors' behavior be different in competitive IPO? Will the new pricing structure be able to elicit more information from them?

We conjecture that competition among banks could, as a side-effect, spur competition between investors. This idea comes from the observation that orders submitted directly to bookrunners are treated more favorably compared to orders made to other syndicate

members. Though the analysis of allocations is highly problematic due to the proprietary character of the data, two studies exploring the detailed allocations of leading European banks provide empirical evidence for the above statement. Cornelli and Goldreich (2001) find that investors who submitted the orders to the bookrunner, all else equal, obtained 35 percent extra allocations. In the dataset of Jenkinson and Jones (2004) the effect of submission to the bookrunner is even more pronounced with 55 percent increase in allocations for all IPOs (68 percent for hot IPOs, 25 percent for non-hot IPOs). Big investors benefit from "their" bank being appointed as the bookrunner, and therefore, they may be willing to submit higher valuations of the issue to "help" their bank to win. Investors, therefore, may become involved in the competition against other banks' investors.

We then introduce the following two research hypotheses:

Hypothesis 1. *Investors will reveal more information about the share value in IPO with competitive stage than in traditional bookbuilt IPO.*

Hypothesis 2. *The underpricing will be lower in IPO with competitive stage than in traditional bookbuilt IPO.*

3. Experimental design: Setup

The experimental setup is designed to capture the crucial characteristics of the competitive IPO and at the same time to be parsimonious enough for experimentation. An issuing company (Issuer) has an objective to distribute N shares maximizing the proceeds from going public. Issuer conducts a competition among M banks for the position as a Bookrunner. In course of the competition each competing bank must gather opinions about the value of the shares from the stable group of their clients (institutional investors) who repetitively participate in IPOs. Investors are endowed with equal capital and can demand fixed number of shares or no shares. Institutional investors possess information about the

value of the issue, and their aim is to maximize the profit equal to the difference between the price of the issue and its true value multiplied by the number of shares allotted[3]. Each investor is in a long-term relationship with a single bank. This assumption is adopted for simplicity, removing it would complicate the experiment without changing the results qualitatively. For investors, being in a long-term relationship with the bank that is appointed as Bookrunner implies preferential treatment of their orders, i.e. *coeteris paribus*, Bookrunner's customers obtain more shares than non-clients. Based on the information obtained from their investors, each bank builds an indicative price range. The bank with the highest price range becomes Bookrunner. All the investors are invited to submit price orders within the price range. Bookrunner sets the final price and allocates the shares. For testing the hypotheses, as a benchmark we will model bookbuilding-like procedure without the competition among banks.

3.2 Subjects and information structure

As argued in the previous section, competitive IPO all but eliminate the conflict of interests between the issuing company and the investment bank, therefore, we will consider these two agents as one aggregated agent. As the focus of this study is the investors' behavior, the decisions of issuer-underwriter are taken automatically, according to a profit-maximizing algorithm, while the subjects are assigned the role of investors.

We used a "between-person" experimental design with two distinct treatments: Treatment C (denoting competitive IPO) and Treatment B (denoting bookbuilding). In both treatments all subjects are endowed with 500 units of experimental currency (forints) to which the profits/losses were added/subtracted respectively. In treatment C, subjects are

[3] For the sake of simplicity, we do not model the retail investors' participation.

divided in four groups (clients of 4 banks), the groups remain the same throughout the sessions to reflect the repetitive character of the game; in treatment B there is only one group.

The information structure adopted in our experiments follows those frequently used in experimental auction studies (Kagel and Levin, 1986; 1999). We assume that shares have a "true value" V (which could be interpreted as secondary market price) drawn from a uniform distribution with support *[a; b]* [4]. Subjects are not informed about the realization of V, but each subject i receives a private signal S_i about the value V, which is independently drawn from a uniform distribution defined on *[V-e; V+e]*. The parameter e is common knowledge to all subjects. Subjects do not know the signals of other subjects. Different signals simulate either pessimistic (signal below the true value) or optimistic valuation of the issue by various investors. We set the support for the true value to be *[10; 110]* and the support for investor signals to be *[V-5; V+5]*. The large width of the true value distribution support was chosen in order to obtain signals obtained by subjects inside the true value range *[10; 110]* with probability close to one, i.e. there will be no signals more informative than others.

3.3 Competitive IPO (Treatment C)

Each session of the treatment will consist of 24 periods, each period being interpreted as an IPO. As mentioned before, groups consisting of three subjects are stable throughout the session. In each period 30 shares will be put on for the distribution. Each subject can submit fixed bid q for 10 shares, however she can obtain less than this amount.

Each period (IPO) proceeds as follows.

- In Step 1, the true value V is realized and subjects are given private signals S_i.
- In Step 2, subjects submit their valuations v_{ij}' (j stands for the group). The optimal price range is built automatically for each group j:

[4] We abstract from possible interactions between primary and secondary markets and consider the true value exogenous.

$$\left[\overline{v_{ij}^{'}} - 2; \overline{v_{ij}^{'}} + 2\right] \; ; \quad \overline{v_{ij}^{'}} = \frac{1}{3}\sum_{i} v_{ij}^{'}, j = \overline{1,4}.$$

- In Step 3, subjects learn the winning (i.e., the highest) price range and submit price bids p_i to buy 10 shares, the price must be inside the price range or zero, if a subject decides not to acquire shares.
- In Step 4, the issue price p^* is set and shares are allocated by the following rules:

i) if the total demand is less or equal 30, p^* is set at the lowest submitted price; all the bids are satisfied;

ii) if the total demand is higher than 30 but less than 60, p^* is set at the full subscription; the shares are allocated to the bidders who submitted prices higher than final price by the following rule: the clients of Bookrunner are assigned akq; others kq, where $a = const,\ a > 1,$ q is quantity bid, and k is rationing coefficient defined as $k = \frac{Q}{a\sum_{b} q + \sum_{nb} q}$, where $\sum_{b} q$ is the sum of winning bids by the clients of Bookrunner, $\sum_{nb} q$ - by other winning subjects, and Q is the total amount of IPO

iii) if the total demand is 60 or more, p^* price is set at the level of double subscription (60 shares demanded), those bidders who bid higher than p^* receive shares by the rule described above.

- In Step 5, the payoff of subject i is calculated as $(V - p^*)\ q_i$, where q_i is the quantity assigned to subject i.

3.4 Bookbuilding (Treatment B)

Treatment B is analogous to Treatment C with several exceptions. First, there are no groups (all the subjects are clients of one bank) and therefore in Step 4 in ii) and iii) all

winning bidders are treated in the same manner – they obtain shares pro rata: each winning subject gets kq shares, where $k = \frac{Q}{\sum q}$, Q is the total amount of IPO, $\sum q$ is the sum of winning bids submitted. Second, having left the setup in this treatment as it is, we would give no incentives to subjects to submit higher than minimum valuations at the stage of building the price range. Indeed, by reporting very low valuations subjects bring the price range down without facing any negative consequences of getting small allocations because by bidding at the higher end of the price range at the next stage they can secure the allocations. In practice, this would not be the case because investors know that if their valuations are significantly lower than the issuer's estimated value, IPO is suspended. We will introduce the similar condition in this treatment: if the medium bid submitted is less than tolerance level (which we define at $0.7V$), IPO is cancelled.

3.5 Experiment rounds

The experiments were conducted in the Computer Laboratory of Bocconi University. Subjects were undergraduate and graduate students recruited by public advertisement at Bocconi University. Each subject was allowed to participate in one session only.

60 subjects have participated in the experiments: 30 subjects in treatments C and further 30 in treatment B. Each session consisted of 24 periods and lasted 60 – 80 minutes. Before each session, instructions (see Appendix) were read out loud, all questions were answered and a short test, checking the understanding of the rules was run. At the end of each session the participants were asked to fill out the questionnaire and experimental currency was exchanged in euros at a defined rate (average payoffs were 15 euro in Bookbuilding treatments and 11 euro in Competitive IPO treatments). All subjects were paid a show-up fee of 5 euros.

The experimental software was developed, programmed and conducted by *z-Tree* (Zurich Toolbox for Readymade Economic Experiments (Fischbacher, forthcoming)).

4. Experimental results

Section 4.1 illustrates investors' behavior with specific emphasis on information revelation under different treatments. After analyzing the whole sample we divide the subjects in several categories depending on their bidding strategies and perform the analysis of the subsample of bidders more likely to be found among IPO investors. Next, we explore the last 12 rounds of the experiments in order to give a closer look at the experienced subjects' behavior. In Section 4.2 underpricing is examined for all subjects and for experienced ones. Further, we look at the position of the final price inside the price range and its relationship with underpricing.

4.1 Information Revelation

Figure 1 provides scatter diagrams of indicative bids reported to the banks relative to the signals received by bidders. Examining the diagrams the first eye-catcher is that in Treatment C the prevailing majority of indicative bids is densely concentrated around the signals while in Treatment B bids are much more dispersed. Another interesting observation, which holds true for both treatments, is that indicative bids are not only distributed below the signals but also largely and significantly above (more than 10). This phenomenon is at first-sight confusing because it appears to be more pronounced in bookbuilding experiments rather than in competitive IPO. Bids significantly above signals could have several explanations. In treatment B a possible rationale could be the intent of some bidders to counteract low bids by other bidders pushing the price range beyond the threshold level below which the IPO would be cancelled. In competitive IPO the probability of hitting the threshold is significantly

smaller as the price range is conditioned only by the highest bidders i.e. investors of the Bookrunner bank. Thus, the reason behind exaggerated indicative bids could be more than mitigating low bids to avoid the IPO annulment, the attempt to get her bank appointed as a Bookrunner. On the other hand, the observed behavior could stem from reasons not connected with mechanisms under consideration but rather with the carrying out experiments such as failure to induce preferences for some subjects, attention problems, typing errors, and others. We will give a closer look at these explanations when discussing individual bidding strategies.

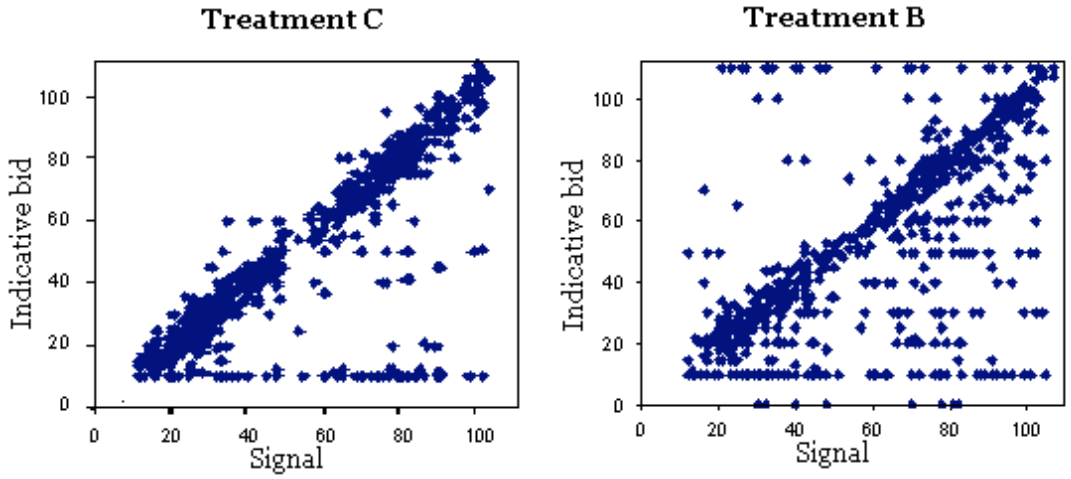

Figure 1. Scatter diagrams of indicative bids relative to signals in Treatments B and C.

For testing the information revelation hypothesis we will apply nonparametric Wilcoxin ranked-sign test (the null hypothesis being that the differences between the indicative bids and the signals in two treatments have the same distribution). No distributional assumptions are required for this test. The analysis will be performed for pooled data only. Table I reports the difference between the indicative bids and the signals obtained in Treatment B and Treatment C. The last column provides the difference in the variables under consideration between two treatments.

Pooled data show that in both treatments on average subjects submit indicative bids below the signals, though in competitive IPO the bids are closer to the signals (-7.84, Treatment B; -5.82, Treatment C). According to Wilcoxin ranked sign test this difference between treatments is significant at 1% level.

Table I

INFORMATION REVELATION
(mean of the difference between the indicative bid and the signal; standard error in parentheses)

	All subjects		
Session (Number of Subjects)	Treatment B	Treatment C	Difference (C minus B)
1	-3.75	-8.11[a]	-4.36
(n = 12)	(12.08)	(13.89)	(21.02)
2	-12.06	-2.74	9.33
(n = 9)	(17.32)	(6.31)	(16.82)
3	-9.06	-5.85	3.23
(n = 9)	(20.72)	(7.68)	(19.23)
Pooled	-7.84	-5.82	2.02***
	(16.55)	(9.53)	(18.81)

[a] The values are due to two subjects excluding which the values would be -0.63 (4.29)
*** Wilcoxin ranked sign test, 1% level, for pooled data only

However, looking at separate sessions we notice that in the first session of Treatment C the difference between the indicative bid and signal is larger in absolute value than the corresponding value of session 1 and the mean value for overall sample. Examining the individual bidding data uncovers that this fact is due only to two subjects with average differences -35.21 and -56.13 while for the rest of the subjects the mean is -0.63. Thus, behind the aggregate data there are very diverse bidding behaviors to be explored.

Graphical analysis of individual bidding information suggests dividing main bidding patterns in four classes according to the magnitude of information revelation. More specifically, we group subjects in four different types:

Type I. For subjects attributed to this category the difference between indicative bid and signal was less than 10 in absolute value in all rounds. The cutoff value of 10 was set taking into account that private signals were drawn from the range *[V-5; V+5]*, therefore, the bids not exceeding the signal by 10 in absolute value can be considered realistic. The subjects of this type contributed the most to the price discovery.

Type II. The difference in absolute value mainly stayed below 10 (in more than 80% of rounds) and has exceeded the cutoff value at least once but less than four times. Similar to Type I these subjects played positive part in determining the price range submitting credible bids in majority of rounds.

Type III. The difference exceeding 10 in absolute value had place in more than 20% of rounds (at least in five) and the bids above the signals by more than 10 make up less than 10%. Subjects belonging to this group followed the strategy of submitting indicative bids significantly below their signals with exception of at most two times when their bids were considerably above their signals.

Type IV. The rounds in which the difference exceeded 10 in absolute value were more than 20%, the difference above 10 was in more than 10% of rounds. Further, there can be distinguished two subcategories: i) the subjects with bids swinging from very low to very high; and ii) the bidders without large negative swings.

Figure 2 illustrates bidding strategies of representative subjects from each group.

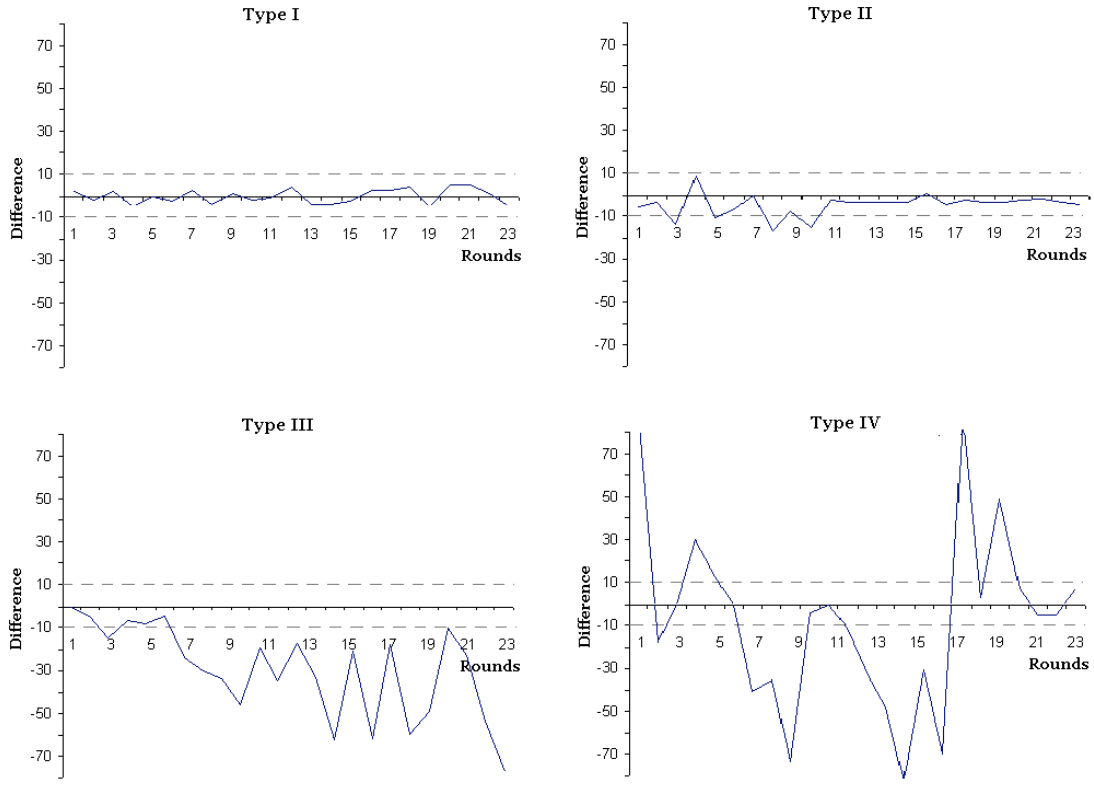

Figure 2. Bidding patterns of representative subjects from different types.

Table II reports the distribution of bidding types in both treatments. The type composition varies drastically across the treatments – bidders of Type I and II (revealing more information) constitute 46.7% in bookbuilding experiment while in competitive experiment their share is as high as 76.6%, and, correspondingly, bidders of the remaining two categories make up more than a half (53.3%) in treatment B and less than a quarter (23.3%) in treatment C. Furthermore, the most peculiar type – Type IV – makes a considerable part (23%) in treatment B whereas there is only one person in treatment C who belongs to this class.

Table II.

BIDDING TYPE DISTRIBUTION (%)

	Treatment B				Treatment C			
Type/ Session	I	II	III	IV	I	II	III	IV
1	25.0	33.3	16.7	25.0	66.7	16.7	16.7	
2	44.4		33.3	22.2	11.1	44.4	33.3	11.1
3	11.1	22.2	44.4	33.3	77.8	11.1	11.1	
Pooled	26.7	20.0	30.0	23.3	53.3	23.3	20.0	3.3

As mentioned above subjects, submitting indicative bids extremely large relative to the signals obtained can have several rationales. Let us explore each treatment separately. In the bookbuilding setting, exaggerated indicative bids could be an attempt to avoid IPO cancellation by offsetting others' too low bids. Subjects following to some extent this strategy would be attributed to the second subcategory, in our sample there are two out of seven, the rest of subjects alternating too high bids with very low ones, for which we were not able to identify any pattern other than a reaction to the particular opponents' behavior in previous rounds.

In competitive IPO, extremely high values bidding could be again a strategy to mitigate low bids, but in this case executed by subjects-investors of the same Bank with the final goal of getting "their" bank appointed as Bookrunner. In this setup we observed only one player of Type IV, and her strategy is not in contradiction with this explanation. However, though securing the place of Bookrunner in four out of five periods where she submitted too high values, the resulting price range was over-inflated thus resulting in negative or zero profits for this player and others, which clearly provide evidence of the dangers associated with such a strategy.

On the other hand, too low bids deprive the chance to get "your" bank appointed as Bookrunner, and in any case does not decrease the price range[5]. Thus, the bidding patterns of Type III are not very sensible if the purpose is profit maximization. This kind of behavior stems from the limitations of experimental methodology that gives high but not full control over subject preferences.

One can argue that subjects of Type IV for bookbuilding experiment and of Type III and IV for competitive IPO experiment are hardly to meet among professional investor, thus, below we provide analysis excluding subjects of Type IV for bookbuilding and subjects of Type III and IV for competitive treatment. Table III presents the results of this reduced sample. Generally, the results are stronger than of the whole sample: the difference in information revelation significantly increases from 2.02 to 8.41 (Wilcoxin ranked sign test at 1% level).

Table III

INFORMATION REVELATION (REDUCED SAMPLE)
(mean of the difference between the indicative bid and the signal; standard error in parentheses)

	Subjects of Type I-III for treatment B and of Type I-II for treatment C		
Session (Number of Subjects)	Treatment B	Treatment C	Difference (C minus B)
1	-4.71	-0.63	4,09
(n = 12)	(8.69)	(4.29)	(10,57)
2	-15.68	-2.08	13,65
(n = 9)	(17.90)	(2.68)	(16,87)
3	-12.32	-2.10	10,23
(n = 9)	(16.02)	(2.68)	(15,51)
Pooled	-9.86	-1.45	8,41***
	(14.09)	(3.74)	(14,01)

*** Wilcoxin ranked sign test, 1% level, for pooled data only

Now we look at the data of last 12 rounds when subjects had time to get familiar with the structure, gain experience, and develop the strategies. This sub-sample represents a major

[5] Unless low bids serve to offset high bids, which is not the case in the experimental data retrieved.

interest, as the focus of this work is institutional investors on the new issues markets who constitute stable group. Table V reports the results of the analysis of this data. The previous results as for the higher information revelation in competitive IPO against bookbuilding get reinforced: in treatment B the gaps between indicative bids and signals increase considerably while there is a contrary tendency in treatment C, consequently, the difference between treatments raises to 10.50 (Wilcoxin ranked sign test at 1% level).

Table IV

INFORMATION REVELATION: LAST 12 ROUNDS
(mean of the difference between the indicative bid and the signal; standard error in parentheses)

	All subjects		
Session (Number of Subjects)	Treatment B	Treatment C	Difference (C minus B)
1	-6,76	-1,48	5,28
(n = 12)	(11,14)	(5,20)	(13.12)
2	-16,77	-2,58	14,18
(n = 9)	(20,41)	(3,31)	(18.95)
3	-15,95	-1,37	14,58
(n = 9)	(17,37)	(2,74)	(16.89)
Pooled	-12,21	-1,71	10,50***
	(16,28)	(3,97)	(16.28)

*** Wilcoxin ranked sign test, 1% level, for pooled data only

4.2 Underpricing

Figure 2 provides scatter diagrams of the final price with respect to the true value and the development of underpricing (measured as the difference between the true value and the final price) throughout the experiment in different treatments.

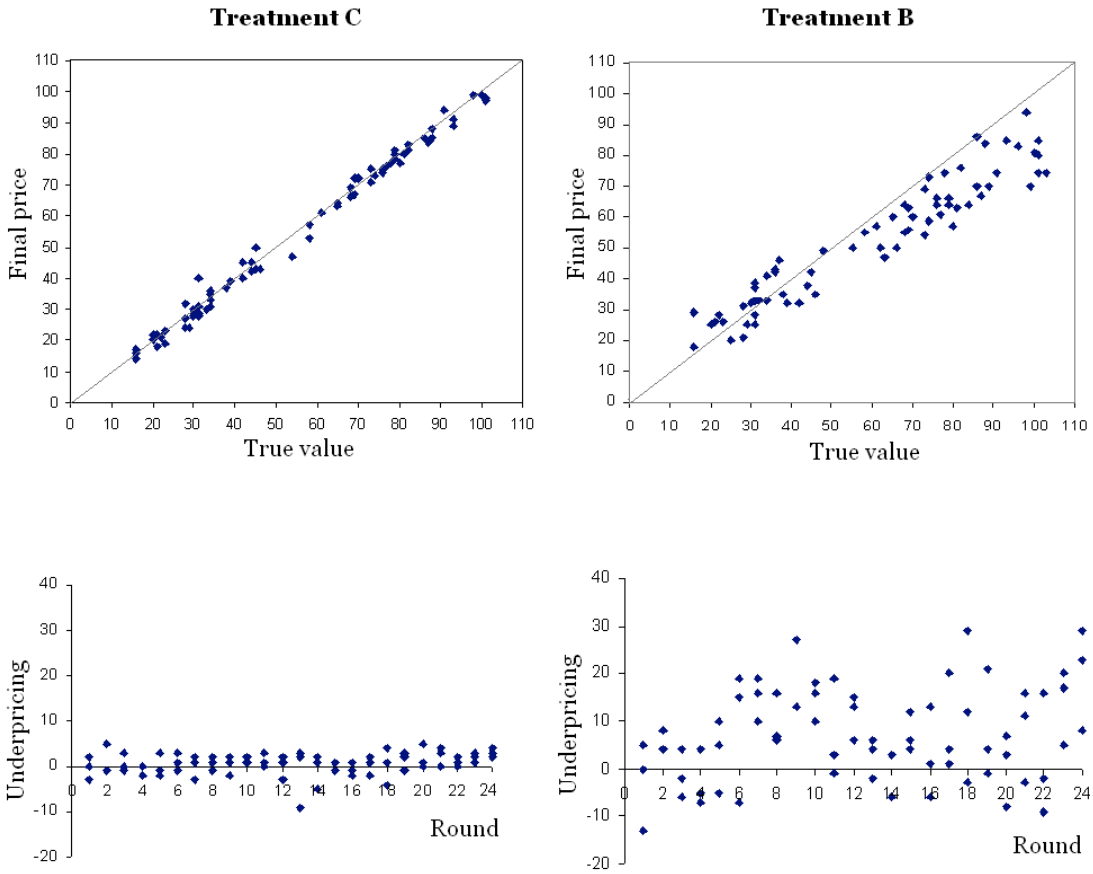

Figure 2. Underpricing in bookbuilding and competitive IPO treatments
Top panel: Scatter diagram of the final price with respect to the true value.
Bottom panel: Underpricing development throughout the time

The top panel clearly demonstrates that the magnitude of underpricing is drastically lower in treatment C compared to treatment B as well as the dispersion. Interestingly, while the final price stays close to the true value in all ranges in the competitive IPO setting, in bookbuilding, the price tends to move farther from the true value as the latter increase. Further, the cases of negative underpricing are present under both treatments but in bookbuilding they only occur for the lower part of the true value range (from 10 to 50) whereas in competitive IPO the negative underpricing is observed for the entire range.

The bottom panel gives a first impression about the evolution of underpricing over time. Under treatment C there is little development, however, while the underpricing magnitude stays about the same, the negative underpricing, more frequent in the beginning

practically disappears towards the end of sessions. The picture is quite different for bookbuilding: in the first 5 periods underpricing stays below 10 with only one exception and bursts in the following periods with the levels raising as high as 20 and even 30 in several cases. As for the negative underpricing, it occurs with approximately the same frequency as in competitive IPO treatment but there is no evidence of learning – subjects overprice the issue during the entire experiment, further, the magnitude of this overpricing is slightly higher compared to bookbuilding treatment. Table V reports the mean values and standard deviations of underpricing for all rounds and for the last 12 rounds under both treatments.

Table V

UNDERPRICING
(mean of the difference between the true value and final price; standard error in parentheses)

	All rounds			Last 12 rounds		
Session (Number of Subjects)	B	C	Difference (C minus B)	B	C	Difference (C minus B)
1	2,08	0,83	-1,25	2.00	1.75	-0.25
(n = 12)	(4,72)	(1,15)	(4,46)	(3.17)	(1.04)	(3.21)
2	9,88	-0,5	-10,38	9.83	-0.58	-10.42
(n = 9)	(6,72)	(2,46)	(6,84)	(7.33)	(3.32)	(6.92)
3	9,58	1,92	-7,75	9.67	1.33	-8.33
(n = 9)	(10,12)	(1,03)	(10,35)	(11.39)	(1.00)	(11.44)
Pooled	7,18	0,72	-6,45***	7.17	0.83	-6.33***
	(7,82)	(1,79)	(7,98)	(8.15)	(1.90)	(8.39)

*** Wilcoxin ranked sign test, 1% level, for pooled data only

The difference between treatments is significant (Wilcoxin ranked sign test at 1% level) both for all rounds and for the last 12 rounds. The average underpricing remains the same for both samples, and this is attention-grabbing if we keep in mind that the information revelation has changed considerably in the second half of experiments for both treatments: from -7.84 to -9.86 and from -5.82 to -1.45 in treatment B and treatment C respectively.

While this fact can be explained in a competitive IPO setting where the price range (and thus, to large degree, underpricing) is determined exclusively by the group of bidders with the highest valuations, in bookbuilding each bid matters. As lower valuations inevitably imply lower price ranges the only explanation for unchanged underpricing would be that the final price inside the price range is adjusted to the underpricing-to-be. That is, the lower is the average share valuation, the closer the final price will be to the top extreme of the price range.

Table VI reports the position of the final price with respect to the middle of the price range[6]. As shown, in a competitive IPO the final price end up being set at the lower end of the range (-1.49), which is in line with the bidders expected behavior of pushing the price range as high as possible at the competitive stage and then trying to obtain the minimum price.

TABLE VI

The position of the final price inside the price range
(with respect to the middle)

	All rounds		
Session (Number of Subjects)	B	C	Difference (C minus B)
1	0,79	-1,63	2,42
(n = 12)	(0,81)	(0,59)	(1,00)
2	0,54	-1,63	2,17
(n = 9)	(1,37)	(0,5)	(1,33)
3	-0,33	-1,21	0,88
(n = 9)	(1,42)	(0,40)	(1,46)
Pooled	0,33	-1,49	1,82***
	(1,25)	(0,59)	(1,35)

*** Wilcoxin ranked sign test, 1% level, for pooled data only

In bookbuilding the final price position is slightly above the middle (0.33) and the variance is quite high. Spearman's correlation for treatment B between the final price position and the

[6] The width of the price range is 5, thus the lowest position is -2, and the highest is 2.

difference between the true value and average valuation is 0.75 significant at 1% level supporting the above stated hypothesis.

5. Discussion and policy implications

Feeling the urge for better control over underpricing IPO practitioners have recently introduced new issuing methodologies, competitive IPO being the most mind-striking recent one. While only a limited number of companies went public using this mechanism, their flotation results are impressive with an average underpricing four times less than average of European IPOs that year. This paper tries to shed some light on competitive IPO expected outcomes, focusing particularly on investors' behavior. The experiments conducted demonstrate that in competitive IPO investors consistently reveal more information compared to traditional bookbuilding, and for experienced investors the difference in information revelation between two mechanisms becomes even more pronounced. The underpricing (and its volatility) is significantly lower for newly introduced method. Interestingly, although the gap between information revelation under competitive IPO and bookbuilding increases considerably as investors become more experienced, this does not impact the level of underpricing. Deeper investigation brings to light the strong positive correlation between the difference between the true value and average valuation and the final price position inside the price range.

Keeping in mind the differences between the laboratory environment and real primary markets, we should be careful to extrapolate the data from one setting to the other. However, the systematic behavioral differences under two methods revealed in the experiments are suggestive for design of efficient IPO, although many other factors which are not the subject of this study should be examined carefully. For example, some detractors stipulate that competitive IPO leads to the potential conflict of interest as the contest among banks puts the

pressure on the analysts of the relevant banks to produce positively biased research. Further, competitive IPO requires hiring financial advisor whose responsibility is to monitor closely the whole process. While this is a negligible expense for large companies, for smaller scale firms this cost should be taken into account while calculating the benefits from lower underpricing. Probably, more than the size of the company going public *per se*, a trickier factor may be that size is also crucial for the ability to attract many banks to the competition. Thus, while potentially well-suited for large issues, competitive IPO could be less appealing for smaller firms. As an alternative to traditional issuing methods, the latter may consider to go public by employing Ausubel auction (Ausubel, 2004), a new multi-unit mechanism proved to perform well in some environments (Grimm and Engelmann, 2003; Kagel et al., 2001; Kagel and Levin, 2001; Manelli et al., 2001). Investors and issuers' behavior with this methodology are the focus of further direct and comparative research.

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Appendix A.
Experiment instru9ctions to players

Instructions for treatment B

You are about to take part in an experiment which consists of 24 rounds. In each round a different private company will sell its **30** shares for the first time. The exact value V of the shares is not known, however, it is known that this value lies between **10** and **110**.

You are one of 12 investors, each of you wants to buy **10 shares** of each of these companies. Your advisor makes forecast of the shares value with the precision ± 5, for example, if the shares value V is 50, the advisor's estimate can be between 45 and 55.

All investors are the clients of the bank through which they will buy shares.

The sale of shares:

0. The value V is chosen randomly before each round.

1. You obtain the estimate of the shares and report to the bank the price you are ready to pay for the shares.

2. The bank calculates average price. The price range is set [p' - 2; p' + 2]. It means that the minimum price for which you can buy shares is $p' - 2$. If this minimum price is below the threshold set by the company, the sale is cancelled. There is no limit for maximum price.

3. If you decide to buy 10 shares, you enter the price (equal or higher than the minimum price) or, if you decide not to buy, you do not enter anything.

4. The final price and the winners are determined by the following rules.

    a. If the demand for shares is less or equal 30, the final price p^* is a minimum price submitted, each participating investor gets 10 shares.

b. If the demand for shares is more than 30 but less than 60, the final price p^* is set at the level at which demand is equal to 40 shares. The investors whose bid price is higher or equal than p^*, obtain equal proportion of the total number of shares, e.g. if there are 6 players who entered p^* or higher, all 6 players obtain 5 shares.

c. If the demand for shares is 60 shares or more, the final price p^* is set at the level at which demand is equal to 60 shares. The shares are distributed as in the point *b*.

5. Your profit is calculated at every round as the number of shares obtained q multiplied by the difference between the value V and the price p^* : $q \cdot (p^* - V)$, that is if the price you paid is smaller than the true value of the share, you receive positive profits, otherwise – negative. At the end of the experiment the sum of all your profits will be converted in euro at rate 20 points = 1 Euro and will be paid to you.

Thank you for taking part in our experiment!

Instructions for treatment C

You are about to take part in an experiment which consists of 24 rounds. In each round a different private company will sell its **30** shares for the first time. The exact value V of the shares is not known, however, it is known that this value lies between **10** and **110**.

You are one of 12 investors, each of you wants to buy **10 shares** of each of these companies. Your advisor makes forecast of the shares value with the precision ± 5, for example, if the shares value V is 50, the advisor's estimate can be between 45 and 55.

Each investor is a client of the bank through which he can purchase shares. There are 4 banks, so that each bank has a group of 3 investors as its clients. During the whole experiment investors remain the clients of the same bank.

The sale of shares:

6. The value V is chosen randomly before each round.

7. You obtain the estimate of the shares and report to your bank the price you are ready to pay for the shares.

8. Each bank calculates average price of its group of clients.
   The bank with the highest average price *p'* becomes Bookrunner (what it means for investors – clients of this bank are explained later). The price range is set **[*p'* - 2; *p'* + 2]**. It means that the minimum price for which you can buy shares is *p'* – 2. If this minimum price is below the threshold set by the company, the sale is cancelled. There is no limit for maximum price.

9. If you decide to buy 10 shares, you enter the price (equal or higher than minimum price!) or, if you decide not to buy, you do not enter anything.

10. The final price and the winners are determined by the following rules.

    a. If the demand for shares is less or equal 30, the final price *p** is a minimum price submitted, each participating investor gets 10 shares.

b. If the demand for shares is more than 30 but less than 60, the final price p^* is set at the level at which demand is equal to 40 shares. The investors whose bid price is higher or equal than p^*, obtain shares. **The clients of the bank-Bookrunner receive twice as much shares as other investors.** For example, among winning 4 investors the clients A and B are of Bookrunner, and clients C and D are not. Then 30 shares will be distributed in such a way: A and B get 10 shares each, C and D 5 shares each.
c. If the demand for shares is 60 shares or more, the final price p^* is set at the level at which demand is equal to 60 shares. The shares are distributed as at point *b*.

11. Your profit is calculated at every round as the number of shares obtained q multiplied by the difference between the value V and the price p^* : $q \cdot (V - p^*)$, that is if the price you paid is smaller than the value V of the share, you receive positive profits, otherwise – negative. At the end of the experiment the sum of all your profits will be converted in euro at rate 1 euro per 20 points and will be paid to you.

Thank you for taking part in our experiment!