Using A Two Treatment Factorial Design To Analyze The First Day Percent Change In Price For Initial Public Offerings

Barry Thornton, Jacksonville University, USA
Michael Adams, Jacksonville University, USA
Russell Baker, Jacksonville University, USA

ABSTRACT

An area of considerable interest in finance is the behavior of IPO stock prices on the first day of issue. This paper uses a sample of 282 IPOs from 2002 through 2007 to investigate the performance of the first day percent change in price (FDPCP) of these stocks. A two treatment factorial design is utilized to determine if two factors impact the mean value of this variable. The first factor, or treatment, is the relationship between the final offer price and the price range found in the prospectus associated with SEC Form S-1, also known as the "red herring." The second treatment is the state of the market at the time of issue, bull or bear. This experimental design allows for the testing of three hypotheses. The first hypothesis looks at the relationship between the mean value of the FDPCP and the value of the final offer price relative to the filing range found in the initial prospectus. The second hypothesis looks at the relationship between the mean value of the FDPCP and the state of the market at the time of issue, while the third hypothesis seeks to determine if there is an interaction between the two treatments.

Keywords: Factorial Design, Two-Way Analysis of Variance, IPO Pricing, First Day Percent Change in IPO Price Using a Two Treatment Factorial Design to Analyze the First Day Percent Change in Price for Initial Public Offerings

INTRODUCTION

*P*ricing the stock of a firm making its initial public offering is a difficult undertaking. Of course, there is less historical operating data that can be used to help determine the appropriate offer price coupled with no market data. Furthermore, the final offer price must be chosen in such a way as to attract investors, provide the desired amount of venture capital, allow the sale of the entire issue and hopefully avoid leaving money on the table.

When a firm decides to go public, the SEC requires the submission of Form S-1. This form includes an initial prospectus with a preliminary range for the offer price. Subsequent to the filing of form S-1, the underwriting bank (or syndicate, if there is more than one underwriter) then meets with prospective investors to promote and market the issue. This series of meetings with potential investors is referred to as the road show. The road show allows the underwriter or syndicate to build a book of orders for the new issue. Additionally, the road show and process of book building permit the underwriter or syndicate to get a better feel for the actual demand for the IPO. This additional knowledge of investor sentiment for the issue may result in an adjustment to the offer price either below (in the case of low demand) or above (in the case of high demand) the filing range as stated in the initial prospectus.

One well established feature of an IPO is the first day price increase, known as the first day "pop." For a variety of reasons, both rational and irrational, IPO stocks are consistently underpriced. Investors who sell the newly issued stock on the first day of trading (known as "flipping" the stock) typically experience a large gain. For

example, 72.3% of the stocks analyzed in this study had first day gains, as opposed to losses 17.4% of the time and 10.3% break-evens. However, there is considerable variation in the first day percent change in the price of these stocks. The purpose of this paper is to examine the role of two factors that may affect the first day percent change in price - the relationship between the final offer price and the filing range in the preliminary prospectus (below, within, or above), and the state of the market at the time of issue (bear or bull).

REVIEW OF LITERATURE

Most studies of the behavior of FDPCP focus on the fact that IPOs are consistently underpriced. The dominant strand of the IPO underpricing literature posits that underpricing occurs due to information asymmetries that cause adverse selection in allocating share (Rock, 1986), or because underpricing is needed to entice informed investors to reveal information to the underwriters, as in the book building models that start with Benveniste and Sprint (1989). Other theories of underpricing are based on agency problems in which the underwriters objective function departs from that of the issuer (Boehmer and Fishe, 2000), (Bias et. al, 2002) (Lougran and Ritter, 2004), Ritter and Welch (2002) claim there are no rational theoretical models that fully explain initial underpricing. Ljunqvist, Nanda, and Singh (2003) present a behavioral model that generates all three phenomena. For a discussion of these issues see Viswanathan and Wei (2004). De Jong and Dahlquist (2003), Schultz (2003), Loughran and Ritter (2000) and Brav, Geezy and Gompers (2000).
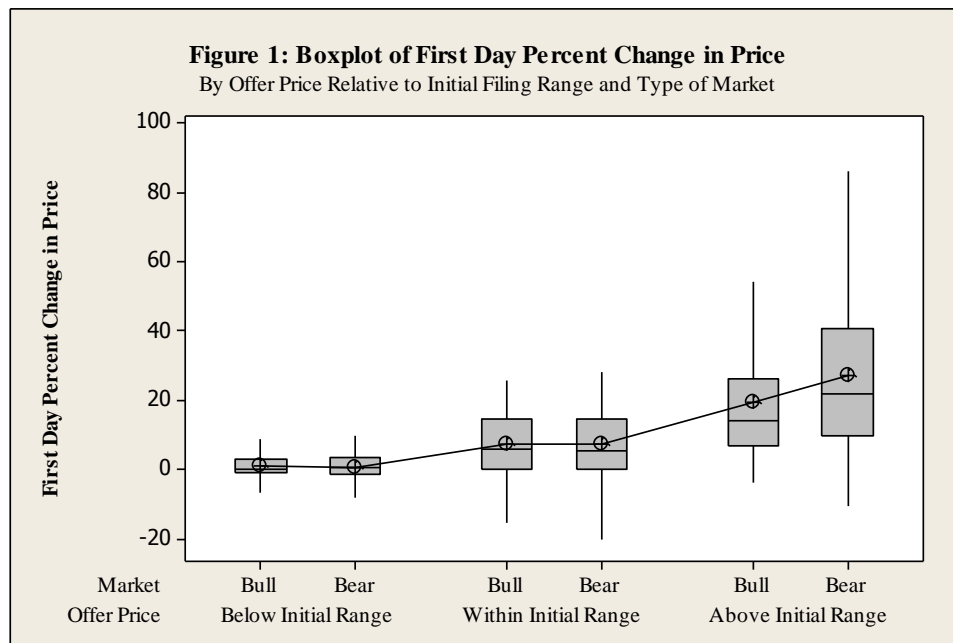
In the theoretical model of Booth and Chua (1996), underpricing is employed to increase the base of investors that are interested in the new issue and increase aftermarket liquidity. In Westerfield (2003), underpricing is also used to influence the composition of the investor base. If Booth and Chua are correct, then underpricing should be negatively correlated with illiquidity, but this runs counter to the empirical results in Ellut and Pagano, and hence casts doubt on the empirical relevance of Booth and Chua's model. In a related work, Adams, Thornton and Hall (2008) present a behavioral model in which underpricing results from asymmetric information difference between the issuer and the investor. If investors are more informed than the issuer (e.g., about demand for shares), then the issuer faces a pricing paradox. Pricing an offer too high can lead to investor fear of the "winner's curse" and the resulting information cascades. If the issuer is better informed than investors, pricing an offer too low often leads to investor's reluctance due to their perception of the "lemons" problem associated with the IPO allocation of shares.

DATA AND METHODOLOGY

A random sample of 282 IPOs was selected from Renaissance Capital's IPOhome.com and Hoovers for the analysis. Descriptive statistics for the variable of interest, FDPCP, are presented in Table 1. Figure 1 is a boxplot that provides a graphical presentation of the same information. The descriptive statistics and boxplot suggest that there is very little difference in the mean value of FDPCP across the two states of the market, and considerable difference in mean FDPCP by the relationship between the final offer price and the original filing range.

Table 1: Descriptive Statistics for First Day Percent Change in Price

Market	Final Offer Price Relative to Initial Range	Mean	S.D.	n
Bear	Below	1.16%	10.56%	47
	Within	7.42%	12.98%	47
	Above	19.13%	18.25%	47
	Total	9.24%	16.04%	141
Bull	Below	0.31%	7.25%	47
	Within	7.01%	10.56%	47
	Above	23.66%	23.66%	47
	Total	11.53%	19.24%	141
Both	Below	0.73%	9.02%	94
	Within	7.21%	11.77%	94
	Above	23.20%	21.41%	94
	Total	10.38%	17.72%	282

Figure 1: Boxplot of First Day Percent Change in Price
By Offer Price Relative to Initial Filing Range and Type of Market

First Day Percent Change in Price

| Market | Bull | Bear | Bull | Bear | Bull | Bear |
| Offer Price | Below Initial Range | | Within Initial Range | | Above Initial Range | |

A two-treatment factorial design was utilized to analyze the behavior of FDPCP. This allowed for the investigation of 2 main effects and 1 interaction effect. The first main effect is the impact of the value of the final offer price relative to the initial filing range on the mean value of FDPCP. The second main effect is the influence of the state of the market on the mean value of FDPCP. An interaction effect exists if there is any relationship between the two main effects. An interaction between the two main effects precludes any further analysis of the main effects, if such analyses are warranted.

The three effects can be thought of in terms of three hypothesis tests. The statistical procedure employed in a two-treatment factorial design is a two-way analysis of variance (ANOVA). All three hypothesis tests were tested at the five percent level of significance. The three hypotheses associated with the three effects of the two-treatment factorial design are listed below:

Null Hypothesis 1: There is no difference in the mean value of FDPCP by the value of the final offer price relative to the initial filing range.

Alternate Hypothesis 1: There is a difference in the mean value of FDPCP by the value of the final offer price relative to the initial filing range.

Null Hypothesis 2: There is no difference in the mean value of FDPCP by the state of the market.

Alternate Hypothesis 2: There is a difference in the mean value of FDPCP by the state of the market.

Null Hypothesis 3: There is no interaction between the state of the market and the value of the final offer price relative to the initial filing range.

Alternative Hypothesis 3: There is an interaction between the state of the market and the value of the final offer price relative to the initial filing range.

RESULTS

Table 2 summarizes the results of the two-way ANOVA performed on the sample data. If the p-value for an effect is less than the stated level of significance (0.05), the null hypothesis should be rejected.

Table 2: Two-Way Analysis of Variance Results

Effect	Computed F	P-Value
Main Effect 1: Offer Price Relative to Initial Price Range	56.44	0.000
Main Effect 2: State of Market	1.66	0.198
Interaction Effect	2.71	0.068

The evidence from the sample shows that there is no interaction effect, so an analysis of the main effects can be undertaken. The results of the two-way ANOVA indicate that the state of the market has no effect on the mean value of FDPCP, so no additional analysis is required. However, the results imply that the mean value of FDPCP is affected by the value of the offer price relative to the range in the prospectus that accompanies SEC Form S-1.

Table 3 shows 95% confidence intervals for the difference in the mean value of FDPCP among all 3 pairwise comparisons based on the value of the IPO's final offer price relative to the filing range in the preliminary prospectus. These intervals were constructed using Tukey's method. If an interval contains the value zero, it can be concluded that the two groups could share the same mean. In such a case, there is no significant difference in the mean value between the two groups. Similarly, if the interval does not contain the value zero, there is a significant difference in the mean value between the two groups.

Table 3: 95% Confidence Intervals for the Difference in the Mean Value of FDPCP

Offer Price Relative to Initial Range	Lower Confidence Limit	Upper Confidence Limit
Within – Below	1.35%	11.62%
Above - Below	17.34%	27.61%
Above - Within	10.86%	21.13%

Table 3 demonstrates that the mean value of FDPCP for the "within" group is at least 1.35% higher than that of the "below" group, and that it could be as much as 11.62% higher when the effects of sampling error are taken into consideration. The other pairwise comparisons are analyzed in a similar way. The analysis indicates that the mean value of FDPCP is significantly higher for the "above" group than for both the "within" and "below" groups. Moreover, the mean value of FDPCP is significantly higher for the "within" group than for the "below" group.

CONCLUSIONS

The first conclusion is that the first day performance of IPOs is robust with respect to the state of the market. Whether the stocks are issued during a bear or bull market doesn't appear to affect the first day performance of these stocks. The second conclusion reached is that the first day performance of IPOs depends largely on the value of the final offer price relative to the price range submitted in the original prospectus. In particular, IPOs that have experienced a price adjustment above the initial filing range have an average gain of more than 23% in the first day of trading. Even those IPOs with final offer prices within the initial filing range have an expected gain of 7% associated with a holding period of only one day. These two results compare quite favorably to those IPOs with price adjustments below the preliminary filing range, with a mean first day percent change in price of less than 1%.

This difference in first day performance can be seen in the Table 4, which only considers whether an IPO stock made a gain, loss, or broke-even on the first day of trading. The conclusion that can be drawn from this table and the preceding analysis is dramatic. An IPO stock that has had its offer price adjusted above the initial filing range is as close to a "sure thing" that one can find in the world of investing.

Table 4: Distribution of Gains, Losses, and Break-Evens in First Day Trading

Offer Price Relative to Initial Range	First Day Gain	First Day Break-Even	First Day Loss
Below	53.19%	17.02%	29.79%
Within	69.15%	11.70%	19.15%
Above	94.68%	2.13%	3.19%
Total	72.34%	10.28%	17.38%

The message for investors is clear. IPOs that have an offer price adjusted above the filing range found in the preliminary prospectus have a high probability of generating a favorable outcome. Of course, this begs the most important question of all – which investors have access to such IPOs?

The final conclusion is that IPOs are consistently underpriced, both in the U.S. and foreign markets. If this were not the case, the distribution of gains, losses, and break-evens would be more uniform and the expected first day percent change in price would be close to zero. The evidence from this study strongly suggests that this is clearly not the case. The advantages of underpricing for the investor have already been discussed, so it remains to be determined how underpricing IPOs benefits the other two participants in the IPO transaction. The other participants are the underwriter (or underwriters, in the case of a syndicated offering) and the issuing firm.

Investment banks assume a risk in underwriting an IPO. It is possible that all shares will not sell at the offer price (a "broken issue"). Since the underwriter typically purchases all shares from the issuing firm, the underwriting firm could end up with an inventory of unsold shares in the case of an unsuccessful offer. This fact helps to explaining the prevalence of the systematic underpricing that is seen in the IPO market. However, this underpricing comes at a cost to the investment bank in the form of smaller commissions generated.

An underpriced IPO has another advantage for an investment bank. These underwriters determine the allocation of the IPO shares, and provide a way for underwriters to benefit investors who have been good customers, or may become customers in the future. This offers a partial answer to the question asked above – what investors have access to the desirable IPOs that have offer prices above the initial filing range?

Presumably, the participant that would be most opposed to the systematic underpricing of IPOs is the issuing firm. Underpricing leaves significant amount of "money left on the table." It's plausible to assume that investors would have been willing to purchase the stock at the higher first day closing price in the secondary market. However, issuing firms and original shareholders fear a "broken issue" as much as do underwriters. The negative publicity associated with such an issue, along with the failure to raise the desired amount of capital, provides a strong incentive to insure the entire issue is sold. The easiest way to accomplish this goal is through underpricing.

The analysis of the sample of IPOs in this paper has generated three important facts about the first day performance of these stocks. First, the state of the market does not significantly affect the mean value of FDPCP. Second, the relationship between the final offer price and the initial filing range profoundly affects the mean value of this variable. In particular, if the final offer price is adjusted to be above the initial filing range, a large first day gain can be expected. Finally, there is little interaction between the state of the market and the relationship between the final offer price of an IPO and the filing range found it its preliminary prospectus.

AUTHOR INFORMATION

Dr. Michael Adams is an associate professor of finance at Jacksonville University and has published numerous scholarly articles in the area of behavioral finance, IPOs, and issues related to small firm entrepreneurial ventures. Dr. Adams received his PhD from the University of Arkansas.

Dr. Russell Baker is an associate professor of MIS at Jacksonville University and has published extensively in the areas of MIS, Instructional Technology and Strategic Alignment. Dr. Baker received his DBAfrom the University of Sarasota.

Dr. Barry Thornton is an associate professor of economics at Jacksonville University and has published many scholarly articles in the areas of IPOs, behavioral finance and higher education pedagogy. Dr. Thornton received his EdD from the University of North Florida.

REFERENCES

1.   A Brav, C Geczy, PA Gompers (2000), Is the abnormal return following equity issuances anomalous? *Journal of Financial Economics* 56, 2000:209-249.
2.   Adams, Michael, Barry Thornton and George Hall 2008. "IPO pricing phenomena: Evidence of behavioral biases," *Review of Business and Economics Research* 6(4), May, 2008:67-74.
3.   Aggarwal, Reena 2003. "Allocation of initial public offerings and flipping activity," *Journal of Financial Economics*. 68(1), 2003:111-135.
4.   Aggarwal, Reena, and Pat Conroy 2000. "Price discovery in initial public offerings and role of the lead underwriter," *Journal of Finance*, 55(6), December, 2000:2903-2922.
5.   Aggarwal, Reena, N. Prabhala, and Manju Puri 2002. "Institutional allocation in initial public offerings: Empirical evidence," *Journal of Finance, 57*(3) June, 2002:1421-1442.
6.   Ang, James S. and Shaojun Zhang (2006). "Underwriting relationships: Information production costs, underwriting fees, and first mover advantage," *Review of Quantitative Finance and Accounting*, Sept., 2006:205-229.
7.   Benveniste, Lawrence M. and Paul A. Spindt 1989. "How investment bankers determine the offer price and allocation of new issues," *Journal of Financial Economics 24*, 343-362.
8.   Boehmer, Beatrice and Ekkehart Fish 2006. "Do institutions receive favorable allocations in IPOs with better long-run returns?" *Journal of Financial and Quantitative 41*(4), Dec., 2006:809-828.
9.   Bradley, D.J. and B.D. Jordan 2002. "Partial adjustment to public information and IPO underpricing," *Journal of Financial and Quantitative Analysis 37*, 2002:595-616.
10. Cornelli, Francesca, and David Goldreich 2001. "Bookbuilding and strategic allocation," *Journal of Finance*, 56(6): 2337-2370.
11. Cornelli, Francesca and David Goldreich 2003. "Bookbuilding: How informative is the order book?" *Journal of Finance*, 58(4):1415-1443.
12. Corwin, Shane A. and Schultz, Paul H., 2003 The Role of IPO Underwriting Syndicates: Pricing, Information Production, and Underwriter Competition March 2003. AFA 2004 San Diego Meetings. Available at SSRN: http://ssrn.com/abstract=389723 or DOI: 10.2139/ssrn.10.2139/ssrn.389723
13. Daily, Catherine, Trevis Certo, Dan Dalton and Rungpen Roengpitya 2003. "IPO underpricing: A meta-analysis and research synthesis," *Entrepeneurship: Theory and Practice 27*(3), Spring 2003:271-295.
14. Drake, Philip D. and Michael Vetsuypens. 1993. "IPO underpricing and insurance against legal liability," *Financial Management 22*(1), Spring 1993:64-73.
15. Fishe, Raymond P.H. and Ekkehart Boehmer 2001. "Equilibrium rationing in Initial Public Offerings of equity," Retrieved December 16, 2007 from SSRN: http://ssrn.com/abstract=273610, June 14, 2001.
16. Guo, ReJin 2005. "Information collection and IPO underpricing," *Review of Quantitative Finance and Accounting 25*(1), Aug., 2005:5-19.
17. Habib, Michel, and Alexander Ljungqvist 2001. "Underpricing and entrepreneurial wealth losses in IPOs: Theory and evidence," *Review of Financial Studies 14*, 433-458.
18. Hanley, Kathleen Weiss 1993. "The underpricing of initial public offerings and the partial adjustment phenomenon," *Journal of Financial Economics 34*, 231-250.

19.   Hoovers.com. Retrieved April 10, 2008 http://www.hoovers.com.
20.   Kim, Moonchul and Jay Ritter 1999. "Valuing IPOs," *Journal of Financial Economics 53*(3), September 1999:409-437.
21.   Krigman, L., W. Shaw, and K. Womack 1999. "The persistence of IPO mispricing and the predictive power of flipping," *Journal of Finance 54*, 1015-1044.
22.   Ljungqvist, Alexander, and William Wilhelm 2002. "IPO allocations: discriminatory or discretionary?" *Journal of Financial Economics,* January, 2002. Retrieved December 1, 2007 from SSRN: http://ssrn.com/abstract=263927.
23.   Ljungqvist, Alexander, IPO Underpricing: A Survey. Handbook In Corporate Finance: Empirical Corporate Finance, B. Espen Eckbo, ed., Forthcoming
24.   Loughran, Tim, and Jay Ritter, 2002. "Why don't issuers get upset about leaving money on the table in IPOs?" *Review of Financial Studies 15*(2), March 2002:413-444.
25.   Lowry, Michelle and William Schwert 2004. "Is the IPO pricing process efficient?" *Journal of Financial Economics 71* (2004):3-26.
26.   Parlour, Christine and Uday A. Rajan 2005. "Rationing in IPOs," *Review of Finance 9*(1), March, 2005:33-63.
27.   Renaissance Capital, IPOhome.com Retrieved April 7, 2008, from http://www.ipohome.com
28.   Ritter, Jay (2008). "Some factoids about the 2007 IPO market," March, 2008. Retrieved April 1, 2008 from http://bear.cba.ufl.edu/ritter/ipodata.htm.
29.   Ritter, Jay and Ivo Welch 2002. "A review of IPO activity, pricing and allocations," *Journal of Finance 57*(4), 2002:1795-1828.
30.   Rock, Kevin, 1986. "Why new issues are underpriced," *Journal of Financial Economics 15*, 187-212.
31.   Stougton, N. and M. Zechner 1998. "IPO mechanisms, monitoring and ownership structure," *Journal of Financial Economics 49*, 45-77.

NOTES