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How Has the Valuation of Technology IPOs Changed Since the Dot-Com Bubble?

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HOW HAS THE VALUATION OF TECHNOLOGY
IPOS CHANGED SINCE THE
DOT-COM BUBBLE?

by

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Abstract

In my paper, I extended Aggarwal, Bhagat and Rangan's "The Impact of Fundamentals on IPO Valuation". I examine IPO valuations over three time periods: 2002-2006, 2007-2011 and 2012-2016. In these time periods, I analyze the first day returns these firms experience along with testing the significance of four variables on their valuations: Total Assets, Previous Year's Sales, Previous Year's R&D Expense, and Sales-to-Assets Multiple. The results point to a shift in valuation tactics from valuing in line with investors' expectations in the early years to undervaluing them in more recent years. Also, Sales and R&D have statistical significance for firm's valuations over recent years while Total Assets remains constant and the Sales-to-Assets multiple does not have significance.

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1. Introduction

Companies are continuously looking for areas of growth for their business. A good way to achieve that growth is to invest in long-term capital ventures that can benefit the company for years to come rather than have a short-term impact. These long-term projects typically require a larger initial outlay but have the potential to provide the company with a reliable series of cash flows for many years. Finding capital to invest in these projects is not difficult, but allocating the right amount to various areas is. This is known as the companies financing structure.

1.1. Forms of Financing

There are two forms of financing for a company: debt and equity. Debt financing is when a company receives funds from outside investors without turning over ownership to the lender. Debt financing is typically in the form of bonds or loans, with both following the same premise of having terms that define their structure. The first defining term is their duration, as a lender will want to have a set date that determines when the borrower will have to pay back the borrowed amount by. This can define the investment as being either short-term (under twelve months) or long-term (greater than twelve months). The longer the duration, the riskier an investment becomes as it gives a larger time frame for uncertain factors to play a role. The second term is the stated interest rate, because a lender will forfeit the opportunity of investing their own capital and have a more secure profit by investing in risk-free assets that will mature over time only when their opportunity cost is greater. A stated rate on a bond takes into account many factors to determine a rate at which the borrower should pay the lender to utilize their assets. This rate will take into account the risk-free rate and add in several other factors to imbed a premium. These premiums are used to cover uncertain risks that may prevent the borrower

from repaying the lender. Some common risks include the default risk of the company and the risk of the project being invested in failing.

The second form of financing is through equity, where an individual will invest funds to a company and in return, the company will give the investor a partial stake in their business. Equity financing can take two forms: private and public. Private equity differs substantially from public equity. Private equity is not publicly available or publicly traded, therefore only certain investor groups can take part in private equity. These investors are typically coined as "Angel Investors" or "Venture Capitalists". This is in large part due to the fact their clientele is primarily new companies looking to gain financing but do not have the credibility or desire to go public just yet. This investment class has positives and negatives. It is beneficial for both parties in that they do not have the governing body of the Securities Exchange Commission (SEC) watching over them and examining their financials. However, for the investor, they may feel uncomfortable investing in a company that is not governed on strict terms. This results in the investor weighing their risks to their returns, and will typically only take part in the venture if it seems profitable. This brings up a second positive, as investing in such young companies gives one the opportunity to experience large returns. The profit sharing aspect is another positive for the investor in that they will receive a larger cut of the pie given that there are fewer investors.

1.2. Initial Public Offerings

When a company has been private for so long and believes they have exhausted all other financing options, or feel they have a greater potential for success, they then decide to go public. This brings us to the second type of equity financing and the one that this paper will focus on, which is public equity. When a company decides to go public they approach an underwriting firm that specializes in taking companies public. They will then analyze the company's situation,

its reasoning for going public, and eventually determine which type of security they should offer, how much of it and at what price it should be offered. This process is called the Initial Public Offering (IPO) of a company. When a company is publicly traded at this point, they are more susceptible to valuation fluctuations due to their valuations being done based on their stock price. Since publicly traded securities are traded on organized exchanges, like the New York Stock Exchange (NYSE) or NASDAQ, they are extremely liquid assets and can be traded very easily. That being said, any publicity or news stories relating to the company can cause large shifts in the company's stock price in either direction. In addition to news stories, the SEC requires companies to release quarterly results of their financials that can help guide investors in which direction these companies are going in the year. This is referred to as "earnings" for the company and stock prices have the potential to make large shifts based on this information.

The IPO of a company is a pivotal moment for the company's existence. Now that they are publicly traded, they have strict laws and regulations they must follow. They are also more prone to having media coverage of their company affect company valuation. During the 1990s, company valuation for publicly traded tech companies was astronomically high. They were trading at historic multiples that seemed quite excessive. This overvaluation was due to the speculative success of technology in society. Technology related companies experienced a period of unexplainable growth which eventually came crashing down in early 2000. This crash was fed by irrational valuation tactics which led to the questioning of these analysts and investors who thought having such high multiples was acceptable. This paper analyzes the new valuation tactics taken right after the crash and to see if anything has changed.

1.3. Financial Crisis

The time frame that I analyze is 2002 through 2016, which was a volatile time frame. The market's recovery from the burst of the Dot-Com Bubble was then crushed by the Financial Crisis of 2008 and 2009. The Financial Crisis will have significant effects on the scope of this paper as the recessionary period following the crisis resulted in very minimal activity in the IPO market.

The Financial Crisis was the worst economic crisis to occur in the US since the Great Depression. In large part, it was caused by several factors that ranged from subprime lending programs to a financial system that was too interconnected. Its crash was felt worldwide as all global financial systems had some tie to the US markets. During the crash, major stock market indices lost nearly 30% of their market value. This crash resulted in increased regulation on the financial systems which had adverse effects on the IPO market. With the economy crashing, no company was looking to go public as it was an awful time to do so. During the recovery, companies began coming out of the rubble and seeking to go public again, but this new regulation would begin affecting them as well, which will be considered for the analysis during that time frame.

2. Literature Review

2.1. Previous Studies on IPO Fundamentals

For this paper, I extend the study of Aggarwal, Bhagat and Rangan (2009). Their research analyzes IPOs specifically between 1986 – 2001. They break this timeframe down into three periods. The first being 1986-1990, to get an idea of IPO valuation during a typical market time frame. The second time period is January 1997 – March 2000, noted as the "boom period" for the Dot-Com Bubble. The last time frame is April 2000 – December 2001, which is known as the "crash period" as the bubble burst. The purpose of their research is to analyze how IPOs during this period were valued and what went into their valuations. They conclude that speculation led to overvaluation. This is seen when companies with negative earnings were valued higher than companies with positive earnings. In my research, I examine whether valuations have shifted since this bubble burst.

Seeing that the internet was just being introduced during the late 1990s and early 2000s, it was difficult for these new firms to be valued given how much upward potential there was for the internet. Several papers examine IPOs during this time frame to try and understand how the valuations of internet companies differed from non-internet companies.

Hand (2003) acknowledges that internet stocks had extreme price valuations during the Dot-Com bubble and investigates their valuation trends between 1997 and 1999. His research targets 167 internet firms and evaluates their investor related valuation for the period and the impact of certain fundamentals on their pricing. The research concludes that revenue results are not an indicator of price valuation rather it is based more on selling and marketing expenses which investors find valuable. This is due to the fact most of these firms experienced negative

earnings for the period as most internet companies did so they used additional fundamentals to value the respective firms.

Bartov, Mohanram, and Seethamraju (2002) noted the trend in internet related companies and how well their performance was in the equity market. They back-tested the results of 98 internet and 98 non-internet IPOs listed between 1996-1999 to identify their valuation trends. Their results found a substantially high valuation for internet related companies even though they did not prove to be profitable. With the growing popularity and usage of the internet during this time period, investors speculations drove these firm's values through the roof.

Morris and Perviaz (2002) investigated the IPO process more extensively for these internet related companies in comparison to non-internet companies. They looked at the various stages of the firm's IPO and where they differed in terms of relative valuation. The non-internet IPOs exhibited the typical trend of higher positive earnings, higher valuation and negative earnings, lower valuations during the pricing phase in the prospectus. A second conclusion though they found was that internet firms experienced more of a valuation increase from the prospectus price to the offer price and first day opening price in comparison to non-internet firms. A potential catalyst they saw was that these firms were viewed more of an investment as they will have a higher value in later years when the internet reaches its full potential.

2.2. Differences Between This Study and Previous Research

Previous studies conducted on IPO matters for technology was more focused on internet firms rather than the sector seeing that was the area with the most growth potential. Now that investors recognize the internet's actual potential and technology is becoming more and more prevalent today, I chose to evaluate the whole sector.

In addition to the sector change, previous studies have eluded to before the Dot-Com bubble and building up to it where as I continue the research on and investigate the aftermath of the period. This study also has another market event with the Financial Crisis playing a role on the data as it falls in the middle of the period. This allows for analysis of a recovery period, 2002 to 2006, as the market recovers from the Dot-Com Bubble. A bust period, 2007 to 2011, as the market sold off from the Financial Crisis. And a second recovery period noted as being a historical bull market, 2012-2016.

The last difference for this study is the variables chosen to regress against. Previous studies included sales, assets and R&D but for this study, I will include an additional variable, sales-to-assets multiple at time of going public. This will be a relative valuation measure which determines productivity of the firm and will extend the valuation scope.

3. Methodology

The question I look to answer now is: How has valuation of technology IPOs changed since the Dot-Com Bubble? Seeing how speculation has led to such an over-valued market, have things changed? Seeing how far technology has progressed since the pioneering of the internet, are these newly listed companies having the proper valuation before going public? Several recent technology related IPOs have had huge run-ups on their IPO date, so are they being undervalued now?

To examine these factors, I look specifically at technology companies that went public between the date range, January 2002-August 2016. I take the initial listing price of the company and examine the total return they experienced on their first trading day. I will then graph out the average first day returns on an annual basis and see how investor valuations compared to IPO valuations.

In addition to the first day return data, I perform regression tests between offer value and certain fundamentals. These include, previous year's Sales, Total Assets, Research and Development expense and their Sales-to-Assets Multiple. Taking the natural log of these variables over time will smooth the data and allow for an easier comparison and analysis.

4. Hypothesis

Based on my preliminary research, I see that technology IPOs were far to overvalued in the late 1990s and early 2000s, but now investment banks taking these companies public are being more cautious and undervaluing them to avoid another Dot-Com Bubble. I hope to see a shift in the average return data as investment banks and investors valuations become more in-line.

In terms of the regression test, I expect to see a strengthening in significance of the Sales-to-Assets multiple and Research and Development variables over time as I suspect they lead to a better understanding of future profits for a new technology company. I chose these variables because the Sales-to-Assets multiple points to a higher productivity level for the firm and Research and Development spending is critical for a firm to stay one step ahead of their competition.

5. Data

5.1. Data Gathering

For this study, data will be extracted from Bloomberg and manipulated in Excel. In the Bloomberg database, the Security Screener function will be used to find which U.S. technology companies went public in the 2002-2016 date range. The screen parameters and their specifications are displayed in Table 1.

After this screen, a list of 216 securities was created which presented company name and ticker. This list was exported to excel and used as a reference point for the second part of data gathering. A Bloomberg plugin in excel allowed for extraction of data that linked to the individual company ticker. Table 2 displays the pieces of information extracted from Bloomberg and their reference code.

Once all this information is compiled, it is formatted into a pivot table to allow for ease when sorting and calculating various metrics. The data is in chronological order and broken into three date ranges which are displayed in Table 3.

With these time periods, it allows for comparisons over multiple years to see changes in valuation tactics. Period one is a sample of recovery after the Dot-Com bubble, period two is a sample of a recessionary period with the financial crisis and period three is a sample of the second recovery after the financial crisis.

5.2. Data Calculations

After extracting all the company data, some calculations are performed before running the regression tests. These calculations are displayed in Table 5.

Once all the calculations were performed, I take the natural log of the following variables: Offer Value, Previous Year's Sales, Previous Year's Total Assets, Previous Year's R&D Expense, and Previous Year's Sales-to-Assets Multiple. This calculation reduces the effect of outliers on the data set.

5.3. Average Data

After gathering all the data for this research, I constructed a table displaying how many IPOs occurred in each year along with the average for each of the other variables I will be testing to get a rough idea of where this research would be headed. Here is the constructed table displaying these findings.

After an initial analysis on the number of IPOs each year, I recognized two groups of relatively concentrated years for the IPO market, 2004-2007 and 2010-2015. The years outside these date ranges experienced a relatively stagnated IPO market. In addition, first day returns seemed to be consistently high in later years in comparison to earlier years.

Table 5 displays each IPO in chronological order. This provides a way to observe trends in larger IPO for technology related firms in terms of the given time horizon. Based on the chart, we can see more high market cap firms going public in more recent years in comparison to earlier years.

5.4.Multiple Regression Model

This data set encompasses 216 technology companies who went public between 2002 and

2016. To test the significance of the five variables chosen (previous year's sales, previous year's

R&D expense, previous year's total assets and sales-to-assets multiple), a multiple regression

model will be used.

For this test, the natural log of each variable is taken to eliminate any bias towards outliers in

the data set. The natural log will be calculated in excel via the *LN( )* function.

The following multiple regression model will be used to test the hypothesis of changing

variables' significance over the three time periods:

$$MARKET\ CAP_J = \alpha + \beta_1(SALES) + \beta_2(TOTASSETS) + \beta_3(RDEXP) +$$

$$\beta_4(SALESTOASSETS) + e_j$$

Where:

MARKET CAP$_j$ =   This variable is a measure of the investment banks implied

value of the firm they're taking public. This is calculated as

shares outstanding times the offer price to give an overall

market value

SALES$_j$ =   This variable is the previous year sales data for the firm going

public. The sales information will provide insight into how

the firms product/service offerings are performing in the

market.

TOTASSETS$_j$ = This variable will display the firm's previous year total assets carried on their balance sheet before going public. This will provide insight into how large the firm is relative to their market valuations.

RDEXP$_j$ = This variable will show how much the firm invests into research and development for the previous year before going public. This is a strong indicator of future growth but too much could utilize all of the firm's funds too fast.

SALESTOASSETS$_j$ = This variable will measure the productivity of the firm by looking at how well their sales stack up against their total assets. A higher number will indicate the firm is highly productive and vice versa.

e$_j$ = A random error term

After running the multiple regression model for each time period, the data is compiled and examined to see any trends in methods of valuation.

6. Results

6.1. Return Calculations

The first test to be run on the data was to calculate the first day returns for each of the following 216 securities. This was done in excel by calculating the percent change from the offering price to the first day close. The offering price is the investment banks valuation for the specific firm and the closing price is the valuation the market (the investment community) finds for the security. The percent change between the two prices shows the discrepancy in valuation measures between the two groups. Table 6 displays the average first day returns for each year.

Any positive percent change for the first day return goes to show an undervaluation on the side of the investment bankers and a negative percent change for the first day return shows an overvaluation from the investment bankers.

6.2. Regression Calculations

The second test to be performed was the regression tests for each period. This tests was to see the significance of certain variables on valuation measures for these firms being taken public. From the regression results for each period, the P-Value and coefficients were to be analyzed to determine relative significance. This test was conducted in excel and the results were compiled into Table 7.

From these results, we can see a growing trend of significance in both the previous year's sales and previous year's R&D expense as the coefficients are seen growing with a deteriorating P-Value. Previous year's total assets remained relatively constant in significance throughout the tests and the sales-to-assets multiple lost significance over the three periods.

7. Conclusion

In conclusion, we can see that investment banks gave relatively higher valuations that were closer to being in line with investors valuations. This conclusion is drawn from the low returns these firms experienced on their first trading days indicating very minimal valuation discrepancy from investment banks to traders. This is seen shifting over the years and regressing more recently to more inline valuations. A potential catalyst for this current regression is a more stagnant IPO market over the recent years as the number of IPOs has been relatively low.

A second conclusion to be drawn from the multiple regression model is that my hypothesis did not hold true for the growing importance of sales-to-assets multiple but did hold true for the increasing significance of R&D expense. Another variable that proved to be statistically significant was the previous year's sales which displayed how well the firm's products were performing in the market currently.

Appendix: Tables

Table One

Bloomberg Security Screener Parameters

Table 1: Bloomberg Security Screener Parameters

This list displays each of the parameters used in the security screener to compile the data for this research project. The overall goal was to compile all technology related companies that went public on a U.S. exchange between January 1st, 2002 to August 31st, 2016.

Parameter	Specification
Date Range	*01/01/2002 through 08/31/2016*
Type of Offering	*Initial Public Offering*
Sector	*Technology*
Exchange	*United States Exchanges*

Table Two

Bloomberg Terminal Codes and Variables Extracted

Table 2: Bloomberg Terminal Codes and Variables Extracted

The following list is the excel codes used with the Bloomberg Plug-In to extract certain pieces of data rather than compiling the information manually. Each code would be in a respective column aligned with company tickers and then they would reference the listed ticker and extract the following pieces of data.

Company Information	Bloomberg Code
Company Name	LONG_COMPANY_NAME
IPO Price	EQY_INIT_PO_SH_PX
# of Shares Issued	EQY_INIT_PO_SH_OFFER
Listing Date	EQY_INIT_PO_DT
Previous Year's Sales	SALES_REV_TURN (Reference Listing Year – 1)
Previous Year's Total Assets	BS_TOT_ASSET (Reference Listing Year – 1)
Previous Year's R&D Expense	IS_RD_EXP (Reference Listing Year – 1)
First Day Closing Value	PX_CLOSE (Reference Listing Date)

Table Three

Period's Date Ranges

Table 3: Period's Date Ranges

For this research study, the data needed to be separated into different ranges to allow for comparison when it comes to the multiple regression model. Seeing that there was fifteen years, it was easy to do three groups of five-year periods. The following date ranges were used in regards to their respective periods.

Period	Date Range
Period 1	*January 1st, 2002 – December 31st, 2006*
Period 2	*January 1st, 2007 – December 31st, 2011*
Period 3	*January 1st, 2012 – August 31st, 2016*

Table Four

Calculations Used and Their Respective Formulas

Table 4: Calculations Used and Their Respective Formulas

After all the data was collected, a few calculations needed to have the final form needed for the various tests. Each calculation was performed in excel and uniform for each company. The following table displays each calculation and its respective formula.

The first is total offer value which provides insight into how investment banks value firms. The second is first day change which measures the discrepancy investors found with the investment banks valuation and theirs. The third is a sales-to-assets multiple which is a measure of productivity for each firm before going public which will be a variable in the multiple regression model.

Calculation	Formula
Total Offer Value	$Total\ Offer\ Value = IPO\ Price\ per\ Share\ x\ Total\ Shares\ Issued$
First Day Change	$First\ Day\ Change = \dfrac{First\ Day\ Closing\ Market\ Price\ per\ Share}{IPO\ Offer\ Price\ per\ Share} - 1$
Sales-to-Assets Multiple	$Sales\ to\ Assets\ Multiple = \dfrac{Previous\ Year's\ Sales}{Previous\ Year's\ Total\ Assets}$

Table Five

IPO Offering Values in Chronological Order

Table 5: IPO Offering Values in Chronological Order

The following table displays each individual IPO offering value and lists them in chronological order. This provides a graphical representation of the results to see where there were periods of high value IPOs and if there was any periods of high/low value firms going public. Based on the graph, we can see higher value firms went public in more recent years (2011-2016) in comparison to earlier years (2002-2010).
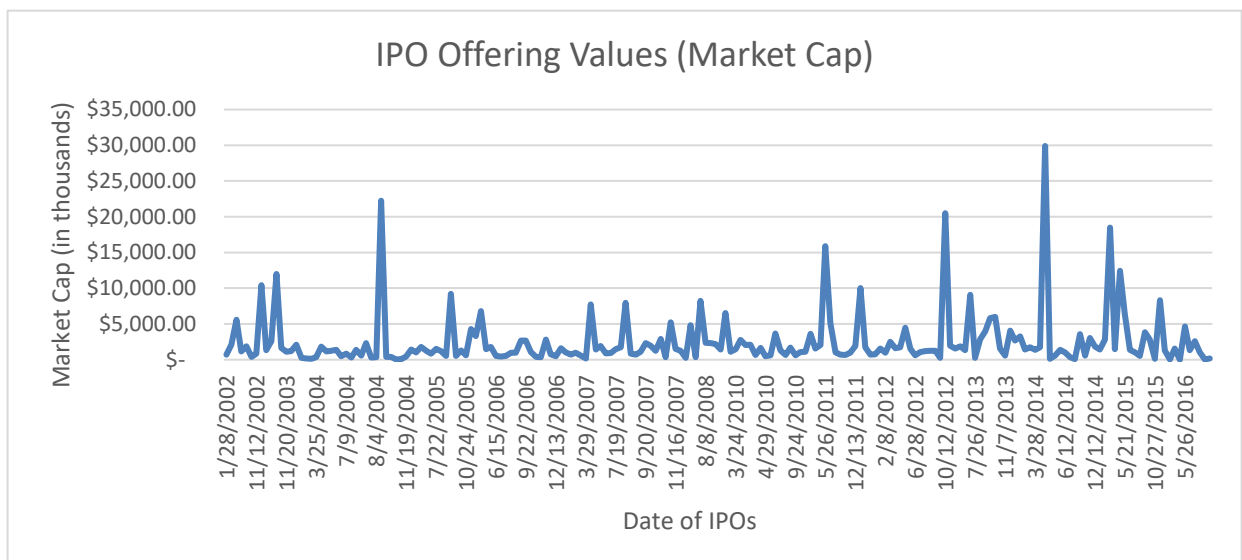
Table Six

Average First Day Returns for Each Year

Table 6: Average IPO Data for Each Year

This chart aggregated all the data and found the average for each given year along with the number of companies that went public each year. This allows for a comparison over the years of certain IPO characteristics including market cap and first day returns. This shows the average discrepancy over the years between investment bank valuations and investors valuations.

	Number of IPOs Each Year	Avg. Market Cap	Avg. 1st Day Return
2002	8	2885.9	-7.0%
2003	8	2787.7	14.3%
2004	25	1764.5	1.2%
2005	15	2555.0	5.9%
2006	22	2221.2	7.0%
2007	30	1981.0	19.2%
2008	3	5296.5	10.0%
2009	5	2719.4	10.0%
2010	17	2162.8	9.2%
2011	11	3989.7	16.2%
2012	18	2572.9	27.2%
2013	13	3146.5	37.0%
2014	18	3119.6	29.5%
2015	15	4065.7	21.5%
2016	8	1435.3	14.9%

Table Seven

Multiple Regression Model Results

Table 7: Multiple Regression Model Results

The following table displays the multiple regression model results for all three time periods. For each time period, SALES is the previous year's sales amount the firm had. ASSETS is total assets for the firm the year prior to going public. RDEXP is the previous year's R&D expense for the previous year before going public. SALESTOASSETS is the Sales-to-Assets multiple for the firm before going public to determine productivity.

Variables	Coefficient	P-Value
2002 - 2006		
SALES	-0.01302704	0.951980214
ASSETS	0.502119776	0.020630553
RDEXP	0.075476061	0.330103601
SALESTOASSETS	-0.382658487	0.336809067

R Square	0.480010672	
Number of Observations	69	

Variables	Coefficient	P-Value
2007 - 2011		
SALES	-0.01302704	0.435481125
ASSETS	0.502119776	0.114863561
RDEXP	0.075476061	0.848609927
SALESTOASSETS	-0.382658487	0.319718402

R Square	0.511455597	
Number of Observations	60	

Variables	Coefficient	P-Value
2012 - 2016		
SALES	0.268883811	0.197966565
ASSETS	0.362407166	0.06935713
RDEXP	0.234900674	0.027119425
SALESTOASSETS	-0.166365055	0.575753449

R Square	0.554473869	
Number of Observations	71	

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