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DEPARTMENT OF FINANCE

Industry Performance and the Underpricing of Initial Public Offerings

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Firms often choose to raise capital through an initial public offering of equity. There are a variety of factors incorporated into a decision to go public, and the process leading up to an initial public offering is often characterized by uncertainty. As a result, the initial return of initial public offerings, which is the difference between the offer price and the first-day closing price, has been an intensely debated topic. The initial return is typically positive, which indicates underpricing of the equity issue. Often, this positive return is quite significant. For several decades, there have been numerous attempts in research to find determinants of underpricing. This paper focuses on one independent variable, industry performance in advance of an initial public offering, to determine whether industry performance leading up to an initial public offering has an effect on the observed underpricing.
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Chapter 1: Introduction and Literature Review

Firms often face critical decisions when confronted with a situation where capital must be raised to invest in a new project, expand existing operations, or finance the repayment of debt. Many firms in this situation choose to raise capital through an initial public offering of equity. The pricing of initial public offerings has been an intensely debated topic, and the foundation of many discussions is the underpricing of these equity issues. Ritter and Welch (2002) sampled 6,249 initial public offerings from 1980-2001 and found the average first-day return to be 18.8 percent. Research has led to the development of various theories that attempt to explain why initial public offerings may be underpriced. Saha and Ferrell (2007) summarize three of the most prominent explanations for underpricing as being liability exposure, information asymmetry, and signaling. Liability exposure suggests issuing firms and underwriters intentionally engage in underpricing to reduce litigation risk. Information asymmetry is commonly supported and focuses on information disparities throughout the pricing of an initial public offering. Signaling indicates the intentional underpricing of an initial public offering to signal that the issuing firm is high quality.

Many discussions regarding the prominent explanation of liability exposure focus directly on the relationship between litigation risk and underpricing, recognizing the potential for significant litigation costs for an issuing firm. To reduce this risk, an issuing firm may intentionally underprice their initial public offering. Lowry and Shu (2002) support this assumption by concluding that issuing firms with higher levels of litigation risk underprice more than issuing firms with lower levels of litigation risk. This
hypothesis is known as the insurance effect. Data also suggests that the decision to underprice often results in lower levels of litigation risk. The deterrence effect states that higher underpricing lowers expected litigation costs.

Alexander (1993) discusses a contrasting theory. The low average settlement costs per lawsuit and the low frequency of lawsuits imply that the high cost of underpricing an initial public offering may not be advisable. Despite the clear rationale behind this argument, the low average settlement costs per lawsuit and the low frequency of lawsuits may also be indicative that underpricing has been an effective measure in eliminating or reducing litigation risk.

Hughes and Thakor (1992) also demonstrate a relationship between litigation risk and the underpricing of initial public offerings, but they assert that litigation risk is not the sole explanation for underpricing. Hughes and Thakor (1992) argued that underpricing is evident outside of the United States in regions where litigation risk is not a threat. Damage to the reputation of the underwriter could be an alternative explanation for intentional underpricing.

Drake and Vetsuypens (1993) reject a relationship between litigation risk and the underpricing of initial public offerings. Their examination involves 93 initial public offerings, which were followed by litigation relating to the 1933 and 1934 Securities Act. The litigation was primarily related to price declines some time after the initial public offering. Thus, this examination further undermines the hypothesis that underpricing an initial public offering is an effective means to reducing litigation risk.

Research related to the prominent explanation of information asymmetry as an explanation for underpricing points to disparities in the relevant information held by two
or more parties during the pricing of the initial public offering. Barzel, Habib, and Johnsen (2004) recognize that many researchers have focused on information asymmetry between issuers, underwriters, and investors. Research often considers the degree of information uncertainty in addition to the relationships of disparities in information asymmetry.

Ritter (1998) recognizes that many theories suggest that issuing firms with a higher degree of internal information uncertainty will be underpriced more. To reduce this uncertainty, an issuing firm will hire underwriters and auditors to confirm that the offer price is consistent with internal information. Underwriters and auditors have to look after their own reputations, and these firms will be incentivized to reduce the degree of uncertainty. The aforementioned prominent explanation of liability exposure also relates to this argument. Ritter (1998) offers an explanation that suggests an issuing firm with a higher degree of uncertainty will underprice more, and an issuing firm with a lower degree of uncertainty will underprice less.

Ritter and Welch (2002) discuss a contrasting theory, asserting that an issuing firm with a lower degree of uncertainty will underprice more. An issuing firm that has a low degree of uncertainty will be more informed than investors, and issuing firms that are high quality will attempt to signal their quality by deliberately underpricing their equity.

Welch (1989) explains the prominent explanation of signaling in detail. In short, a low-quality firm has the ability to underprice at the initial public offering to appear as a high-quality firm. However, after the equity issue the true value of the equity will become evident, and a low-quality firm will not have the ability to portray itself as a high-quality firm in a seasoned offering. Welch (1989) concludes that underpricing is,
therefore, a signal of a high-quality firm. Koh, Lim, and Neo (1992) concur, linking positive firm value to a higher degree of underpricing.

The signaling theory has not gone without criticism, however. Spiess and Pettway (1997) tested the signaling theory on 172 firms. These firms all issued an initial public offering of equity from 1987 to 1991 and also had a seasoned offering of equity within three years of the initial public offering. The basis of their test compared the return incurred from the signal with the cost of the underpricing. The results were inconsistent with the signaling theory set forth by Welch (1989). Michaely and Shaw (1994) found evidence antithetical to the signaling theory as well. By taking into account seasoned offerings and dividend payments, their research found no evidence linking positive future returns to the cost of underpricing.

Research supporting and opposing the three prominent explanations of liability exposure, signaling, and information asymmetry has been abundant. Additional theories that attempt to illustrate the underpricing of initial public offerings have also been developed in recent years. For example, Binder, Steiner, and Woetzel (2002) set forth a straightforward argument, recognizing that a modest level of compensation is suitable for investors assuming the risk of investing in an initial public offering.

Arguments involving market timing are abundant as well. Ritter and Welch (2002) demonstrate a moderate correlation between volume of initial public offerings and the average first-day return. The positive correlation between the volume of initial public offerings and the average first-day return could indicate that an issuing firm will undertake an initial public offering when equity valuations are higher. Therefore, this explanation set forth by Ritter and Welch (2002) suggests high volume would be
expected following periods of increased performance. Lowry and Schwert (2002) also recognize the correlation between the volume of initial public offerings and the average initial return. This analysis concludes that underwriters integrate the market valuation of prior initial public offerings into the offer price. In addition, evidence suggests that a firm is expected to undertake an initial public offering in close proximity to comparable firms.

Rajan and Servaes (1996) present another argument involving the timing of initial public offerings. They research a sample of initial public offerings and determine that a higher degree of underpricing results in increased analyst following. The higher degree of underpricing also leads to increased optimism regarding the earnings potential and growth prospects of recent initial public offerings. The examination states that more firms complete initial public offerings when analysts are optimistic. Underpricing may be an effort to attract interest, and there is a window of opportunity for an issuing firm when the initial public offering market is characterized by high initial returns.

Ibbotson and Jaffe (1975) discuss the existence of markets in which the performance of initial public offerings is anomalous to customary performance. The examination analyzes the potential relationship between the performance of an initial public offering and the performance of preceding initial public offerings. This analysis confirms that the aforementioned relationship is existent but not in all circumstances. Ritter (1984) elaborates on the existence of markets in which the performance of initial public offerings is anomalous to customary performance. This examination asserts that risk is a considerable factor in the degree of underpricing and that the composition of issuing firms with regards to risk is a determinant in the performance of the initial public offering market. This analysis sets forth the assumption that performance anomalous to
customary performance is isolated to certain industries as opposed to the entire initial public offering market. Allen and Faulhaber (1989) suggest that underpricing may emerge for a given duration within a certain industry. This conclusion returns to the signaling theory, presenting the notion that issuing firms of high quality may attempt to signal their quality by deliberately underpricing their initial public offering.

Helwege and Liang (2002) discuss stages in the initial public offering market. This assessment of the initial public offering market outlines levels of performance and establishes that stages of superior and inferior performance are often concentrated within select industries. The assessment concludes that multiple industries experience superior performance simultaneously, and that stages of superior performance are sourced from investor optimism. Rajan and Servaes (2002) accept that irrational investors may assume a position subsequent to an initial public offering based on the preceding performance of the industry. Irrational investors may coincide with the prevalent demand subsequent to an initial public offering and pay an elevated price for the security. This phenomenon could offer a reasonable explanation for the underpricing as well as the long-term underperformance of the security.
Chapter 2: Hypothesis

Diversified theories have been published to explain the underpricing of initial public offerings, and there have been numerous attempts in research to find determinants of underpricing. This paper focuses on one independent variable, industry performance in advance of an initial public offering, to determine whether industry performance leading up to an initial public offering has an effect on the observed underpricing. Prior research has scarcely examined industry performance leading up to an initial public offering as a potential determinant of underpricing. I expect to reveal, at minimum, a moderate positive correlation between these variables.
Chapter 3: Research Method

The completion of this thesis first required that I engage in exploratory research. It was essential that this exploratory research provided me with a complete and in-depth understanding of the pricing of initial public offerings with additional insight into underpricing theories. This exploratory research developed my literature review, which directed my focus and manufactured my thesis question.

It was necessary that I defined a standard for determining initial public offering returns. I deliberated between first-day returns, first-month returns, and first-year returns. I also considered whether it was logical to consider all of the above. Wharton Research Database Services offered access to the Center for Research in Security Prices, which is within the Booth School of Business at the University of Chicago. Consistently acquiring the first-day closing price from the Center for Research in Security Prices was not feasible as there were significant deficiencies in the data. On the other hand, consistently acquiring the second-day closing price was viable. The second-day closing prices were extracted from the Center for Research in Security Prices in a manner that could result in the occasional inclusion of third-day closing prices. However, there were no third-day closing prices in a sample of issuing firms that were examined. Although the Center for Research in Security Prices on Wharton Research Database Services offered sufficient first-month closing prices and adequate first-year closing prices, these extended return periods were not necessarily representative of underpricing. Calculating the percentage return from the offer price to the second-day closing price was an adequate measure of underpricing. I acquired a file detailing offer prices from Dr. Michelle Lowry,
Professor of Finance in the Smeal College of Business at the Pennsylvania State University. This file, derived from Thomson Reuters SDC Platinum, contained a comprehensive record of initial public offering data from 1970 through 2010.

I also utilized the file as a source for establishing a sample of issuing firms. The file incorporated the CUSIP identification system, which contained six-character and nine-character variations of the alphanumeric codes. The Center for Research in Security Prices on Wharton Research Database Services permitted the upload of an eight-character variation of the alphanumeric codes. I converted each nine-character CUSIP from the file to an eight-character CUSIP. The Center for Research in Security Prices on Wharton Research Database Services returned an output with a lesser quantity of issuing firms than the quantity requested by the input. The Code Lookup utility was effective in ascertaining accurate input data for issuing firms that were not returned with the preceding output. The Code Lookup utility did provide further output, but data for a considerable quantity of issuing firms was still not obtainable using the Center for Research in Security Prices on Wharton Research Database Services. I investigated issuing firms from the Thomson Reuters SDC Platinum file that were not operative in the data output. The Thomson Reuters SDC Platinum file cataloged 151 firms issuing equity in 2010. Sufficient output was not available for approximately 20 percent of the sample. Approximately 80 percent of these firms were either traded off-exchange, also referred to as over-the-counter, or on foreign exchanges. Approximately 20 percent of the firms that did not have sufficient output, which was approximately three percent of the entire sample for 2010, were missing a second-day closing price. The obtainable output from 2010 was adequate for completion of this thesis. Further examination confirmed this
trend was moderately comparable in earlier years. To further constrain my selection of issuing firms, I included the share code in the output. The security was not included in my analysis if the second character of the share code indicated the security represented a company incorporated outside the United States, a closed-end fund, or a real estate investment trust. The Standard Industrial Classification was also effective in the elimination of irrelevant securities. Issuing firms classified under Standard Industrial Classification code 6282 (Investment Advice) were eliminated. Firms classified under Standard Industrial Classification code 6719 (Offices of Holding Companies, Not Elsewhere Classified) were eliminated. Issuing firms classified under Standard Industrial Classification code 6722 (Management Investment Offices, Open-End) were eliminated. Issuing firms classified under Standard Industrial Classification code 6726 (Unit Investment Trusts, Face-Amount Certificate Offices, and Closed-End Management Investment Offices) were eliminated. Issuing firms classified under Standard Industrial Classification code 6733 (Trusts, Except Educational, Religious, and Charitable) were eliminated. Issuing firms classified under Standard Industrial Classification code 6770 (Blank Checks) were eliminated. Issuing firms classified under Standard Industrial Classification code 6798 (Real Estate Investment Trusts) were eliminated. Issuing firms classified under Standard Industrial Classification code 6799 (Investors, Not Elsewhere Classified) were eliminated. Issuing firms classified under Standard Industrial Classification code 9999 (Nonclassifiable Establishments) were eliminated.

Determining a measure of underpricing for the selected issuing firms, at this point in my research, was critical. A measure of underpricing was calculated using the percentage return from the offer price to the second-day closing price. Although this was
an adequate measure of underpricing, it was necessary to calculate the market-adjusted returns for comparative purposes. I evaluated several options for incorporating a market-adjusted return. The Russell 1000 Index was one option. The Russell 1000 Index represents approximately 92 percent of the traded equity market in the United States, and its composition varies over time. One advantage of using the Russell 1000 Index would have been its annual reconstruction by Russell Investments, which is completed to ensure new and growing equities are reflected. Another advantage of the Russell 1000 Index would have been the characteristics of the firms within, which are more representative of initial public offering firms than the characteristics of the firms within in some other indices. However, I ultimately decided on the S&P 500 Composite Index, which was obtainable using the Center for Research in Security Prices on Wharton Research Database Services. This was also chosen due to the reputation of the S&P 500 Composite Index, which is widely regarded as the best single gauge of large cap equities in the United States. What is more important, however, is that the S&P 500 Composite Index is often used as a benchmark indicator of the entire traded equity market in the United States. Calculation is based on the average performance of the common stock of the largest 500 firms in the United States. The S&P 500 Composite Index represents approximately 75 percent of the traded equity market in the United States, and its composition varies over time. The return on the S&P 500 Composite Index was obtainable for each date, so the return from the first-day was averaged with the return from the second-day to attain a figure, which was subtracted from the percentage return from the offer price to the second-day closing price. The result was a market-adjusted measure of underpricing.
Subsequent to calculating a measure of underpricing, it was imperative for me to define industries in which the issuing firms could have been assembled. Potential standards for assembling the issuing firms included the Standard Industrial Classification, the North American Industry Classification System, and the Global Industry Classification Standard. The Center for Research in Security Prices on Wharton Research Database Services offered satisfactory output for the Standard Industrial Classification and the North American Industry Classification System. The Global Industrial Classification Standard was not feasible as the standard was not existent as a potential output. The accessibility of the Standard Industrial Classification and the North American Industry Classification System presented two opportunities for defining issuing firms. The effectiveness of each standard was dependent on whether it would be feasible to assemble issuing firms into industries where performance data on those industries would be obtainable.

Dr. Kenneth French, Professor of Finance in the Tuck School of Business at Dartmouth College, distributed daily return data for customized industry portfolios. The Standard Industrial Classification operated as the foundation for the structure of the customized industry portfolios. At the lowest extremity, the collection of industry portfolios was constructed to define five distinctive industries. At the highest extremity, the collection of industry portfolios was constructed to define 49 distinctive industries. Between these extremities, six additional collections of industry portfolios existed, each with an assortment of distinctive industries. The collection of industry portfolios constructed to define twelve distinctive industries emerged as the most appropriate ensemble for this thesis. A preliminary assessment of issuing firms indicated that
utilizing twelve distinctive industries would allow for a comprehensive analysis across diverse market sectors without excessive segmentation, which could dilute the outcome. The twelve distinctive industries outlined by Dr. Kenneth French were consumer nondurables, consumer durables, manufacturing, energy, chemicals, business equipment, telecommunications, utilities, shops, healthcare, money, and other. Other was excluded.

Measuring industry performance in advance of an initial public offering was dependent on developing a model that would adequately assess various time frames prior to issuance. The dilemma at this stage in my research was to offer an abundant selection of time frames while simultaneously limiting the quantity of data. Industry performance in advance of an initial public offering was measured through eleven distinctive time frames prior to issuance. The eleven distinctive time frames prior to issuance were five days, ten days, 30 days, 60 days, 90 days, 120 days, 150 days, 180 days, 240 days, 300 days, and 360 days. The calculation involved averaging the returns of the industry portfolios within these time frames, with the most recent date in each sample being the date of issuance.

Industry performance in advance of an initial public offering and the degree of underpricing of an initial public offering had to be assembled within various time frames to offer an assortment of conclusions. I deliberated between assembling the data into six-month, one-year, five-year, and ten-year time frames. I decided to assemble the data into one-year time frames, and I also included one assembly of the entire sample, which included 839 issuing firms from 2001 through 2010.
Chapter 4: Analysis

I executed a comprehensive statistical analysis of the data for the 839 issuing firms. The purpose of this comprehensive statistical analysis was to determine whether industry performance in advance of an initial public offering has an effect on the underpricing of an initial public offering. Prior to this comprehensive statistical analysis, I calculated several descriptive statistics. Since some of these descriptive statistics have been discussed in prior academic research, I related established relationships involving these descriptive statistics to my thesis question.

One fundamental measure of central tendency was first calculated. The mean of the market-adjusted returns for the 839 issuing firms, which is the most probable outcome, was 11.7 percent. As mentioned earlier, Ritter and Welch (2002) sampled 6,249 initial public offerings from 1980 through 2001 and found the average first-day return to be 18.8 percent. Although the mean of the market-adjusted returns for the 839 issuing firms was considerably less than this comparison, Loughran and Ritter (2004) found the mean return from 2001 through 2003 to be 11.7 percent. Coincidentally, this number was equivalent to the mean of the market-adjusted returns for the 839 issuing firms. Thus, the sample of 839 issuing firms did appear to have a mean return that was representative of other mean returns calculated in academic research. The mean return was calculated using the formula below.

\[
\text{Mean} = E(x) = \bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i
\]

The median of the market-adjusted returns for the 839 issuing firms, which is the outcome halfway between the endpoints, was 6.6 percent. The mode of the market-
adjusted returns for the 839 issuing firms, which is the most often occurring outcome, was .1 percent. The maximum was 239 percent and the minimum was negative 32.6 percent.

The variance of the market-adjusted returns for the 839 issuing firms, one basic measure of dispersion, was calculated to be .038 using the formula below.

\[
Variance = \frac{1}{(n-1)} \sum_{i=1}^{n} (x_i - \bar{x})^2
\]

The standard deviation of the market-adjusted returns for the 839 issuing firms was calculated to be .194 using the formula below.

\[
Standard \ deviation = \sqrt{Variance}
\]

The calculation of standard deviation, a measure of dispersion, represented the level of volatility within the sample of returns. Lowry, Officer, and Schwert (1998) noted the understandable differences in the characteristics of issuing firms. Returning to the theory of information asymmetry, one argument involves the increased levels of uncertainty that occur in the valuation process for certain issuing firms. There would be an inherent relationship between uncertainty during the valuation process and the dispersion of the returns. When there is an increased level of dispersion, returns have a tendency to be higher. While my central question focused on industry performance in advance of an initial public offering, another industry-focused relationship that appeared practical was whether an increased level of volatility of initial public offering returns within an industry could contribute to either increased or decreased first-day returns of subsequent initial public offerings within that industry. Further investigation would involve calculating the volatility of initial public offering returns within each industry and
investigating a relationship between these figures and the returns of subsequent initial public offerings within the industry.

The skewness of the market-adjusted returns for the 839 issuing firms was calculated to be 3.11. This indicated that a larger percentage of the distribution was positioned to the right of the mean and was calculated using the formula below.

\[
Skewness \ Coefficient = \frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^3 \quad \text{or} \quad \sum_{i=1}^{n} p_i (x_i - \bar{x})^3
\]

Green and Hwang (2011) presented evidence of a positive correlation between IPOs with increased levels of expected skewness and high first-day returns. When there were decreased levels of expected skewness, first-day returns were lower. Their examination indicated skewness preference was an important incremental source of first-day returns. Considering the evidence set forth by Green and Hwang, one important question to note was whether a positive skewness in prior initial public offerings within an industry could contribute to increased first-day returns of initial public offerings within the industry. While my central question focused on industry performance in advance of an initial public offering, another relationship that appeared practical was that industry performance contributed to positive skewness of initial public offerings within an industry. Then, the positive skewness of initial public offerings within an industry contributed to increased first-day returns of subsequent initial public offerings within that industry. Further investigation would involve calculating the skewness of initial public offering returns within each industry and investigating a relationship between these figures and the returns of subsequent initial public offerings within the industry.
As mentioned earlier, the purpose of a comprehensive statistical analysis was to determine whether industry performance in advance of an initial public offering has an effect on the underpricing of an initial public offering. This comprehensive statistical analysis started with the calculation of various correlations. The calculation of correlations will always produce numbers between negative one and positive one. Numbers further from zero indicate a stronger correlation. The calculation of a positive correlation would have indicated that industry performance in advance of an initial public offering moves in the same direction as the return on the initial public offering. The calculation of a negative correlation would have indicated that industry performance in advance of an initial public offering moves in the opposite direction as the return on the initial public offering. Correlation was calculated using the formula below.

$$ \rho = \frac{\sigma_{AB}}{\sigma_A \sigma_B} $$

Table 4.1, Table 4.2, and Table 4.3 were inserted to summarize various correlations. The columns within the tables distinguish between each of the eleven time frames of industry performance in advance of an initial public offering. In Table 4.1, the rows separate the initial public offerings into one-year time frames. These one-year time frames were determined by the offer date of the initial public offering. In Table 4.2, the rows separate the initial public offerings into twelve distinctive industries. In Table 4.3, I included an assembly of the entire sample of initial public offerings within all industries from 2001 through 2010. This consists of all 839 issuing firms. Table 4.1, Table 4.2, and Table 4.3 are located on the next page.
### Table 4.1

Correlation Between Industry Performance in Advance of an Initial Public Offering at Various Time Frames and the Underpricing of an Initial Public Offering – Issuing Firms Separated by Offer Date

<table>
<thead>
<tr>
<th>Year</th>
<th>360 Days</th>
<th>300 Days</th>
<th>240 Days</th>
<th>180 Days</th>
<th>150 Days</th>
<th>120 Days</th>
<th>90 Days</th>
<th>60 Days</th>
<th>30 Days</th>
<th>10 Days</th>
<th>5 Days</th>
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</thead>
<tbody>
<tr>
<td>2001</td>
<td>-0.246</td>
<td>-0.277</td>
<td>-0.183</td>
<td>-0.147</td>
<td>-0.144</td>
<td>-0.137</td>
<td>0.112</td>
<td>0.072</td>
<td>0.321</td>
<td>0.237</td>
<td>0.285</td>
</tr>
<tr>
<td>2002</td>
<td>-0.120</td>
<td>-0.117</td>
<td>0.030</td>
<td>-0.161</td>
<td>0.105</td>
<td>0.150</td>
<td>0.243</td>
<td>0.030</td>
<td>-0.118</td>
<td>-0.154</td>
<td>-0.082</td>
</tr>
<tr>
<td>2003</td>
<td>0.043</td>
<td>0.097</td>
<td>0.356</td>
<td>0.391</td>
<td>0.401</td>
<td>0.494</td>
<td>0.473</td>
<td>0.572</td>
<td>0.435</td>
<td>0.205</td>
<td>0.107</td>
</tr>
<tr>
<td>2004</td>
<td>-0.040</td>
<td>0.090</td>
<td>0.074</td>
<td>0.008</td>
<td>0.001</td>
<td>0.103</td>
<td>0.135</td>
<td>0.148</td>
<td>0.284</td>
<td>0.203</td>
<td>0.192</td>
</tr>
<tr>
<td>2005</td>
<td>0.139</td>
<td>0.147</td>
<td>0.199</td>
<td>0.203</td>
<td>0.215</td>
<td>0.171</td>
<td>0.174</td>
<td>0.166</td>
<td>0.212</td>
<td>0.152</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>0.059</td>
<td>0.027</td>
<td>0.002</td>
<td>-0.018</td>
<td>0.040</td>
<td>0.087</td>
<td>0.219</td>
<td>0.174</td>
<td>0.109</td>
<td>0.158</td>
<td>0.141</td>
</tr>
<tr>
<td>2007</td>
<td>-0.026</td>
<td>0.007</td>
<td>-0.074</td>
<td>-0.055</td>
<td>-0.099</td>
<td>-0.096</td>
<td>-0.183</td>
<td>-0.125</td>
<td>-0.004</td>
<td>0.045</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>-0.059</td>
<td>-0.088</td>
<td>-0.153</td>
<td>-0.040</td>
<td>-0.087</td>
<td>-0.302</td>
<td>-0.255</td>
<td>-0.186</td>
<td>-0.015</td>
<td>-0.196</td>
<td>-0.102</td>
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<tr>
<td>2009</td>
<td>-0.374</td>
<td>-0.329</td>
<td>-0.123</td>
<td>-0.033</td>
<td>0.003</td>
<td>0.239</td>
<td>0.552</td>
<td>0.308</td>
<td>0.391</td>
<td>0.396</td>
<td>0.474</td>
</tr>
<tr>
<td>2010</td>
<td>0.226</td>
<td>0.159</td>
<td>0.195</td>
<td>0.230</td>
<td>0.114</td>
<td>0.059</td>
<td>0.131</td>
<td>-0.006</td>
<td>0.159</td>
<td>0.149</td>
<td>0.014</td>
</tr>
</tbody>
</table>

### Table 4.2

Correlation Between Industry Performance in Advance of an Initial Public Offering at Various Time Frames and the Underpricing of an Initial Public Offering – Issuing Firms Separated by Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>360 Days</th>
<th>300 Days</th>
<th>240 Days</th>
<th>180 Days</th>
<th>150 Days</th>
<th>120 Days</th>
<th>90 Days</th>
<th>60 Days</th>
<th>30 Days</th>
<th>10 Days</th>
<th>5 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer NonDurables</td>
<td>0.035</td>
<td>0.161</td>
<td>0.174</td>
<td>-0.059</td>
<td>-0.101</td>
<td>0.030</td>
<td>0.067</td>
<td>0.058</td>
<td>-0.113</td>
<td>-0.058</td>
<td>-0.087</td>
</tr>
<tr>
<td>Consumer Durable</td>
<td>0.176</td>
<td>0.038</td>
<td>0.212</td>
<td>0.109</td>
<td>-0.025</td>
<td>-0.154</td>
<td>0.127</td>
<td>-0.004</td>
<td>-0.174</td>
<td>0.111</td>
<td>-0.129</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.164</td>
<td>0.021</td>
<td>-0.015</td>
<td>0.057</td>
<td>0.130</td>
<td>0.171</td>
<td>0.200</td>
<td>0.034</td>
<td>-0.076</td>
<td>0.093</td>
<td>0.196</td>
</tr>
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<td>0.009</td>
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### Table 4.3

Correlation Between Industry Performance in Advance of an Initial Public Offering at Various Time Frames and the Underpricing of an Initial Public Offering – All Issuing Firms

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<th>Year</th>
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<th>240 Days</th>
<th>180 Days</th>
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<th>90 Days</th>
<th>60 Days</th>
<th>30 Days</th>
<th>10 Days</th>
<th>5 Days</th>
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<td>0.040</td>
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<td>0.088</td>
<td>0.124</td>
<td>0.101</td>
<td>0.098</td>
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</table>
In Table 4.1, as previously mentioned, the rows separate the initial public offerings into one-year time frames determined by the offer date. Each one-year time frame has a distinctive pattern. In 2001 and 2009, correlations were negative for higher time frames and positive for lower time frames. Figure 4.1 was inserted as a visual representation of this trend, and Figure 4.1 is located on the next page. In 2002, correlations were negative for higher and lower time frames and positive for time frames in the middle. Figure 4.2 was inserted as a visual representation of this trend, and Figure 4.2 is located on the next page. From 2003 through 2006 and in 2010, correlations were positive for almost all time frames. Figure 4.3 was inserted as a visual representation of this trend, and Figure 4.3 is located on page 21. From 2007 through 2008, correlations were negative for almost all time frames. Figure 4.4 was inserted as a visual representation of this trend, and Figure 4.4 is located on page 21. The preceding analysis did not suggest the existence of any recurring patterns. Figure 4.5 includes all offer dates, and Figure 4.5 is located on page 22.
Figure 4.3

Correlation Between Industry Performance in Advance of an Initial Public Offering and the Underpricing of an Initial Public Offering

Time Frames of Industry Performance in Advance of an Initial Public Offering


Figure 4.4

Correlation Between Industry Performance in Advance of an Initial Public Offering and the Underpricing of an Initial Public Offering

Time Frames of Industry Performance in Advance of an Initial Public Offering

- 2007  - 2008
In Table 4.2, as previously mentioned, the rows separate the initial public offerings into twelve distinctive industries. Similar to the first section of the table, each industry has a distinctive pattern. This analysis did not suggest the existence of any recurring patterns. Correlations were positive for almost all time frames in manufacturing, energy, and money. Figure 4.6 was inserted as a visual representation of this trend, and Figure 4.6 is located on the next page. Correlations were negative for almost all time frames in telecommunications. Figure 4.7 was inserted as a visual representation of this trend, and Figure 4.7 is located on page 24. Correlations were negative in higher time frames and positive in lower time frames for chemicals and business equipment. Figure 4.8 was inserted as a visual representation of this trend, and Figure 4.8 is located on page 24. Correlations fluctuated between positive and negative in consumer nondurables, consumer durables, utilities, shops, and healthcare. Figure 4.9
was inserted as a visual representation of this trend, and Figure 4.9 is located on page 25. Figure 4.10 includes all offer dates, and Figure 4.10 is located on page 25.
In Table 4.11, correlations were calculated for the entire sample of initial public offerings within all industries from 2001 through 2010. In the highest time frames, 360 days and 300 days, correlations were slightly negative. In the next highest time frame, 240 days, the correlation was positive. Correlations remained positive in lower time frames and increased as time frames decreased. Figure 4.11 was inserted as a visual representation of Table 4.3, and Figure 4.11 is located below.

![Figure 4.11](image)

The completion of several regression analyses was a critical component of this investigation. Regression analyses are useful for estimating relationships among variables. Variables included in the regression analyses include a dependent variable and one or more independent variables. The dependent variable in the regression analyses was the underpricing of the initial public offering. The determination of one or more
independent variables was necessary. Industry performance in advance of an initial public offering was one of the independent variables. Additional independent variables were also included.

Bansal and Khanna (2012) note that the age of the firm, the year of the initial public offering, the pricing mechanism, the ownership structure, the issue size, and the market capitalization explained approximately 44 percent of the variation in the degree of underpricing. Their study involves the Bombay Stock Exchange. \( H_0 \), the null hypothesis, indicates there is no significant difference between several independent variables and the degree of underpricing. \( H_1 \) predicts a relationship between the year of the initial public offering and the degree of underpricing. For nine years, the null hypothesis is not rejected. However, the null hypothesis is rejected for three years where relationships are evident. \( H_2 \), \( H_3 \), and \( H_4 \) predict relationships between various measures of ownership structure and the degree of underpricing. The null hypotheses are not rejected for each of these. \( H_5 \) predicts a relationship between the number of shares offered and the degree of underpricing, and the null hypothesis is rejected. \( H_6 \) predicts a relationship between the age of the firm and the degree of underpricing, and the null hypothesis is not rejected. \( H_7 \) predicts a relationship between issue size and the degree of underpricing, and the null hypothesis is rejected. \( H_8 \) predicts a relationship between market capitalization and the degree of underpricing, and the null hypothesis is rejected. \( H_9 \) predicts a relationship between a measure of subscription and the degree of underpricing, and the null hypothesis is rejected. \( H_{10} \) predicts a relationship involving the pricing mechanism, and the null hypothesis is rejected. \( H_{11} \) predicts a relationship concerning government versus private issuing firms, which is not relevant in the United States. The null hypothesis is
not rejected. H\textsubscript{12} predicts a relationship between offer timing and the degree of
underpricing, and the null hypothesis is rejected.

Many of the variables that Bansal and Khanna studied were related to the
details of the initial public offerings. Güntürkün, Gürarda, and Erdoğan (2012) analyze
various macroeconomic variables as an alternative. Some of these macroeconomic
variables include a consumer price index, a consumer confidence index, an interest rate, a
measure of global oil prices, and GDP per capita. This study involves the Instanbul Stock
Exchange.

Chiraphadhanakul and Gunawardana (2005) complete their study with nine
independent variables. Since this study involves the Thai Stock Market, the first
independent variable was the 60-day trend of the Stock Exchange of Thailand’s Index.
The second independent variable was the 60-day trend of the Stock Exchange of
Thailand’s volume. Other variables which were specific to the issuing firm included age,
firm size, return on assets, debt ratio, return on average of three years return, price-to-
earnings ratio, and price-to-earnings ratio of three years. Similar to my analysis,
Chiraphadhanakul and Gunawardana (2005) investigate relationships within various
industries as well as the entire market. They note the relationship between each variable
and the degree of underpricing depends on the characteristics of each sector.

The additional independent variables included in my analysis were influenced
by the aforementioned studies, but the accessibility of data was a significant factor as
well. As previously mentioned, I acquired a file from Dr. Michelle Lowry, which was
derived from Thomson Reuters SDC Platinum and contained a comprehensive record of
initial public offering data from 1970 through 2010. Included in this file were several
potential independent variables. The file included the number of shares offered by each issuing firm. The multiplication of the offer price and the number of shares offered provided the total offer amount. This was inserted as one independent variable in my analysis. I used the natural logarithm of the total offer amount. Booth and Booth (2003) discuss the relationship between total offer amount and the degree of underpricing. They note initial public offerings with a higher total offer amount are believed to have a decreased level of risk, which leads to a decreased level of underpricing. Nonetheless, Booth and Booth (2003) also use offer price as a control. They assert that a higher offer price may lead to an increased level of underpricing.

The file from Thomas Reuters SDC Platinum also indicated whether each initial public offering was a reverse leveraged buyout. The reverse leveraged buyout is an initial public offering of an issuing firm that was previously taken private through a leveraged buyout. Bowman and Graves (2005) emphasize the difference between previous issuing firms that were taken private through a leveraged buyout and those that were not. Their research relates the time period between the leveraged buyout and the subsequent initial public offering to the degree of underpricing. Cao and Lerner (2009) assert reverse leveraged buyouts typically outperform other initial public offerings. Klasa (2009) discusses how a reverse leveraged buyout tends to have a decreased level of underpricing. Klasa (2009) emphasizes the concept of information asymmetry and its relevance to the decreased level of underpricing. The reverse leveraged buyout was inserted as one independent variable in my analysis. This was inserted as a binary variable. The number one indicated an issuing firm that was previously taken private
through a leveraged buyout. The number zero indicated an issuing firm that was not previously taken private through a leveraged buyout.

The file from Thomas Reuters SDC Platinum also indicated whether each issuing firm was backed by venture capital. Flagg (2007) returns to the theory of information asymmetry. Since venture capital involvement is believed to decrease the level of information asymmetry, an issuing firm backed by venture capital should expect a decreased level of underpricing. Flagg discussed how venture capital involvement often is associated with intensive monitoring and the verification of the value of the issuing firm. Lee and Wahal (2004) published a contrasting theory. In their analysis, issuing firms backed by venture capital were underpriced approximately 14.7 percentage points higher than issuing firms not backed by venture capital. Whether or not an issuing firm was backed by venture capital was inserted as one independent variable in my analysis. This was inserted as a binary variable. The number one indicated an issuing firm that was backed by venture capital. The number zero indicated an issuing firm that was not backed by venture capital.

Regression Analysis A included 14 independent variables. The natural logarithm of the total offer amount of an initial public offering, a binary variable for an issuing firm previously taken private through a leveraged buyout, a binary variable for an issuing firm backed by venture capital, and eleven time frames of industry performance in advance of an initial public offering were used. All the regression analyses are based on the 839 issuing firms from 2001 through 2010.

The p-value is the estimated probability of rejecting the null hypothesis, $H_0$. The null hypothesis indicates there is no relationship between the independent variable
and the dependent variable. The alternative hypothesis is the opposite of the null hypothesis. In the Regression Analysis A, there were 14 alternative hypotheses. The significance level at which the null hypothesis would be rejected for all the regression analyses conducted was set at less than 5 percent. Therefore, a p-value that is less than or equal to .05 is referred to as statistically significant. One source suggests a p-value that is less than or equal to .001 is referred to as statistically highly significant.

Regression Analysis A suggests there are three statistically highly significant independent variables. The natural logarithm of the total offer amount of an initial public offering returned a p-value of .00000 when rounded to five decimals spaces. The null hypothesis for this independent variable was rejected. The binary variable for an issuing firm backed by venture capital also returned a p-value of .00000. The null hypothesis for this independent variable was rejected as well. The 90-day time frame of industry performance in advance of an initial public offering returned a p-value of .00034. This advised the rejection of the null hypothesis for this independent variable. Nonetheless, the null hypothesis was not rejected for all other time frames of industry performance. The null hypothesis was also not rejected for the binary variable for an issuing firm previously taken private through a leveraged buyout.

Since time frames of industry performance did overlap, further regression analyses were completed. The eleven time frames were inserted as independent variables in separate regression analyses. The five-day time frame is an independent variable in Regression Analysis B, the ten-day time frame is an independent variable in Regression Analysis C, the 30-day time frame is an independent variable in Regression Analysis D, the 60-day time frame is an independent variable in Regression Analysis E, the 90-day
time frame is an independent variable in Regression Analysis F, the 120-day time frame is an independent variable in Regression Analysis G, the 150-day time frame is an independent variable in Regression Analysis H, the 180-day time frame is an independent variable in Regression Analysis I, the 240-day time frame is an independent variable in Regression Analysis J, the 300-day time frame is an independent variable in Regression Analysis K, and the 360-day time frame is an independent variable in Regression Analysis L. The twelve regression analyses are summarized in Table 4.4, and Table 4.4 is located on the next page.
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<th>Regression</th>
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<th>D</th>
<th>E</th>
<th>F</th>
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<th>I</th>
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</table>

* Entire row contains coefficient
** Entire row contains p-value corresponding to coefficient above

Table 4.4
Coefficient and P-Value of Independent Variables from Regression Analyses A through L; R Square and Observations from Regression Analyses A through L
I extracted the p-values of the time frames of industry performance from Regression Analyses B through L and assembled these values to create Figure 4.12. P-values are on the horizontal axis and time frames are on the vertical axis. Figure 4.12 depicts a pattern in which time frames between five days and 90 days are either statistically significant or statistically highly significant. The five-day, ten-day, and 60-day time frames are statistically significant. The 30-day and 90-day time frames are statistically highly significant. Times frames between 120 days and 360 days are not statistically significant. Figure 4.12 is located on the next page. Similar to the initial regression analysis, the natural logarithm of the total offer amount of an initial public offering returned statistically highly significant p-values throughout all time frames. Another recurring pattern involved the binary variable for an issuing firm backed by venture capital. These regression analyses returned statistically highly significant p-values throughout all time frames. The binary variable for an issuing firm previously taken private through a leveraged buyout was not statistically significant throughout all time frames.
Figure 4.12

P-Value of Time Frame of Industry Performance in Advance of an Initial Public Offering

Time Frames of Industry Performance in Advance of an Initial Public Offering
Chapter 5: Conclusion

As mentioned at the commencement of this paper, firms often choose to raise capital through an initial public offering of equity. There are a variety of factors incorporated into a decision to go public, and the process leading up to an initial public offering is often characterized by uncertainty. As a result, the pricing of initial public offerings has been an intensely debated topic. The difference between the offer price and the first-day closing price is considered the initial return. The initial return is typically positive, which indicates underpricing of the equity issue. Often, this positive return is quite significant. For several decades, there have been numerous attempts to relate underpricing to a range of independent variables. This paper focused on one independent variable, which was industry performance leading up to an initial public offering. I attempted to determine whether industry performance leading up to an initial public offering has an effect on the observed underpricing. Throughout this paper, industry performance in advance of an initial public offering represented a number of time frames. The calculation of various correlations was completed to analyze the relationship within each of these time frames. When I completed a table and figure to analyze the correlations within each year, there was a slight pattern evident where time frames closer to the initial public offering were characterized by higher correlations. The correlation results indicated evidence of a consistent pattern across years. Nonetheless, some years were exceptions. When I completed another table and figure to analyze the correlations within each industry, there was no apparent pattern. The correlation results did not indicate evidence of a consistent pattern across industries. The final table and figure
relating to correlations considered the entire sample of initial public offerings. In this examination, higher correlations were evident in time frames closer to industry performance. Overall, there appears to be a relationship between lesser time frames of industry performance in advance of an initial public offering and the underpricing of an initial public offering. The completion of several regression analyses enforced this detection, as the p-values of industry performance in advance of an initial public offering were lower for lesser time frames. In conclusion, I believe there is reasonable evidence to suggest industry performance leading up to an initial public offering has an effect on the observed underpricing when lesser time frames are considered.
Chapter 6: References (Excluding Data Sources)


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