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Overinvestment and the Operating Performance of SEO Firms

Fangjian FU
Singapore Management University, fjfu@smu.edu.sg

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Fangjian Fu*

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Abstract

Prior studies have documented that firms' operating performance deteriorates following seasoned equity offerings (SEOs). This paper proposes and empirically tests the hypothesis that the poor performance is caused by managers' overinvestment. I show that, subsequent to the offering, SEO firms tend to invest more heavily than non-issuing control firms that are in the same industry and have enough financial slack and similar amounts of investment opportunities. More importantly, I find a negative relation between post-issue investment and operating performance, controlling for investment opportunities and pre-issue performance. The evidence supports an overinvestment interpretation as it stands in contrast to the prediction of an optimal investment model, in which firms in anticipation of decreased operating performance should invest less. Overinvestment results in a reduction in asset productivity, and is more severe for firms with relatively fewer investment opportunities.

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**Fangjian Fu is an Assistant Professor of Finance at Singapore Management University's Lee Kong Chian School of Business at 50 Stamford Road, Singapore 178899. Email: fjfu@smu.edu.sg, Tel: +65 6828 0244.*

Previous studies have documented that firms' operating performance deteriorates following seasoned equity offerings (SEOs). Meanwhile, the post-issue stock returns of SEO firms are inordinately low relative to various benchmarks of expected returns.[1] A popular explanation seems to be managers' timing the market, in which their decision of SEO is due to the anticipation of poor future performance. In this paper, I present an overinvestment explanation for the poor firm performance after SEOs. Managers' overinvestment of SEO proceeds leads to the poor performance. More specifically, I find that controlling for the differences in industry, investment opportunities, and financial slack, SEO firms still invest more heavily than non-issuing firms and the excess investment is negatively related to the post-issue operating performance. Further evidence shows that overinvestment significantly reduces the asset productivity of SEO firms.

Why do managers of SEO firms over-invest after equity offerings? Jensen (1986, 1993) argues that managers have various incentives to grow their firm beyond the optimal size. They can enjoy more private benefits by managing a larger firm and their compensation has too much weight on asset growth instead of profitability. Seasoned equity offerings are an effective way to grow firm size. For example, the average SEO proceeds in my sample are 24% of the issuing firm's market value and they are all cash. The probability of overinvestment increases with free cash flow under managers' control.

From the contracting perspective, firms are not required to disclose the specific use of SEO proceeds before the offering. Consequently, managers have discretion over the use of proceeds after the offering. Even though external equity is more costly than internal fund before the offering, it is not different from internal fund once under managers' control. There is virtually no monitoring as in debt financing. Moreover, managers' percentage of equity ownership often reduces after SEOs and shareholders become more diffuse. As a result, the monitoring of large shareholders reduces and managers have less incentive to abstain from overinvestment. Worse,

[1] See, for example, Hansen and Crutchley (1990) and Loughran and Ritter (1997) for findings of deterioration in operating performance, and Spiess and Affleck-Graves (1995), Loughran and Ritter (1995, 2000), and Jegadeesh (2000) for findings of poor stock return performance. Ritter (2003) gives a comprehensive review of SEO long-run return studies.

equity offerings increase the firm's public float, which enhances managers' ability to raise more capital through borrowings (Barclay, Fu, and Smith, 2009).

I test the overinvestment hypothesis by examining the post-issue corporate investment and its impact on operating performance. Instead of using some proxies such as managers' equity ownership to measure agency conflicts, I choose to examine the post-SEO investment directly. Abel and Blanchard (1983) shows that a firm's optimal investment is a positive function of its expected marginal profit of capital. Consistent with this notion, I develop a simple model to show that if SEO firms invest to maximize firm value (without agency costs), they should invest less if they anticipate a larger reduction in operating performance. Changes in operating performance are thus positively related to investment in the cross-section, if the investment is optimal. In contrast, overinvestment by definition reduces firm value. Changes in operating performance are negatively related to overinvestment, if managers over-invest. Findings of a negative relation would therefore lend support to the overinvestment hypothesis.

I examine 2,873 SEOs during 1980-1999 and find empirical evidence consistent with the overinvestment hypothesis. The new equity issues increase shares outstanding by 26% on average. The operating ROA, measured by operating cash flow divided by total assets net of cash, decreases by more than 2% for the median issuer. In the meantime, firms increase investment dramatically. During the first three years subsequent to the offering, SEO firms on average invest capital that amounts to 67% of their firm value before the offering. Compared to the investment before the SEO, the net increase is 1.5 times for the median issuer and is almost 13 times on average. The SEO proceeds are used not to retire debt, not to increase working capital, but to invest. Some firms even issue new debt to invest more.

Although the tendency of aggressive investment raises the question whether all the capital are invested to increase firm value, it is noteworthy that most SEO firms are growth firms with a lot of investment opportunities. In order to evaluate the possibility of overinvestment, it is necessary to account for investment opportunities of SEO firms. I match each SEO firm to a non-issuing control

firm in the same industry with a similar amount of investment opportunities. The control firm is not financially constrained so that it can invest fully to the demand of its investment opportunities. Investment opportunities are measured by the market-to-book ratio of assets before the offering.[2] I find that 67% of SEO firms in my sample invest more than their control firms. The difference in investments, labeled as abnormal investment, is used to measure the relative likelihood of overinvestment. Firms with negative abnormal investment (33% of the sample), i.e. issuers that invest less than their control firms, are assumed not over-investing. Firms with positive abnormal investment are more likely involved in overinvestment relative to the previous group.

I find that the post-issue operating performance is negatively related to abnormal investment of firms with positive abnormal investment, after controlling for other relevant factors. This evidence lends support to the overinvestment hypothesis. In contrast, among firms with negative abnormal investment (i.e., firms assumed not over-investing), the operating performance is positively related to their investment, as predicted by the optimal investment theory. This inverse U-shape relation between investment and operating performance holds under both regression and decile sorting analyses. Further analyses rule out the possibility that the negative relation between investment and operating performance is caused by the lag effect of investment.

One conclusion of my study is that free cash flow problems increase after SEOs. The agency costs of free cash flow are widely documented in the literature. For example, Jensen (1986) points out that the increases in oil price since 1973 generated large increases in free cash flow in the petroleum industry. Managers did not pay out the excess resources to shareholders. Instead, the industry continued to spend heavily on exploration and development activities even though average returns were below the cost of capital. Lang, Stulz and Walkling (1991) suggest that some tender offer mergers and acquisitions are driven by the free cash flow of the bidder firm. Blanchard, Lopez-de-Silanes and Shleifer (1994) suggest that the managerial behavior after a cash

[2] The market-to-book ratio of assets could also capture stock overvaluation. Since SEO stocks are often regarded as overvalued at the time of offering, the use of this ratio could exaggerate the true investment opportunities and therefore my estimated abnormal investment of SEO firms tends to be conservative.

windfall in the form of a won or settled lawsuit is explained by the agency model. Lang, Poulsen and Stulz (1995) imply that the agency costs of free cash flow increase after asset sales. Bates (2005) provides explicit evidence to show that firms that retain the cash proceeds from large asset sales systematically over-invest relative to an industry benchmark. Nohel and Tarhan (1998) find that operating performance improves after firms buy back stocks through tender offers. They suggest that this is because stock repurchase firms pay out free cash flow and employ assets more efficiently. Equity offerings are often regarded as the opposite of stock repurchases and bring in a large amount of cash to the issuer, so very likely the free cash flow problems increase after the equity offerings.

This study, however, is not the first to notice the increase in free cash flow problems due to equity issues. Jung, Kim, and Stulz (1996) suggest that increased free cash flow problems are able to explain the negative stock price reaction to SEO announcements. Lee (1997) finds that long-run stock returns of secondary offerings through which existing shareholders sell a large amount of shares to the public do not underperform their benchmarks, while SEOs experience significantly lower returns relative to their benchmarks. He suggests that the evidence can be explained by increased free cash flow problems after SEOs. I show the poor operating performance after SEOs are also explained by the increased free cash flow problems.

My paper is closely related to two other studies, which document a significant relation between investment and stock return underperformance. Loughran and Ritter (1997) find firms that rapidly increase capital expenditures have lower subsequent stock returns than other firms. Lyandres, Sun, and Zhang (2008) argue that an investment factor, long in low-investment stocks and short in high-investment stocks, helps to explain new issues puzzles. Adding this factor into standard factor regressions reduce the SEO stock return underperformance by about 75%. I show that investment also explains the operating underperformance of SEO firms.

The remainder of this paper is organized as follows. In Section I, I describe the SEO data. I examine the operating performance in Section II. Section III examines the post-issue uses of

proceeds. In Section IV, I present a simple model to illustrate the relation between the post-issue investment and operating performance without and with overinvestment respectively, and then investigate the relation empirically. A short conclusion follows.

I. The Data of Seasoned Equity Offerings

The sample selection starts with all seasoned equity offerings in the years 1980 to 1999 (inclusive), as reported in the Securities Data Corporation (SDC) electronic database. I choose 1980 as the beginning year because the operating performance of many small firms is not reported in COMPUSTAT before 1980. SEO issuers are relatively small in size, so results based on the SEOs of large firms could be biased. The sample period ends at 1999 to allow for at least five years data of post-issue operating performance. I impose several filters:

(1) The SEO stock must be listed on CRSP's file of monthly stock returns at the time of the offering. This criterion ensures that SEO stocks are traded at NYSE, AMEX, or Nasdaq.

(2) The issue must involve common stock only (CUSIP issue type check digit 10 or 11). This criterion ensures a focus on operating companies. Closed-end funds, Real Estate Investment Trusts, and American Depository Receipts are excluded.

(3) The SEO is not made by a utility (SIC code 4910-4949) or a financial institution (SIC code 6000-6999). Public utility firms have less of an information asymmetry problem (Smith (1986)). Strict regulations make managers' investment decisions less discretionary relative to other industrial firms. Consequently, overinvestment is also less of a concern in utility firms. More importantly, I do not find post-issue poor performance for utility firms. Banks may involuntarily issue new equity to meet regulatory capital requirements. An additional reason for the exclusion of financial institutions is that their extremely high leverage ratios distort many of the accounting ratios.

(4) The firm has not conducted an SEO in the previous five years.[3]

(5) The issuing firm's book value of assets in the fiscal year prior to the offering is available in the CRSP and COMPUSTAT merged database.

(6) If it is a combined offering, its primary shares consist of more than 50% of all the offering shares.

The whole procedure produces a sample of 2873 SEOs, which constitutes the basis for most of the empirical investigations in this paper.

Overinvestment is defined to be the excess investment after exhausting positive NPV projects. Therefore the magnitude of SEO proceeds has to be big enough to generate material impact on firm performance. I evaluate this value by comparing SEO proceeds to the issuing firm's value.[4] Table I shows that the average cash inflow to the issuing firm is indeed substantial. The mean SEO proceeds (P) are about 24% of the issuer's market value of assets (V) at the end of the fiscal year before the offering. The mean ratio of new to old shares is 0.26, suggesting that the average equity size increases more than a quarter after the offering. SEO firms have many investment opportunities, as reflected by their high market-to-book ratio of assets (V/A). However the huge amount of cash proceeds is still possible to exceed the optimal investment needs.

[Table I enters here approximately]

SEO firms are not required to disclose the specific use of proceeds in the prospectus that they file to the SEC before the offering. Most issuers only vaguely claim that the proceeds are for "general corporate purposes". External capital is therefore not different from internal capital once under managers' control. Given the enormous amount of cash inflows to the firm and the lack of

[3]Once a firm did an SEO, that firm cannot reenter the sample until five years from the issue date have passed. This practice follows Healy and Palepu (1990), and Loughran and Ritter (1997). They argue that the purpose is to reduce dependence of statistical tests. The results remain the same if these repeated SEOs are included.

[4] I define SEO proceeds to be the cash inflow that goes to the issuing firm. In primary equity offerings, the SEO proceeds equal total offering proceeds, while for combined offerings, the SEO proceeds are less than the total offering proceeds. The difference goes to the selling shareholders.

contracting on the use of proceeds, I hypothesize that free cash flow increases after the offering, at least for some SEO firms. In this paper, I examine whether some SEO firms over-invest and their operating performance is negatively affected after the offering.

II. The Operating Performance Surrounding SEOs

This section examines the operating performance of SEO firms. Due to the skewness of accounting ratios, it is typical to report median values in studies examining operating performance. In Table II, I report the median operating income to assets ratio, earnings per share, return on assets, cash flow return on assets, asset turnover and operating margin on sales for the sample of SEO firms. The horizon starts from the third fiscal years before the offering and ends at the fifth fiscal years after the offering.

As suggested by Barber and Lyon (1996), I use the operating income to assets ratio (operating ROA hereafter) as the primary measure of operating performance in this study.[5] It is estimated as operating income before depreciation (COMPUSTAT data item 13) divided by the average of the beginning- and ending-period cash-adjusted assets (total assets (data item 6) minus cash and marketable securities (data item 1)). The numerator, operating income before depreciation, is commonly referred to as EBITDA – earnings before interest, taxes, depreciation, and amortization. Because many issuers may temporarily park some of the SEO proceeds in the form of cash and marketable securities before investing in operating assets, I subtract cash and marketable securities from the total assets for the denominator. This portion of assets is not supposed to generate income at the same rate as the firm's operating assets do.

I decompose operating ROA into two components: asset turnover and operating margin on sales. Asset turnover, computed as sales (data item 12) divided by the average of the beginning- and ending-period cash-adjusted assets, measures the sales dollars generated from each dollar of

[5] This measure is frequently used in studies of operating performance, for example, Healy, Palepu and Ruback (1992), Loughran and Ritter (1997), Nohel and Tarhan (1998) among others. Relative to earnings (net income), operating income before depreciation is less affected by managerial discretions and thus measures the true operating performance better.

investment in assets. So it measures the productivity of operating assets. Operating margin on sales is computed as EBITDA divided by sales, which measures the operating income generated by per sales dollar. The degree of competition has a significant impact on this variable. Intensive competition reduces operating margin on sales. Operating ROA equals the product of asset turnover and operating margin on sales as follows:

$$\begin{aligned} Operating\ ROA &= Asset\ Turnover * Operating\ Margin \\ &= \frac{Sales}{(Assets - Cash)} * \frac{EBITDA}{Sales} \end{aligned} \tag{1}$$

The decomposition helps to identify the underlying reasons for changes in operating ROA. For example, if managers invest capital in negative NPV projects, it reduces asset productivity but does not have much direct impact on operating margin on sales. So overinvestment should decrease operating performance by reducing asset turnover.

Besides operating return on assets, I examine three alternative measures of operating performance: earnings per share, return on assets, and cash flow return on assets. The COMPUSTAT data items for these measures are described in Table II. The use of cash flow return on assets helps to overcome the potential earnings manipulation problem as documented in some studies.[6] However, Barber and Lyon (1996) point out that among all the performance measures they examined, the cash flow ROA yields the least powerful test statistics. Moreover, recent studies such as Shivakumar (2000), Brous, Datar and Kini (2001), and Denis and Sarin (2001) cast doubt on the effectiveness of earnings management around SEOs. Trading off benefits and costs, I choose to use operating ROA as the primary measure of operating performance and other variables to check result robustness.

The numbers presented in Table II suggest a clear trend. The operating performance measured by all of these four variables increases before the offering, peaks at the offering, and drops

[6] See, for example, Teoh, Welch and Wong (1998), Rangan (1998). These studies find that managers of issuing firms tend to manager earnings upward by boosting up accounting accruals in the year before and the year of the offering.

substantially after the offering. For the median issuer, operating ROA is 15.03% three years before the offering, peaks at 16.67% in the year of the offering, and falls to 11.26% five years after the offering. Earnings per share (EPS) for the median SEO starts at $0.39 three years before the offering, reaches $0.57 in the offering year and then drops to $0.18 within five years of the offering. The median ROA begins at 4.30% three years before the offering, reaches 5.28% in the offering year, and drops to 1.62% five years after the offering. Similarly, the median cash flow ROA peaks at 23.38% in the offering year and falls to 11.77% after five years. The time-series patterns of operating performance are very similar to the findings of Loughran and Ritter (1997). Their sample consists of 1338 SEOs during 1979 to1989. My sample size is twice as large due to my longer sample period.

[Table II enters here approximately]

When I refer to changes in operating performance after the SEO, I am comparing the performance in the post-issue years to the performance in the years before the SEO. The performance in the offering year is excluded because it is hard to differentiate which part of the measure is before and which part is after the offering. I define the three fiscal years before the offering to be the pre-issue years, and the five fiscal years after the offering to be the post-issue years.

Two different methods are used to estimate the change in operating performance. The first method is straightforward. For each SEO firm, I estimate the median (and mean) performance in the pre-issue years and the post-issue years respectively, and define their difference as the post-issue performance change. This method implicitly assumes high persistence of operating performance and therefore, issuer's own pre-issue performance is regarded as the benchmark for the expected post-issue performance. In Panel A of Table III, I report the median change in operating performance across all the SEO firms. Medians are evaluated by the Wilcoxon signed rank test. All these four measures of operating performance decline significantly after the offering

(*p*-value less than 0.001). Among them the median operating ROA decreases by 2.87%. The decomposition of operating ROA shows that the decrease is mainly attributable to a significant drop in asset turnover (a median drop of 21.71%). I do not find a significant change in operating margin on sales. Note that overinvestment leads to inefficient deployment of assets and reduces asset turnover. The severe drop in asset turnover hints that managers' overinvestment of SEO proceeds may be a reason for the deterioration of operating performance.

[Table III enters here approximately]

I also estimate the change in operating performance by an alternative method. In choosing a model of expected operating performance, Barber and Lyon (1996) suggest matching sample firms to control firms based on firm size and pre-event performance because this method yields well specified test statistics in most scenarios. The matching of pre-event performance is important to control the mean-reverting property of accounting-based measures. Regarding the choice of a statistical test, they recommend the non-parametric Wilcoxon test statistics. To implement this method, I first limit the universe of control firms to firms that are traded on the AMEX, NYSE, or Nasdaq, and have not issued equity in the previous five years. Thus, control firms are non-issuers. Second, for each SEO firm, I require its control firms to have book value of assets within 50%-150% of the issuing firm at the end of the offering year (year zero). Third, I require control firms' operating ROA in the fiscal year before the offering (year -1) be within 90%-110% of the SEO firm. Last, I select the control firm that has the closest match on operating ROA.[7] The operating performance of the control firm is regarded as the benchmark of expected performance for the SEO firm. I calculate the difference as the abnormal operating performance of the issuer in each year.

The next steps are similar to the first method. For each SEO firm, I compute the difference between the median abnormal performance during the five post-SEO years and the median

[7] About 300 SEOs do not find size and performance matched control firms. These SEOs are excluded from the following analysis. I do not relax matching criteria to avoid potentially large measurement errors.

abnormal performance during the three pre-SEO years. The results are reported in Panel B of Table III. The median (mean) difference in operating ROA across SEO firms is -2.23% (-2.68%) and the drop is statistically significant at 1%. Examination on the two components again shows that the drop is mainly due to the decrease in asset turnover. The median (mean) change in asset turnover is -15.26% (-22.27%) after equity offerings, while the change in operating margin on sales is not different from zero. In short, different methods yield consist results -- the operating performance of SEO firms drops significantly after the offering and the drop is largely induced by the reduction in asset productivity.

III. The Use of SEO Proceeds

An SEO brings in a large amount of cash inflow to the issuer and after the SEO the issuer's operating performance reduces significantly. If I look into details, each unit of operating assets does not generate same amount of sales revenue as before. A natural question to ask is what these firms do with the large amount of capital. Do managers use the money to maximize firm value?

I hypothesize four main uses of SEO proceeds: investing, retiring debt, increasing working capital, or hoarding cash. Table IV presents the median leverage ratio, change in debt, ratio of working capital to operating income, change in working capital, change in cash & marketable securities, and investment from three years before through five years after the offering. Book leverage is fairly stable before the SEO. The median is around 25%. Market leverage decreases before the offering due to the increase in stock price and therefore the denominator of market leverage. Leverage decreases significantly in the offering year (year 0) since SEOs increase the equity portion of the firm. The decrease however does not last longer than three years. Leverage ratios revert to the pre-issue level at the end of the third year after the SEO. The quick reversal of leverage ratio suggests that firms do not primarily use SEO proceeds to retire debt. This is confirmed by the mean change in debt reported in the third column. The numbers are all positive in the years after the SEO and the amounts issued after SEOs are no less than those of the pre-issue

years. I calculate the cumulative change in debt from year 0 to year 5 for each SEO firm and find that over 70% of SEO firms increase debt during this period and fewer than 30% of firms either maintain their debt level or retire debt after the SEO. Instead of retiring debt, SEO issuers typically issue substantial amount of debt shortly after SEOs.[8]

[Table IV enters here approximately]

SEO firms may use the proceeds to increase working capital. I compute working capital as the difference between current assets net of cash and marketable securities and current liabilities net of short-term debt. The numbers are deflated by operating income before depreciation (*EBITDA*). This ratio shows a slow decrease after SEOs. Issuers in fact maintain less working capital for a unit of income. The next column reports the net dollar change in working capital. I observe a more than 100% increase in year 0 and 1 relative to year -1, but the magnitude is not big relative to the SEO proceeds. Moreover, the net changes afterwards are just similar to the pre-SEO years. Combining the evidence, I argue that increase in working capital does not absorb much of the SEO proceeds.

Note my definition of working capital excludes cash and marketable securities. Issuers may park proceeds temporarily in cash and marketable securities after offerings. The dollar change in cash and marketable securities increases before the offering, but in small magnitude, until the year of the offering where the median change jumps to 5.81 million. Issuers then reduce the holding of cash and marketable securities during the three years subsequent to SEOs. SEO firms may store a part of their proceeds in the account of cash and marketable securities and then spend it in subsequent years.

The last column shows the median annual investment during the nine year window. Investment includes capital expenditure (COMPUSTAT data item 128), acquisition expense (data

[8] The median changes in debt are zeros or close to zero in each of the five post-SEO years. This however does not suggest that half of the firms add no debt in the post-issue years. This is because debt issues are often in lump-sum amounts and the majority of firms usually do not change their debt amount in a given year.

item 129), and increase in investment (data item 113). Note that investment is a flow variable, like net changes in debt, working capital, and cash in previous columns. The level of new investment is fairly stable before the offering. The median magnitude is about $4 million. However, it jumps to $10 million at year 0, further to $14 million during subsequent years. The post-issue increase in investment is substantial and persistent. The mean investment displays a similar time-series pattern but in much higher values, because investment usually occurs in lump-sum amounts.

To summarize, the dominant use of the SEO proceeds is to expand investment mainly including capital expenditure and acquisition expenses. Retiring debt is not likely a major use of proceeds. The effects of SEOs on leverage are transient. Issuing firms in fact issue substantial amounts of debt to move leverage back to the pre-issue level. The increase in working capital is small in magnitude and not significant in the long-run. Firms tend to hoard some proceeds in cash account. This part of proceeds may finally be used to expand investment.

IV. Post-Issue Investment and its Impact on Operating Performance

This section examines the post-issue investment of SEO firms and its impact on firm performance. I first develop a simple model. The model predicts that if firms invest optimally, the change in operating performance is *positively* related to the investment. However if firms over-invest, the relation between investment and change in operating performance is negative.

A. A Simple Model of Investment and Operating Performance

The model has two periods, the period before the equity offering and the period after the offering. For simplicity, I assume that firms pay all the operating profits out to shareholders and are then liquidated at the end of the second period. Before the offering, the issuer has assets A_0. The existing assets generate operating profit E_0 in each of these two periods. So the return on assets before the offering is $\frac{E_0}{A_0}$. Issuing firms raise capital through the SEO and make investment

decision. Investment (*I*) takes places in the period after the offering and increases the firm's assets. For simplicity, I assume that the discount rate of assets is zero. So the assets involve as follows:

$$A_1 = A_0 + I\,, \tag{2}$$

The investment generates profit in the period after the offering. The profit is positive if capital is invested in positive NPV projects and could be negative if capital is over-invested. Overinvestment is defined as the investment in value-destroying projects. The net profit therefore is determined by the investment that increases firm value and overinvestment. I specify the total investment as:

$$I = I^* + \varepsilon\,, \tag{3}$$

where I^* represents the investment that increases firm value and ε represents overinvestment. The net profit, $\Pi(I) = \Pi(I^*, \varepsilon)$, is increasing in I^* and decreasing in ε. The operating income generated in the second period, denoted as E_1, is the sum of E_0 and $\Pi(I)$. The return on assets in this period $\frac{E_1}{A_1} = \frac{E_0 + \Pi(I)}{A_0 + I}$.

I first assume that SEO firms invest optimally to maximize firm value, i.e. they do not over-invest. $\varepsilon = 0$, and I = I^*. The literature of investment suggests that optimally a firm should invest until the marginal cost of investing equals the shadow value of installed capital. The optimal investment is essentially determined by the firm's investment opportunities (Tobin (1969), Abel (1983), Abel and Blanchard (1983)). In Figure I, I illustrate the optimal investment of a firm. The horizontal axis represents the firm's investment deflated by its existing assets (I/A_0) and the vertical axis is the marginal *q*, which measures the marginal return on investment. The marginal *q* is decreasing in investment, as described by the law of diminishing marginal benefit. Mathematically, the derivative of marginal *q* with respect to investment is negative, i.e. the slope of marginal *q* is negative. For simplicity, I approximate the marginal *q* curve by a downward sloping line. However, the linearity is not required. The results to be presented hold under a convex or concave marginal *q* curve as long as marginal *q* is decreasing in investment. For simplicity, I

assume the marginal cost of investment to be one. It is clear that the marginal profit is decreasing in investment and that firms should invest until the marginal q reaches the marginal cost of investment which is one. Assuming an increasing and convex adjustment cost of investment does not change the basic implication. This would only make the decrease of net profit in investment faster. If the issuing firm's marginal q is at point B in the figure, optimally the firm should invest until its marginal q reaches point E, where q=1. The optimal investment deflated by assets is denoted by I^*/A_0, and the net profits generated by the optimal investment is the shaded area, which is $\Pi(I^*)/A_0$. The average returns on the optimal investment is $\Pi(I^*)/I^*$.

[Figure I enters here approximately]

Suppose now the marginal q at the time of the SEO is higher than B, this q line shifts upward. The firm has a larger set of investment opportunities and should optimally invest more. The net profit measured by the shaded area in Figure I also increases. More importantly, the decreasing property of marginal profit in investment implies that the increase in net profit is convex in optimal investment. As a result, $\Pi(I^*)/I^*$, the average return on optimal investment, is also increasing in optimal investment. In short, investment opportunities at the time of the SEO determine the optimal investment, the net profit, as well as the average return on optimal investment after the offering.

The variable of interests, the change in operating performance after SEOs, can be derived as follows:

$$\Delta ROA = \frac{E_1}{A_1} - \frac{E_0}{A_0}$$

$$= \frac{E_0 + \Pi(I^*)}{A_0 + I^*} - \frac{E_0}{A_0} \tag{4}$$

$$= \frac{\frac{\Pi(I^*)}{I^*} - \frac{E_0}{A_0}}{\frac{A_0}{I^*} + 1}$$

The first term in the numerator, the average return on investment, $\frac{\Pi(I^*)}{I^*}$, is increasing in the optimal investment $\frac{I^*}{A_0}$. The second term, $\frac{E_0}{A_0}$, is the operating ROA before the offering. The first term in the denominator, $\frac{A_0}{I^*}$, is the reciprocal of $\frac{I^*}{A_0}$, so it is decreasing in $\frac{I^*}{A_0}$. Since the numerator is increasing and the denominator is decreasing in the optimal investment, the change in operating returns on assets (ΔROA) is positively related to $\frac{I^*}{A_0}$. So I have the following proposition:

Proposition 1: *Assuming that firms invest to maximize firm value and that the net profit function is concave in investment and convex and increasing in optimal investment, the change in operating performance is positively related to optimal investment.*

The model above predicts a monotonically positive relation between the optimal investment and the change in operating performance. However, it does not consider the potential agency conflicts between managers and shareholders. Prior studies and anecdotal evidence suggest that managers have incentives to invest capital in value-decreasing projects in pursuit of their own benefits. So $\varepsilon > 0$ in Equation (3). Overinvestment, by definition, incurs losses and affects the operating performance negatively. This is shown in the following equation:

$$\Delta ROA = \frac{E_1}{A_1} - \frac{E_0}{A_0} = \frac{E_0 + \Pi(I^* + \varepsilon)}{A_0 + (I^* + \varepsilon)} - \frac{E_0}{A_0} \quad (5)$$

The numerator of the first term is decreasing in ε and the denominator is increasing in ε for any fixed *I**, the ROA after the offering is therefore decreasing in ε. I have the following proposition:

Proposition 2: *If SEO firms over-invest, the overinvestment reduces a firm's operating performance. Controlling for the optimal investment, the change in operating performance is negatively related to overinvestment.*

In short, if SEO firms do not over-invest, I expect to observe a positive relation between change in operating ROA and investment. Investment opportunities are the exogenous factor that determines both the optimal investment and future operating performance. However, if SEO firms over-invest, this overinvestment reduces firm value and operating performance. Findings of a negative relation between investment and operating performance would lend support to the overinvestment hypothesis.

B. Post-Issue Investment of SEO Firms

For each SEO firm, I compute the post-SEO annual investment as the mean investment during year 0 through year 2 and deflate it by the firm value at the end of the fiscal year before the offering. I also estimate the net investment growth rate (d*I*/*I*) as the difference between the post-issue and pre-issue investments scaled by the pre-issue investment, which is the investment at fiscal year -1. Panel A of Table V presents the results. The median post-issue investment deflated by the book value of assets (*I*/*A*) is 24.73%. The median issuer increases book assets by 74% through investment during year 0 to year 2. The median value of investment deflated by market value (*I*/*V*) is 11.80%. So issuers' investment after the SEO is fairly high relative to their existing assets. The mean values are higher than the medians. This positive skewness indicates that some firms invest very aggressively. The median net investment growth rate is above 100%, implying that the majority of SEO firms double and even triple their investment after the offering.

[Table V enters here approximately]

The model in the previous section suggests that the cross-sectional relation between investment and change in ROA hinges critically on the likelihood of overinvestment. Change in ROA is positively related to investment if firms invest optimally and controlling for the optimal investment, could be negatively related to investment if SEO firms over-invest. To test this prediction, I need to estimate the likelihood of overinvestment. Overinvestment is defined as the investment in excess of the optimal investment. So it is the difference between the observed investment and the optimal investment, provided that the difference is positive.

To estimate the optimal investment, I match each SEO firm to a non-issuing control firm on investment opportunity. The control firm is in the same industry as the SEO firm, is not financially constrained, and has the closest amount of investment opportunities to the SEO firm. The literature of investment suggests that investment opportunity and financial constraint are two important determinants of investment.[9] I exclude potentially financial-constrained firms from the matching pool of control firms so that the investment of these firms depends on their investment opportunities only. Financial slack is measured by the interest coverage ratio, which is earnings before interests and taxes (*EBIT*) divided by interest expense. I require control firm candidates to have an interest coverage ratio greater than three and above the first quartile in its industry (as classified by the 2-digit SIC code).[10] Following Smith and Watts (1992) and among others, investment opportunities are measured by the market-to-book value of assets (*V/A*). Among the

[9] The *q*-theory of investment implies that optimal investment is increasing in a firm's investment opportunities and investment opportunity is the only factor that determines investment. Later studies (e.g. Fazzari, Hubbard and Peterson (1988), Hubbard (1998) among others), nevertheless, point out that the *q*-theory of investment fails to consider the effects of financing constraints on investment. In other words, the *q*-theory only looks at the demand for investment, but does not consider the supply of capital. If a firm has little internal capital and limited access to the capital markets, its observed investment will deviate from the optimal amount predicted by the *q*-theory. These studies find supporting empirical evidence on the role of financing constraint in investment.

[10] Both conditions have to be satisfied to be in the matching candidate pool. Financial analysts usually view firms with an interest coverage ratio greater than 3 as financially strong firms. See the textbook by Stickney and Weil (2003), page 274-275. The ratio is often used to measure a firm's financial slack as in Bates (2005).

remaining pool, the control firm with the closest match on *V/A* is chosen as the final matched firm. To ensure matching of high quality, I exclude the 5% of the matched sample that has the largest differences in *V/A* between the SEO firm and its control firm.[11] The investment of the matched control firm is regarded as the benchmark of optimal investment for the SEO firm. I interchangeably refer to the difference between the investment of SEO firms and their control firm as benchmark-adjusted investment or abnormal investment.

In Panel B of Table V, I report the summary statistics of the benchmark-adjusted investment of SEO firms. The median is 8.24% of the issuer's book value of assets, or 4.07% of its market value. The mean values are again much higher than the medians. On average, SEO firms invest more than their control firms after the offering. In fact, about 67% of SEO firms invest more than their control firm i.e. the estimated abnormal investment is positive. Only one-third of the SEO firms invest less than their control firms and the magnitude of "under-investment" is small. This is also indicated by the positive skewness of abnormal investment.

Here I note a caveat. SEO firms tend to be high growth firms with many investment opportunities. One of the reasons for their offering of new equity is to raise investment capital. Since SEO firms are not a random sample, it is still possible that issuing firms optimally invest more than their control firms even if their market-to-book ratios are similar. In other words, the benchmark model of investment may not fully capture the optimal investment of SEO firms and the findings of positive abnormal investment do not necessarily mean that the firm is over-investing. Being aware of this caveat, I do not argue that SEO firms over-invest simply based on the estimated mean and median abnormal investment, although they are positive and statistically significant. Instead, I focus my attention on the relative magnitude of abnormal investment across SEO firms. I assume that relative to firms with negative abnormal investment, firms with positive abnormal investment are more likely over-investing. Among firms with positive abnormal

[11] People might argue that *V/A* prior to the SEO is inflated by the temporary overvaluation of the stock and therefore does not necessarily capture the true investment opportunities. If this is true, my matching tends to be conservative in labeling a firm as an overinvestment pursuer because I use an inflated measure of investment opportunity to find the control firm.

investment, I assume that firms with larger abnormal investment are more likely over-investing. In order to detect whether some SEO firms over-invest, I examine the cross-sectional relation between the post-issue investment and the change in operating performance. The previous model predicts a positive relation in firms with negative abnormal investment and a negative relation in firms with positive abnormal investment. Findings of the negative relation would support the overinvestment hypothesis.

C. Empirical Relation between Investment and Firm Performance

I examine the relation between investment and firm performance first by decile analysis. I divide the sample of SEO firms into deciles based on the ranking of the post-issue abnormal investment. Firms in the first (last) decile consist of the 10% of sample firms that have the lowest (highest) abnormal investments. Since about 34% of issuers invest less than their control firm, the firm with zero abnormal investment is in the fourth decile. Firms in the fifth to the tenth deciles invest more than their control firm and have positive benchmark-adjusted investment. Figure II shows the distribution of the median proceeds, raw investment (the observed investment), and abnormal investment over the SEO deciles. All the numbers are deflated by the book value of assets in the fiscal year prior to the offering. Note the pattern of raw investment is very similar to that of the estimated abnormal investment. In fact the cross-sectional correlation between the raw and abnormal investments is 81%. This implies that the cross-sectional variation in abnormal investment is mainly driven by issuers' investment instead of the matching model. Firms that invest more after the offering tend to have higher abnormal investment. The curve of proceeds shows an interesting convexity over investment deciles. In terms of magnitude, the median raw investment is lower than the proceeds in the first six deciles, is about the same in the following two deciles, and is much higher than the proceeds in the last two deciles.

[Figure II enters here approximately]

After splitting the SEO sample into deciles, I compute the median changes in operating ROA and its two components – asset turnover and operating margin on sales in each decile. Table VI presents the results and Figure III shows the graphic patterns. The relation between the change in operating ROA and the abnormal investment roughly displays an inverse U-shape. The relation is positive in firms of the first four deciles, while the relation is generally negative in the remaining firms. Note firms in the first four deciles have relatively lower abnormal investment. In fact the abnormal investment of most of these firms is negative. Firms in the last six deciles have positive abnormal investment and therefore relative to the group of firms with negative abnormal investment, these firms are more likely involved in overinvestment. Consistent with the prediction of the model, the cross-sectional relation between investment and change in firm performance is positive if the likelihood of overinvestment is low, and is negative if the likelihood of overinvestment is high. The finding of negative relation strongly supports the overinvestment hypothesis. For firms that invest aggressively, their operating performance drops by more.

[Table VI and Figure III enter here approximately]

Change in asset turnover indicates a decreasing pattern over SEO investment deciles, i.e. asset productivity drops by more if issuing firms over-invest to a greater extent. For firms in the decile of the highest abnormal investment, the drop in asset turnover is 54%. Changes in operating margin on sales are negative and significant at the 5% level only in first two deciles, and are positive in the last five deciles. So the performance deterioration of firms with positive abnormal investment is completely driven by the substantial drops in asset turnover. If managers squander capital in negative NPV projects, the average asset productivity will decline. Therefore, the evidence that the operating performance deterioration is accompanied by drop in asset turnover lends support to the overinvestment hypothesis.

In order to check the result robustness, I partition the SEO sample into deciles on the basis of the raw investment subsequent to the SEO. The purpose is to investigate whether the results are critically affected by the matching model of optimal investment. The results remain intact. I also use the univariate regression method to estimate average change in operating performance. The results are qualitatively very similar.[12] For firms that invest more than their control firm, I observe a significant deterioration in their operating performance. The deterioration can better be explained by the overinvestment hypothesis.

The inverse U-shape relation between investment and the changes in operating performance suggests the importance of post-issue investment in explaining the performance deterioration. I argue that the deterioration of firms with positive abnormal investment is mainly caused by managers' overinvestment. An alternative explanation is the lag effect of investment. Namely, investment increases operating assets immediately, but it may take years for the new operating assets to generate gains. The time gap between investment and the performance measured in this study is on average two years.[13] I assume that most investments of positive NPV projects should generate operating income at an expected rate after two years. In case the gap of two years is not long enough, I check the robustness in different ways.

First, I estimate the post-issue investment as the average of the investments in year 0 and 1, and the post-issue performance as the median from year 2 to year 5. This procedure ensures no overlapping period between investment and the performance measured and also increases the average gap between them. The results remain. Second, I investigate the operating performance from year +6 to year +10 for firms with positive abnormal investment. If performance deterioration of these firms is caused by lag effects, I expect to observe a run-up in performance beyond five years after the offering. I however do not find a significant reversal of performance during year +6

[12] I report the results in the previous version and draw inferences mainly from these results. The reason for dropping it is because the simple difference between pre- and post- issue performance as reported in this version is more intuitive and yields same inferences.

[13] I estimate the post-issue investment as the average of year 0, 1, and 2. The post-issue operating performance is measured up to year 5.

to year +10. Third, I examine the relation between abnormal investment and performance in a subsample of issuers with short operating cycles. The lag effects of investment should be less severe in these firms. The length of the operating cycle is measured as in Dechow (1994).[14] I however find that the negative effect of investment on firm performance in this subsample is as severe as that in the whole sample. The evidence together suggests that the negative relation between investment and subsequent firm performance are unlikely caused by the lag effects of investment. Moreover, the lag effects of investment do not explain the positive relation between investment and change in performance for firms that invest less than their control firm.

I examine nine years of operating performance surrounding SEOs, including three pre-issue years and five post-issue years. The estimated performance changes are based on the median performance during the pre- and post-issue years. To avoid the survivorship bias, I do not require firms to have all the nine years of performance data. I do not find a reason that this favors my results. In any event, however, I check the robustness by defining the pre- and post-issue years differently. I define the pre- and post-issue years respectively as the three years before and after the offering. Alternatively, I define the pre- and post-issue years as the second and third years before and after the offering (by taking out the years immediate before and after the offering). None of these actions affects the main results.

In addition to the decile analysis, I also examine the relation between investment and firm performance by regression analysis. In order to avoid cross correlations in regression residuals, I employ the standard Fama-MacBeth regressions, that is, the regressions are run for each year and the time-series mean and standard deviation of slopes are used to draw inferences.[15] For instance, there are 65 SEOs in 1990. I run the regression of 1990 based on the variables of these 65 issuing firms. The dependent variable of the regressions is the post-issue operating performance (*ROA_a*),

[14] Operating cycle = $\left(\frac{(AR_t + AR_{t-1})/2}{Sales/360}\right) + \left(\frac{(Inv_t + Inv_{t-1})/2}{COGS/360}\right)$, where AR stands for account receivable, Inv stands for inventory, and COGS cost of good sold.

[15] The reasons for employing Fama-MacBeth regression in corporate finance research are elaborated in Fama and French (2002). This method has been adopted by recent corporate finance studies such as Barclay, Fu, and Smith (2009).

measured as the median operating ROA during the post-issue years (year 1 to year 5). Table VII reports the regression results. The model predicts that expected operating performance is positively related to investment if SEO firms do not over-invest. I test this hypothesis by the first regression model. Firms entering the first model have negative abnormal investment. Relative to other SEO firms, they are less likely involved in overinvestment. The independent variables include the post-issue investment deflated by book value of assets *(Ln(I/A)),* pre-issue operating performance measured by the median operating ROA during year -1 to year -3 (ROA_b), and issuer firm size *(Ln(A)).* The regression results confirm the positive relation between investment and expected operating performance when issuers are not over-investing. The coefficient of investment is positive and significant at the 1% level (8.28 with a t-statistic of 3.17). Operating performance shows some persistence, as reflected by the positive and significant coefficient of the pre-issue performance (0.45 with a t-statistic of 6.69). The average slope of firm size is significantly positive, implying that the deterioration in operating performance is less severe in larger firms than in small firms.

[Table VII enters here approximately]

Excess investment decreases firm performance and destroys value. The model also predicts that if managers over-invest after the SEO, the overinvestment can result in lower operating performance. Testing this hypothesis however requires control for the optimal investment. Since optimal investment is a function of investment opportunity, I control for it by including the proxy for investment opportunity - *Ln(V/A)*. The second and third regression models are designed to test this hypothesis. Firms entering these two regressions have positive abnormal investment. Relative to firms in the first regression model, they are more likely over-investing. The overinvestment hypothesis predicts a negative coefficient for the (excess) investment variable and a positive coefficient for the investment opportunity variable. I find the predicted results. The average slope

of investment is -3.32 with a t-stat of -2.75. Controlling for investment opportunity, the post-SEO operating ROA is decreasing in investment. I obtain similar results if the investment variable is replaced by the estimated abnormal investment. The average slope of investment opportunity is 11.05 with a t-stat of 3.54. SEO firms with relatively better investment opportunities yield better performance after the offering. Since the abundance of investment opportunity mitigates the free cash flow problem, this evidence also lends support to the overinvestment hypothesis. The slope of pre-issue performance is still positive and statistically significant. The magnitude is less than that of the first model (0.32 vs. 0.45), suggesting that good pre-SEO performance persists less into the future for over-investing firms.

In the third regression, I add an interaction variable, which is the product of the post-issue investment (*Ln(I/A)*) and a dummy variable for investment opportunities (*Dum*). The dummy equals 1 if the market-to-book value of assets (*V/A*) is below the median across firms, and equals 0 otherwise. Other explanatory variables are the same as in the second regression. Firms that enter the regression again have positive abnormal investment. The overinvestment hypothesis predicts that the coefficient of the interaction variable should be negative because, all else being equal, the negative effect of overinvestment on performance is more severe in firms with fewer investment opportunities. Supporting the overinvestment hypothesis, the average slope of this interaction variable is negative and statistically significant (-2.29 with a *t*-statistic of -2.62). Overinvestment reduces operating performance by more in firms with fewer investment opportunities.

In the last regression, I use SEO proceeds as an explanatory variable. In order to compare across firms, I deflate the proceeds by issuing firm's market value prior to the offering. Similar to the third model, I employ an interaction variable of the proceeds and the investment opportunity dummy, and find that the average slope of the proceeds variable is negative though statistically not significant and that the slope of the interaction variable is negative and statistically significant at the 1% level (-2.04 with a *t*-statistic of -2.15). This suggests that for firms without abundant

investment opportunities, more SEO proceeds exacerbate the free cash flow problem. The slope of investment opportunity and pre-issue performance remains positive and statistically significant.

The results from Fama-MacBeth regressions are consistent with the findings from decile analysis. Evidence suggests that managers' overinvestment does exist in some SEO firms and has significantly negative effects on the operating performance of these firms. The deterioration is more severe if issuing firms do not have abundant investment opportunities but invest aggressively after the offering.

V. Conclusion

The operating performance of SEO firms decreases substantially after offerings. Meanwhile, the stock price performs poorly. What causes the disappointing performance? I propose managers' overinvestment as one explanation. A large amount of cash proceeds are at the discretion of managers after the equity offering so that the free cash flow problems increase. Managers over-invest subsequently and firm performance deteriorates.

If managers invest to maximize firm value, I expect to observe a positive relation between investment and future operating performance. Investment opportunities call for investment and optimal investment generates profit. The relation could flip sign if a significant part of the investment is not used to increase firm value. Empirically, I document evidence that supports the existence of overinvestment. I find that the positive relation between investment and subsequent operating performance exists only in firms that are not likely over-investing. The relative likelihood of overinvestment is measured by the difference in investment between the SEO firm and its non-issuing control firm. The control firm is in the same industry as the SEO firm, is not financially constrained to invest, and has a similar amount of investment opportunities to the SEO firm. For SEO firms that invest more than their control firms, the post-issue operating performance is negatively related to investment controlling for the optimal investment and pre-issue

performance. This negative relation stands in contrast to the prediction of the optimal investment model and therefore supports the overinvestment hypothesis.

My paper contributes to the literature in the following aspects. It points out that equity offerings and future operating performance are endogenously related and emphasizes the important impact of post-issue investment on firm performance. It provides to the literature a new explanation that aids understanding of the post-issue investment behavior and the poor operating and stock price performance of many SEO firms.

My findings suggest that managers of some firms can make use of the capital markets to generate free cash flow and then squander resources at the expense of shareholders. This challenges existing hypotheses that regard the acquisition and control markets as efficient monitors or a perfect control mechanism of free cash flow problems. For example, Easterbrook (1984) assumes that the capital markets can monitor managers at low cost. It is thus beneficial to make the firm more dependent on (and therefore closely monitored by) the capital markets, suggesting this as one of the reasons why firms pay dividends. Dividend payouts disgorge the free cash flow under mangers' control and force the firm to visit the capital markets frequently for investment capital. From the corporate control perspective, Jensen (1986) also suggests that the capital markets are able to control agency costs of free cash flow. If managers of a firm squander capital in negative NPV projects, another firm will acquire the firm and increase value by re-allocating resources efficiently. In contrast, the findings of my study suggest that some managers make use of the capital markets to generate free cash flow and then squander it at the expense of shareholders. The desirable monitoring of the capital markets described by Easterbrook (1984) does not apply to a typical SEO firm. Most SEO firms neither pay dividends nor frequently issue equity. Although the capital markets discourage seasoned equity offerings by lowering issuers' stock price significantly at the announcement, offerings by firms with few investment opportunities are not prevented. The corporate control function of the capital markets does not work well for SEO firms either. Prior studies suggest that SEO firms are overpriced for a long time after the offering. Control markets

cannot solve the overinvestment problem because no rational bidder has an incentive to buy an overvalued firm (Jensen, 2005). This study implies that the ability of the capital acquisition and control markets to prevent overinvestment of SEO firms is rather limited. Other mechanisms, such as reinforcement of corporate governance and better contracts to align interests of different parties, are still in need.

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Figure I. The Optimal Investment of a Firm

This figure illustrates the optimal investment of a firm. The horizontal axis represents the firm's investment deflated by its existing assets (I/A_0) and the vertical axis is the marginal q which measures the marginal return on investment. The marginal q is decreasing in investment, as described by the law of diminishing marginal benefit. This is shown in the figure by the negative slope of the marginal q curve. The marginal cost of investment is assumed to be one. I^*/A_0 denotes the optimal investment deflated by assets with respect to the marginal q at point B. The shaded area stands for the net profits generated by the optimal investment.

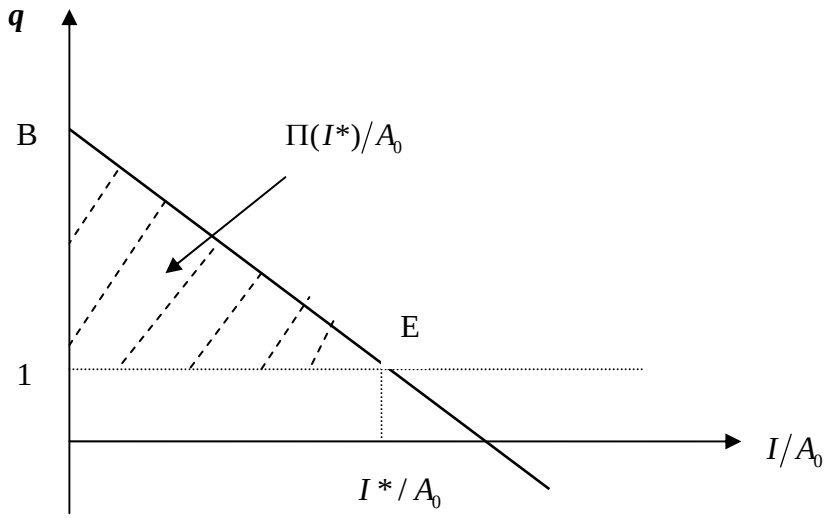


Figure II. The Distribution of SEO Proceeds and Subsequent Investment

This figure shows the distribution of the median SEO proceeds, raw and abnormal investment over SEO deciles. Variables are deflated by the book value of assets before the offering. The SEO sample is partitioned into deciles on the basis of the post-issue abnormal investment. Firms in the first decile have the lowest abnormal investment and firms in the last decile have the highest abnormal investment.

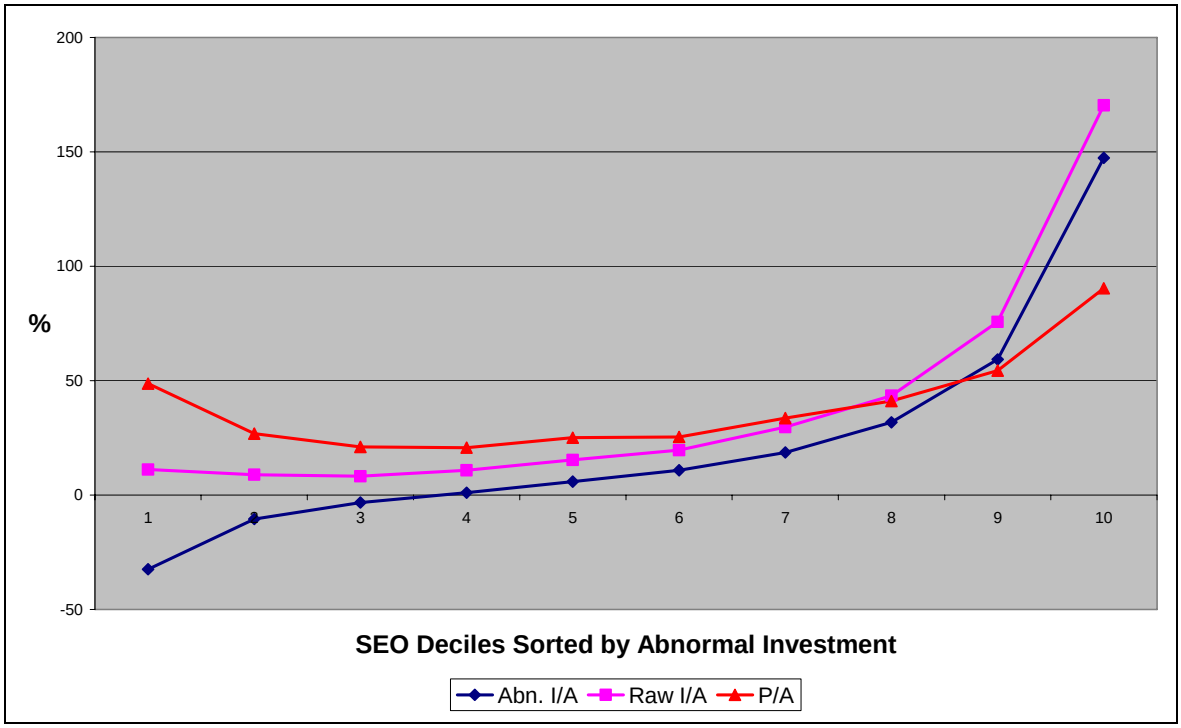
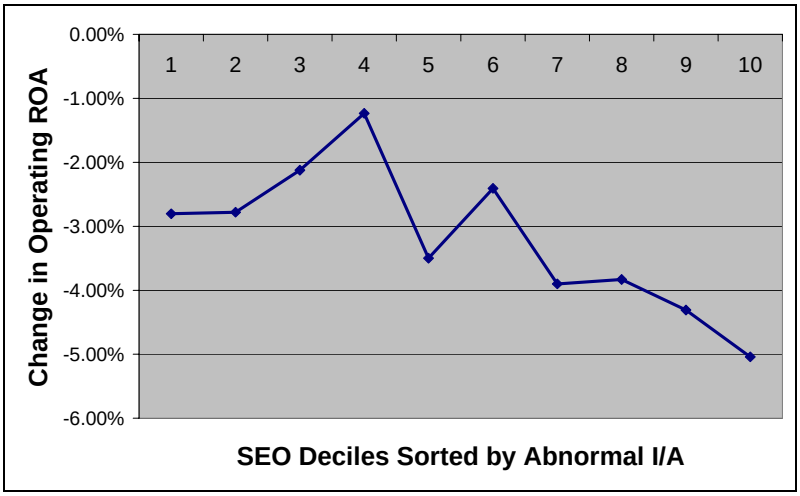
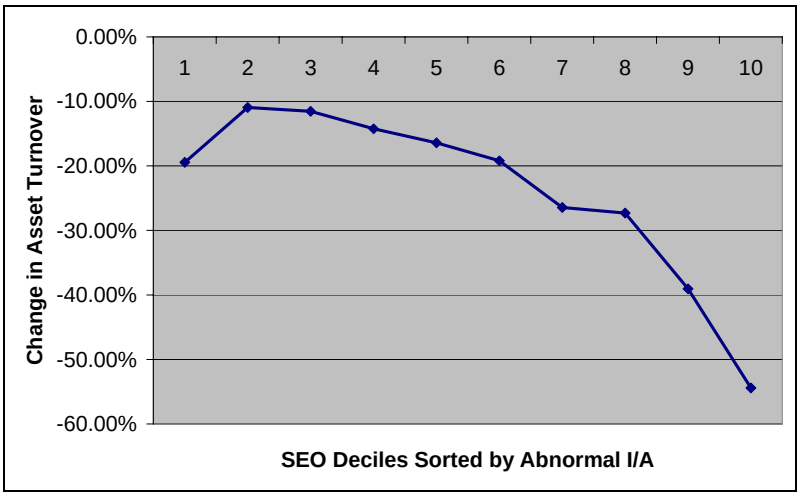


Figure III. Median Change in Operating Performance of the SEO Investment Deciles

The following figures corresponds to Table VI and display the median changes in operating ROA, asset turnover and operating margin on sales in each SEO decile. Decile partitions are based on the post-issue abnormal investment. Firms in the first decile have the lowest abnormal investment and firms in the last decile have the highest abnormal investment.





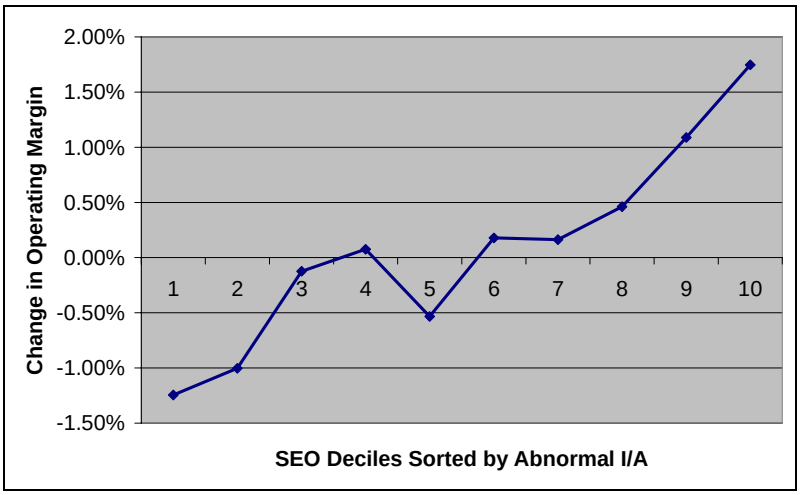


Table I. Summary Statistics of Seasoned Equity Offerings

The SEO sample is obtained from the Securities Data Corporation (SDC). It consists of 2873 seasoned equity offerings during the period of 1980 to 1999. The following criteria are applied to select the sample: (1) The stock is listed on the CRSP monthly stock file at the time of the offering; (2) The issue involves common stock only; (3) The company is not a regulated utility (SIC code 4910-4949), or a financial institution (SIC code 6000-6999); (4) The firm has not conducted an SEO in the previous five years; (5) The book value of assets of SEO firms must be present on the CRSP and COMPUSTAT merged database; (6) If it is a combined offering, its primary shares consist of more than 50% of all the offering shares. NS/OS represents the ratio of new shares to existing shares outstanding. The SEO proceeds (*P*) are the cash inflow that goes to the issuing firm, as measured by the product of new offering shares and the offer price. *A* is the book value of assets in the fiscal year prior to the offering (COMPUSTAT data item 6). *V* stands for the market value of assets, as measured by book value of asset minus book value of equity plus market value of equity (COMPUSTAT data6-data60+data199*data25). *BE and ME* respectively represent the book value and the market value of equity in the fiscal year prior to the offering. Ind_A represents the industry median book value of assets where industry is classified by two-digit SIC codes.

Variable	Mean	Median	Quartile 1	Quartile 3	Std Dev	N
NS/OS	0.26	0.20	0.13	0.29	0.48	2821
P/V	0.24	0.17	0.09	0.28	0.35	2496
P/A	1.06	0.41	0.17	0.93	3.91	2873
V/A	2.71	1.79	1.25	3.05	2.54	2496
BE/ME	0.44	0.34	0.19	0.57	0.37	2496
A/Ind_A	8.31	1.15	0.43	3.51	28.99	2858

Table II. Median Operating Performance Surrounding SEOs

This table presents the median operating surrounding SEOs. The data are obtained from the CRSP/COMPUSTAT merged database. The horizon covers from the third year before the offering to the fifth year after the offering. The variables are defined as follows: Operating returns on cash-adjusted assets (Operating ROA) is measured as data13/average(data6-data1); Earnings per share (EPS) is data58; Return on assets (ROA) is measured as data18/average(data6); Cash flow return on assets (Cash flow ROA) is measured as (data13+ Δ data2+ Δ data3- Δ data70- Δ data72+ Δ data68)/average(data6-data1). The function of average( ) is to take the average of the beginning- and ending-period values. The operating ROA is decomposed into two variables so that operating ROA equals the product of asset turnover and operating margin on sales. Asset turnover is computed as data12/average(data6-data1); and operating margin on sales is computed as data13/data12. All variables except EPS are in percentages. Year zero is the fiscal year of the offering. *N* is the number of issuing firms whose operating ROA is available.

Year	Operating ROA	EPS *($)*	ROA	Cash flow ROA	Asset turnover	Operating margin on sales	*N*
-3	15.03	0.39	4.30	17.49	151.04	9.64	1628
-2	15.09	0.36	4.33	18.68	150.02	9.96	2014
-1	16.44	0.42	4.81	20.85	151.03	10.58	2504
0	16.67	0.57	5.28	23.38	144.44	11.39	2826
+1	14.18	0.45	3.89	18.77	128.63	10.27	2720
+2	12.03	0.32	2.57	14.39	122.35	9.05	2563
+3	11.81	0.25	2.01	13.25	120.37	9.12	2379
+4	11.87	0.25	2.03	12.93	118.17	8.98	2207
+5	11.26	0.18	1.62	11.77	119.10	8.62	2045

Table III. Change in Operating Performance after SEOs

This table presents the median change in operating performance, estimated using two different methods, surrounding SEOs. The variables are defined in Table II. Panel A presents the median difference in *raw* operating performance between the post- and pre-issue years. The pre-issue years are defined to be the three years before the offering; and the post-issue years are the five years after the offering. For each SEO firm, I compute the median values of operating performance in the pre-issue years and in the post-issue years respectively. I then calculate their difference between the pre- and the post-issue performance. The reported numbers are the median difference across firms. Panel B presents the median difference in *abnormal* operating performance between the post- and pre-issue years. The method of abnormal performance estimation follows Barber and Lyon (1996). Sample SEO firms are matched with control firms on the basis of the book value of assets at the end of the offering year and the operating ROA in the fiscal year before the offering. The following procedure is the same as that to compute the numbers in Panel A. If there is missing data, the median is computed using data for the remaining years. The results are evaluated using the Wilcoxon signed rank test. The medians that are significantly different from zero at the 1% level are marked with *.

Panel A: Median change in raw operating performance and the Wilcoxon test

VAR	Operating ROA	EPS *($)*	ROA	Cash flow ROA	Asset turnover	Operating margin on sales	*N*
Median	-2.87*	-0.09*	-1.88*	-8.62*	-21.71*	0.00	2382

Panel B: Median change in abnormal operating performance and the Wilcoxon test

VAR	Operating ROA	Asset turnover	Operating margin on sales	N
Median	-2.23*	-15.26*	0.00	2312

Table IV. Use of SEO Proceeds

The table reports the median leverage, working capital, change in cash, and investment within the nine-year window of SEOs, including three years before, the year of, and five years after the SEO. The variables are defined as follows:

$$Debt = Long-term\ Debt + Debt\ in\ Current\ Liabilities = data9 + data34;$$

$$Book\ Leverage = \frac{Debt}{Book\ Value\ of\ Assets} = \frac{(data9 + data34)}{data6};$$

$$Market\ Leverage = \frac{Debt}{Market\ Value\ of\ Equity + Book\ Value\ of\ Assets - Book\ Value\ of\ Equity} = \frac{(data9 + data34)}{((data25 * data199) + data6 - data60)}$$

$$Working\ Capital\ (WC) = Current\ Assets(net\ of\ cash) - Current\ Liabilities\ (net\ of\ short-term\ debt) = (data4 - data1) - (data5 - data34)$$

$$WC / Income = WC / data13$$

$$Cash = Cash\ \&\ Marketable\ Securities = data1$$

$$Investments = CAPEX + Acquisitions + Increase\ in\ Investment = data128 + data129 + data113$$

Year Relative to SEO	Book Leverage	Market Leverage	Δ Debt ($ million)		WC/ Income	Δ WC ($ million)	Δ Cash ($ million)	Investment ($ million)	
			Med	*Mean*				Med	Mean
-3	0.25	0.18	0.02	39.94	0.93	0.43	0.05	3.34	141.59
-2	0.24	0.16	0.19	36.83	0.85	0.65	0.14	3.73	141.80
-1	0.26	0.14	0.74	30.96	0.76	0.88	0.22	4.84	138.23
0	0.16	0.08	0.00	15.63	0.83	1.86	5.81	9.99	174.34
+1	0.20	0.13	1.27	31.90	0.74	1.99	-0.46	14.40	183.14
+2	0.22	0.14	0.34	38.52	0.73	0.94	-0.04	14.39	206.38
+3	0.24	0.16	0.04	65.28	0.73	0.70	-0.04	13.78	262.61
+4	0.25	0.17	0.00	56.55	0.73	0.47	0.06	13.53	299.79
+5	0.24	0.17	0.00	6.21	0.66	0.30	0.01	12.89	336.02

Table V. Post-Issue Investment of SEO firms

The table reports summary statistics of the post-issue investment of SEO firms. Investment (*I*) is the sum of capital expenditure (COMPUSTAT data item 128), acquisition expense (data item 129) and increase in investments (data item 113). I compute the mean annual investment during year 0 through year 2, and deflate it by the book value of assets (*I/A*) or the market value of the firm (*I/V*) in the pre-issue year. d*I/I* stands for net investment growth calculated by dividing the difference between the post-issue and pre-issue investments by the pre-issue investment. Panel A reports the raw investment. Panel B reports the abnormal investment relative to a control firm that has the closest market-to-book value of assets (*V/A*) to the SEO firm and that is not financially constrained (the matching firm has an interest coverage ratio greater than 3 in magnitude or above the bottom quartile in the industry of the same two-digit SIC code, whichever is larger).

Variables	N	Mean	Median	Quartile 1	Quartile 3
Panel A: Raw investment					
I/A	2840	67.98	24.73	11.70	57.92
I/V	2465	22.39	11.80	5.69	24.70
d*I/I*	2804	1269.55	145.35	24.25	462.57
Panel B: Benchmark adjusted investment					
I/A	2438	30.30	8.24	-3.19	31.83
I/V	2438	12.11	4.07	-1.99	15.34
d*I/I*	2386	665.58	59.01	-76.79	296.27

Table VI. Median Change in Operating Performance: Sorting SEO Firms into Deciles by Benchmark-Adjusted Investment

The sample of SEO firms is divided into deciles on the basis of the benchmark-adjusted post-issue investment. Firms in the first decile have the lowest abnormal investment and firms in the last decile have the highest abnormal investment. The table reports the median change in operating performance after the offering for each SEO decile. For each SEO firm, I compute the medians of operating performance in the pre-issue years and in the post-issue years respectively, and then calculate the difference between the pre- and the post-issue performance. The reported numbers are the median difference across firms in each decile. The pre-issue years are defined to be the three years before the offering; and the post-issue years are the five years after the offering. If there is missing data, the median is computed using data for the remaining years. Figure III shows the graphic patterns of the changes.

Investment deciles	Operating ROA	Asset turnover	Operating margin on sales	N
1 (Low)	-2.80*	-19.46*	-1.25*	244
2	-2.78*	-10.94*	-1.00*	244
3	-2.12	-11.55*	-0.12	244
4	-1.23	-14.26*	0.08	244
5	-3.50*	-16.43*	-0.53	243
6	-2.41*	-19.22*	0.18	244
7	-3.90*	-26.45*	0.16	244
8	-3.83*	-27.32*	0.46	244
9	-4.31*	-39.06*	1.09	244
10 (High)	-5.04*	-54.41*	1.75*	243

Table VII. Fama-MacBeth Regressions of Operating Performance

The table reports the Fama-MacBeth regression results. The dependent variable (*ROA_a*) is the post-issue operating ROA, measured as the median operating ROA in the post-issue years (year 1 to year 5). The independent variables are the post-issue investment *(Ln(I/A)),* investment opportunities measured by *(Ln(V/A)),* offering proceeds deflated by firm value (*Ln(P/V)*), pre-issue operating ROA (*ROA_b*), firm size (*Ln(A*)), and a dummy variable of investment opportunities (*Dum*). *Dum* equals 1 if *V/A* is below the median, and 0 otherwise. Firms in the first regression invest less than their control firms (abnormal investment is negative). Firms in the second and third regressions invest more than their control firms (abnormal investment is positive). The regression of the fourth model applies to all firms. Regressions are run for each fiscal year in the period of 1980 – 1999. The table reports the means (across years) of the regression intercept and slopes. The *t*-statistics for the means, defined as the time-series mean divided by its standard error, are in parentheses. N is the average number of observations in fiscal year regressions.

ROA_a	**I**	**II**	**III**	**ROA_a**	**IV**
Ln(I/A)	8.28	-3.32	-2.30	**Ln (P/V)**	-1.34
	(3.17)	(-2.75)	(-2.71)		(-0.64)
Ln(V/A)		11.05	8.49	**Ln(V/A)**	10.24
		(3.54)	(3.06)		(3.73)
Ln(I/A)*Dum			-2.29	**Ln(P/V)*Dum**	-2.04
			(-2.62)		(-2.15)
ROA_b	0.45	0.32	0.34	**ROA_b**	0.41
	(6.69)	(5.12)	(6.54)		(9.33)
Ln(A)	4.11	1.53	1.40	**Ln(A)**	3.33
	(4.86)	(3.72)	(3.01)		(3.79)
Intercept	--37.83	-6.79	-5.54	**Intercept**	-10.83
	(-3.77)	(-1.07)	(-1.08)		(-1.87)
N	34	72	72	*N*	106