Optimal investment and long run underperformance of SEO

Abstract

This paper use a real option model based on rational pricing to explain the stylized return around seasoned equity offering (SEO) by optimal investment strategy. Managers time the market to exercise its growth options only when the value of the option becomes large enough. Consequently, prices always run-up before issues and returns is low after wards to reflect the decreasing in firm's systematic riskiness. The introduction of Commitment-to-Invest into the model helps to reduce the riskiness gradually after SEOs. Simulated data suggest that with reasonable parameter values the model can generate returns matches many futures of real data.

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1. Introduction

In the baseline setting of corporate finance, projects are executed if they have a positive net present value (NPV). However, when projects can be postponed, net present values become insufficient to determine the optimal investment strategy, because managers can wait for more favorable market conditions to issue new security[①]. Those projects that can be timed to invest become growth options of firms.

There are many previous studies use the real option model to explain specific return scenarios around different corporate events[②]. And my work will nest in the literature that relates SEO long run under performance to real investment. Carlson, Fisher, and Giammarino (CFG 2006) develop a comprehensive real option theory of SEO episode returns assuming asymmetric information. This theory is broadly linked to contributions by Berk, Green, and Naik (1999), Brennan and Schwartz (1985), Carlson, Fisher, and Giammarino (2004), Cooper (2006), Gomes, Kogan, and Zhang (2003), Kogan (2004), Li, Livdan, and Zhang (2007), Lucas and McDonald (1990), McDonald and Siegel (1985), Pastor and Veronesi (2005), and Zhang (2005). Those works argue that an option to grow the company through execution of the project is a levered claim. The required return on a levered claim is higher than the required return on an unlevered claim on the same assets. Exercising the real option, i.e., making the investment necessary to start the project unlevers the claim. Thus, when firms grow they convert real options into assets in place. The assets may be risky, but an option on these assets is even

① Graham and Harvey (2001) present survey evidence that suggests managers are concerned about the appropriate timing of equity issues.

② Real options model are applied for returns in M&A, stock splits, stock repurchase.

riskier. Those models can predict a pattern of stock return that consistent with empirical finds③. The abnormal low return does not happen because the SEO is timed, but rather because there has been a fundamental shift in the riskiness of the firm's assets.

The model I will use in this work is closely related to models in CFG (2006). However, while the model in CFG (2006) impose asymmetric information between managers and investors to generate gradually shifted long run abnormal return, the model in this work generate return dynamics similar to the empirical results without imposing restriction on information updating. The trick is to replace a single period investment plan to long run projects, which generates extra risks that disappear with time. Investment project can impose additional investment requirement that cannot be waived or postponed. This commitment of investment can increase firm's risks. Because the cash inflow (profit of firms) is riskier than the cash outflow (commitment to increase the investment in a period of time). Introducing commitment into investment arrangement, implies that other than market return, size, and book to market, a fourth factor that correlated with the cost of the commitment is needed to explain cross-sectional underperformance of returns after SEOs.

The main body of the paper will be organized as follow: In section 2, I will define a growth option model under efficient market hypothesis, characterize the optimal investment policy and implied risk dynamics of the firm around SEO events. Section 3 discusses all the implications of the model, especially those related to long run under-performance of the stocks.

③ Ritter (2003) based on a large literature, summarizes that stocks on average have 72% prices run-up one year prior to issuance, a -2% negative announcement reaction and -27.6% abnormal return for a five year buy-and-hold portfolio

Then in section 4, I will use real data to test some of the implications. Section 5 using simulated method of moments to calibrate parameters of the model.

2. Real Option Model

2.1 Firms Technology, Growth Options and Demand Dynamics

For simplicity assume there are two types of options $j \in$ {C, N}. Options of type C means after the initial investment, for a fixed time in the future, the firm committed to invest additional amount, while type N options need only one full investment. Firm can spend $\lambda \geq k_1 - k_0$ to convert a C or N type option into an investment project.

Following the model of Carlson, Fisher, and Giammarino (CFG, 2006) Firm's production activity can be summarized as follow:

An all equity firm produce according to:

$$P_t = X_t Q_t^{\gamma-1} \tag{1}$$

where, Q_t is the instantaneously output rate, X_t is an exogenous state variable following:

$$dX_t = gX_t dt + \sigma X_t dz_t, \tag{2}$$

z_t is a standard Brownian motion , and g *and* σ are drift and standard deviation of the growth rate X_t.

At t=0, all firms start with installed capital level k_0, and produce with strictly increasing production function $Q_t = Q(K_t)$. Let τ be the point of time the firm exercises its growth option.

The investment decision after exercising a C type option will consist of two parts. First, invests a lumpy up-front cost λ such as construction down payments or building design cost at time τ, then invest a continuous investment flow at a growth rate $\nu \geq 0$ during time $[\tau, \tau + T]$. Therefore, the capital level of the firm with a type C option can be summarized by

$$K_t = \begin{cases} k_0 & if \quad t < \tau \\ k_1 e^{\upsilon(t-\tau)} & if \ \tau \leq t \leq \tau + T \\ k_2 & if \quad t > \tau + T \end{cases} \tag{3.c}$$

Where, $k_1 \equiv k_0 + I$, $k_2 \equiv k_1 e^{\upsilon T}$

A firm exercises a type N option at τ will has capital levels as:

$$K_t = \begin{cases} k_0 & if \quad t < \tau \\ k_1 & if \quad t \geq \tau \end{cases} \tag{3.n}$$

Firms will lose their growth option randomly and the stopping time τ_s follows an exponential distribution with parameter ρ_j, where j is the index for types of growth option. Let,

$$Y_t = \begin{cases} 0 & if \ t < \tau_s \\ 1 & if \ t \geq \tau_s \end{cases}$$

be the indicator function for losing an growth option, then the unconditional stopping time of a specific options is $\exp(-\rho_j t)$. A firm are more likely to lose its growth option if ρ is big. The existence of potentials to lose the option is not essential in the basic setup, but will help when firms have more than one option at a time.

2.2 Firms Intrinsic Value at Different Life Stage and Optimal Investment

Assume manager of the firm have full information of types of options it have in hand. And acting in favor of current shareholders by maximizing firm's intrinsic value, defined as the price that will be paid by a competitive markets that has access to the same information as the managers. Therefore, the model rules out all possible conflicts between manager's and current shareholders. The manager chooses to maximize the intrinsic value of the firm by choosing investment policy D and production Q.

$$V_t = \max_{Q,D,} \{ \int_t^{\infty} e^{-r(s-t)} [(P_s Q_s - F_s) ds - \lambda \ D_s] \mid F_t \}$$

Where, F is a fixed cost that assume by now proportional to firm's capital level. Therefore, the intrinsic value of the firm will be a function of X, Y, K, and j. Let i={0,1,2} be the indexes of the life stage(capital level) of the firm.. Then $V_{ij}(X_t \ , \ Y_t)$ will explicitly recognize this dependence. Notice that the operating revenue $QP(Q) = XQ^{\gamma}$ is increasing in output, and no marginal cost assumed in this model. Firm's optimal production plan is to produce at full capacity. This assumption is essential to make sure there exists a closed form solution for the optimal investment strategy. New investment need time to gain its full capacity, and output level is summarized by

$$Q_t = \begin{cases} K_t & if \ t < \tau_j \\ K_t - b(K_t - k_0) & if \ \tau_j \le t \le \tau_j + T \\ K_t & if \ t > \tau_j + T \end{cases} \tag{4}$$

Above setting adapted to the time to build assumption of an investment by introducing b into the model. Investment will not be able to produce at full capacity immediately. And parameter

b captures the waste of low productivity. For simplicity, T is assuming to be constant across different type of growth options. (Other plausible settings is a type N option may have a smaller T, since the company get all the investment at one time, so more flexible (have more free cash) to arrange additional cost after the down payment.

Now, I will move on to calculate the value of firms at different life stage. A firm had completed its expansion at time t will have its value equals the assets value at hands only.

$$V_{2C} = \frac{X_t Q_2^{\gamma}}{\delta} - \frac{F_2}{r}, \; V_{2N} = \frac{X_t Q_1^{\gamma}}{\delta} - \frac{F_1}{r} \tag{5}$$

Firm had exercised its growth option but did not complete the whole process, will have different current value. Because exercising different types of options can generate discrepancies of capital level over time period $[\tau, \tau + T]$, thus will generate different cash flows and operation costs. Let D=1 be the indicator function that firm exercises its growth option and C=1 be the indicator function that the type of investment plan the firm had exercised is investment with commitment in the future.

The value of a premature firm that exercised an option without commitment is,

$$V_1(D=1, C=0) = \frac{X_t k_1^{\gamma}}{\delta} - \frac{F_1}{r} - \frac{X_t (k_1^{\gamma} - k_0^{\gamma})}{\delta} b\{1 - \exp[-\delta(\tau + T - t)]\ \} \tag{6.n}$$

$$rewrite, \qquad \equiv X_t V_{1N,t}^{A} - \frac{F_1}{r} = V_{2N} - F_b$$

$$where, \quad V_{10,t}^{A} = \frac{k_1^{\gamma}}{\delta} - \frac{(k_1^{\gamma} - k_0^{\gamma})}{\delta} b\{1 - \exp[-\delta(\tau + T - t)]\ \}$$

The first two terms in first line of (6, n) is just the value of a mature firm, and the last term is a measure for the cost of time to build denoted as Fb. And this cost Fb decreases with time t and disappears after T.

To simplify expressions in this work, define $\Gamma_t(x) = \exp\{-x(\tau + T - t)\}$.

A premature firm that exercised a type C growth option at τ will have a value:

$$
\begin{aligned}
&V_1(D=1, C=1) = \\
&X_t\left(k_2^{\gamma}\frac{\Gamma_t(\delta)}{\delta} + k_1^{\gamma}e^{\upsilon(t-\tau)}\frac{1-\Gamma_t(\delta-\nu)}{\delta-\nu} - b\left(k_1^{\gamma}e^{\upsilon(t-\tau)}\frac{1-\Gamma_t(\delta-\nu)}{\delta-\nu} - k_0^{\gamma}\frac{\Gamma_t(\delta)}{\delta}\right)\right) \\
&\qquad -\frac{\lambda_1 e^{\upsilon(t-\tau)}}{r-\nu}\{1-\Gamma_t(r-\nu)\ \} \\
&\qquad -\frac{F_1 e^{\upsilon(t-\tau)}}{r-\nu}b\{1-\Gamma_t(r-\nu)\} - \frac{F_2}{r}\Gamma_t(r) \\
&\equiv X_t V_{11,t}{}^{A} - V_t^{C} - F_{11,t} \qquad (6.c) \\
&Where,\ V_{11,t}{}^{A} = k_2^{\gamma}\frac{\Gamma_t(\delta)}{\delta} + k_1^{\gamma}e^{\upsilon(t-\tau)}\frac{1-\Gamma_t(\delta-\nu)}{\delta-\nu} - b\left(k_1^{\gamma}e^{\upsilon(t-\tau)}\frac{1-\Gamma_t(\delta-\nu)}{\delta-\nu} - k_0^{\gamma}\frac{\Gamma_t(\delta)}{\delta}\right) \\
&V_t^{C} = b\lambda_1 e^{\upsilon(t-\tau)}\frac{1-\Gamma_t(r-\nu)}{r-\nu},\ \ F_{11,t} = bF_1 e^{\upsilon(t-\tau)}\frac{1-\Gamma_t(r-\nu)}{r-\nu} + F_2\frac{\Gamma_t(r)}{r}
\end{aligned}
$$

$V_{11,t}{}^{A}$ captures changes of all future revenues when exercise the option at t. V_t^{C} measures value of costs generated by increment of invests.

From (6,n) and (6,c), the optimal investment decisions and growth option value before exercising can be characterized as following:

Proposition 1: the optimal investment strategy[④] for a juvenile firm (i=0) facing an option with commitment to invest is

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[④] Dixit and Pindyck (1994) proves the result in their book. See appendix for a short proof.

$$\mathrm{x_C}(C=1)=\frac{\xi}{\xi-1}\frac{\lambda_1+V_\tau^C+F_{11,t}+F_0\ /r}{V_{11,\tau}^A-K_0^\gamma/\delta}=\varepsilon\frac{\xi}{V_{10,\tau}^A-K_0^\gamma/\delta}=\frac{B_C}{A_C}\frac{\xi}{\xi-1}$$

$$V_0(X_t,C=1,Y_t)=X_t\frac{Q_0^\gamma}{\delta}-\frac{F_0}{r}+\left(\frac{X_t}{x_C}\right)^\xi\varepsilon(1-Y_t), \qquad (7,c)$$

$$\textit{where,}\quad \xi=\sqrt{(\frac{1}{2}-\frac{r-\delta}{\sigma^2})^2+\frac{2(r+\rho)}{\sigma^2}}+\frac{1}{2}-\frac{r-\delta}{\sigma^2}$$

$$\textit{and}\quad \varepsilon=\frac{\lambda_1+V_\tau^C F_{11,t}-F_0\ /r}{\xi-1}=\frac{B_C}{\xi-1}$$

Proposition 2: the optimal investment strategy for a juvenile firm facing an option with no commitment to invest is

$$\mathrm{x_N}(C=0)=\frac{\xi}{\xi-1}\frac{\frac{F_2}{r}+\frac{F_0}{r}+\lambda_2}{V_{10,\tau}^A-K_0^\gamma/\delta}=\varepsilon\frac{\xi}{V_{10,\tau}^A-K_0^\gamma/\delta}=\frac{B_N}{A_N}\frac{\xi}{\xi-1}$$

$$V_0(X_t,C=0,Y_t)=X_t\frac{Q_0^\gamma}{\delta}-\frac{F_0}{r}+\left(\frac{X_t}{x_N}\right)^\xi\varepsilon(1-Y_t), \qquad (7,n)$$

$$\textit{where,}\quad \xi=\sqrt{(\frac{1}{2}-\frac{r-\delta}{\sigma^2})^2+\frac{2(r+\rho)}{\sigma^2}}+\frac{1}{2}-\frac{r-\delta}{\sigma^2}$$

$$\textit{and}\quad \varepsilon_N=\frac{\frac{F_2}{r}+\frac{F_0}{r}+\lambda_2}{\xi-1}=\frac{F_2+F_0+\lambda_2 r}{r(\xi-1)}=\frac{B_N}{\xi-1}$$

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a wedge which always values more than 1, and can reach values such as 2 or 3, for real parameters, and increases with the economic uncertainty.

Firm will exercise their growth options when the state variable $X_t = x_\tau$ for the first time. Compare results in (7, c) to the results in CFG (2006), x_C is bigger, since the commitment cost V_τ^C motivate the firms to wait longer.

3. Implications of the Model

3.1 Parameters with optimal investment

Before I proceed to calculate implied return dynamics of the model, it will be helpful to examine the investment policy in (7,n) and (7,c) in more detail. Recall that the NPV of an immediately exercised option can always be written in the form of $NPV(X_t) = X_t A - B$ for both types of growth options[5].

And, the optimal investment policy and option value will respectively be

$$x = \frac{B}{A}\frac{\xi}{\xi - 1} \text{ and } V_G = \left(\frac{X_t}{x}\right)^{\varsigma} \frac{B}{\xi - 1} = X_t^{\xi} A^{\xi} B^{1-\xi} f(\xi)$$

Remember, ξ>1[6] is a function of ρ, δ, σ, and increasing in ρ, δ , decreasing in σ. Also, ρ did not affect the value of A or B. To see this easily, notice that ρ only controls how easily the firm can lose its growth option and the distribution of Y is independent from all other variables(X in this model) . So two firms differ only by its type (different ρ) will have identical expressions for A and B. When σ is small, ξ is big, and x is small. A less volatile state variable of the market, make the manager more willing to exercise a growth option. When ξ is high, the option is more risky in a sense that the convexity of the option value is big.

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[5] See Appendix 1 and 2 for a proof.
[6] See CFG (2004) for a proof.

In the setups, δ= r-g, where g is the constant drift of x under the risk neutral measure and r is the risk free rate. When g is big, δ is small and ξ is big. However, δ will also affect the value of A and B as a discount factor or part of the discount factor for different costs and revenues.

However, from expressions (6,c), (6,n), (7,c) and (7,n), B does not be affected by δ, and A is strictly decreasing in δ in both types of options. So x is increasing in δ and decreasing in g. A possible reason for these relationships is a smaller g makes the dynamics of X more slowly in a sense that on average it takes more time for X to reach a certain value.

Now, I will go on to compare the value of different growth options.

$$V_t^G = \left(\frac{X_t}{x}\right)^{\xi} \varepsilon = \left(\frac{X_t}{x}\right)^{\xi} B \ /(1-\zeta) \propto X_t^{\zeta} \frac{A^{\zeta}}{B^{\zeta-1}}$$

Recall that

$$B_N = \frac{F_2}{r} + \frac{F_0}{r} + \lambda_2 \ ,$$

$$B_C = \frac{F_0}{r} + bF_1 \frac{1-\Gamma_\tau(r-\nu)}{r-\nu} + F_2 \frac{\Gamma_t(r)}{r} + \lambda_1 (1 + \frac{1-\Gamma_\tau(r-\nu)}{r-\nu})$$ and

$$A_N = V_{10,\tau}^A - K_0^\gamma / \delta = \frac{K_2^\gamma}{\delta} - b\frac{(K_2^\gamma - K_0^\gamma)}{\delta}\{1-\Gamma_\tau(\delta)\} - K_0^\gamma / \delta \ ,$$

$$A_C = V_{11,\tau}{}^A - K_0^\gamma / \delta = k_2^\gamma \frac{\Gamma_\tau(\delta)}{\delta} + (1-b)k_1^\gamma \frac{1-\Gamma_\tau(\delta-\nu)}{\delta-\nu} - \frac{K_0^\gamma}{\delta}(1 - b\frac{\Gamma_t(\delta)}{\delta}) \qquad (9)$$

To make the calculation easy, assume no operation cost and no time to build, thus F=0, b=0. Then

$$B_C = \lambda_1 + V_\tau^C, B_N = \lambda_2$$

$$A_C = k_2^\gamma \frac{\Gamma_\tau(\delta)}{\delta} + k_1^\gamma \frac{1-\Gamma_\tau(\delta-\nu)}{\delta-\nu} - \frac{K_0^\gamma}{\delta}, A_N = \frac{k_2^\gamma}{\delta} - \frac{K_0^\gamma}{\delta} \tag{10}$$

After normalize $k_0 = 0$

$$\ln V_C^G - \ln V_N^G = \zeta(\ln A_C - \ln A_N) - (\zeta - 1)(\ln B_C - \ln B_N)$$

Notice that for a type C option, as T increasing we need to reduce v to make the final capital level equals K_2. And the change of values is derived from both changes in v and T. So it is not clear at this point how A_C and B_C changes with T. I will leave this to the next section when I simulate data using different values of parameters. When the option is type N, B is not affected by change of T, and A is decreasing in T(through time-to-build). From (7,n), it is clear that x is increasing in T and V_G is decreasing in T. T is a measure of time to wait before new capital can be fully productive. Larger T is similar to imposing the assumption that firms being hit by a more persistent negative productivity shock, which reduce firms cash flow as long as the effects of shocks did not vanish. This will reduce the value of the firm and the value of the growth option. When T is large, the growth option is less attractive to managers, with all other parameters equal, managers postpone the investment plan. Now I will move on to analysis the implied return and risks of a firm.

3.2 Risks Dynamics without Commitment to Invest: 3 Factor Model.

Assume investors are rational and no asymmetric information between investors and managers. The market value then is just firm's intrinsic value. With all the results derived in section 2.1[7], define $\beta_t = \mathrm{cov}(dV_t / V_t, dX_t / X_t) / \sigma^2$[8].

Then a general form of beta for firm can be summarized as

$$\beta_{ij\theta,t} = 1 + \frac{V_{0j\theta}^{G}}{V_{ij\theta.t}}(\zeta - 1) + \frac{F_{ij,t}}{V_{ij\theta.t}} = 1 + \beta_t^{G} + \beta_t^{F_{i,j}} \tag{11}$$

Without commitment to invest, exercise growth option immediately changes beta by

$$\Delta\beta_{i\theta N,\tau} = \beta_{\theta N,\tau}^{G} + \beta_{\theta N,\tau}^{F_0} - \beta_{\theta N,\tau}^{F_2} \tag{12}$$

Assume first there is no operating cost. Recall proposition 1, firm exercise its growth option when the value of the option is sufficiently large (when the state variable X first get close enough to the optimal investment boundary x). From 10, $V_\tau^G = \frac{X_\tau^\zeta}{x_\tau^\zeta}\lambda/(\zeta - 1) \approx \lambda/(\zeta - 1)$, the option is exercised when the value of the option for the first time reach the boundary x.

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[7] See CFG (2006), firm's value can be dynamically replicated by changing weights in a portfolio of a risk free bonds B and a market portfolio return M, where the market portfolio returns as a dynamic that is perfectly correlated with the percentage change in the demand state variable X. The market portfolio and the bond help to define a risk-neutral measure, under which the beta of the firm is determined by the weights of M and B in the hedging portfolio.

[8] See Carlson 2004 proposition 2 for details.

Also notice that $\beta_\tau^G = \frac{V_\tau^G}{X_\tau V_0^A + V_\tau^G}(\zeta - 1) = \frac{Q_2^\gamma - Q_0^\gamma}{Q_0^\gamma + \frac{Q_2^\gamma}{\zeta - 1}}$ [9]. This size of drops of risks from exercising an option is decreasing in firms' initial size also ratios of capital levels $\frac{Q_0}{Q_2}$. And this is consistent with findings from previous literatures that the size of underperformance is larger for small firms. Also, if two firms are of the same size at starting, the firm that increases its capital level larger than the other will have less riskiness drops from expansion. Therefore, in the data, we should expect to see a negative correlation between size of proceeds in SEO and size of long run underperformance.

However, if we include operation leverage F, it will reduce the size of the decreasing in firms' riskiness because $\frac{F_0}{V_0} < \frac{F_2}{V_2}$ in the model.

By assumption F is a linear function in capital level, ratios of operational cost over asset value only are constant when we have constant to scale. The larger the value of the growth option relative to value of assets in hand, the less abnormal returns we should expected after issuance. Assume no asymmetric information, then value of firm is the market value of a firm and value of asset at hands is the book value. If firm are same in size, then the firm with a low book-to market ratio (growth firms), have a bigger drops of beta at expansion. This can help to explain why people match issuers with non issuers by size and book-to-market ratio. To summarize, with no commitment to invest, firm's riskiness decreases more when firm's size is small. After

[9] Without operation leverage, the size of beta on growth option decreasing in initial capital.

control for size, book to market can help to span the riskiness changes caused by difference in operation leverage.

3.2 Commitment-to- Invest : 4 factor model

With one period investment and market efficiency, the real option model implies a sharp drop of riskiness of firm at the time of expansion. However, this will not be able to explain the documented long-run underperformance after SEOs. In this section, I will show why the introduction of commitment to investment assumption can generate a gradually shift of firm' risks. To see this, I will first characterize the beta of firms with a C type option.

With commitment to invest, the beta of a firm becomes:

$$\beta_{ij\theta,t} = 1 + \frac{V_{0j\theta}^{G}}{V_{ij\theta.t}}(\zeta - 1) + \frac{V_{1j\theta,t}^{C}}{V_{1C\theta,.t}} + \frac{F_{ij,t}}{V_{ij\theta.t}} = 1 + \beta_{0t}^{G} + \beta_{0t}^{C} + \beta_{t}^{F_{i,j}}$$

Therefore, the immediately change of riskiness is

$$\Delta\beta_{C,\tau} = \beta_{0C,\tau}^{G} - \beta_{1C,\tau}^{C} + \beta_{\tau}^{F_0} - \beta_{C,\tau}^{F_1} \tag{13}$$

First, with no operation leverage, all betas on F drop out of (13). The immediate reduction in riskiness caused by changing options to assets in place is weakened by risks generated by commitment invest. Commitment to investment beta decreases to zero at the end of expansion when firms' capital reaches K2. To calibrate the size of the change, assume b=0, no time to build. Then

$$\beta_{0C,\tau}^{G}=\frac{V^{G}}{V_{0}}=\frac{V^{G}(\zeta-1)}{X_{\tau}\frac{k_{0}^{\gamma}}{\delta}+V^{G}}=\frac{V^{G}(\zeta-1)}{\frac{\zeta V^{G}}{A_{C}^{\tau}}\frac{k_{0}^{\gamma}}{\delta}+V^{G}}=\frac{(\zeta-1)}{\zeta\frac{k_{0}^{\gamma}}{\delta}/\left(k_{2}^{\gamma}\frac{\Gamma_{\tau}(\delta)}{\delta}+k_{1}^{\gamma}\frac{1-\Gamma_{\tau}(\delta-\nu)}{\delta-\nu}-\frac{K_{0}^{\gamma}}{\delta}\right)+1} \quad (14)$$

Similar as in no commitment to investment case, $\beta_{0C,\tau}^{G}$ increases with K_1 *and* K_2 and decreases in K_0 .

$$\beta_{1C,\tau}^{C}=\frac{V_{c}}{V_{1}}=\frac{\lambda\frac{1-\Gamma(r-\nu)}{r-\nu}}{X_{\tau}V_{1}^{A}-\lambda\frac{1-\Gamma(r-\nu)}{r-\nu}}$$

$$=\frac{\lambda\frac{1-\Gamma(r-\nu)}{r-\nu}}{\zeta\frac{\left(k_{2}^{\gamma}\frac{\Gamma_{t}(\delta)}{\delta}+k_{1}^{\gamma}\frac{1-\Gamma_{t}(\delta-\nu)}{\delta-\nu}\right)}{\left(k_{2}^{\gamma}\frac{\Gamma_{\tau}(\delta)}{\delta}+k_{1}^{\gamma}\frac{1-\Gamma_{\tau}(\delta-\nu)}{\delta-\nu}-\frac{K_{0}^{\gamma}}{\delta}\right)}-\lambda\frac{1-\Gamma(r-\nu)}{r-\nu}} \quad (15)$$

From (14), β_{τ}^{C} increases with λ when everything else equal; and decreases with K_0 .

So risk deduction from exercising a real option is reduced by commitment to invest constraint and the size of the effect increases with the value of the commitment. Substituting (14) and (15) back in to (13), it is clear that $\Delta\beta_{C,\tau}$ decreasing in K_0 and λ. The argument when adding operation cost F is similar to the no commitment case. So with commitment to invest, an additional factor will be needed to counting on the costs of commitment. A firm need to pay a hier capital rate at issuance will have a subsequence larger underperformance after control size and book to market. Lyandres, Sun, and Zhang (2008) show that a long-short portfolio based on

investment ratings gives a priced factor that helps to reduce SEO underperformance. I will test on this and other possible proxies for capital cost λ in the empirical section.

4 Empirical Analysis

Based on discussions in section 3, I will test the implication of the model with real data. To do this, first I need to construct portfolio of issuers and matched non-issuers at calendar date.

4.1 Data and Buy-and-Hold Abnormal Returns

The real option model with commitment to invest implies that issuers will have lower returns compared to their size, book-to-market matched non-issue firms. And the abnormal low return is caused by a drop in systematic risk. The size of the abnormal return should be increasing in firm size and book to market ratio, and decreasing in cost of new capital.

All the security issuance data are downloaded from the SDC New Issues database. It includes all public issues traded on NYSE, AMEX, or Nasdaq by U.S. companies that are not coded as IPO's, unit issues, ADR's or ADS's from January 1980 to December 2003. To be included, identified issues must meet the following criteria: (1) The company is listed on the Center for Research in Securities Prices (CRSP) daily, NYSE/Amex or NASDAQ at the time of the issue; (2) the company is not a regulated utility or financials ; (3) the issue is a primary seasoned offering (offerings including any secondary shares are excluded); (4) the issue involves common stock only (joint offerings and unit offerings are excluded); and (5) the issue is a firm commitment, underwritten offering; (6) issues no other type of offerings simultaneously. Table 1 summarizes the frequency and size distribution of seasoned equity offerings by year. On average there will be 300 SEOs

each year, with fewer issues at the end of 1980th and more issues around middle 1990s. This pattern coincides with the stock market timing. When stock market is in better condition, number of SEO is big. This can be considered as a effect of lower capital cost. The second column of table 1 is the average size of proceeds offered in SEOs by year. The size of proceeds gradually increases in time.

Table 2 documents statistical facts of SEOs by the stated purpose of issuance. Three main categories are considered: 1) Issues with specific investment plans; 2) issues for debt repayment or recapitalization; 3) general corporate purpose (managers choose to be inexplicit at filling). Among all three categories, GCP (general corporate purpose) has the largest market capitalization of 875 millions a year, followed by INV (Investment) and REC(Recapitalization) sized 30% and 45 % less respectively. The mean size of proceeds increases with market capitalization from 77 in RE to 113 in GCP. However, RE has the highest relative offer size of 27% while GCP only has ratio around 15. The fifth line show that INV and GCP do not have higher leverage ratios compared to firms in the same industry. This reduces the possibility that managers at filling are afraid of telling truth when firm is distressed, because firms in INV and GCP do not have incentives or needs to change their capital structure. The last line summarizes the percentage of offers sold by the shareholders. Firms in INV have the least percentage of "insiders" selling. And GNC has the largest percentage of secondary offerings. This can be a sign that either firms are in bad shape or firms stock prices has been over-valued.

I follow common practice and obtain matches for my sample firms on size, book to market. Specifically, I form 10 book to market deciles by NYSE break points on the day the variable Then for each SEO, identify PERMNO in the same Book-to-Market deciles with issuers, and not issued equity in the previous 5 years. Choose the one has closest size as a match for the issuer. Any missing values in the matched return in a 5 year horizon are replaced by the returns of the second best match. Table 3 presents five year buy-and-hold abnormal returns for all issues and subgroups distinguished by the stated purpose of issuing. Similar to previous empirical studies, there is a -26% abnormal return for all industrial issues matched on size and book-to-market. Among all three subgroups, REC has the highest abnormal returns. On average, issuers underperform matched non-issuers by 6.5% a year for the subsequence 5 years. Both of the results are significant at 1% level. The firms in GCP has a five year BHAR=-17.18, smaller than the whole sample and is significant at 10% level. The INV group has an insignificant difference of 13% for 5 years. Investments do affect returns if manager do not lie at filling.

Recall the real models with single period investment generates no long run underperformance, but rather a sharply announcement effect. The long run underperformance in this setting is related to the long run investment projects which need consecutively new investment until the project is completed. This long run arrangement need firm to use additional internal capital in a certain period of future time. And this commitment can increase firms risk level because it is a levered claim. firms investmentment plan including commited future investment that cannot be timed, the drop of riskiness of firms will depend on how much extra cost this commitment investment this the model imple that In order to test weather investment are capable to

explain return dynamics, I cite a table from Zhang (2005) describes the investment-to-asset and profitability among issuers groups and matched groups by year. From table 4, issuers have a higher invest to asset than non-issuers. And the Z is higher than 2 for the whole sample period. The difference motivates studies to sort on this new investment related variable. Figure 2 plot the real distribution of SEOs in each Investment-to-Asset deciles. And the number of SEO is increasing in Investment-to-Asset.

To move on, I repeat steps in previous paragraph to generate 5 year Buy and Hold abnormal returns with size, Book-to-Market and investment-to-asset matched firms. Table 5 summarized the 5 year returns for both portfolios and the difference (abnormal returns). The abnormal return still exists with 3 matching criteria, however is not significant as in 2 criteria case. INV still have the lowest difference while GCP had a higher underperformance at this time.

4.2 Cross-sectional Returns and Factor Pricing Model

Real option model with commitment to invest implies that one additional factor related to the cost of new capital should be included to explain the conditional returns of stocks after SEO. As discussed in section 3, a possible candidate is the investment ratings of the firm. In this section I will compare results from CAPM, Fama-French three factor model, momentum 4 factor models and investment rated 4 factor model. Table 7 reports the coefficients estimates of different model cross all three subgroups. (Continue……)

6. Simulation of the model

In this section, we use return dynamics reported in previous literature to calibrate the model with commitment to invest. The specific moments we seek to match are taken from Ritter (2003). These are: (1) for the SEO sample an average return of 72% in the year prior to issuance; (2) an SEO announcement effect of2%; (3) 5 -year post-SEO average annualized returns of 11.3%; and (4) average 5-year annualized returns for size and book-to-market matches of 14.7%. In addition I need (5) 12 month return s prior to issues of SEOS. Follow CFG (2006), I impose the restriction f0 = f1 = 0. Without fixed costs, firm values are homogeneous in q0, so normalize to q0 = 1. The parameters κ0 and κ1 and κ2 are not identified by return moments, so specify their difference as λ = (κ1 − κ0)=(κ2- κ1). This constant increment will help to identify commitment to investment growth rate ν. Finally, the demand elasticity γ does not appear central to either our economic intuition or the quantitative matching of the moments above; so choose $\gamma = 0.5$.

The parameters r, σ, and g can be related to long-run averages from financial data. Follow previous literature set r to 0.04 annually, consistent with time series averages of T-bill rates. The parameter σ is set to 0.20, consistent with market portfolio return volatility. Finally, in the absence of fixed costs, set the drift g to log (1 + 0.113)[10].

I use the simulated method of moments to estimate the three remaining parameters, namely, the demand growth rate μX, the length of commitment to invest T, and the post-SEO output rate $q1$. Since we use post-event returns of SEO firms to calibrate μM, three moments remain (run-up, announcement, and post-event matched firm returns), and the model is exactly identified. The basic idea of the estimation procedure is the same as CFG (2006) and

[10] CFG(2006) report a g=log(1.113) imply an annual risk premium of 7%, which is consistent with Ritter (2003).

summarized in the appendix. First I started with two levels of b: b=0, no time to built, and b=0.5. As show in Table 9, based on the results from the primary calibration, a positive b increasing T from 1.8 to 4 and reduce q1 from 3.75 to 3.

(Continue)

Appendix

Proof of proposition1:

Let

$$NPV(X_t, C=1) = V_{t=\tau}(D=1, C=1) - Xt\frac{Q_0^{\gamma}}{\delta} - \frac{F_0}{r} - \lambda_1$$
$$= X_t(V_{11,\tau}^{A}\frac{Q_0^{\gamma}}{\delta}) - (V_{\tau}^{C} + \lambda_1 + \frac{F_0}{r} + F_{11,\tau})$$
$$\equiv X_t A_C - B_C$$

denote the value of the option with commitment to invest if immediately exercises, conditional on $Y_t = 0$. The objective is,

$$\max_s \hat{E}_t[(1-Y_{t+s})e^{-rs}NPV(X_{t+s}, C=1) \mid F_t]$$
$$= \max_s \hat{E}_t[e^{-(r+\rho)s}NPV(X_{t+s}, C=1) \mid F_t]$$

From Chapter 5 of Dixit and Pindyck (1994), the basic result for the perpetual investment opportunity can be summarized in the following equations (see p.142):

$$F(V) = A\,V^{\beta_1}$$

$$V^* = \frac{\beta_1}{\beta_1 - 1}\,I$$

The first equation shows the investment opportunity value (F) equal to a constant (A) times the value of implanted project (V) with a exponent which is more than one. This exponent is a function of the parameters (see p.152): risk-free interest rate (r), dividend yield (or convenience yield), and the volatility (standard deviation of the rate of variation of the project value). The second equation, points out the optimal investment rule: invest if the market value of the project is equal or more than the threshold (V*) value.

Proof of Proposition 2:

The value of a no commitment to invest growth option that exercises immediately, conditional on $Y_t = 0$, is

$$
\begin{aligned}
&NPV(X_t, C=0) = V_{t=\tau}(D=1, C=0) - Xt\frac{Q_0^{\gamma}}{\delta} - \frac{F_0}{r} - \lambda_2 \\
&= Xt(V_{10,t}^{A} - \frac{Q_0^{\gamma}}{\delta}) - (\frac{F_2}{r} + \frac{F_0}{r} + \lambda_2) \\
&\equiv XtA_N - B_N
\end{aligned}
$$

After decompose the NPV, the results will be like in proposition 2.

Table 1

Average size of Proceeds each year for Seasoned Equity offerings

Year	Number of offerings	Average Proceeds($ Million)	Total proceeds(Billions)
1980	382	30.28795812	11.57
1981	416	29.25480769	12.17
1982	444	34.52702703	15.33
1983	813	31.73431734	25.8
1984	251	24.46215139	6.14
1985	400	41	16.4
1986	507	41.49901381	21.04
1987	314	55.22292994	17.34
1988	140	43.78571429	6.13
1989	230	40.65217391	9.35
1990	188	48.08510638	9.04
1991	508	65.70866142	33.38
1992	562	61.01423488	34.29
1993	736	67.5951087	49.75
1994	474	67.15189873	31.83
1995	619	84.53957997	52.33
1996	767	86.51890482	66.36
1997	736	101.9701087	75.05
1998	562	110.4270463	62.06
1999	438	198.5159817	86.95
2000	397	249.8488665	99.19
2001	427	182.7868852	78.05
2002	422	162.535545	68.59
2003	502	141.4143426	70.99
total	11235		959.13

Table 2

Descriptive statistics of SEOs by intended use of funds categories

This table presents descriptive statistics for 4032 sample SEO issuers during 1980–2003 with the stated purpose of issuing be investment, debt repayment or general corporate purpose. These categories are investment (*N* = 497), recapitalization (*N* = 1032), and general corporate purposes (*N* = 1703). Market value is the stock price times the number of shares outstanding on the day prior to the offer. Offer proceeds equals the offer price times the number of shares offered. Relative offer size equals the number of shares offered divided by the number of shares outstanding on the day prior to the offer. Debt ratio is the ratio of long-term debt plus short-term debt to total book assets, and is the year-end figure in the year prior to the issue. Industry-adjusted debt is the debt ratio of the issuing firm minus the debt ratio of the median firm in the issuer's industry. Percentage secondary is the percentage of total shares in the offering that are issued by selling shareholders, where the seller rather than the firm receives the proceeds. Sample firms are required to have at least some primary component.

	Investment		Recapitalization		General Corporate Purpose	
	Mean	Median	Mean	Median	Mean	Median
Market Value ($Millions)	579	261	488	289	875	427
Proceeds($ Millions)	92.1	51.2	77.0	67.4	113.4	76.8
Relative offer size	0.19	0.20	0.27	0.24	0.15	0.14
Debt Ratio	0.17	0.06	0.36	0.35	0.13	0.04
Industry adjusted debt	0.02	-0.06	0.17	0.12	0.00	-0.05
Secondary(percentage)	9.4	0.02	23.4	11.3	28.6	15.4

Table 3

Five Year Buy-and-Hold abnormal returns with Size and Book-to Market matched non-issuers

This table presents buy-and-hold abnormal stock returns (BHARs) of issuing firms in relation to matched non-issuers five years after the offering. Samples are matched on size and market-to-book. The first row displays BHARs for all firms, and the subsequent three rows display BHARs for three categories of firms based upon their stated intended use of proceeds: (1) firms where investment is the stated use of proceeds; (2) firms where recapitalization is the stated use of proceeds; and (3) firms where general corporate purposes is the stated use of proceeds. The adjusted *t*-statistics are based on the methods of Mitchell and Stanford (2000).

	5yrs BHAR %	Adjust T-statistics
All issuers	-26.32	-3.73***
Investment	-13.65	-1.19
Recapitalization	-32.10	-4.27***
General corporate purpose	-17.18	-1.99*

Table 4

Equity Issuers and Matched Nonissuers' Investment-to-Asset and Profitability in Calendar Time, 1980 to 2003

This table is part of table 8 in Zhang (2005). Median values and Z-statistics associated with the Wilcoxon test of these two characteristics are reported for the issuers and matching non-issuers portfolios in the fiscal yearend prior to SEO. The null hypothesis is that the characteristics of issuers and nonissuers are both drawn from the same distribution. Z value between -2 to 2 will fail to reject the null. The profitability is defined as net income before extraordinary items (Compustat item 18) divided by lagged book value of assets (item 6). And investment-to-asset equals the change in gross property, plant, and equipment (item 7) divided by book assets.

	Investment-to Assets			Profitability		
	Issuers	Non-Issuers	Z	Issuers	Non-Issuers	Z
Year						
1980	0.131	0.071	9.08	0.158	0.181	1.62
1981	0.123	0.068	8.62	0.143	0.167	0.45
1982	0.103	0.072	5.71	0.144	0.147	2.84
1983	0.078	0.066	5.4	0.136	0.135	1.9
1984	0.079	0.052	4.28	0.129	0.103	2.35
1985	0.109	0.071	6.72	0.172	0.117	5.22
1986	0.081	0.06	4.61	0.154	0.104	4.1
1987	0.089	0.057	3.88	0.119	0.087	0.1
1988	0.089	0.054	3.81	0.13	0.088	2.13
1989	0.103	0.05	6.1	0.126	0.088	3.26
1990	0.078	0.05	3.29	0.13	0.096	1.31
1991	0.084	0.05	5.88	0.112	0.106	-0.35
1992	0.069	0.042	5.09	0.093	0.089	0.63
1993	0.058	0.043	6.16	0.102	0.09	1.57
1994	0.059	0.047	4.46	0.103	0.107	-1.04
1995	0.078	0.054	6.29	0.118	0.11	-0.43
1996	0.074	0.055	5.65	0.094	0.105	-2.04
1997	0.106	0.061	7.82	0.132	0.121	0.74
1998	0.077	0.057	5.11	0.117	0.109	-0.09
1999	0.104	0.052	6.96	0.11	0.139	-2.49
2000	0.105	0.054	7.29	0.066	0.13	-3.37
2001	0.058	0.055	3.72	0.102	0.139	-2.37
2002	0.062	0.042	5.13	0.11	0.093	2.32
2003	0.027	0.024	3.76	0.047	0.059	-3.18
Average	0.084	0.054	5.62	0.1186	0.1129	0.6325

Table 5

Monthly Cross-Sectional Regressions of Returns onto New Equity Shares and Investment-to-Asset

This table reports monthly Fama-MacBeth cross-sectional regressions of future stock returns onto firm- specific variables. Log (ME) is the logarithm of market capitalization at the end of the most recent June. Log (BE/ME) is the logarithm of book-to-market ratio where book equity is from the most recent fiscal year-end. Investment-to-asset is the change in gross property, plant, and equipment (item 7) divided by book assets. A market-timing measures related to new equity shares is construct from Baker and Wurgler (2002). New equity share is the sale of common and preferred stock minus the purchase of common and preferred stock, divided by the sum of the sale of debt, the change in current debt, the sale of common and preferred stock, net of the purchase of common and preferred stock. To reduce the impact of outliers, the sample is truncated the bottom and top 0.5% of the observations for new equity share. T-statistics are reported in parenthesis. The adjusted R^2 are the time series averages of the adjusted R^2 from the monthly cross-sectional regressions.

log(ME)	log(B/M)	New Equity Share	Investment to Asset	Adj_R
-0.151	0.436	0.282		4.12%
(-2.90)	(-2.16)	(-1.77)		
-0.125	0.345	0.272	-0.761	4.86%
(-2.35)	(-2.21)	(-1.7)	(-2.15)	
-0.128	0.346		-0.525	2.21%
(-2.23)	(-4.02)		(-4.23)	

Table 6

Five-year buy-and-hold stock percent returns (BHR) for U.S. issuers and size, Book-to-market and investment-to-asset matched control firms, 1980–2003

The abnormal buy-and-hold returns shown in the column marked "Diff" represent the difference between the BHR in the "Issuer" and "Match" columns. The rows marked "N" contain number of issues. The p-values for equal-weighted abnormal returns are p-values of the t-statistic using a two-sided test of no difference in average five-year buy-and-hold returns for issuer and matching firms. The investment-to-asset ratio is measured as sum of the annual changes in gross property, plant and equipment (COMPUSTAT annual item 7) and inventories (item 3) divided by the lagged book value of assets (item 6).

Statement of purpose	N	Issuer	Match	Diff	p
All	5707	0.71	0.9	-0.19	0.021
General corporate Purpose	1703	0.69	0.88	-0.19	0.032
Mergers and Acquisitions	823	0.62	0.77	-0.15	0.014
Investment	497	0.72	0.83	-0.11	0.12
Refinance/debt payment	1032	0.70	0.93	-0.23	0.008
Secondary	639	0.59	0.95	-0.36	0.024

Table 7

Calendar Time Regressions of Long-run Stock Returns

This table presents monthly estimates from regressing calendar-time portfolio monthly returns on five factors. The factors are Fama French (1993) three factors (MKT, SMB, HML), momentum factor (MOM) from Carhart (1997) and a long-short portfolio based on investment rating (IVR) as in Lyandres, Sun, and Zhang (2008). Both equally weighted and value weighted returns are regressed on 4 different combination of factors. The column marked as CAPM is regress issuer portfolio returns on the market portfolio. The Fama-French is the standard three factor model. And data are from French's data library. 4-factor (1) add mom as an additional factor; while 4 factor (2) replace mom by IVR. Following Mitchell and Stanfford (2000), the alpha is adjusted by expected alpha, which is estimated as the mean alpha from 1000 calendar-time portfolio regressions with randomly selected non-issuing firms that are in the same size/book-to-market group as the sample firms.

	CAPM		FAMA-FRENCH		4-FACTOR (1)		4-FACTOR (2)	
	All Issuances							
	Equally weighted	Value weighted	Equally weighted	Value weighted	Equally weighted	Value weighted	Equally weighted	Value weighted
ALPHA	-0.389*	-0.34	-0.17	-0.201	0.04	0.02	-0.13	-0.14
	(0.19)	(0.28)	(0.24)	(0.27)	(0.33)	(0.22)	(0.04)	(0.05)
MKT			1.16***	1.17***	1.08***	1.02***	1.09***	1.03***
			(0.05)	(0.02)	(0.12)	(0.07)	(0.11)	(0.09)
SMB			0.92***	0.88**	0.81***	0.77***	0.60***	0.67***
			(0.04)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)
HML			-0.24**	-0.33***	-0.20**	-0.24***	-0.38***	-0.47***
			(0.13)	(0.11)	(0.08)	(0.07)	(0.03)	(0.04)
MOM					-0.41***	-0.50***		
					(0.04)	(0.04)		
IVR							-0.23**	-0.33**
							(0.09)	(0.13)
Adj_R2	0.37	0.38	0.87	0.89	0.92	0.93	0.90	0.95

Table 7(Continued)

Investment

	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted
Alpha	-0.47	-0.43	-0.41	− 0.39	0.04	0.03	-0.10	-0.07
	(0.30)	(0.27)	(0.33)	(0.40)	(0.40)	(0.37)	(0.31)	(0.30)
MKT			1.21***	1.33***	1.11***	1.07***	1.37***	1.26***
			(0.06)	(0.07)	(0.09)	(0.08)	(0.11)	(0.01)
SMB			0.11***	0.93***	1.09***	0.96***	93***	0.87***
			(0.09)	(0.10)	(0.08)	(0.06)	(0.07)	(0.07)
HML			-0.22***	− 0.21**	-0.3**	-0.35***	-0.44***	-0.4***
			(0.07)	(0.10)	(0.14)	(0.11)	(0.09)	(0.08)
MOM					-0.53***	-0.5***		
					(0.07)	(0.07)		
IVR							-0.37***	-0.35***
							(0.07)	(0.05)
Adj_R2	0.35	0.36	0.74	0.78	0.81	0.84	0.87	0.89

Recapitalization

	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted
Alpha	-0.87**	-0.80**	-0.69*	-0.62	-0.86**	-0.63*	-0.71*	-0.72**
	(0.35)	(0.34)	(0.39)	(0.40)	(0.41)	(0.37)	(0.43)	(0.33)
MKT			1.44***	1.37***	1.67***	1.31***	1.65***	1.51***
			(0.10)	(0.09)	(0.09)	(0.07)	(0.12)	(0.10)
SMB			0.87***	0.82***	0.82***	0.77***	0.90***	0.83***
			(0.11)	(0.10)	(0.11)	(0.09)	(0.07)	(0.08)
HML			-0.56***	-0.58***	-0.47***	-0.55***	-0.35***	-0.33***
			(0.09)	(0.09)	(0.12)	(0.1)	(0.07)	(0.06)
MOM					-0.35***	-0.34***		
					(0.06)	(0.05)		
IVR							-0.45***	-0.53***
							(0.12)	(0.12)
Adj_R2	0.23	0.25	0.73	0.65	0.78	0.75	0.88	0.91

Table 7 (Continued)

General Corporate purpose

	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted	Equally Weighted	Value Weighted
Alpha	-0.56	-0.45	0.04	0.03	0.43	0.40	-0.21	-0.15
	(0.35)	(0.37)	(0.33)	(0.32)	(0.37)	(0.35)	(0.31)	(0.29)
MKT			1.23***	1.18***	1.47***	1.31***	1.24***	1.03***
			(0.09)	(0.10)	(0.10)	(0.09)	(0.10)	(0.12)
SMB			0.91***	0.89***	1.04***	0.90***	0.87***	0.83***
			(0.08)	(0.07)	(0.07)	(0.06)	(0.05)	(0.05)
HML			-0.58***	-0.51***	-0.68***	-0.60***	-0.77***	-0.72***
			(0.11)	(0.12)	(0.10)	(0.09)	(0.11)	(0.10)
MOM					-0.47***	-0.44***		
					(0.07)	(0.06)		
IVR							-0.19*	-0.27**
							(0.11)	(0.12)
Adj_R2	0.28	0.35	0.47	0.45	0.58	0.63	0.50	0.57

Table 8

Average monthly abnormal equal-weighted portfolio return for three-to-five year holding periods following securities offerings by U.S. firms.

The table reports the time-series estimate of the constant term α by regressing the excess return on a portfolio of issuing firms on a set of pricing factors in an empirical asset pricing model. The issuer portfolio is formed using equal-weights. The issuer's stock typically enters the portfolio in the month following the issue month, and is held from three to five years or being delisted from the data set. Superscript * indicates that α is statistically significantly different from zero at the 1% level.

Study	Issuer Type	Sample Size	Sample Period	Holding Period	α
Jagadeesh (2000)	All	2992	1970-1993	5 yrs	-0.31*
Brav, Geczy, and Gompers (2000)	All	3775	1975-1992	5 yrs	-0.19
Eckbo, Masulis, and Norli (2000)	Ind	3315	1964-1995	5 yrs	-0.05[1]
Eckbo, Masulis, and Norli (2000)	Ind	3315	1964-1995	5 yrs	-0.14[2]
Eckbo, Masulis, and Norli (2000)	Utl	880	1964-1995	5 yrs	-0.13[1]
Bayless and Jay (2003)	Ind	1239	1971-1995	5 yrs	-0.54
Krishnamurthy,Spindt,Subramaniam,Woidtke (2005)	All	1477	1983-1992	3 yrs	-0.36*
Eckbo and Norli (2005)	Ind	1704	1964-1995	3 yrs	-0.03[4]
Lyandres, Sun, and Zhang (2005)	All	6122	1970-2003	3 yrs	0.02[3]
D'Mello, Schlingemann, and Subramaniam	All	1621	1982-1995	3yrs	-0.31*

[1]Pricing model with macroeconomic risk factors.
[2]Pricing model with Fama-French factor.
[3]Pricing model with Fama-French, momentum, liquidity factors.
[4] Pricing model with Fama-French, momentum, and investment factor.

Figure 1

Frequency Distribution of SEO Firms across Size and Book-to-Market Quintiles

This first figure plots the number of SEO firms in each of the 25 size and book-to-market portfolios. The second figure plots the frequency of equity issues in each decile. Issue rate equals the average of number of issues each year over total number of firms in each portfolio. The size and book-to-market quintile breakpoints are from Kenneth French's website.

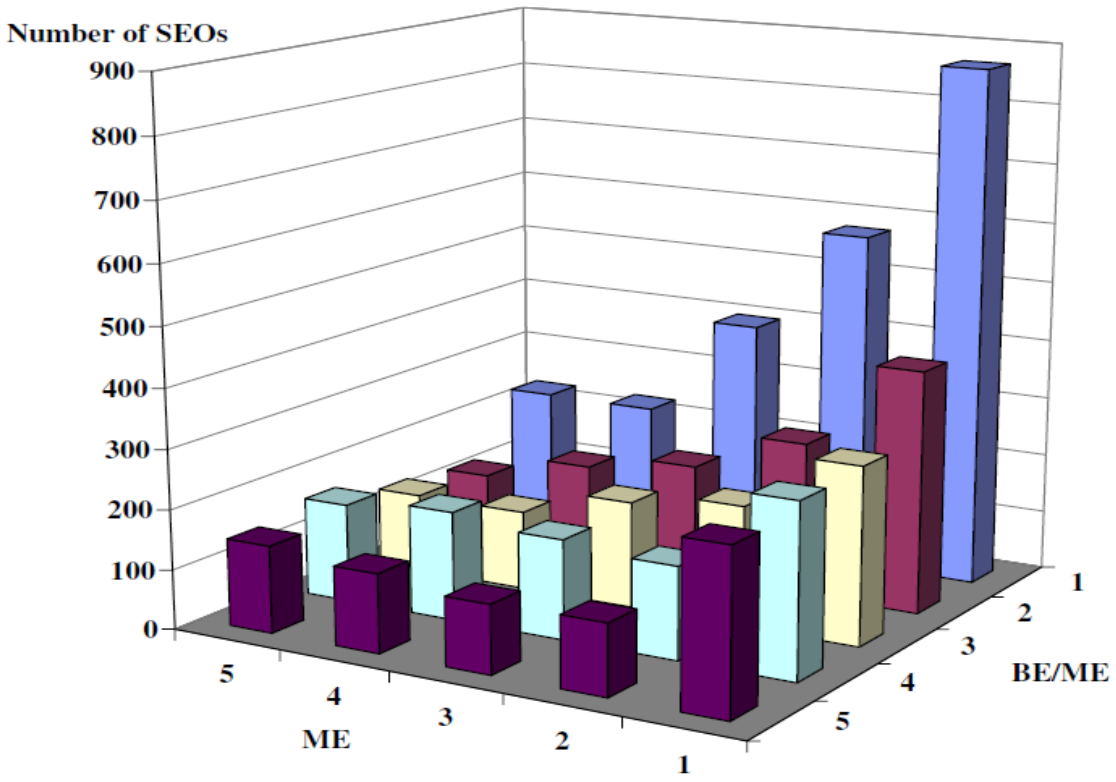


Figure 1 Continued

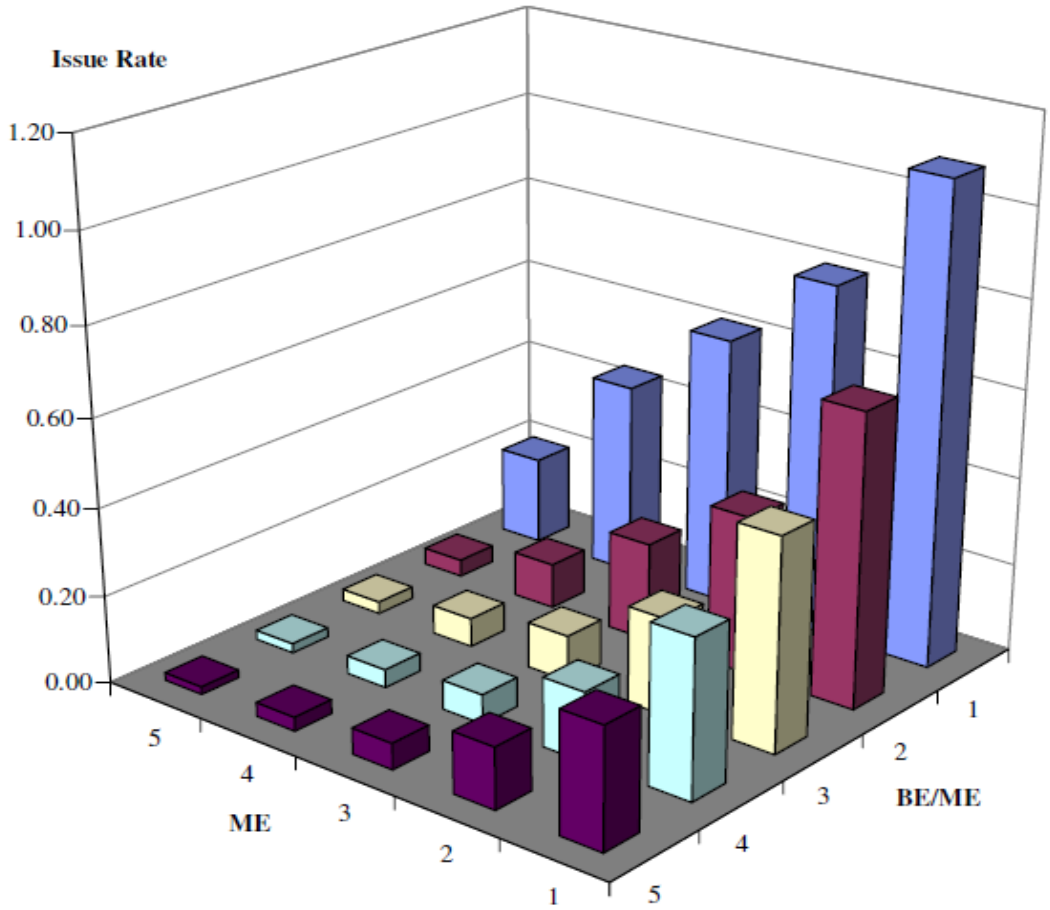


Figure 2

The Frequency Distribution of SEOs across Investment-to-Asset Deciles

This figure plots the number of SEO firms in each of the investment-to-asset deciles. Book assets is measured as Compustat annual item 6, and capital investment is measured as the change in item 7 (gross property, plant, and equipment). Follow Zhang (2005), the investment to assets deciles breakpoints are from sorted non-issuing firms by their investment-to-asset ratios.

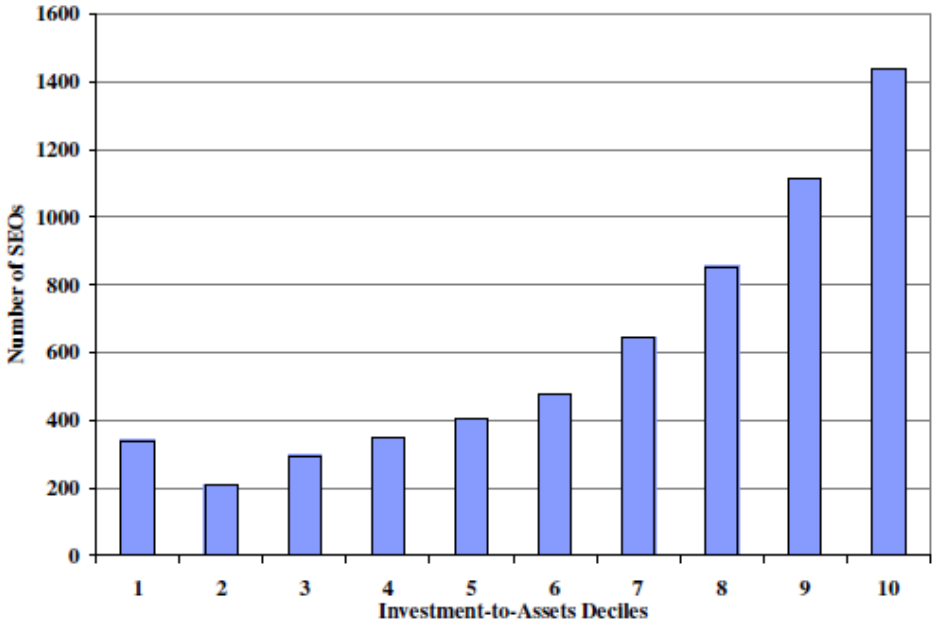
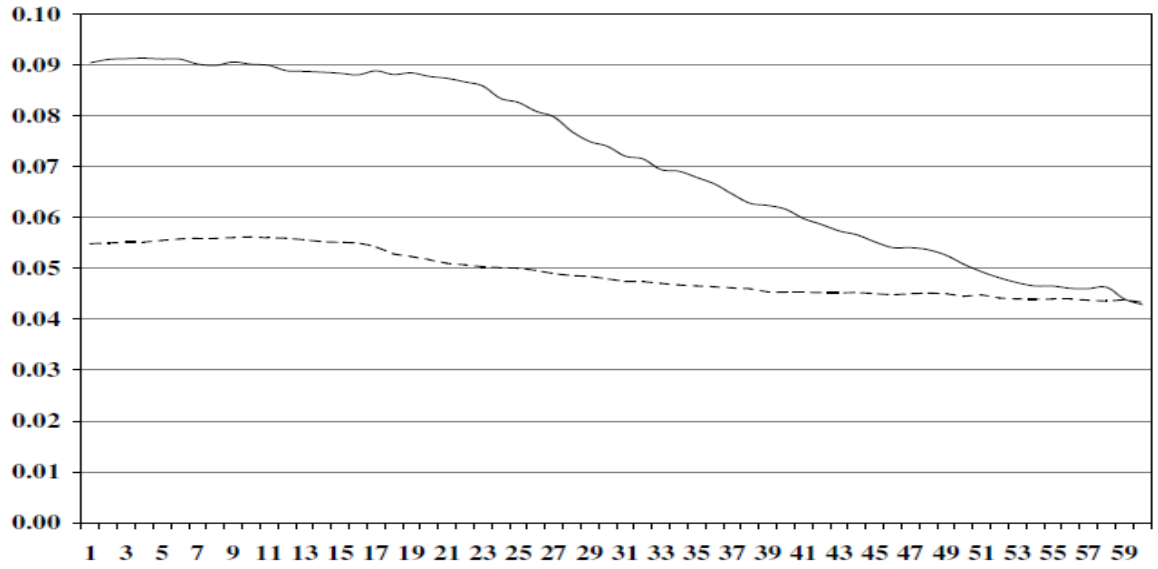
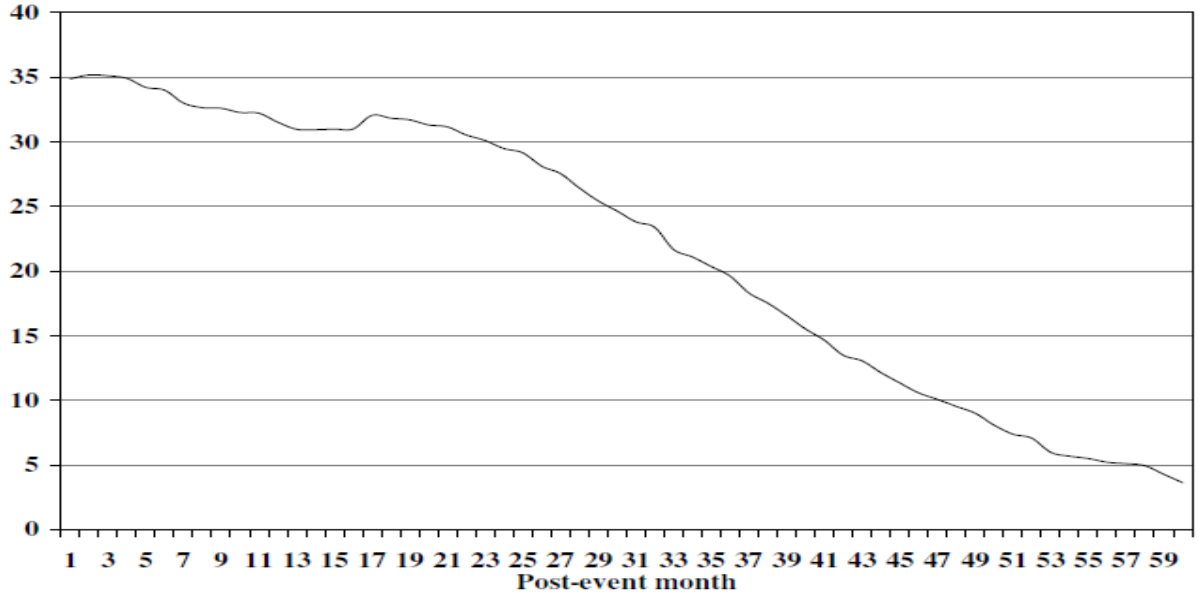


Figure 3

Equity Issuers' and Matching Nonissuers' Investment-to-Asset 60 Months after Equity Issuance, 1980 to 2003

This figure plots SEO firms' and matching nonissuers' median investment-to-asset during 60 months after equity issuance in Panels A, as well as their corresponding Z-statistics from the Wilcoxon test for testing distributional differences in Panels B. Z statistics between -2 and 2 indicate failure to reject the null hypothesis of equal distribution of characteristics between SEOs and their matching _rms. Month 0 is the month of equity issuance.

Panel A: Investment to assets in issuers and non-issuers



Panel B: Z, Investment to Asset