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## Managers' private information, investor underreaction and long-run SEO underperformance

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# Working Paper Series

## Managers' private information, investor underreaction and long-run SEO underperformance

Pawel Bilinski  
Norman Strong

Manchester Business School Working Paper No 587

### Manchester Business School

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seasoned equity offerings, investor underreaction, manager's private information

## **Abstract**

Applying the framework of conditional event studies shows that equity issues reveal managers' private information about stock mispricing, which investors only partially discount into stock prices at the seasoned equity offering (SEO) announcement date. Negative abnormal returns occur as prices fully impound the information over a 17-month post-offer period. SEOs exhibit no subsequent underperformance. The study provides a more realistic explanation of SEO underperformance and a framework for testing behavioral explanations of abnormal performance following corporate events.

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# **Managers' private information, investor underreaction and long-run SEO underperformance\***

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# **Managers' private information, investor underreaction and long-run SEO underperformance**

## **Abstract**

Applying the framework of conditional event studies shows that equity issues reveal managers' private information about stock mispricing, which investors only partially discount into stock prices at the seasoned equity offering (SEO) announcement date. Negative abnormal returns occur as prices fully impound the information over a 17-month post-offer period. SEOs exhibit no subsequent underperformance. The study provides a more realistic explanation of SEO underperformance and a framework for testing behavioral explanations of abnormal performance following corporate events.

New equity issuers underperform benchmark stocks over a five-year post-offering period (Loughran and Ritter, 1995, Eckbo, Masulis, and Norli, 2000, Lyandres, Sun, and Zhang, 2008). Loughran and Ritter (1995) offer a behavioral explanation for this finding, namely the underreaction hypothesis. The underreaction hypothesis states that investors partially process the information signalled by managers at the seasoned equity offering (SEO) announcement date and stock price immediately impounds only part of its content. Prices impound the remaining signal content as post-announcement information confirms the announcement signal, causing long-run underperformance.<sup>1</sup> Loughran and Ritter (1995, 48) conclude, “our numbers imply that if the market fully reacted to the information implied by an equity issue announcement, the average announcement effect would be –33 percent, not –3 percent.”

Previous studies test the underreaction hypothesis indirectly by investigating whether investors rationally interpret publicly available information around the equity offering.<sup>2</sup> Untested in these studies, is the assumption that publicly available information (e.g. discretionary accounting accruals or analyst forecasts) proxies for the announcement date private information to which investors underreact. However, a significant relation between, for example, discretionary accruals and issuer returns, could result from a direct relation that affects all stocks, rather than an effect specific to the equity issue, and thus offers weak support for the underreaction hypothesis.<sup>3</sup>

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<sup>1</sup> Typical announcement period average abnormal returns range from –1.16% (Jegadeesh, Weinstein, and Welch, 1993) to –3.56% (Mikkelsen and Partch, 1986). Average 5-year buy-and-hold abnormal performance ranges from –23.2% (Eckbo, Masulis, and Norli, 2000) to –59.4% (Loughran and Ritter, 1995).

<sup>2</sup> Section 1 reviews studies of the underreaction hypothesis in the context of SEOs.

<sup>3</sup> Xie (2001) finds that investors overprice discretionary accruals. A hedge portfolio long (short) in firms with the most negative (positive) discretionary accruals generates positive abnormal performance over the following two

This study tests the underreaction hypothesis head on. The underreaction hypothesis assumes that information asymmetry between managers and investors allows managers to determine when the firm's stock is overpriced. Managers act rationally on their private information about stock overvaluation in making an SEO, but investors underreact to the SEO announcement signal and stock mispricing persists at the issue date. Manager and investor valuations align over a post-issue period, which eventually eliminates pre-issue valuation differences but leads to negative abnormal performance while the adjustment takes place. A significant negative relation between managerial private information revealed at the announcement and post-issue returns supports the underreaction hypothesis. We use Acharya's (1988) latent (conditional) information framework to model managers' private information at the issue announcement and relate it directly to post-issue stock returns.<sup>4</sup>

Our central finding is that issuers' post-offering returns covary negatively with the magnitude of managers' private information revealed at the announcement, consistent with the underreaction hypothesis. The results are robust to controlling for overoptimism in analyst earnings-per-share forecasts for new equity issuers, SEO return attrition before the end of the holding period, delisting returns, and hot issue periods. A more detailed analysis of the underreaction to the issue announcement shows that it corrects within 17 months of the equity issue. Thereafter, SEO returns are consistent with investor discount rates. This gives a more

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years. Xie (2001, 359) argues that “[discretionary accruals] mispricing is not limited to settings that give managers opportunistic incentives to manipulate earnings, such as before IPOs or seasoned equity offerings”.

<sup>4</sup> Acharya's latent information model assumes rational agents and efficient markets in which stock prices immediately impound information signalled by managers at the announcement date. We extend the framework of latent information models to analyse less-than-rational investor behavior.

reasonable description of the speed of market correction compared to the five-year periods in Loughran and Ritter (1995) and Spiess and Affleck-Graves (1995).

Our tests control for the rational discount rate hypothesis, which states that, controlling for more risk dimensions beyond size and book-to-market, equity offerings lower SEO firms' expected returns. For example, Eckbo, Masulis, and Norli (2000) argue that reduced leverage decreases SEO sensitivity to inflation shocks and default risk. This study finds support for the discount rate hypothesis in event time, in contrast to previous studies that work primarily in calendar time. It documents that SEOs are larger, more liquid, with higher investment rates and book-to-market ratios, and lower gearing than benchmark stocks. However, in contrast to previous findings, the discount rate effect alone does not explain low post-issue SEO stock returns.

This study is the first to decompose SEO post-issue underperformance relative to size and book-to-market benchmarks into a short-term underreaction effect and a long-run discount rate effect. Formally modelling managers' private information and their choice to make an SEO ensures unbiased and consistent discount rate estimates and consequent return decomposition into underreaction and discount rate effects.

The paper continues as follows. Section 1 reviews previous literature that examines the underreaction and discount rate explanations for post-SEO returns and develops our empirical hypothesis. Section 2 develops an econometric model to test our hypothesis. Section 3 presents our data on new equity issues and our sample selection criteria. Section 4 confirms previous evidence of SEO underperformance based on a standard estimator of abnormal returns. We test our hypothesis and present empirical results in Section 5. Section 6 concludes.



## **1. Previous literature and the development of the underreaction hypothesis**

Direct evidence on irrational investor behavior around equity offerings is difficult to obtain. As a result, previous studies investigate whether investors rationally interpret publicly available information on manager and analyst actions around the equity offering. Rangan (1998) and Teoh, Welch, and Wong (1998) show that issuers' discretionary accruals increase before the offering and covary negatively with post-issue returns. Both studies argue that this is consistent with investors incorrectly extrapolating pre-issue earnings performance into the future. However, Shivakumar (2000) finds that the market rationally anticipates earnings management before the offering and undoes its effect at the offering announcement. He argues that test misspecification explains findings in Rangan (1998) and Teoh, Welch, and Wong (1998). Jegadeesh (2000) suggests that investors are systematically over-optimistic about issuers' future earnings performance at the offering announcement. Following the issue, investors re-adjust their expectations in response to disappointing earnings results. He reports that SEOs underperform by twice as much around post-issue quarterly earnings announcements as outside these periods. Denis and Sarin (2001) find significantly negative abnormal returns around quarterly earnings announcements over a five-year post-issue period only for the smallest quartile of equity issuers in the second year after the offering. However, Brous, Datar, and Kini (2001) find no evidence of abnormal returns around quarterly post-issue earnings announcements. Ali (1996) reports that analyst earnings forecasts for the fiscal year after the offering are more optimistic for issuers than for non-issuers. Dechow, Hutton, and Sloan (2000) show that sell-side analysts overestimate post-offering long-term SEO earnings growth. Ali (1996) and Dechow, Hutton, and Sloan (2000) argue that if analyst earnings and earnings growth forecasts proxy for market expectations of future SEO performance, optimistic forecasts imply

irrational expectations about future stock performance, supporting the underreaction hypothesis. However, Hansen, and Sarin (1998) argue that analyst optimism in earnings and earnings growth forecasts is similar for issuing and non-issuing stocks with comparable growth rates.

A critical assumption behind the above studies is that publicly available information (e.g. discretionary accounting accruals) proxy for the announcement date managerial private information to which investors underreact. However, if the empirical variables are weak proxies for managers' private information, measurement error can produce misleading tests of the underreaction hypothesis. This may explain why the results of previous studies on the underreaction hypothesis differ so much and are inconclusive.

We test the underreaction explanation from a new angle. We recognize that the underreaction hypothesis assumes that information asymmetry between managers and investors allows managers to determine when the firm's stock is overpriced. Managers act rationally on their private information about stock overvaluation in making an SEO, but investors underreact to the SEO announcement signal and stock mispricing persists at the issue date. Manager and investor valuations align over a post-issue period, which eventually eliminates pre-issue valuation differences but leads to negative abnormal performance while the adjustment takes place. We directly model managers' private information at the issue announcement and relate it to post-issue stock returns to test the underreaction hypothesis.

Similar to the conditional latent information model framework, we distinguish between the anticipated (public) component and the surprise component (managerial private information) of the issue announcement. Using market- and firm-level information available before the offering, investors form expectations about the likelihood and the information content of a potential equity issue. For example, investors use accounting information, news reports, and

stock price movements to assess the degree of firm misvaluation and the likelihood of managers making an equity offering. A highly anticipated issue invokes a small announcement date reaction, since managers' private information revealed at the announcement is small. Rational investors should form unbiased expectations of firm value at offering announcements and stock prices should impound managers' private information immediately and fully. As a result, average post-issue SEO stock returns should be consistent with firms' discount rates. However, if investors only partially discount the signal content at the announcement, mispricing persists at the issue date. Post-issue SEO abnormal returns are negative, as stock prices gradually impound the signal content. Figure 1 illustrates the relation between investor behavior, managers' private information, and SEO stock price. Figure 1a shows the evolution of SEO stock price before and after the announcement if investors are rational. Based on accounting and market information, investors predict an equity issue and the likelihood that the company sells overvalued equity, which the stock price impounds before the issue announcement.<sup>5</sup> At the announcement, investors fully discount managers' private information and there is no long-run abnormal SEO performance. The anticipated and surprise components form the total issue effect. Figure 1b shows the SEO price path when investors partially discount managers' private information at the announcement date. Stock price fully impounds the signal content over a post-issue period, leading to SEO underperformance, consistent with the underreaction hypothesis.<sup>6</sup> Once the stock price fully impounds the signal, SEO returns reflect the discount rate. A significant negative

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<sup>5</sup> For simplicity, Figure 1 ignores SEO price run-up before the issue announcement.

<sup>6</sup> Although the SEO announcement reveals managerial private information, empirical studies measure long-run SEO abnormal performance relative to the issue date. We follow this convention for comparability with previous studies.

relation between managers' private information and post-issue SEO buy-and-hold returns supports the underreaction hypothesis,

*Underreaction hypothesis: post-issue SEO stock returns vary negatively with managers' private information signalled at the announcement date.*

The underreaction hypothesis contrasts with the discount rate hypothesis, which says that reduced risk exposure explains low SEO returns. Eckbo, Masulis, and Norli (2000) use a six macroeconomic factor model to capture issuer returns in calendar time. They argue that equity offerings reduce leverage ratios compared to size and B/M benchmarks, which reduces risk exposure to unexpected inflation, default spread, and changes in the slope of the term structure. Eckbo and Norli (2005) analyse SEO liquidity risk dynamics following the offering in calendar time. They report that a liquidity augmented Carhart (1997) model explains the five-year post-issue returns of 1,704 NYSE/AMEX listed industrial SEOs over 1964–1995. However, using the Carhart momentum factor does not fully distinguish the discount rate and behavioral explanations for low SEO returns. Bilinski, Liu, and Strong (2009) find that new equity issuers are significantly more liquid and bear less liquidity risk than their size and B/M matches over a three-year post-offering period. They show that a liquidity-augmented CAPM explains SEO performance. Lyandres, Sun, and Zhang (2008) propose an investment based explanation for low issuer returns. They argue that firms raise equity to convert risky growth options into fixed assets, lowering firm risk. They document that three-year post-issue SEO returns covary negatively with an investment factor, which explains their low post-issue performance.

The evidence that reduced risk exposure explains low SEO returns comes from calendar time analysis. However, calendar time analysis has lower power to detect abnormal returns than event time analysis. Simulating events with more severe misvaluations in small stocks and high-

volume periods, Loughran and Ritter (2000) report that Fama–French three-factor calendar time regressions capture only 50% of true abnormal returns, compared with 80% for event time buy-and-hold abnormal returns relative to size and B/M benchmarks. Ang and Zhang (2004, 255) find in simulations that the power of Fama–French three-factor calendar time regressions “decreases sharply as event horizon increases”. In event time, we should find a significant relation between risk-related firm characteristics and post-issue returns for both SEOs and their size and B/M matches, but SEOs should have lower post-issue risk exposure.

Loughran and Ritter (1995) and Spiess and Affleck-Graves (1995) find that it takes up to five years for the initial underreaction to SEO announcements to disappear. This is at odds with empirical evidence that suggests irrational investor behavior is short-lived. Womack (1996) finds that the initial underreaction to unfavourable changes in analyst recommendations corrects within six months of the report announcement. Bernard and Thomas (1989) report that the initial underreaction to earning announcements corrects within three quarters of the earnings announcement date. A more likely scenario, therefore, is that stock price fully impounds managers’ private information well within five years and a discount rate effect dominates over the remaining holding period. We next develop a formal model to test this.

## **2. A model of long-run SEO abnormal returns when mispricing causes the event**

This section develops a model of long-run SEO abnormal returns when managers time new equity issues to exploit market mispricing, investors underreact to managers’ private information revealed at the issue announcement, and stock price impounds the full signal content over a post-offering period. We start by describing the traditional estimator of abnormal returns when the source of abnormal performance is unknown. We call this the unconditional estimator

of SEO abnormal return. We then show how managers' information about stock mispricing affects the likelihood of a new equity issue. Conditional on investors underreacting to managers' private information and impounding the information in price over a post-issue period, we propose a conditional abnormal return estimator. The conditional estimator relates managers' mispricing assessment to post-event SEO abnormal performance.

### 2.1 The unconditional estimator of SEO abnormal returns

A typical event study compares the return performance of an event firm to a counterfactual benchmark. To model this formally, consider equity issuing firm  $i$ 's post-event return,  $R_{1i}$ , in excess of the risk free rate,  $r_f$ , as a function of systematic risk,  $X_i$ , a firm specific component,  $u_{1i}$ , and an event induced stock price reaction,  $d_1$ , where the 1 subscript indicates the act of issuing.<sup>7</sup> Similarly, the counterfactual return for SEO firm  $i$ ,  $R_{0i}$ , in excess of the risk free rate,  $r_f$ , is a function of risk,  $X_i$ , a firm specific component,  $u_{0i}$ , and a non-event induced performance,  $d_0$ , where the subscript 0 indicates the act of not issuing.<sup>8</sup> Two outcome equations give the post-event expected returns

$$E(R_{1i} - r_f | X_i) = d_1 + X_i \beta_1 + E(u_{1i}) \text{ for SEO firm } i \text{ in the act of issuing} \quad (1)$$

$$E(R_{0i} - r_f | X_i) = d_0 + X_i \beta_0 + E(u_{0i}) \text{ for SEO firm } i \text{ in the act of not issuing} \quad (2)$$

The *unconditional issue effect* is the difference between equations (1) and (2).<sup>9</sup> In the general case where the equity offering changes the issuer's risk, this is

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<sup>7</sup> The event window in long-run event studies that defines  $R_{1i}$  usually spans three to five years.

<sup>8</sup> The counterfactual state is the hypothetical state in which an equity issuer chooses not to issue.

<sup>9</sup> The term "unconditional" denotes that returns are not conditional on managers' decision to announce an issue.

$$E(R_{1i} | X_i) - E(R_{0i} | X_i) = d_1 - d_0 + X_i (\beta_1 - \beta_0) \quad (3)$$

where a negative  $d_1 - d_0$  corresponds to SEO underperformance. The underreaction hypothesis predicts that investors only partially revalue the issuer's stock at the offering announcement in response to managerial private information, while the remaining revaluation generates SEO post-issue underperformance. Previous studies (Rangan, 1998, Teoh, Welch, and Wong, 1998, Ali, 1996, and Dechow, Hutton, and Sloan, 2000) use pre-offering earnings management and optimistic analyst earnings and earnings growth forecasts to proxy for the announcement date managerial private information to which investors underreact. A significant negative relation between the proxy and the unconditional issue effect  $d_1 - d_0$  supports the underreaction hypothesis. However, if the empirical variables are weak proxies for managerial private information, measurement error can produce biased parameter estimates and lead to misleading tests. The next subsection develops a conditional estimator of SEO returns that distinguishes between the underreaction and the discount rate explanations of post-issue SEO performance in an unbiased and consistent fashion. The conditional estimator also adjusts for potential correlation between the endogenous decision to issue and the discount rate effect,  $X_i (\beta_1 - \beta_0)$ , which biases parameter estimates in equation (3) in a similar fashion to the omitted variables bias.

## 2.2 A conditional estimator of SEO returns

To get unbiased estimates of the discount rate effect and test the underreaction hypothesis, we use a two-step conditional return framework. The first step models managers' decision to issue. Managers issue equity based on their assessment of the expected offering's

benefits, denoted  $D_i^*$ . The latent variable  $D_i^*$  is a function of observable and unobservable components,  $Z_i$  and  $u_{di}$ , giving the equity issue selection equation

$$D_i^* = Z_i\gamma + u_{di} \quad (4)$$

The component  $Z_i\gamma$  captures the anticipated benefits of the issue that both managers and investors observe. For example, managers and investors can use market and accounting measures such as Tobin's  $q$  or stock price performance to form unbiased expectations of the motives for and benefits of an equity issue. The component  $u_{di}$  captures the issue's benefits observable by managers alone, i.e. managers' private information. In line with the underreaction hypothesis,  $u_{di}$  captures the benefit of issuing overvalued equity.<sup>10</sup>

Firms issue only if the benefits exceed a threshold set by managers, i.e.  $D(Z_i) = 1$  iff  $D_i^* \geq 0$ , where the normalized threshold is zero. Investors observe the issue decision ( $D_i = 1$ ) and the component  $Z_i\gamma$ . They do not observe  $u_{di}$  but can infer it from the issue decision. For example, they can infer from a firm's decision to issue that managers' private information,  $u_{di}$ , is high if  $Z_i\gamma$  is low. Similarly for non-issuers, high  $Z_i\gamma$  is likely to be associated with small  $u_{di}$  for the benefits of issue to be below the threshold.

We observe returns in the issue (non-issue) state if  $D(Z_i) = 1$  ( $D(Z_i) = 0$ ), which implies that outcomes are conditional on  $D_i^*$ . Accordingly, the conditional expected SEO excess returns in the two states are

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<sup>10</sup> Our setting does not distinguish who benefits from an overvalued equity issue. Myers and Majluf's (1984) model attributes the benefits to old shareholders. Jensen and Meckling's (1976) agency theory argues that managers pursue private goals at the cost of destroying firm value.



$$E(R_{1i} - r_f | X_i, D_i^* \geq 0) = X_i \beta'_1 + E(u_{1i} | u_{di} + Z_i \gamma \geq 0) \quad (5)$$

$$E(R_{0i} - r_f | X_i, D_i^* < 0) = X_i \beta'_0 + E(u_{0i} | u_{di} + Z_i \gamma < 0) \quad (6)$$

for SEO firm  $i$  in the acts of issuing and not issuing.<sup>11</sup> If the underreaction hypothesis holds, post-issue abnormal performance is due to prices gradually incorporating managers' private information,  $u_{di}$ , i.e.  $E(u_{1i} | u_{di} + Z_i \gamma \geq 0) \neq 0$  and  $E(u_{0i} | u_{di} + Z_i \gamma < 0) \neq 0$ . Assuming bivariate normal distributions for  $u_{1i}$ ,  $u_{di}$  and  $u_{0i}$ ,  $u_{di}$  with covariances  $\sigma_{u_d u_1}$  and  $\sigma_{u_d u_0}$ , equations (5) and (6) become

$$\begin{aligned} E(R_{1i} - r_f | X_i, D_i^* \geq 0) &= X_i \beta'_1 + E(u_{1i} | u_{di} \geq -Z_i \gamma) = X_i \beta'_1 + \sigma_{u_d u_1} \frac{\phi(-Z_i \gamma / \sigma_{u_d})}{1 - \Phi(-Z_i \gamma / \sigma_{u_d})} \\ &= X_i \beta'_1 + \sigma_{u_d u_1} \frac{\phi(Z_i \gamma / \sigma_{u_d})}{\Phi(Z_i \gamma / \sigma_{u_d})} = X_i \beta'_1 + \sigma_{u_d u_1} \lambda_{1i} \end{aligned} \quad (7)$$

$$\begin{aligned} E(R_{0i} - r_f | X_i, D_i^* < 0) &= X_i \beta'_0 + E(u_{0i} | u_{di} < -Z_i \gamma) = X_i \beta'_0 + \sigma_{u_d u_0} \frac{-\phi(Z_i \gamma / \sigma_{u_d})}{1 - \Phi(Z_i \gamma / \sigma_{u_d})} \\ &= X_i \beta'_0 + \sigma_{u_d u_0} \lambda_{0i} \end{aligned} \quad (8)$$

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<sup>11</sup> When  $u_{1i}$  and  $u_{0i}$  are correlated with  $u_{di}$ , i.e. when investors underreact to managers' private information revealed at the issue announcement and  $\text{corr}(u_{di}, X_i) \neq 0$ , equations (5) and (6) give unbiased and consistent estimators of  $\beta^1$ . This arises from modelling manager's endogenous decision to issue and including its effect in the regression specification based on equations (5) and (6), which corrects for the omitted variables bias.

In equations (7) and (8),  $\phi(\cdot)$  and  $\Phi(\cdot)$  are the standard normal pdf and cdf and  $\lambda_{1i}$  and  $\lambda_{0i}$  are the inverse Mills ratios, which measure the magnitude of managerial private information revealed at the announcement.<sup>12</sup>

The probability of an equity offering increases with  $u_{di}$ , which measures the benefits of issuing overvalued equity. Thus, for given  $Z_i$ , SEOs must have higher  $u_{di}$  than non-issuers to reach the issue threshold. If the market underreacts to the signal about  $u_{di}$  revealed by the offering, an equity issue implies future stock price underperformance compared to non-issue as stock price gradually impounds the signal content.<sup>13</sup> Consequently, high  $u_{di}$  is associated with small  $u_{1i}$  and large  $u_{0i}$  in equations (7) and (8). A negative covariance between  $u_{di}$  and  $u_{0i}$  leads to lower post-issue SEO returns but a negative covariance between  $u_{di}$  and  $u_{1i}$  leads to higher returns for non-issuing firms for a given discount rate.<sup>14</sup> This follows because stock prices adjust after the issue to correct the mispricing and the magnitude of the correction is  $\sigma_{u_d u_1} \lambda_{1i}$  ( $\sigma_{u_d u_0} \lambda_{0i}$ ) in the issue (non-issue) state assuming bivariate normal distribution. Thus, the

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<sup>12</sup> Normalizing the variance of  $u_{di}$  to 1 does not affect generalizability, since the probit model that estimates the inverse Mills ratios identifies only the transformed parameters  $\gamma/\sigma_{u_d}$ .

<sup>13</sup> In Myers and Majluf (1984) and its extensions, undervalued firms prefer not to sell equity to prevent wealth transfer from old to new shareholders. As a result, the pool of equity issuers is on average overvalued and an issue conveys negative news about firm value. Extensive empirical evidence on negative announcement date abnormal returns supports this prediction.

<sup>14</sup> From the properties of truncated distributions,  $\lambda_1 \geq 0$  and  $\lambda_0 \leq 0$ . Firm overvaluation leads to the issue decision ( $\lambda_1 \geq 0$ ), while undervaluation deters a firm from issuing ( $\lambda_0 \leq 0$ ).

adjustment depends on the private information  $u_{di}$  (since a lower  $Z_i\gamma$  leads to a higher  $\lambda_{1i}$ ),<sup>15</sup> on the strength of the correlation between the error terms in the selection equation (4) and outcome equations (1) and (2) ( $\rho_1 = \sigma_{u_i u_d} / \sigma_{u_i} \sigma_{u_d}$  and  $\rho_0 = \sigma_{u_{0i} u_d} / \sigma_{u_{0i}} \sigma_{u_d}$  for the issue and non-issue states), and on the variances of  $u_{1i}$  and  $u_{0i}$ . This gives the *conditional issue effect*

$$E(R_{1i} | X_i, D_i^* \geq 0) - E(R_{0i} | X_i, D_i^* < 0) = \sigma_{u_d u_1} \lambda_{1i} - \sigma_{u_d u_0} \lambda_{0i} + X_i (\beta'_1 - \beta'_0) \quad (9)$$

where  $\sigma_{u_d u_1} \lambda_{1i} - \sigma_{u_d u_0} \lambda_{0i}$  is the post-event stock price adjustment in the issue vs. non-issue states, as the market impounds the information  $u_{di}$ , and  $X_i (\beta'_1 - \beta'_0)$  is the differential risk exposure. Equation (9) distinguishes the behavioral explanation for low SEO returns (investor underreaction to the private signal  $u_{di}$ ) from the rational (discount rate) explanation. It shows that SEO abnormal performance relates to the private information (the surprise component) that the issue announcement conveys. For example, a highly anticipated issue conveys little new information at the announcement date and post-issue abnormal performance should be small. In addition, if investors underreact to information about stock mispricing that is publicly available before the announcement (e.g. positive abnormal stock returns preceding the issue announcement), including these variables in the regression controls for any delayed reaction to public information.

Equation (9), unlike equation (3), enables a test of the underreaction hypothesis. The hypothesis predicts a negative covariance between managers' information about stock mispricing and post-issue returns. If the underreaction hypothesis is true,  $\sigma_{u_d u_1}$  should be significantly

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<sup>15</sup> For a given  $Z_i\gamma$ , if a firm issues, investors can infer that  $u_{di}$  is larger than in the non-issue state to reach the threshold  $Z_i\gamma + u_{di} \geq 0$ . As  $Z_i\gamma$  decreases,  $u_{di}$  needs to increase to reach the threshold, leading to a larger  $\lambda_{1i}$ .

negative for equity issuers. Equation (9) also shows that abnormal performance varies across issuing firms with the magnitude of private information  $\lambda_{1i}$  and it provides unbiased and consistent test of the discount rate effect. A discount rate effect corresponds to  $X_i(\beta'_1 - \beta'_0) < 0$ .

To control for SEO returns in the hypothetical non-issue state, we use benchmark stocks. Following Loughran and Ritter (1995) and other studies, we use size and B/M matched control firms.<sup>16</sup> As benchmark stocks do not announce a non-issue decision and issue decisions are largely unexpected, we expect to observe an insignificant relation between  $\sigma_{u_i u_0}$  and benchmark stock returns. To estimate how rapidly prices impound the issue signal, we vary the return holding period.

### 3. Data and sample selection criteria

Our sample of seasoned equity offerings is from the SDC New Issues database. The sample period is January 1970 to December 2007. To allow for a three-year holding period, the last offering is in December 2004. The selection criteria follow Eckbo, Masulis, and Norli (2000) and Brav, Geczy, and Gompers (2000). The sample includes all US domiciled companies listed on NYSE/AMEX/Nasdaq that make SEOs of pure primary shares or combinations of primary and equity sales by a major shareholder (combinations) in the US market. The sample includes industrial, financial and utility firms but excludes unit offerings and SEOs that

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<sup>16</sup> Baker and Wurgler (2000) extend the dimension of market timing arguing that managers are able to time not only individual stock mispricing, but also market-wide mispricing, thus increasing the overall issue gains. They draw on the findings in Loughran and Ritter (1995) that equity issues cluster at market peaks and find that the proportion of new equity in total external financing covaries negatively with future stock returns. SEO size and book-to-market matching over the post-issue period controls for market-wide mispricing.

simultaneously offer debt, preferred stock, or warrants. It also excludes private placements, exchange offers of stock, 144A offers, cancelled offers, spin-off related issues and SEOs within a three-year period after the IPO.<sup>17</sup> These criteria lead to an initial sample of 8,223 issues. Excluding equity offerings by the same company that occur within the three-year holding period of the first equity offering, reduces the sample to 5,121. Retaining offerings of common stock only (CRSP share codes 10 and 11) with stock return data available for at least a month after the issue leaves 4,931 issues. Collecting information on market and (positive) equity book values used for matching leaves 4,665 SEOs, of which we find control stocks for 4,422 issuers. NYSE/AMEX and Nasdaq listed stocks that have not issued new equity for the past three years provide a pool of potential matching stocks. To obtain a conditional estimator of abnormal returns, we require additional data, such as capital expenditures, earnings, debt, and asset values. These additional requirements reduce the sample to 2,879 SEOs. Our data are from the CRSP /Compustat merged database.

Table 1 reports the distribution of the initial sample of 4,422 SEOs, when we require information on stock returns, and book and market equity values only, and a final sample of 2,879 SEOs, where we impose additional data requirements. We split SEOs across NYSE/AMEX and Nasdaq exchanges, broad industry groups (financial, industry, and utility), nine Fama and French size and B/M portfolios, and issue period. Of the initial (final) sample, 45.73% (46.58%) of SEOs list on NYSE/AMEX and 54.27% (53.42%) on Nasdaq. Industrial issuers are the largest group of equity issuers, with 3,572 (2,498) industrial SEOs in the initial (final) sample. Splitting issuers into three portfolios, small (*S*), medium (*Me*), and big (*B*) by

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<sup>17</sup> Excluding equity issues within a 3-year period after the IPO prevents IPO underperformance influencing the results.

market value of common equity using NYSE breakpoints, 2,368 (1,489) are small capitalization firms in the initial (final) sample. A corresponding split on B/M into high (*H*), medium (*M*), and low (*L*) shows that there are 1,708 (1,148) low B/M stocks in our initial (final) sample, of which 877 (534) are small. Previous studies document that small, low B/M stocks dominate equity issuers. These stocks are subject to larger valuation errors and more susceptible to misvaluation. The number of issuers increases over time, with 379 (169) SEOs occurring in the 1970s and 1,479 (1,084) between 2000 and 2004 for the initial (final) sample.

#### **4. The long-run performance of SEOs: unconditional estimates of the issue effect**

Existing evidence of SEO underperformance comes primarily from buy-and-hold abnormal return estimates using size and B/M matches. We replicate matching based on the closest neighbour approach. Matching each issuer with non-issuing firms in a 30% calliper of the issuer's equity value at the year-end before the offering, we then select a control firm with the closest B/M to the issuer's. Non-issuers are companies that have not issued equity in the past three years. To avoid hindsight bias, for offers in the first six months of the year book value is for the fiscal year two years earlier; for offers in the second six months of the year, book value is from the previous year. The definition of B/M follows Fama and French (1992). Each control stock pairs with one SEO over the three-year holding period. If a control stock delists or issues equity, we choose a new match from the original list of eligible controls. If an issuing firm delists, we truncate the SEO and its match return on that date.

Sample firm *i*'s  $t_i$ -month buy-and-hold return (BHR) is  $BHR_i = \prod_{\tau=1}^{t_i} (1 + R_{i\tau}) - 1$ , starting at the beginning of the month following the issue and finishing at the earlier of the three-year anniversary or the delisting date. The average holding period return across  $N$  sample stocks is

$\overline{BHR} = \sum_{i=1}^N x_i BHR_i$  where  $x_i$  denotes equally-weighted (EW) or value-weighted (VW). Value weights are market capitalization scaled by the value-weighted CRSP NYSE/AMEX/Nasdaq stock market index one month before the offer to ensure that early and late sample observations have consistent weights.<sup>18</sup>

Table 2 reports average BHRs for issuers and their matches over a three-year holding period. Column *Diff*, denoting the difference between these two figures, gives the percentage buy-and-hold abnormal return (BHAR) of issuers. Panel A reports the results for the sample of 4,422 SEOs. The average EW (VW) BHAR is -24.48% (-20.81%). NYSE/AMEX issuers underperform less than Nasdaq issuers: -19.02% (-19.27%) compared to -29.08% (-29.23%) using EW (VW).<sup>19</sup> The underperformance is significant in all specifications at 5% based on skewness-adjusted *t*-statistics recommended by Lyon, Barber and Tsai (1999).

Numerous studies point out that test statistics can be negatively biased due to cross-sectionally correlated abnormal returns. Jegadeesh and Karceski (2009) propose a correlation and heteroskedasticity consistent test that adjusts for cross-sectional correlation. They construct monthly cohorts of stocks by grouping securities that experience an event in month  $t$ . Their *t*-statistic takes the form  $t = w' \overline{AR}(H) / w' V w$ , where  $w$  is a vector of weights,<sup>20</sup>  $\overline{AR}(H)$  is the average abnormal return of each monthly cohort over holding period  $H$  (36 months in this case)

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<sup>18</sup> The value-weighted CRSP NYSE/AMEX/Nasdaq stock market index has a December 1972 value of a 100 and a December 2004 value of 3,038.

<sup>19</sup> Based on buy-and-hold abnormal returns and size and book-to-market control firm matching, Spiess and Affleck-Graves (1995) report a 22.84% underperformance, Jegadeesh (2000) a 34.3% underperformance, Brav, Geczy, and Gompers (2000) 26.3%, and Eckbo, Masulis, and Norli (2000) 23.2%.

<sup>20</sup> For EW, the  $i^{\text{th}}$  element is the ratio of the number of events in month  $t$  to the total sample size; for VW, the  $i^{\text{th}}$  element is the ratio of the monthly cohort's market value to the total sample market capitalization.

and  $V$  is the  $T \times T$  variance–covariance matrix of  $\overline{AR}(H)$ , where  $T$  is the number of monthly cohorts. Serial covariances closer than  $H$  months apart are due to overlapping returns; all higher order covariances are set to zero. Jegadeesh and Karceski (2009) propose a generalized version of White’s heteroskedasticity-consistent variance estimator to estimate  $V$ . Table 2 reports  $t$ -statistics based on Jegadeesh and Karceski (2009) and corresponding  $p$ -values in the last two columns. This reduces  $t$ -values in absolute terms by between 60% and 85%. Nevertheless, abnormal returns remain significant at 5% (with the exception of EW Nasdaq BHARs, which are significant at 8%).

Table 2, Panel B reports abnormal performance for the sample of 2,879 SEOs and shows no significant differences in underperformance compared to Panel A. Using Jegadeesh and Karceski’s  $t$ -statistic, a smaller sample size increases standard errors and reduces significance to 7.2% (5.1%) for the pooled (NYSE/AMEX) sample using EW (VW) BHARs and gives no abnormal performance for Nasdaq issuers, but leaves all other inferences intact. In unreported results, a Wilcoxon sign-rank test indicates a significant median underperformance at 1% for the pooled sample and for individual exchanges. We conclude that both SEO samples exhibit significant underperformance.

The unconditional estimator of abnormal returns in equation (3) highlights the differential risk exposure of SEOs and benchmark stocks as a potential explanation for issuer underperformance. Previous studies suggest that post-offering SEO performance relates to a number of risk factors and market characteristics. These include the issuer’s equity market value and B/M ratio (Loughran and Ritter, 1995), leverage (Eckbo, Masulis, and Norli, 2000), stock liquidity (Eckbo and Norli, 2005, Bilinski, Liu, and Strong, 2009) and investment rates (Lyandres, Sun, and Zhang, 2008). In addition to these characteristics, we use stock price run-up



and return volatility to proxy for a firm's pre-issue misvaluation, uncertainty about true firm value, and expected issue costs. Bayless and Jay (2003) and Bilinski, Liu, and Strong (2009) report significantly positive pre-issue abnormal price performance. High return volatility indicates increased uncertainty about firm value, which may discourage investors from participating in new issues. This leads to higher offering costs as the risks of offering failure, flotation costs, and underwriter spreads increase. Cooper and Grindler (1996, 466) point out that "[i]ncreased volatility in general will increase the difficulty in setting the final offer price. If the final offer price is set too high, the issue may not sell well, and if it is set too low, the existing shareholders suffer a wealth transfer loss".

Table 3, Panel A verifies the above predictions, by reporting results from a regression with three-year BHRs of SEOs or their matches as the dependent variable (equations 1 and 2). The independent variables include, in log form, B/M ratio ( $B/M$ ), equity market value ( $MV$ ), leverage ( $LEV$ ), and illiquidity level ( $LM12$ ).<sup>21</sup>  $LEV$  is the ratio of debt to total assets.  $LM12$  is the standardized turnover-adjusted number of zero-trading-volume days over the prior 12 months (Liu, 2006).<sup>22</sup> The independent variables also include the investment-to-assets ratio ( $INV/A$ ), pre-issue abnormal performance ( $pAB$ ), and return volatility ( $VOL$ ).  $INV/A$  is the change in property plant and equipment plus the annual change in inventories scaled by lagged value of assets.  $pAB$  is the difference between the firm's and the CRSP VW NYSE/AMEX/Nasdaq index

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<sup>21</sup> Market values are deflated by the VW CRSP NYSE/AMEX/Nasdaq market index to give comparability over time.

<sup>22</sup> Several studies report overstated Nasdaq trading volume relative to NYSE/AMEX due to Nasdaq dealers counting the selling and buying of the same shares as two separate transactions (Anderson and Dyl, 2007, He and Wu, 2003). A common rule of thumb is to adjust for the double-counting of Nasdaq volume by dividing by 2, which we follow in calculating  $LM12$ .

buy-and-hold returns over the six months before the issue. *VOL* is the standard deviation of six-month pre-issue returns. *B/M*, *LEV* and *INV/A* are for the prior December at least six months before the offering date. *MV*, *LM12*, *pAB* and *VOL* are for one month before the issue date. Accounting variables, *MV*, and *LM12* are winsorized based on the CRSP population at  $\pm 1\%$ .

The results show no relation between SEO long-run performance and pre-issue firm size, liquidity, or pre-issue return performance.<sup>23</sup> An insignificant relation with *pAB* suggests that stock price impounds publicly available information about firm misvaluation at the announcement date. High *B/M* issuers earn higher post-issue returns and a *LEV* coefficient of 0.153 confirms results in Eckbo, Masulis, and Norli (2000) that increased leverage and a resultant higher exposure to default risk leads to higher required rates of return. The coefficient on *INV/A* is negative ( $-0.323$ ), consistent with Lyandres, Sun, and Zhang (2008) who argue that SEOs convert risky growth options into fixed assets, lowering the firm's risk. A negative coefficient on *VOL* ( $-0.648$ ) suggests that high offering costs and uncertainty about firm value reduce post issue returns. Matching stocks' BHRs covary with pre-issue *B/M* and *LEV* only.

Table 3, Panel B investigates the role of the discount rate effect,  $X_i(\beta_1 - \beta_0)$ , in explaining long-run SEO underperformance. Using the method of matching, we mimic the unobservable expected return on sample firm *i* in the non-issuing state  $E(R_{0i}|X_i)$  by the return on a benchmark *j*,  $E(R_{0i}|D_i = 0, X_i) = E(R_{0j}|D_j = 0, X_j)$ . This leads to the discount rate effect being a function of differences in characteristics,  $X_{0i} \neq X_{0j}$ , and risk exposures,  $\beta_1 \neq \beta_0$ . Column *Beta diff* reports coefficient differences for the two regressions in Panel A. SEOs have significantly lower *B/M* and *VOL* coefficients than matching stocks. However,  $d_1 - d_0$  remains

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<sup>23</sup> Results in Table 3 use robust standard errors.

significant, which shows that controlling for the discount rate effect, SEOs underperform their control stocks, although the underperformance halves from  $-27.33\%$  in Table 2, Panel B to  $-13.9\%$ . The last four columns of Panel B report mean firm characteristics for SEOs ( $X_{SEO}$ ), matches ( $X_{matches}$ ) and their difference ( $X_{diff}$ ) over the 3-year post-issue holding period.<sup>24</sup> SEOs are made on average by larger, more liquid stocks, with higher investment rates and book-to-market ratios, and lower gearing than benchmark firms.

Based on the results in Table 3, new equity issuers have lower post-issue risk than matching stocks, consistent with the discount rate explanation. However, controlling for risk, SEOs continue to underperform their benchmarks, which suggests that the discount rate effect alone does not explain low issuer returns. Next, we turn to the conditional estimator of SEO abnormal returns to test the underreaction explanation for low SEO post-offering performance.

## 5. Predicting the equity issue decision and conditional estimates of the issue effect

To estimate the conditional estimator of SEO abnormal returns in equation (9), we need  $\lambda_{1i}$  and  $\lambda_{0i}$  from the equity issue selection equation (4). We use Heckman's (1979) two-step procedure to estimate the equity issue decision and decompose the expected returns to SEOs for the issue and non-issue states. The procedure uses a probit model to estimate the anticipated component of the issue decision in equation (4),  $Z_i\gamma$ . Accounting variables are for the prior December at least six months before the offering date. Market based explanatory variables are from the month before the event. This ensures that the probit model uses the latest information

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<sup>24</sup> In calculating mean three-year post-issue characteristics we use all annual non-missing characteristics available for SEOs and control stocks. The table omits  $pAB$  and  $VOL$ , which relate to the pre-issue period. Table 6 below reports mean  $pAB$  and  $VOL$  for SEOs, matching stocks, and their difference.

with no look-ahead bias. Accounting variables, *MV*, and *LM12* are winsorized based on the CRSP population at  $\pm 1\%$ . We group explanatory variables into five categories according to issue motives.

#### *Firm overvaluation and firm value uncertainty*

Loughran and Ritter (1995) argue that stock mispricing encourages firms to issue overvalued equity. Hirshleifer (2001) predicts a greater investor irrationality effect on firms with greater uncertainty about their value and poor information environments. Consistent with this prediction, Zhang (2006) finds a significant relation between information uncertainty, irrational investor behaviour, and stock returns.<sup>25</sup> We use five variables to capture variation in firm mispricing and value uncertainty. *pAB* measures pre-offering misvaluation and *VOL* proxies for pre-issue uncertainty about firm value and expected offering costs. Higher *VOL* means greater uncertainty about firm value, increasing the risk of offering failure, flotation cost, and underwriter spreads. Year dummies (*Year dummies*) capture waves of new equity issues as firms cluster in timing offerings to exploit periodic stock misvaluation (Loughran and Ritter, 2000). Year dummies also capture Schultz's (2003) pseudo market timing hypothesis, which argues that equity issue waves coincide with peaks in market performance. Twelve dummies (*Industry dummies*) based on Kenneth French's industry definitions capture industry variation in mispricing (Spiess and Affleck-Graves, 1995). An indicator variable (*Exchange*) distinguishes Nasdaq from NYSE/AMEX listed firms. Brous, Datar, and Kini (2001, 156) argue that “[i]n

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<sup>25</sup> Zhang (2006, 105) defines information uncertainty as “ambiguity with respect to the implications of new information for a firm's value, which potentially stems from two sources: the volatility of a firm's underlying fundamentals and poor information”.

contrast to NYSE/AMEX issuing firms, Nasdaq issuing firms are likely to be smaller in size, with less stringent exchange-related listing and disclosure requirements, lower number of analysts following, lower institutional ownership, and lower frequency of voluntary disclosures and, thus, are more likely to be mispriced”.

### *Agency costs*

Managers may issue equity to pursue private goals at the cost of destroying firm value. Jensen (1986) points out that equity issues may aggravate the free cash flow problem and increase manager–shareholder conflicts of interest. As a result, high agency costs may discourage a firm from issuing. Large firms face higher agency costs due to larger and more diffused shareholder base. Himmelberg, Hubbard, and Palia (1999) suggest higher agency costs in larger firms due to higher monitoring costs. We use the log of equity market value ( $\ln MV$ ) to proxy for conflicts of interest arising from agency conflicts.<sup>26</sup>

### *Growth options*

Carlson, Fisher, and Giammarino (2006) and Zhang (2005) point out that firms make SEOs to pursue profitable growth opportunities. We use the B/M ratio ( $B/M$ ) and Lyandres, Sun, and Zhang’s (2008) investment ratio ( $INV/A$ ) to measure growth options. Lyandres, Sun, and Zhang (2008) argue that the investment ratio is a strong predictor of post-issue SEO performance, consistent with Cochrane’s (1991)  $q$ -theory of investment and the real options model of Carlson, Fisher, and Giammarino (2006). Harjat and Garen (2003) report that 42% of IPOs conduct SEOs within 4 years of their IPOs. Younger firms require more investment capital

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<sup>26</sup> We deflate market value by the VW CRSP NYSE/AMEX/Nasdaq market index to give comparability over time.

at the start of their life cycle. Measuring firm age as the difference between a firm's IPO date and the end of December of each year, we form a dummy variable equal to 1 if a firm's age is less than or equal to four years (*AGE DUMMY*) and zero otherwise.

### *Leverage and financial constraints*

The pecking order theory predicts that firms with insufficient internal funds to finance new investment resort to external financing. We use current year's earnings growth (*EG*), return on assets (*ROA*), and the ratio of capital expenditures (*CAPEX*) to retained earnings plus depreciation and amortization (*IFC*) to measure a firm's ability to generate internal funds.<sup>27</sup> Jensen (1986) and Stulz (1990) point out that high leverage limits a firm's ability to exploit new investment opportunities since adverse liquidity shocks have a negative effect on investment as leverage increases. We use leverage (*LEV*) to control for the higher propensity of high leverage firms to issue equity rather than debt to finance new projects.

### *Stock liquidity*

Eckbo, Masulis, and Norli (2000) point out that an equity issue may improve a stock's liquidity and decrease the firm's discount rate. Bilinski, Liu, and Strong (2009) confirm higher SEO post- versus pre-issue stock liquidity. Butler, Grullon, and Weston (2005) report that investment banks charge lower fees to firms with more liquid stock before the offering. Higher pre-SEO liquidity can ensure higher uptakes of new shares, lowering issue costs. To capture the effect of stock liquidity on the equity issue decision, we use Liu's (2006) (il)liquidity measure (*LM12*).

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<sup>27</sup> *IFC* measures the inverse of the firm's ability to generate internal funds.

To estimate the probit model we require a sample of non-issuing firms. To select this sample, we use a procedure similar to Guo and Mech (2000). We randomly choose 60,000 security month–years (based on a random number generator and selection without replacement) from the monthly CRSP/Compustat merged files over 1970–2004. We exclude firms with insufficient CRSP/Compustat data, leaving a sample of 21,101 non-issuing firm–year observations. We add to these observations our size and B/M benchmark stocks to form a sample of 23,980 pseudo non-issuing events.<sup>28</sup>

Table 4, Panel A reports mean and median values and standard deviations of the probit variables for SEOs, matches, and the remaining CRSP stocks. The final six columns test for differences in characteristics between SEOs and their matches and between SEOs and CRSP stocks. SEOs exhibit higher pre-issue price run-up than matching firms (39.51% vs. 14.51%) and the remaining CRSP stocks (6.65%). They also have higher volatility over this period than their matches and CRSP stocks (15.45% vs. 12.77% vs. 14.05%). Greater SEO return volatility before the issue signals higher uncertainty about firm value and more diffuse investor beliefs. Zhang (2006) shows that greater information uncertainty leads to greater investor underreaction to public signals and stronger price correction. Matching SEOs to control stocks based on size and B/M is successful, but compared to their matches and to the remaining CRSP stocks, SEOs have significantly higher investment rates ( $INV/A = 0.133$  vs. 0.09 vs. 0.101), leverage ( $LEV = 0.502$  vs. 0.475 vs. 0.492), financial constraints ( $IFC = -24.894$  vs.  $-9.046$  vs.  $-4.667$ ) and liquidity ( $LM12 = 4.866$  vs. 8.371 vs. 17.358). SEOs have significantly higher earnings growth compared to the remaining CRSP stocks (0.114 vs. 0.037). Table 4, Panel B reports Pearson

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<sup>28</sup> Size and B/M matching stocks share pseudo non-event dates with the sample of SEOs.

correlations between the variables. The magnitudes of the correlations are low, being 0.075 on average.

Table 5 reports the results of modelling the issue decision using a probit model applied to 26,859 firm–year observations. We find support for misvaluation with positive and significant coefficients on *pAB* (0.515), *Exchange* (0.147) and a number of year and industry dummies (not reported). The negative coefficient on *VOL* (−0.439) indicates that increased uncertainty about firm value and high issue costs discourage a firm from issuing. The positive coefficient on  $\ln MV$  (0.066) suggests that in our sample larger companies are more likely to issue equity. The negative coefficient on  $\ln B/M$  (−0.075) and positive coefficients on *INV/A* (0.566) and *AGE DUMMY* (0.1) show that growth options, high investment rates, and being early in the company life cycle, increase the propensity to issue. We find only partial support for the financial constraints prediction with a negative coefficient on *ROA* (−0.53). High firm leverage increases the probability of equity financing as  $\ln LEV$  has a positive coefficient (0.109). Illiquidity contributes negatively to the issue decision ( $\ln LM12 = -0.015$ ).

The marginal effect of each variable on the issue decision indicates their importance. *INV/A* is the principal positive contributor to the issue decision (8.288%), indicating that firms issue equity to pursue new investments. Low profitability firms with insufficient internal funds are more likely to issue, with a 1% decrease in *ROA* contributing 7.757% to the probability of issue. These results are consistent with Myers and Majluf's (1984) rational equity issue model. We find support for managers timing equity issues to periods where firm stock is mispriced, with pre-issue abnormal performance, *pAB*, having a strong positive impact on the issue decision (marginal effect of 7.541%). *VOL* has a negative influence on issue probability (marginal effect



of  $-6.429\%$ ), which suggests that greater uncertainty about firm value, implying a higher risk of offer withdrawal and high flotation costs, discourages an issue.

Table 5, Panel B reports the predicted probability of equity issue based on the estimates in Panel A for the sample of SEOs, matches, and the remaining CRSP stocks. A random non-issuing CRSP stock has a 9.13% probability of issuing equity in a given year. Matching firms have a higher chance of issuing (13.52%), while SEOs have the highest predicted issue probability (19.59%). Despite investors partly anticipating new equity issues, the results suggest SEOs surprise the market and underscore the importance of the unobservable private information component  $u_{di}$  in the issue decision.<sup>29</sup> If SEO stock prices do not react fully to managerial private information, there will be a negative relation between  $u_{di}$  and post-issue SEO returns.

### *5.1 The long-run performance of SEOs—conditional estimates*

The probit model results confirm that equity offerings are unexpected events and issue announcements convey significant information about  $u_{di}$  that is unobservable before the announcement. If the market rationally impounds this information, there should be a complete and unbiased price reaction at the issue announcement and post-offering stock returns should compensate for risk. If the market initially underreacts to the information and gradually corrects the overvaluation after the event, we should observe post-offering underperformance. In addition, less anticipated SEOs should experience greater post-issue correction and lower returns.

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<sup>29</sup> For example, if investors are rational, stock prices should impound 80.41% of the total issue effect (see Figure 1) on average at the announcement and only 19.59% before the offering.

Table 6, Panel A reports results for the conditional estimator of abnormal return performance for SEOs and their control stocks (equations 7 and 8), where the inverse Mills ratios ( $\lambda_0, \lambda_1$ ) proxy for unobservable private information.<sup>30</sup> As expected, the coefficient on  $\lambda_1$  is negative ( $-0.171, p = 0.022$ ), indicating that greater private information leads to lower post-event performance. The correlation between the error terms in the SEO return regression (equation 1) and the issue decision model (equation 4) is  $-0.159$  with a cross-sectional standard deviation of residuals from the SEO return model of 1.077. SEO performance varies positively with pre-issue *B/M* and *LEV*, and negatively with *INV/A*, *pAB*, and *VOL*. There is no relation between private information and average returns for matching stocks, consistent with the random assignment of pseudo-event dates. The correlation between the outcome and selection equations for matching firms is  $-0.051$  with a standard error of residuals from the non-issue return model of 1.215. Similar to SEOs, long-run BHRs of matching stocks are positively related to pre-issue *B/M* and *LEV*.

Table 6, Panel B reports means of  $\lambda_1$  and  $\lambda_0$  and Pearson correlations between lambdas and the explanatory variables for SEOs and matching stocks. All correlations are significant with the average absolute correlation between lambda and the explanatory variables being 0.207 (0.225) for SEOs (matches). Comparing  $\beta$  estimates from Table 6, Panel A and Table 3, Panel A, including lambda in the SEO regression specification makes *pAB* significant. A negative relation between post-issue SEO returns and pre-issue abnormal returns suggests that investors

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<sup>30</sup> The intercept terms capture any misspecification due to a failure to control for a delayed market reaction.

do not react fully to pre-issue mispricing. The results indicate that adjusting for the delayed market reaction changes statistical inferences and estimates of the discount rate effect.<sup>31</sup>

Table 6, Panel C reports coefficient differences between the two Panel A regressions and tests their significance. Coefficient differences between the explanatory variables show similar significance levels to Table 3, Panel C (except for a  $pAB$  coefficient for SEOs significantly lower at 7.5% in Table 6, Panel C).

Overall, the results in Table 6 confirm the hypothesis that a delayed reaction to managers' private information revealed at the announcement leads to negative post-issue abnormal performance. Post-issue SEO stock returns relate negatively to managers' private information but there is no relation between private information and average returns for matching stocks.

## 5.2 Sensitivity analysis

Table 6 shows a significant negative relation between SEO long-run returns and the inverse Mills ratio,  $\lambda_1$ , proxying for managers' private information revealed at the announcement. This suggests that investors only partially discount the information surprise at the issue announcement and this underreaction corrects over the post-offering period. Next, we examine the sensitivity of the results to overoptimism in analyst earnings-per-share forecasts for

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<sup>31</sup> Although coefficient differences between Table 6, Panel A and Table 3, Panel A are high (e.g. 112% for  $pAB$  for SEOs), they are not statistically significant.

new equity issuers, SEO attrition before the end of the holding period, delisting returns, and periods of high equity issue volume.<sup>32</sup>

Financial analysts specialize in gathering and processing information about firm value on investors' behalf. Unbiased analyst forecasts of future earnings help investors to form accurate estimates of firm value and assist in their investment decisions. However, Ali (1996) and Teoh and Wong (2001) report that around the offering, analysts are on average overoptimistic about SEO post-issue earnings prospects. If analyst earnings forecasts proxy for market expectations about future SEO performance, optimistic forecasts imply irrational expectations of future stock performance. Hence, investor underreaction to SEO announcements and the magnitude of post-issue price correction should increase as analyst forecasts become more optimistic. Table 7, Panel A tests this prediction, where analyst forecast bias (*AFB*) in earnings-per-share (EPS) is actual EPS reported by the company less the median analyst consensus forecast scaled by stock price. Negative *AFB* values indicate optimistic forecasts. The median analyst consensus EPS forecast and stock price are measured one month before the issue.<sup>33</sup> We use analyst one-year-ahead EPS forecasts but our results are similar using longer horizons. We can calculate *AFB* for 1,826 SEOs, which we split into two groups (*Optimistic* and *Pessimistic*) based on median

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<sup>32</sup> We estimate subsample cross-sectional regressions jointly with the equity issue model (equation 4) to ensure consistent standard error estimates. The results are indistinguishable from regression estimates that use the original lambda estimates from Table 5. For example, the percentage difference in SEO lambda coefficients for the two approaches is 3.86% for Optimistic Analyst Forecast Bias in Table 7, Panel A and 5.61% for SEO attrition before the end of the holding period in Table 7, Panel B.

<sup>33</sup> Monthly information on median consensus one-year-ahead earnings-per-share forecast and stock price are from the IBES summary files.

*AFB*.<sup>34</sup> *Pessimistic AFB* stocks have a positive mean and median *AFB* (0.011 and 0.004) compared to negative values for *Optimistic AFB* stocks (−0.045 and −0.011). *Optimistic AFB* SEOs have a  $\lambda_1$  coefficient of −0.189, while  $\lambda_1$  is insignificant for *Pessimistic AFB* SEOs. These results support the prediction that investors underreact more to SEO announcements when analysts issue overly optimistic EPS forecasts, leading to more negative price correction following the offering.

Shumway (1997) and Shumway and Warther (1999) were first to address the impact of omitting delisting returns on stock return calculations. Both studies find that including delisting returns can significantly alter inferences on many anomalies. For example, Shumway and Warther (1999) find that correcting for delisting bias eliminates the size effect for Nasdaq stocks. Beaver, McNichols, and Price (2007) confirm that including delisting returns increases the average return difference between extreme decile portfolios partitioned on earnings, cash flows, and B/M ratio. To ensure omitting delisting returns does not affect our results, we repeat our analysis using CRSP delisting returns. Where a delisting return is missing, we assume a return of −1 for delisting due to liquidation (CRSP codes 400–490), −0.33 for performance related delisting (500 and 520–584), and zero otherwise. Using delisting returns has virtually no effect on coefficient estimates indicating that our findings are robust to delisting bias (results not tabulated). This result is consistent with Shumway (1997) who finds less than a 1% per year difference in three-year underperformance estimates for NYSE/AMEX listed IPOs after adjusting for delisting bias.

SEO attrition before the end of the three-year holding period may affect our results. For example, low buy-and-hold returns over the 36-month post-issue period can result from delayed

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<sup>34</sup> Assigning SEOs with negative (positive) *AFB* to *Optimistic* (*Pessimistic*) portfolios produces the same results.

market reaction or from firm attrition due to bankruptcy or acquisition. If the delisting probability depends on  $\lambda_1$ , low estimated returns may be due to intervening events rather than to a delayed market reaction to an SEO announcement. There are 2,419 SEOs with 36 months of returns. For 455 SEOs the CRSP files identify the reason for delisting before the end of the three-year holding period: 285 delist due to mergers/acquisitions, 157 are delisted by their exchange (NYSE/AMEX/Nasdaq), and 13 delist due to an exchange of shares for another type of asset. While it involves a hindsight bias, Table 7, Panel B repeats our analysis using only SEOs that survive to the end of the three-year holding period. The results are qualitatively similar to those in Table 6, Panel A. Coefficient signs and significance are similar for the sample without return attrition with the exception of *VOL*, which becomes indistinguishable from zero. The magnitude of  $\lambda_1$  decreases from  $-0.171$  in Table 6, Panel A to  $-0.262$  in Table 7, Panel B, but the difference is statistically insignificant.

Loughran and Ritter (2000, 362–363) argue that “[i]f there are time-varying misvaluations that firms capitalize on by taking some action (a supply response), there will be more events involving larger misvaluations in some periods than in others”. Loughran and Ritter (2000) report larger underperformance following periods of heavy issuing activity. If time-varying investor optimism (sentiment) about firm prospects leads to mispricing of a group of stocks and consequent equity issue waves, higher underreaction to managerial information at the announcement can lead to larger underperformance levels following periods of high issue volume.<sup>35</sup> Table 7, Panel C shows conditional estimates of the issue effect in hot and cold issuing periods, where an issue month is hot (cold) if the number of SEOs in a month is above

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<sup>35</sup> Baker and Wurgler (2007) develop an investor sentiment index, which shows significant variation over 1966–2005 (see Figure 2 in Baker and Wurgler, 2007).

(below) the median monthly number of SEOs over the previous 36 months.<sup>36</sup> There are 2,311 equity offerings in hot and 568 in cold issue periods. SEOs in hot periods have a  $\lambda_1$  coefficient of  $-0.23$ , while  $\lambda_1$  is insignificant for SEOs in cold periods. The downward trend in  $\lambda_1$  in moving from low to high issue volume months and relative to the pooled sample in Table 6, Panel A is consistent with the prediction that investors underreact more to SEO announcements made during hot issue periods.

Overall, the sensitivity analysis supports the main findings. Next, we test the prediction that underreaction corrects over a shorter period than five years following the equity issue.

### *5.3 How long is the delayed market reaction?*

The previous analysis uses three-year buy-and-hold returns as the dependent variable. To estimate the length of the (delayed) reaction to SEO announcements, we re-run the regressions varying the buy-and-hold return period and measuring the relation with lambda.

To gauge how quickly the market discounts the announcement date information, Table 8 reports lambda coefficients from regressions where we increase the start date for measuring post-issue buy-and-hold returns by one month but fix the end of the holding period at month 36 after the offering. If stock price fully impounds  $u_{di}$  by month  $\tau$  after the issue, we should find no relation between lambda and buy-and-hold returns over months  $36-\tau$  to 36.<sup>37</sup> The results

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<sup>36</sup> In calculating hot issue periods for 1970–1972, we append our initial sample of 4,422 SEOs with annual data from Eckbo, Masulis, and Norli (2000). We convert the annual to monthly estimates assuming equal monthly issue frequencies.

<sup>37</sup> To ensure consistent standard error estimates, we estimate the probit and the cross-sectional regression each month.

suggest that investors impound the negative announcement date information into stock price over a reasonably short period after the offering rather than over a five-year post-issue period as Loughran and Ritter (1995) suggest. There is a significant negative covariance between managerial private information revealed at the announcement and post-offering long-run returns for SEOs over the course of 17 months after the issue. Following this period, the discount rate effect explains low SEO performance.

## **6. Conclusions**

Loughran and Ritter (1995) and Spiess and Affleck-Graves (1995) argue that managers act on their private information about stock overvaluation in making an SEO, but investors underreact to the SEO announcement signal and stock mispricing persists at the issue date. The market revalues the stock over an extended period following the offering, leading to negative post-offering abnormal returns. We test the underreaction hypothesis using a conditional modelling framework. We show that SEO post-offering returns covary negatively with the magnitude of managerial private information revealed at the announcement. This result is robust to controlling for the effects of overoptimism in analyst earnings-per-share forecasts for new equity issuers, SEO return attrition before the end of the holding period, delisting returns, and periods of high equity issue volume.

The underreaction hypothesis contrasts with the discount rate hypothesis. This study shows that after the equity offering, issuers are larger, more liquid, with higher investment rates and book-to-market ratios, and lower gearing than size and B/M peers. Lower discount rates explain SEO performance following the first 17 months after the offering, but not before this. Previous studies that identify low SEO expected returns as a complete explanation for post-issue



performance work in calendar time and have low power to identify short-lived abnormal performance.

Our study distinguishes rational and irrational explanations of the long-run underperformance following equity issues and shows the duration of the latter effect. The study's research framework is applicable to any corporate event where the endogenous decision to participate depends on managers' private information and investors do not fully react to the announcement date signal. Event studies that examine long horizon effects of stock repurchases and stock financed acquisitions are two examples where the framework can lead to insights.

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Figure 1a. The relation between managers' private information revealed at the issue announcement and SEO stock price when investors behave rationally.

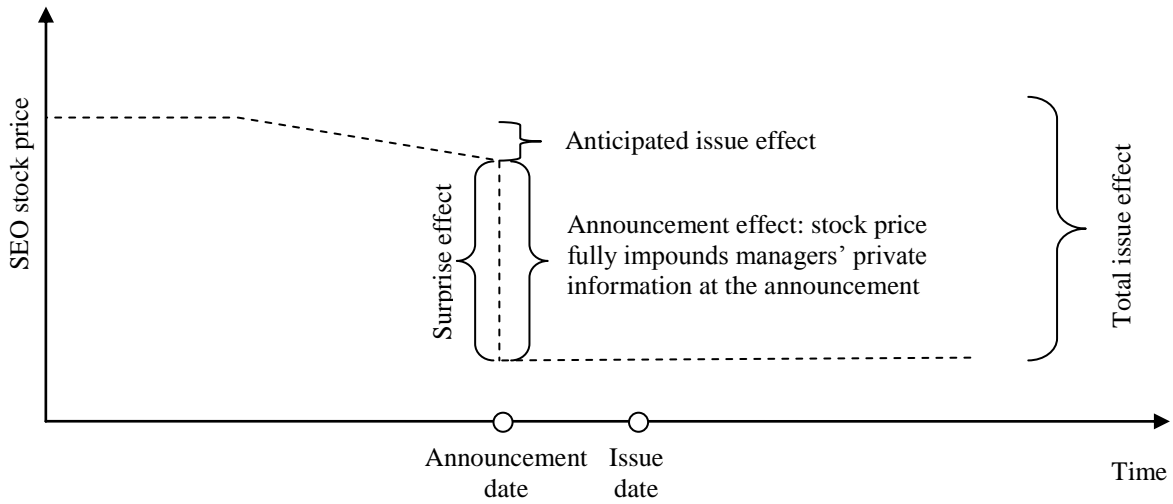


Figure 1b. The relation between managers' private information revealed at the issue announcement and SEO stock price when investors behave less than rationally.

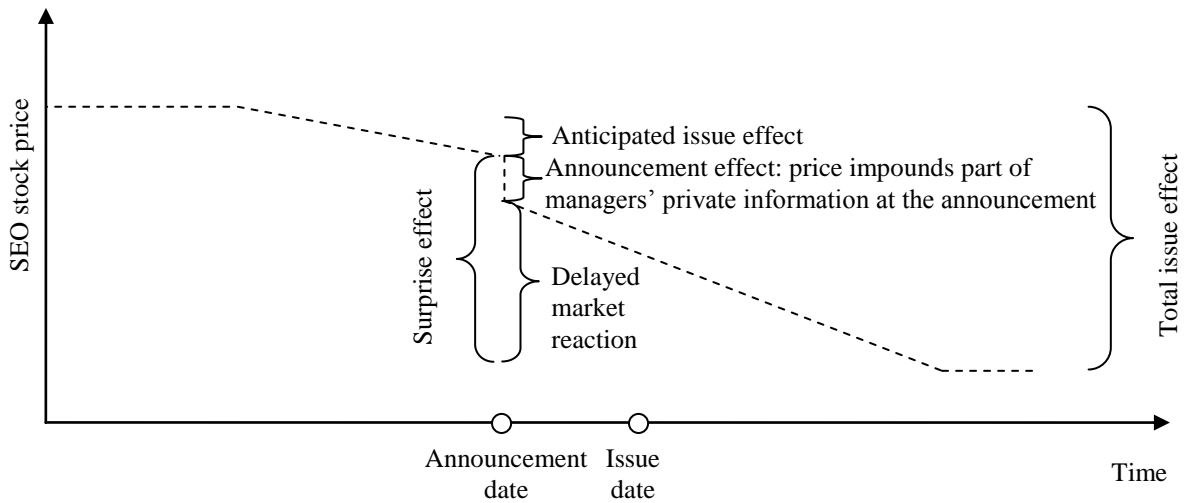


Figure 1. The relation between managers' private information revealed at the issue announcement and SEO stock price

The figure shows the relation between managers' private information revealed at the SEO announcement date and SEO stock price before and after the issue announcement for alternative types of investor behavior. Figure 1a shows the relation assuming that investors act rationally and discount new information into stock price with no delay. Figure 1b shows the relation when investors delay impounding managers' private information revealed at the issue announcement into the stock price.

Table 1. Distribution of SEOs over the sample period 1970–2004

The table shows the distribution of SEOs across NYSE/AMEX and Nasdaq stocks, three industry groups (Financial, Industrial and Utility), Fama and French size (Small, *S*, Medium, *Me*, Big, *B*) and B/M (High, *H*, Medium, *M*, Low, *L*) portfolios, and issue period (1970–1979, 1980–1989, 1990–1999, 2000–2004). Results are for a sample of 4,422 SEOs (*Initial sample*), where we require information on stock returns and book and market value of common equity only, and for a smaller sample of 2,879 SEOs, where we impose additional data requirements (*Final sample*).

	<i>Initial sample</i>	<i>Final sample</i>
Total	4422	2879
NYSE/AMEX	2022	1341
Nasdaq	2400	1538
Financial	466	127
Industrial	3572	2498
Utility	384	254
FF <i>S–L</i>	877	534
FF <i>S–M</i>	792	511
FF <i>S–H</i>	699	444
FF <i>Me–L</i>	562	401
FF <i>Me–M</i>	509	304
FF <i>Me–H</i>	280	173
FF <i>B–L</i>	269	213
FF <i>B–M</i>	256	186
FF <i>B–H</i>	178	113
1970–1979	379	169
1980–1989	1187	578
1990–1999	1377	1048
2000–2004	1479	1084



Table 2. Unconditional underperformance following seasoned equity offerings

The table reports equally-weighted (EW) and value-weighted (VW) buy-and-hold % returns for equity issuers (*Issuer*), size and B/M matched control firms (*Match*), and their difference (*Diff*).  $t$  is a skewness-adjusted  $t$ -statistic testing the hypothesis of no difference between average long-run performance of issuers and their matches, and  $p$  its  $p$ -value.  $t$ - $JK$  is the Jegadeesh and Karceski (2009) heteroskedasticity and correlation consistent  $t$ -test and  $p$ - $JK$  its  $p$ -value.  $N$  is the number of offerings for which we calculate  $BHRs$ . In calculating value weights we standardize market capitalization by the value-weighted CRSP stock market index to ensure comparability over time. The table reports results for a pooled sample and across NYSE/AMEX and Nasdaq stocks. Panel A shows results for a sample of 4,422 SEOs with information on stock returns and book and market values of common equity. Panel B shows results for a smaller sample of 2,879 SEOs with additional data requirements.

Weight Portfolio	$N$	<i>Issuer</i> (%)	<i>Match</i> (%)	<i>Diff</i> (%)	$t$	$p$	$t$ - $JK$	$p$ - $JK$
<i>Panel A: Sample of 4,422 SEOs</i>								
EW All exchanges	4422	20.03%	44.52%	-24.48%	-10.600	0.000	-2.034	0.042
VW		21.83%	42.65%	-20.81%	-14.860	0.000	-2.233	0.026
EW NYSE/AMEX	2022	30.89%	49.91%	-19.02%	-6.370	0.000	-2.233	0.026
VW		24.68%	43.95%	-19.27%	-10.750	0.000	-2.037	0.042
EW Nasdaq	2400	10.89%	39.97%	-29.08%	-8.480	0.000	-1.750	0.080
VW		6.27%	35.50%	-29.23%	-10.010	0.000	-2.160	0.031
<i>Panel B: Sample of 2,879 SEOs</i>								
EW All exchanges	2879	14.98%	42.30%	-27.33%	-9.220	0.000	-1.800	0.072
VW		20.03%	42.19%	-22.16%	-12.390	0.000	-2.132	0.033
EW NYSE/AMEX	1341	26.48%	45.91%	-19.44%	-5.410	0.000	-2.183	0.029
VW		23.19%	43.97%	-20.78%	-9.420	0.000	-1.954	0.051
EW Nasdaq	1538	4.95%	39.16%	-34.21%	-7.480	0.000	-1.542	0.123
VW		0.34%	31.10%	-30.75%	-7.490	0.000	-1.448	0.148

Table 3. Regressions of buy-and-hold returns on pre-event firm and market characteristics

Panel A reports regression estimates (*Estimate*) for equations (1) and (2) where the dependent variable is the three-year buy-and-hold return of SEOs or their matches. The regression takes the form  $R = d + \beta'X$ , where the vector  $X$  includes the B/M ratio ( $B/M$ ), total market capitalization in \$m deflated by the VW CRSP market index ( $MV$ ), Liu's (2006) liquidity measure ( $LM12$ ), and leverage ( $LEV$ ), all in log form, investment-to-assets ( $INV/A$ ), pre-issue return volatility ( $VOL$ ) and pre-issue abnormal performance ( $pAB$ ).  $MV$ ,  $LM12$ ,  $VOL$  and  $pAB$  are measured one month before the issue date.  $B/M$ ,  $LEV$  and  $INV/A$  are for the prior December at least six months before the offering date and, together with  $MV$  and  $LM12$ , winsorized based on the CRSP population at  $\pm 1\%$ .  $SE$  denotes heteroskedasticity consistent (robust) standard errors and  $p$  the relevant  $p$ -value.  $N$  is the number of observations,  $F$  and  $P > F$  are the  $F$ - and corresponding  $p$ -values for model specification and  $Adj R^2$  is the adjusted R-square. Panel B shows the difference in coefficients between SEOs and control stocks (*Beta diff*) and mean firm characteristics for SEOs ( $X_{SEO}$ ), matches ( $X_{matches}$ ) and their difference ( $X_{diff}$ ). Average firm characteristics are over a 3-year post-issue holding period.  $SE$  denotes standard errors and  $p$  is a  $p$ -value for the significance of the differences.

Panel A: Regression estimates for equations (1) and (2)

	SEOs			Matches		
	<i>Estimate</i>	<i>SE</i>	<i>p</i>	<i>Estimate</i>	<i>SE</i>	<i>p</i>
<i>Intercept</i>	0.508	0.040	0.000	0.647	0.052	0.000
$\ln B/M$	0.096	0.029	0.001	0.206	0.029	0.000
$\ln MV$	0.018	0.012	0.117	-0.012	0.014	0.395
$\ln LM12$	-0.004	0.004	0.335	-0.005	0.005	0.296
$\ln LEV$	0.153	0.037	0.000	0.127	0.035	0.000
$INV/A$	-0.323	0.087	0.000	-0.190	0.129	0.141
$VOL$	-0.648	0.196	0.001	0.140	0.329	0.672
$pAB$	-0.054	0.035	0.120	0.015	0.072	0.836
$N$	2879					
$F$	23.15			$F$	13.4	
$P > F$	0.000			$P > F$	0.000	
$Adj R^2$	0.032			$Adj R^2$	0.026	

Panel B: Differences in coefficients and firm characteristics

	Coefficient differences			Characteristics				
	<i>Beta diff</i>	<i>SE</i>	<i>p</i>	$X_{SEO}$	$X_{matches}$	$X_{diff}$	<i>SE</i>	<i>p</i>
<i>Intercept</i>	-0.139	0.066	0.034					
$\ln B/M$	-0.111	0.041	0.008	-0.695	-0.721	0.026	0.011	0.014
$\ln MV$	0.030	0.018	0.096	-1.272	-1.476	0.204	0.011	0.000
$\ln LM12$	0.001	0.006	0.895	-7.572	-5.956	-1.617	0.061	0.000
$\ln LEV$	0.026	0.051	0.607	-0.904	-0.874	-0.030	0.012	0.014
$INV/A$	-0.133	0.155	0.392	0.125	0.077	0.048	0.004	0.000
$VOL$	-0.788	0.383	0.040					
$pAB$	-0.069	0.080	0.388					

Table 4. Variables relating to the equity issue decision

Panel A reports means (*Mean*), standard deviations (*STD*) and medians (*Median*) of variables relating to the equity issue decision (equation 4) for the sample of SEOs, their size and B/M matches, and the remaining CRSP stocks. Column *Diff S-M* (*Diff S-C*) reports differences in characteristics between SEOs and their control firms (the remaining CRSP stocks); *SE* stands for standard errors and *p* is a *p*-value for differences. *Runup* is the previous 6-month buy-and-hold % return, *MKT\_return* is the previous six-month buy-and-hold return on the CRSP VW NYSE/AMEX/Nasdaq index in %, *VOL* is the percentage volatility of stock returns over the previous 6 months, *Exchange* equals 1 if the stock lists on Nasdaq and zero otherwise, *MV* is market value of common equity in \$m deflated by the VW CRSP market index, *B/M* is the B/M ratio, *INV/A* is the change in property plant and equipment plus the annual change in inventories scaled by lagged value of assets, *AGE DUMMY* equals 1 if the difference between the end of year and the firm's IPO date is less than 4 years and zero otherwise, *EG* is the current year's earnings growth, *IFC* is the inverse of internal funding (CAPEX/retained earnings plus depreciation and amortization), *ROA* is return on assets, *LEV* is the debt to total assets ratio, and *LM12* is Liu's (2006) liquidity measure. We measure accounting variables (*B/M*, *INV/A*, *AGE DUMMY*, *EG*, *IFC*, *ROA* and *LEV*) in December at least six months before the offering date and, together with *MV* and *LM12*, winsorize them based on the CRSP population at  $\pm 1\%$ . Market variables are measured one month before the event date. Panel B shows the Pearson correlation coefficients between the variables with *p*-values beneath. *N* is the number of observations.

Panel A. Descriptive statistics for the sample of SEOs, matches and remaining CRSP stocks															
	SEOs ( <i>N</i> = 2879)			Matches ( <i>N</i> = 2879)			CRSP stocks ( <i>N</i> = 21101)			SEOs – Matches			SEO – CRSP		
	<i>Mean</i>	<i>STD</i>	<i>Median</i>	<i>Mean</i>	<i>STD</i>	<i>Median</i>	<i>Mean</i>	<i>STD</i>	<i>Median</i>	<i>Diff S-M</i>	<i>SE</i>	<i>p</i>	<i>Diff S-C</i>	<i>SE</i>	<i>p</i>
<i>Runup</i>	39.51%	0.792	23.33%	14.51%	0.442	9.40%	6.65%	0.458	1.50%	25.00%	0.017	0.000	32.86%	0.015	0.000
<i>MKT_return</i>	9.22%	0.115	10.33%	9.21%	0.115	10.33%	6.08%	0.117	6.70%	0.01%	0.003	0.980	3.14%	0.002	0.000
<i>VOL</i>	15.45%	0.120	12.58%	12.77%	0.105	10.54%	14.05%	0.114	11.20%	2.67%	0.003	0.000	1.39%	0.002	0.000
<i>Exchange</i>	0.534	0.499	1.000	0.503	0.500	1.000	0.459	0.498	0.000	0.031	0.013	0.019	0.076	0.010	0.000
<i>MV</i>	1.827	10.914	0.229	1.702	11.026	0.180	1.801	9.719	0.143	0.125	0.289	0.667	0.026	0.214	0.904
<i>B/M</i>	0.666	0.599	0.507	0.662	0.585	0.507	0.859	0.754	0.662	0.004	0.016	0.801	-0.193	0.012	0.000
<i>INV/A</i>	0.133	0.209	0.084	0.090	0.172	0.055	0.101	0.188	0.066	0.043	0.005	0.000	0.032	0.004	0.000
<i>AGE DUMMY</i>	0.218	0.413	0.000	0.138	0.344	0.000	0.186	0.389	0.000	0.081	0.010	0.000	0.032	0.008	0.000
<i>EG</i>	0.114	1.847	0.144	0.049	1.461	0.089	0.037	1.650	0.089	0.066	0.044	0.135	0.077	0.036	0.034
<i>IFC</i>	-24.894	122.121	1.613	-9.046	108.239	3.967	-4.667	95.574	3.603	-15.848	3.041	0.000	-20.228	2.369	0.000
<i>ROA</i>	0.052	0.217	0.112	0.103	0.174	0.131	0.092	0.170	0.121	-0.051	0.005	0.000	-0.040	0.004	0.000
<i>LEV</i>	0.502	0.215	0.531	0.475	0.218	0.482	0.492	0.209	0.503	0.027	0.006	0.000	0.011	0.004	0.013
<i>LM12</i>	4.866	15.919	0.000	8.371	24.237	0.000	17.358	37.489	0.000	-3.505	0.540	0.000	-12.492	0.393	0.000

Table 4, cont.

*Panel B. Pearson correlations between probit model explanatory variables*

	<i>Runup</i>	<i>MKT_return</i>	<i>VOL</i>	<i>B/M</i>	<i>MV</i>	<i>LM12</i>	<i>LEV</i>	<i>INV/A</i>	<i>IFC</i>	<i>EG</i>	<i>ROA</i>
<i>Runup</i>	1										
<i>MKT_return</i>	0.300 0.000	1									
<i>VOL</i>	0.259 0.000	-0.059 0.000	1								
<i>B/M</i>	0.058 0.000	-0.007 0.228	0.004 0.508	1							
<i>MV</i>	0.002 0.762	-0.001 0.857	-0.096 0.000	-0.045 0.000	1						
<i>LM12</i>	-0.029 0.000	-0.006 0.346	0.037 0.000	0.242 0.000	-0.075 0.000	1					
<i>LEV</i>	-0.011 0.081	0.018 0.004	-0.087 0.000	0.081 0.000	0.020 0.001	-0.008 0.193	1				
<i>INV/A</i>	-0.032 0.000	0.048 0.000	-0.008 0.203	-0.132 0.000	0.002 0.730	-0.086 0.000	0.033 0.000	1			
<i>IFC</i>	-0.047 0.000	0.009 0.140	-0.185 0.000	0.091 0.000	0.026 0.000	0.016 0.008	0.076 0.000	0.070 0.000	1		
<i>EG</i>	0.005 0.440	0.023 0.000	-0.044 0.000	-0.046 0.000	0.011 0.073	-0.052 0.000	0.001 0.900	0.109 0.000	0.030 0.000	1	
<i>ROA</i>	-0.013 0.032	0.030 0.000	-0.324 0.000	-0.002 0.691	0.093 0.000	-0.059 0.000	0.072 0.000	0.133 0.000	0.393 0.000	0.091 0.000	1

Table 5. Probability of an equity issue

Panel A reports probit estimates (*Estimate*) from a model where the dependent variable is a dummy variable equal to 1 for firms making an SEO and 0 otherwise. *pAB* is the difference between the firm's and the market's prior six-month buy-and-hold return, *VOL* is the volatility of firm stock returns in the previous 6 months, *Exchange* equals 1 if the stock lists on Nasdaq and 0 otherwise. The model includes year and industry dummies using definitions from Kenneth French's webpage. *MV* is the market value of common equity in \$m deflated by the VW CRSP market index, *B/M* is the B/M ratio, *INV/A* is the change in property plant and equipment plus the annual change in inventories scaled by lagged value of assets, *AGE DUMMY* equals 1 if the difference between the end of year and the firm's IPO date is less than 4 years and zero otherwise, *EG* is the current year's earnings growth, *IFC* measures the inverse of internal funding (CAPEX/retained earnings plus depreciation and amortization), *ROA* is return on assets, *LEV* is debt to total assets, and *LM12* is Liu's (2006) liquidity measure. We measure accounting variables (*B/M*, *INV/A*, *EG*, *IFC*, *ROA* and *LEV*) in December allowing for a six month reporting gap and, together with *MV* and *LM12*, winsorize them based on the CRSP population at  $\pm 1\%$ . Market variables (*pAB*, *VOL*, *MV* and *LM12*) are measured one month before the event date. *Pred sign* shows the predicted direction of the relation. *SE* denotes robust standard errors, and  $p > |z|$  the *p*-values based on *z*-statistics. Column *ME* measures the percentage marginal effects. Panel B shows the model mean predicted probability of equity issue for CRSP stocks, the sample of SEOs, and their matches.

<i>Panel A. Estimates of the probability of equity issue</i>					
<i>Variable</i>	<i>Pred.sign</i>	<i>Estimate</i>	<i>ME (%)</i>	<i>SE</i>	$p >  z $
<i>Intercept</i>		-0.717		0.062	0.000
<i>pAB</i>	+	0.515	7.541%	0.030	0.000
<i>VOL</i>	-	-0.439	-6.429%	0.158	0.005
<i>Exchange</i>	+	0.147	2.160%	0.031	0.000
$\ln MV$	+	0.066	0.962%	0.009	0.000
$\ln B/M$	-	-0.075	-1.097%	0.014	0.000
<i>INV/A</i>	+	0.566	8.288%	0.057	0.000
<i>AGE DUMMY</i>	+	0.100	1.524%	0.030	0.001
<i>EG</i>	+	0.008	0.114%	0.007	0.279
<i>IFC</i>	-	0.000	-0.002%	0.000	0.164
<i>ROA</i>	-	-0.530	-7.757%	0.071	0.000
$\ln LEV$	+	0.109	1.603%	0.022	0.000
$\ln LM12$	-	-0.015	-0.225%	0.003	0.000
<i>Year dummies</i>				Not reported	
<i>Industry dummies</i>				Not reported	
Number of event observations	2879				
Num. of non-event observations	23980				
Wald $\chi^2$	1898				
Wald <i>p</i> -value	0.000				
Pseudo $R^2$	0.131				
<i>Panel B. Predicted probability of equity issue</i>					
	<i>N</i>	<i>Mean</i>	<i>SE</i>	<i>p</i>	
SEO predicted probability	2879	19.59%	0.003	0.000	
Matches predicted probability	2879	13.52%	0.002	0.000	
CRSP predicted probability	21101	9.13%	0.001	0.000	
SEO-Matches	2879	6.07%	0.003	0.000	

Table 6. A regression of buy-and-hold returns with private information adjustment

Panel A reports regression estimates (*Estimate*) for equations (7) and (8), where the dependent variable is the SEO's or the match's three-year buy-and-hold return. The explanatory variables are the B/M ratio (*B/M*), total market capitalization in \$m deflated by the VW CRSP market index (*MV*), Liu's (2006) liquidity measure (*LM12*), leverage (*LEV*), all in log form, investment-to-assets (*INV/A*), pre-issue return volatility (*VOL*) and pre-issue abnormal performance (*pAB*). *MV*, *LM12*, *VOL* and *pAB* are measured one month before the event date. *B/M*, *LEV* and *INV/A* are for December at least six months before the offering date and, together with *MV* and *LM12*, are winsorized based on the CRSP population at  $\pm 1\%$ .  $\lambda_0$ ,  $\lambda_1$  are the inverse Mills ratios from the equity issue model, proxying for managerial private information revealed at the announcement date. *SE* denotes asymptotically consistent standard errors, and *p* are the corresponding *p*-values. *N* is the number of regression observations, *F* and  $P > F$  are the *F*- and corresponding *p*-values for model specification, *Adj R*<sup>2</sup> is the adjusted R-square, *rho* is the correlation between residuals in the issue selection equation (4) and unconditional expected post-issue returns for SEOs/matches (equations 1 and 2). *Sigma* is the standard error of residuals for the expected returns equations (1) and (2). Panel B reports mean lambda and Pearson correlation coefficients between lambda and other explanatory variables. Panel C shows the difference in coefficients between SEOs and control stocks (*Beta diff*). *SE* stands for standard errors and *p* is a *p*-value for the significance of the differences.

<i>Panel A. Conditional issue effect</i>						
	<i>SEOs</i>			<i>Matches</i>		
	<i>Estimate</i>	<i>SE</i>	<i>p</i>	<i>Estimate</i>	<i>SE</i>	<i>p</i>
<i>Intercept</i>	0.819	0.145	0.000	0.637	0.165	0.000
<i>ln B/M</i>	0.106	0.024	0.000	0.208	0.027	0.000
<i>ln MV</i>	0.022	0.013	0.092	-0.011	0.015	0.464
<i>ln LM12</i>	0.001	0.005	0.858	-0.004	0.006	0.447
<i>ln LEV</i>	0.148	0.035	0.000	0.125	0.040	0.002
<i>INV/A</i>	-0.368	0.099	0.000	-0.197	0.112	0.079
<i>VOL</i>	-0.580	0.206	0.005	0.149	0.234	0.524
<i>pAB</i>	-0.115	0.043	0.007	0.000	0.048	0.999
$\lambda_1$	-0.171	0.075	0.022			
$\lambda_0$				-0.062	0.085	0.464
<i>N</i>	2879					
<i>F</i>	13.44			<i>F</i>	10.56	
$P > F$	0.000			$P > F$	0.000	
<i>Adj R</i> <sup>2</sup>	0.033			<i>Adj R</i> <sup>2</sup>	0.026	
<i>rho</i>	-0.159			<i>rho</i>	-0.051	
<i>Sigma</i>	1.077			<i>Sigma</i>	1.215	

<i>Panel B. Mean lambda and Pearson correlations between lambda and explanatory variables</i>								
	mean lambda	<i>ln B/M</i>	<i>ln MV</i>	<i>ln LM12</i>	<i>ln LEV</i>	<i>INV/A</i>	<i>VOL</i>	<i>pAB</i>
$\lambda_1$	1.505	0.136	-0.100	0.339	0.040	-0.133	-0.161	-0.544
<i>p</i>	0.000	0.000	0.000	0.000	0.033	0.000	0.000	0.000
$\lambda_0$	-0.246	0.166	-0.137	0.348	-0.067	-0.119	-0.153	-0.585
<i>p</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

<i>Panel C. Differences in regression coefficients</i>								
	<i>Intercept</i>	<i>ln B/M</i>	<i>ln MV</i>	<i>ln LM12</i>	<i>ln LEV</i>	<i>INV/A</i>	<i>VOL</i>	<i>pAB</i>
<i>Beta diff</i>	0.182	-0.102	0.033	0.005	0.023	-0.171	-0.730	-0.115
<i>SE</i>	0.219	0.036	0.020	0.008	0.053	0.149	0.311	0.064
<i>p</i>	0.407	0.004	0.096	0.488	0.667	0.250	0.019	0.075

Table 7. Sensitivity analysis

Panel A reports regression estimates (*Estimate*) for SEOs split into *Pessimistic* and *Optimistic* groups based on median Analyst Forecast Bias (*AFB*). *AFB* is actual EPS less the median consensus one-year-ahead analyst EPS forecast scaled by stock price one month before the issue. The explanatory variables are the B/M ratio (*B/M*), total market capitalization in \$m deflated by the VW CRSP market index (*MV*), Liu's (2006) liquidity measure (*LM12*), leverage (*LEV*), all in log form, investment-to-assets (*INV/A*), pre-issue return volatility (*VOL*) and pre-issue abnormal performance (*pAB*). *MV*, *LM12*, *VOL* and *pAB* are measured one month before the event date. *B/M*, *LEV* and *INV/A* are for December at least six months before the offering date and, together with *MV* and *LM12*, are winsorized based on the CRSP population at  $\pm 1\%$ .  $\lambda_1$  ( $\lambda_0$  in Panel B) is the inverse Mills ratio from the equity issue model, proxying for managerial private information. *SE* denotes asymptotically consistent standard errors and *p* is the *p*-value. *N* is the number of regression observations, *F* and  $P > F$  are the *F*- and corresponding *p*-values for model specification, *Adj R<sup>2</sup>* is the adjusted R-square, *rho* is the correlation between residuals in the issue selection equation (4) and unconditional expected post-issue returns for SEOs (matches in Panel B). *Sigma* is the standard error of residuals for unconditional SEO expected returns (matches in Panel B). Panel B shows regression results for equations (7) and (8), where we include SEOs and their controls that survive until the end of the 3-year holding period. Panel C shows regression estimates for SEOs made during high (*Hot*) and low (*Cold*) issue volume months, where an issue month is *Hot* (*Cold*) if the number of SEOs in a month is above (below) the median monthly number of SEOs over the previous 36 months.

<i>Panel A. Grouping SEOs by Analyst Forecast Bias</i>						
	<i>Pessimistic AFB</i>			<i>Optimistic AFB</i>		
	<i>Estimate</i>	<i>SE</i>	<i>p</i>	<i>Estimate</i>	<i>SE</i>	<i>p</i>
<i>Intercept</i>	0.773	0.353	0.029	0.819	0.251	0.001
<i>ln B/M</i>	0.069	0.049	0.153	0.163	0.032	0.000
<i>ln MV</i>	-0.050	0.029	0.089	0.032	0.018	0.073
<i>ln LM12</i>	-0.009	0.011	0.408	0.007	0.007	0.334
<i>ln LEV</i>	0.213	0.073	0.004	0.071	0.042	0.093
<i>INV/A</i>	-0.106	0.207	0.611	-0.411	0.122	0.001
<i>VOL</i>	-0.952	0.592	0.108	-0.300	0.304	0.323
<i>pAB</i>	-0.130	0.105	0.215	-0.195	0.060	0.001
$\lambda_1$	-0.062	0.154	0.688	-0.189	0.109	0.082
<i>N</i>	913			<i>N</i>	913	
<i>F</i>	3.61			<i>F</i>	10.46	
$P > F$	0.000			$P > F$	0.000	
<i>Adj R<sup>2</sup></i>	0.022			<i>Adj R<sup>2</sup></i>	0.077	
<i>rho</i>	-0.054			<i>rho</i>	-0.249	
<i>Sigma</i>	1.158			<i>Sigma</i>	0.759	
<i>Mean AFB</i>	0.011			<i>Mean AFB</i>	-0.045	
<i>Median AFB</i>	0.004			<i>Median AFB</i>	-0.011	

Table 7, cont.

<i>Panel B. SEOs and matches that survive to the end of the three-year holding period.</i>						
	<i>SEOs</i>			<i>Matches</i>		
	<i>Estimate</i>	<i>SE</i>	<i>p</i>	<i>Estimate</i>	<i>SE</i>	<i>p</i>
<i>Intercept</i>	0.939	0.164	0.000	0.647	0.183	0.000
<i>ln B/M</i>	0.117	0.027	0.000	0.203	0.030	0.000
<i>ln MV</i>	-0.008	0.015	0.583	-0.011	0.017	0.511
<i>ln LM12</i>	-0.003	0.005	0.539	-0.008	0.006	0.193
<i>ln LEV</i>	0.170	0.040	0.000	0.143	0.045	0.001
<i>INV/A</i>	-0.445	0.113	0.000	-0.279	0.126	0.027
<i>VOL</i>	-0.134	0.272	0.621	0.168	0.303	0.579
<i>pAB</i>	-0.228	0.051	0.000	-0.030	0.057	0.599
$\lambda_1$	-0.262	0.085	0.002			
$\lambda_0$				-0.140	0.095	0.139
<i>N</i>	2419			<i>N</i>	2419	
<i>F</i>	11.43			<i>F</i>	8.8	
<i>P &gt; F</i>	0.000			<i>P &gt; F</i>	0.000	
<i>Adj R<sup>2</sup></i>	0.033			<i>Adj R<sup>2</sup></i>	0.025	
<i>rho</i>	-0.235			<i>rho</i>	-0.114	
<i>Sigma</i>	1.116			<i>Sigma</i>	1.23	
<i>Panel C. SEOs in hot and cold issuing periods</i>						
	<i>Hot</i>			<i>Cold</i>		
	<i>Estimate</i>	<i>SE</i>	<i>p</i>	<i>Estimate</i>	<i>SE</i>	<i>p</i>
<i>Intercept</i>	0.929	0.139	0.000	0.846	0.504	0.094
<i>ln B/M</i>	0.117	0.024	0.000	0.090	0.074	0.225
<i>ln MV</i>	0.028	0.014	0.042	-0.016	0.040	0.695
<i>ln LM12</i>	0.004	0.005	0.388	-0.014	0.013	0.296
<i>ln LEV</i>	0.142	0.036	0.000	0.174	0.102	0.089
<i>INV/A</i>	-0.325	0.100	0.001	-0.626	0.287	0.030
<i>VOL</i>	-0.620	0.209	0.003	-0.658	0.632	0.299
<i>pAB</i>	-0.139	0.041	0.001	-0.032	0.129	0.804
$\lambda_1$	-0.230	0.068	0.001	-0.133	0.219	0.543
<i>N</i>	2311			<i>N</i>	568	
<i>F</i>	14.05			<i>F</i>	1.72	
<i>P &gt; F</i>	0.000			<i>P &gt; F</i>	0.090	
<i>Adj R<sup>2</sup></i>	0.043			<i>Adj R<sup>2</sup></i>	0.01	
<i>rho</i>	-0.232			<i>rho</i>	-0.097	
<i>Sigma</i>	0.993			<i>Sigma</i>	1.379	



Table 8. The speed of correction to private information

The table reports  $\lambda_1$  regression estimates (*Estimate*), where the start date for measuring post-issue SEO buy-and-hold returns increases by one month, holding the period end fixed at month 36 after the issue.  $\lambda_1$  is the inverse Mills ratio, based on the equity issue model, and proxies for the magnitude of pre-event information asymmetry. The explanatory variables (not reported here) are the B/M ratio (*B/M*), total market capitalization in \$m deflated by the VW CRSP market index (*MV*), Liu's (2006) liquidity measure (*LM12*), leverage (*LEV*), all in log form, investment-to-assets (*INV/A*), return volatility (*VOL*) and pre-issue abnormal performance (*pAB*). *MV*, *LM12*, *VOL* and *pAB* are for one month before the event date. *B/M*, *LEV* and *INV/A* are for December at least six months before the offering date and, together with *MV* and *LM12*, winsorized based on the CRSP population at  $\pm 1\%$ . *Period* shows the buy-and-hold returns holding period and *N* is the number of observations. *SE* and *p* are the asymptotic standard errors and associated *p*-values.

<i>Period</i>	<i>N</i>	<i>Estimate</i>	<i>SE</i>	<i>p</i>
0-36	2879	-0.171	0.075	0.022
1-36	2879	-0.196	0.075	0.009
2-36	2876	-0.170	0.074	0.021
3-36	2864	-0.188	0.075	0.013
4-36	2849	-0.175	0.075	0.020
5-36	2843	-0.195	0.074	0.009
6-36	2838	-0.199	0.068	0.003
7-36	2823	-0.188	0.069	0.007
8-36	2804	-0.175	0.066	0.008
9-36	2794	-0.194	0.067	0.004
10-36	2787	-0.189	0.070	0.007
11-36	2773	-0.185	0.070	0.009
12-36	2757	-0.160	0.070	0.023
13-36	2739	-0.166	0.068	0.015
14-36	2732	-0.171	0.064	0.008
15-36	2717	-0.159	0.065	0.015
16-36	2697	-0.127	0.062	0.039
17-36	2680	-0.114	0.064	0.072
18-36	2663	-0.076	0.063	0.232
19-36	2640	-0.069	0.060	0.255
20-36	2625	-0.074	0.062	0.234
21-36	2608	-0.054	0.058	0.347
22-36	2590	-0.063	0.056	0.256
23-36	2573	-0.063	0.056	0.255
24-36	2558	-0.072	0.052	0.171
25-36	2544	-0.078	0.051	0.128
26-36	2525	-0.067	0.046	0.144
27-36	2515	-0.059	0.044	0.174
28-36	2503	-0.037	0.039	0.342
29-36	2491	-0.026	0.038	0.493
30-36	2478	-0.024	0.037	0.523
31-36	2465	-0.033	0.035	0.353
32-36	2455	-0.039	0.025	0.129
33-36	2447	-0.023	0.022	0.286
34-36	2436	-0.031	0.018	0.087
35-36	2419	-0.042	0.014	0.002