Agency problems in young firms

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Abstract

We document the existence of manager-shareholder agency problems caused by excess cash in young firms. Firms receiving quasi-random cash windfalls from the exercise of the overallotment option during their IPO are more likely to make value-destroying acquisitions. We hand-collect executive compensation data for these firms and find that the CEOs of these firms receive direct pecuniary benefits in the form of higher executive compensation. We run several tests to account for the potential endogeneity of the overallotment option with respect to investment. While previous work on the free cash flow hypothesis has focused on mature firms, we show that these problems also exist in young firms.

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"... freedom to pursue growth and the management-stockholder conflict that accompanies it, appear only over time as the firm expands and matures."
-Dennis Mueller [*Journal of Industrial Economics,* 1972]

1 Introduction

Firms trade off the value of financial slack versus the potential agency conflicts arising from high cash holdings when deciding on their optimal level of cash holdings. The importance of manager-owner agency conflicts related to cash holdings (*i.e.,* the free cash flow hypothesis) has influenced financial policy in large and mature firms, which are often encouraged to return cash to shareholders.[1] The question then arises: should young firms also return excess cash to shareholders, or would these firms be better off if they were given a lot of financial slack and scope for managerial discretion? Large and mature firms often have high and stable cash flows and a shortage of investment opportunities, making them prone to over-investment. Moreover, the scope for private perquisite consumption is increased in these firms as, due to the complexity of their operations, monitoring how managers use corporate funds becomes more difficult. Young and relatively small firms, on the other hand, are much more likely to have investment opportunities, incentive-aligned management, and attentive shareholders. If these young firms were randomly given cash, would their managers engage in empire-building behavior?

In this paper, we study the impact of cash holdings on empire-building behavior in young firms. Consistent with the literature (*e.g.,* Arikan and Stulz [2016]), we define young firms as firms in the "growth" stage of their lifecycle - and study recently IPOed firms. We focus on empire-building behavior (agency problems) associated with corporate cash holdings, also known as the free cash flow hypothesis.[2] It has been difficult to document these agency conflicts because the overall cash holdings of a firm are likely to be correlated with other financial policies for reasons unrelated to agency conflicts. Thus, a correlation between cash and a value destroying action could be misleading. While there has been a large literature on what firms do with capital they raise (including recent papers such as Huang and Ritter [2021]), we look at a setting where all firms raise capital, but some

[1] See the pioneering articles of Mueller [1972], Jensen and Meckling [1976], and Jensen [1986, 1993].

[2] We study one-off cash infusions whereas Jensen [1986] discusses high cash flows. These are, however, analogous when it comes to their expected impact on agency problems.

firms receive more proceeds than others. This cash infusion is not purely random, but allows us to control for a large number of confounding variables. Our setup is thus similar to Von Beschwitz [2018] (who studies mainly mature firms in Germany), but with a focus on firms where agency problems are typically assumed to be less important.[3]

Another problem in testing the free cash flow hypothesis is that it is often difficult to determine whether a managerial action is value-destroying and beneficial to the manager at the same time. For this reason, we focus on M&A (mergers and acquisitions) activity and executive compensation. In an acquisition, the market's assessment of deal quality is observable to researchers, which allows us to see whether deals are value-destroying. Traditionally, it has been assumed that managers receive non-pecuniary benefits from making an acquisition ("empire-building" behavior). However, we also examine executive compensation to measure the direct pecuniary benefits managers receive from cash windfalls to the firms they manage.

We use the exercise of the overallotment (greenshoe) option during the IPO as a quasi-random cash infusion to firms conducting an IPO. The greenshoe option is a call option granted by the issuer (firm going public or its shareholders) to the underwriter (the investment banks organizing the offering). The objective of the greenshoe is to stabilize the share price of the issuing company after the offering. With the greenshoe, the underwriter places 115% of the offering to investors, leaving it with a short position of 15% of the offering size. If the share price goes down, the underwriter covers its short position by buying shares from the market, which is supposed to help support the share price. If, on the other hand, the share price goes up, the underwriter exercises the greenshoe and buys extra shares from the issuer. The latter case leads to a cash infusion of 15% of the offering to the issuer. Virtually all bookbuilt US IPOs contain a greenshoe (Jiao et al. [2017]), and our identification strategy differentiates between firms where the option is exercised and those where it isn't. We explain the mechanics of the greenshoe further in the "Research Design" section.

The greenshoe option has several attractive properties for our research. First, almost all US IPOs include a greenshoe option, meaning that selection bias is likely to be limited. Second, the greenshoe is a function of IPO underpricing - that is, an IPO that is under-

[3]It is commonly assumed that these conflicts are minimal. However, Field and Karpoff [2002] document the use of takeover defenses in recently IPOed firms, consistent with these firms being subject to manager-owner agency problems. However, there may also be non-agency explanations for the use of takeover defenses.

priced will also have its greenshoe exercised. A rational manager trying to maximize IPO proceeds has few levers at their disposal. The number of shares offered in the offering is usually as good as set months before the IPO during the filing process. This means that variation in proceeds is driven by pricing and by the exercise of the greenshoe, with these two working against each other – the greenshoe is exercised if proceeds are below where they could have been (i.e. the IPO is underpriced). Finally, there is considerable variation in share price performance among firms with exercised greenshoes as well as variation in greenshoe exercise among firms with similar medium- or long-run performance. This allows us to compare firms with similar prospects, as proxied by share price performance. Finally, some firms IPO without raising any money (existing shareholders sell shares). This presents us with a placebo test in which the exercise of the greenshoe should be correlated with any potential confounding variables, but not with increased cash holdings.

We first show that firms receiving cash through the exercise of the greenshoe option (*i.e.,* greenshoe firms) make more acquisitions. The cash infusion to greenshoe firms is about 5% of their book assets and these firms are about 5 percentage points more likely to make an acquisition every year in the three years after the IPO (*i.e.,* post-IPO period). This is compared to a baseline acquisition rate of approximately 10 percent per year and is robust to controlling for both the linear stock return of the firm in the 2-months/1-year following the IPO as well as the inclusion of fixed effects based on the quintile of post-IPO returns. These acquisitions have approximately 2 percentage points lower announcement returns than those made by non-greenshoe firms. The average return on these acquisitions is not negative. But, as argued by Von Beschwitz [2018], such difference in announcement returns implies that the *marginal* acquisition made by greenshoe firms has negative returns. Moreover, conditional on an acquisition is made, greenshoe firms are about 10% more likely to have a negative announcement return. Finally, CEOs of greenshoe firms receive roughly 32% higher salary in the year following the IPO. At the full sample mean, this translates to a $800K higher salary.

As the exercise of the greenshoe depends on the one-month return, its exercise is not completely random. Firms with better prospects (*e.g.,* firms likely to make acquisitions and to increase executive compensation), presumably, experience higher first month returns after their IPO, which will increase the chance of exercise of their greenshoe.

To address this potential concern, we do two things. First, we control for 2-month and

1-year post-IPO returns. The idea is as follows: while we acknowledge that the 1-month return affects investments in ways that are unrelated to the cash infusion related to the exercise of the greenshoe option, we instead aim for conditional independence. We attempt to argue that, conditional on having the same 2-month (or 1-year) post-IPO returns, the differences in investment and executive compensation between greenshoe and non-greenshoe firms are attributable to the cash infusion.[4] Since the exercise of the greenshoe option leads to a larger free float, it will be correlated with whatever real outcomes are affected by the number of shares being traded. This identification strategy relies on these not being positively correlated with acquisitions or executive compensation, and we try to argue that this is indeed the case.

We also conduct a placebo analysis using secondary greenshoe exercise. A secondary greenshoe is one where the firm does not receive any cash, instead, selling shareholders do. In these cases, we would expect unobserved factors affecting both greenshoe exercise and investment to still be present, but without an increase in cash. In these cases, we find that, after controlling for 2-month returns, exercise of the secondary greenshoe does not appear to affect investment or executive compensation.[5] The identification strategy is discussed further in the "Research Design" section. We also discuss several potential threats to the validity of our identification strategy.

Related Literature

As mentioned above, testing the free cash flow hypothesis of Jensen [1986] has been difficult because the cash holdings of a firm are not randomly assigned. They may be a function of managerial policies, managerial biases or economic conditions, all of which may affect investment. Therefore, in order to be able to say that "excess" levels of cash holdings cause agency problems, a researcher needs firms to receive cash, as if at random. Only a few papers explicitly test the effect of quasi-random cash infusions on corporate investment policy and provide mixed evidence, focusing mainly on shocks that are likely to have a large effect on large, mature firms as opposed to young firms.

Blanchard et al. [1994] conduct a case study analysing several characteristics of firms

[4]We discuss potential violations of this conditional independence assumption, for instance those highlighted by Dambra et al. [2019], in the "Threats to Validity" section.

[5]One concern about this placebo strategy might be that firms conducting secondary IPOs are fundamentally different from those conducing primary IPOs. For instance, firms doing secondary IPOs may be assumed to have no interest in making investments as they do not raise capital. We show evidence to the contrary - firms making secondary IPOs where the greenshoe option is not exercised make post-IPO acquisitions at a very similar rate to primary IPO firms where the greenshoe option is not exercised.

before and after they win cash awards in lawsuits. They find evidence in line with free cash flow hypothesis: firms that receive cash windfalls increase investment and reduce debt. However, their sample consists only of 11 companies and the analysis lacks statistical power. In a more recent paper, Von Beschwitz [2018] looks at firms that received cash windfalls through a tax reform in Germany. The reform allowed firms holding minority stakes in other firms to sell these stakes without facing capital gains tax. Firms that sold their equity stakes used proceeds to undertake value-destroying acquisitions. Blouin et al. [Forthcoming], on the other hand, finds a positive correlation between a tax cut in the US in 2004, which increased cash holdings of firms, and the announcement returns of mergers after the cut. This suggests that the random infusion of cash enables firms to carry out NPV positive projects by alleviating their financial constraints. All these three papers examine the causal effect of cash on M&A activities of mature firms. In our project, on the other hand, we focus on young firms and examine executive compensation in addition to M&A activity (similar to Cheng et al. [2016], who focus solely on executive compensation).

There is also a considerable literature of papers that generally find that cash holdings are associated with negative outcomes. The negative outcome in Harford [1999] is value-destroying acquisitions, in Dittmar and Mahrt-Smith [2007] poor corporate governance, in Gul and Tsui [1997] and Gleason et al. [2017] higher audit fees, and in Cheng et al. [2016] higher executive compensation. In an influential paper Richardson [2006] utilizes accounting data to construct the optimal levels of cash and investment and reports a positive association between excessive cash holdings and over-investment. Opler et al. [1999], however, report only little evidence that excess cash "burns a hole in management's pockets". The papers above focus on firms in general, with the samples being weighted towards large and mature firms. Only a few papers focus on young firms. Gompers [1995] argues that the agency problem among startup companies is the main reason for observed staged financing in practice. However, there is no direct evidence of the free cash flow problem in these firms. Arikan and Stulz [2016] and Celikyurt et al. [2010]) report high rates of acquisitions by young (recently IPOed) firms. However, these papers do not attribute these acquisitions to agency problems but rather to investment opportunities. Howell and Brown [2020] document that small firms receiving cash infusions via a government R&D grant increase wages of their incumbent employees, which could be considered as a sign of an agency problem. However, they attribute the increase in wages to existence of financial constraints prior to the grant, not to agency problems. To the

best of our knowledge, our paper is the first one that provides direct evidence of agency problems caused by excess cash in young firms.

In the next section, we describe our research design. In section 3, we describe the data used in our paper. Section 4, "Results", presents the key results of the paper. We conclude in section 5.

2 Research Design

Cleanly identifying the impact of cash holdings on firm behavior is challenging because cash holdings are typically correlated with investment opportunities and/or economic conditions. One commonly used feature of IPOs (the overallotment option, commonly known as greenshoe[6]) provides us with an environment where firms receive quasi-random cash infusions (or at least one where we are able to control for key confounders). First, we provide a brief overview of the greenshoe.

Greenshoe mechanics

The greenshoe is an option granted by the issuer or selling shareholders to the underwriters in an IPO, allowing the underwriters to purchase up to 15% of the offering in the 30-days following the offering. The greenshoe is included in almost all bookbuilt US IPOs. The greenshoe is included in IPOs in order to provide price stabilization after the offering and, often, to align underwriter incentives with those of the company with regards to underpricing.

The underwriter thus places 115% of the offering to investors at the offering time, leaving it with a 15% short position. If the price of the company falls after the offering, the underwriter in charge of stabilization can purchase shares in the open market to cover the short position. Otherwise, the underwriter exercises the option and purchases shares from the company, delivering them to investors. If the greenshoe has been granted by the issuing firm and not the selling shareholders, this leads to a cash infusion for the firm.

The exercise of the greenshoe thus depends on the extent of underpricing. This raises the concern that empire-building managers may try to influence IPO pricing in order

[6]The first IPO to include this option was one by the Green Shoe Manufacturing Company in 1960, hence the name.

to affect greenshoe exercise. However, it is important to remember that the probability of greenshoe exercise decreases as the IPO price rises, meaning that managers trade off increased proceeds from the non-greenshoe portion of the offering with the proceeds from the greenshoe. Another concern may be that greenshoe exercise is correlated with managerial traits correlated with empire-building behavior. In this case, it is important to be clear about how these traits are correlated with IPO underpricing (i.e. the difference between the offer price and the market price). We discuss these concerns and others in the "Threats to Validity" section of this paper.

Empirical strategy

Our main empirical analyses therefore regress investment and executive compensation on a dummy that takes the value of 1 when a greenshoe is fully exercised interacted with a dummy that takes the value of 1 for the year of the IPO and after, with controls for the greenshoe dummy in general, the year relative to the IPO and other controls (see the "Results" section for more details). The coefficient on the interaction variable shows how the outcome variable differs for greenshoe firms and non-greenshoe firms after the IPO while the pre-IPO year dummy controls for the pre-IPO level of the outcome variable and the greenshoe dummy should pick up pre-IPO differences between greenshoe and non-greenshoe firms.[7]

Because the greenshoe is more likely to be exercised when the stock price within 30 days after the IPO is high (*i.e.,* when there is underpricing in the IPO), exercise decision, and thus the cash infusion, is partly a function of firm characteristics and future investment opportunities. There are three main sources for this: first, firm-level characteristics may drive both underpricing and investment. This might happen, for example, if firms with better future prospects have higher underpricing in their IPOs. Second, by pushing the stock price up just after the IPO (and at the same time making greenshoe exercise more likely), investors might be providing positive feedback to managers about future opportunities of the firm and thus encouraging them to undertake more investment (Chen et al. [2007]). Third, underpricing may be a function of the overall market return, which may be correlated with investment opportunities.

We attempt to tackle this concern by controlling for the 2-month and 1-year post-IPO returns. The goal is conditional independence – that is, conditional on the same level of

[7]In our acquisitions test, this variable cannot be estimated as pre-IPO acquisitions are coded as 0 for all firms

2-month returns, firms with exercised greenshoes would have the same outcomes as firms without greenshoes in the absence of the greenshoe option. We estimate the following OLS regressions.

$$\begin{aligned} \textit{Dependent variable}_{\mathrm{it}} = \beta_0 + \beta_1 * \textit{Greenshoe}_i * \textit{Post\_IPO}_{\mathrm{it}} + \beta_2 * \textit{Post\_IPO}_{\mathrm{it}} + \beta_3 * \textit{Greenshoe}_{\mathrm{i}} \\ + \beta_4 * \textit{Return}_{\mathrm{i}} + \beta_5 * \textit{Return\_Decile}_i + \textit{Controls}_{\mathrm{i}} + \varepsilon_{\mathrm{it}} \end{aligned}$$

Our sample extends from the fiscal year ending before the IPO to the third fiscal year ending after the IPO. We choose this sample period as the difference in cash levels between greenshoe and non-greenshoe firms becomes insignificant after these years. We include the year prior to the IPO in all specifications as this allows us to control for various pre-IPO characteristics (and show for instance that the pre-IPO levels of executive compensation are similar between greenshoe and non-greenshoe firms). However, in the M&A specifications we only have data on acquisitions after the IPO and therefore $\beta_3 * \textit{Greenshoe}$ cannot be estimated.

The dependent variables are acquisition dummy and executive compensation in our main tables respectively. i and t are firm and year indices. *Greenshoe* is a dummy variable. It takes the value 1 if the greenshoe option is exercised and 0 otherwise. *Post_IPO* is a dummy variable. It takes the value 1 if the observation belongs to the year of the IPO or within two years following the IPO and 0 otherwise. *Return* and *Return_Decile* are calculated using the stock market performance of the security after the IPO. We control for several pre-IPO characteristics for which we observe an economically meaningful difference before the IPO (total assets, cash holdings and IPO size). We do not include contemporaneous controls for two reasons: first, we would either use lagged controls and lose an entire year of observations (lack of data availability 2 years before the IPO) or use contemporaneous controls which are measured as of the end of the year (while M&A occurs during it). Second, these controls may be bad controls in the sense that they are affected by our outcome variables (total assets is associated with acquisition activity for instance).

Our test, therefore, compares two firms with the same 2-month (and 1-year) returns, where one firm had its greenshoe exercised while the other didn't. By doing this, we attempt to rule out any stock price-related confounding effects. These may include firms learning from their share prices or certain firm characteristics being correlated with both

a firm's share price and it's investments. However, this does not mean that the only potential channel through which the greenshoe may affect investment is via cash holdings. We discuss some potential other channels and their validity in the next section, "Threats to Validity," and attempt to rule them out with a secondary-IPO placebo test.

In this placebo test where we show that for IPOs that include secondary greenshoes (where the issuing company does not receive any cash, with all the cash going to the selling shareholders), the exercise of the greenshoe does not correlate with empire-building behavior. We show that in the absence of cash, greenshoe and non-greenshoe firms make acquisitions at similar rates (conditional on certain controls). This helps us rule out *non-cash effects of the greenshoe* (see the section below for some potential examples).

The test essentially involves repeating our main analyses – regressions of either investment or executive compensation on a greenshoe dummy interacted with a post-IPO dummy (and base variables and controls) – in a subsample of IPOs where firms raised no cash. Unlike in our main analyses, we find no effect of the greenshoe on investment within this sample.

This secondary analysis does not require secondary IPOs to invest identically to primary IPOs. However, it does require some level of investment - if firms conducting secondary IPOs made no acquisitions, the difference between greenshoe and non-greenshoe firms would be 0 but also uninformative. However, perhaps surprisingly, we find that the post-IPO acquisition rates are similar for *non-greenshoe* firms, regardless of whether the IPO consisted of primary or secondary shares. Indeed, if IPOs are divided into four groups along two dimensions – greenshoe exercise and primary/secondary split – only the group of IPOs with exercised greenshoes consisting of primary shares invests more.

2.1 Threats to Validity

There are several potential threats to the validity of our estimates and the conclusions we draw from them. We categorize concerns into three main categories - the potential impact of greenshoe exercise on other firm outcomes, the idea that empire-building managers may affect greenshoe exercise and other concerns. We also discuss the various ways we attempt to address these concerns.

Greenshoe exercise affects M&A through something other than cash holdings

One concern might be that the greenshoe exercise changes the firm in ways other than simply cash holdings. Our 2-month and 1-year return controls allow us to account for differences in firm prospects or their information sets, but not for non-cash effects of the greenshoe. While we acknowledge that greenshoe exercise leads to several mechanical changes, such as increase in free float and potentially more dispersed ownership, it is unlikely that any of the direct mechanical effects of the greenshoe have an impact on future acquisitions made by the firm. In addition, our placebo test using secondary greenshoes should help assuage this concern.

There may also be non-mechanical effects arising from greenshoe exercise. Dambra et al. [2019] show that greenshoe exercise leads to an increase in analyst coverage, institutional ownership and liquidity (*i.e.,* a decrease in bid-ask spreads). This raises the concern that greenshoe exercise affects our sample firms in more ways than just via cash holdings. However, the observed changes documented by Dambra et al. [2019] are, in fact, expected to improve corporate governance and, thus, reduce agency problems.[8]

Moreover and more importantly, our placebo test, looking at secondary greenshoes, should account for this: when we look at firms that had their greenshoes exercised but that did not receive any cash, the effects reported by Dambra et al. [2019] should still be present (given that they are driven by an increase in the free float rather than the impact of cash holdings). As we observe no differences in either M&A activity or executive compensation in these firms, it does not seem that the differences they highlight (or others unrelated to cash holdings) between greenshoe and non-greenshoe firms affect our outcome variables.

We find that greenshoe firms also have higher cash balances (relative to assets) than predicted just by greenshoe exercise (see Figure 2). This implies that the agency cost arising from greenshoe exercise is bigger than expected as the extra cash raises the borrowing capacity of the firm. The extra borrowing by itself is completely consistent with

[8]Dambra et al. [2019] also instrument for greenshoe exercise with *market* returns in the 30 days after the IPO. For our research question, this research strategy does not add anything over our empirical strategy, which we argue is able to control for differences in prospects across greenshoe and non-greenshoe firms. Generating quasi-random variation in greenshoe exercise does not help us, especially when this variation is driven by market returns which may be correlated with investment opportunities. We also find that, while there is a clear relationship between market returns and greenshoe exercise, the portion of variation in greenshoe exercise explained by *market* returns is not very high (going from the 10th percentile of *market* returns to the 90th increases the proportion of exercised greenshoes by about 5 percentage points). This means that the "compliers" (firms whose greenshoe is exercised due to high market returns) are not necessarily representative of small firms in general, and the interpretation of any results from an IV strategy would not be clear.

an empire-building motive if it is used to fund acquisitions and other corporate growth.[9] However, it is also important to ensure that this behavior is associated with an empire-building motive rather than some rational growth motive. Our results which imply that the marginal acquisition made by greenshoe firms have negative returns support this view, at least in the context of M&A. While the cash balances may be associated with for instance increasing firm size and decreasing returns to scale, they cannot be reconciled with negative marginal returns.[10]

Manager traits affect greenshoe exercise

There are two big concerns about manager characteristics affecting greenshoe exercise. The first is that empire-building managers run companies where the greenshoe is more likely to be exercised. The second is that managers may anticipate receiving the greenshoe cash and hence have planned their investment around it.

The first concern is that managers who have an empire-building motive will attempt to influence the exercise of the greenshoe. That is, a manager might aim to underprice their offering in order to secure the proceeds of the greenshoe. We do not consider this plausible for a number of reasons. A manager should, in theory, be able to affect IPO proceeds through two different channels: the number of shares sold and the price per share. After an IPO has been filed (at least in the US), the number of shares offered is highly unlikely to change - the only variation in the number of shares ultimately sold comes via the greenshoe. This means that the two "levers" by which a manager can affect the total proceeds are via the greenshoe and the offer price. However, insofar as underpricing is a function of total demand (an offering where demand exceeds the number of shares offered will likely have a higher first day return), these levers work against each other - a manager seeking to maximize greenshoe proceeds will do so by offering shares at a lower price than they could have been offered. A manager maximizing proceeds could, depending on demand at different price levels, either choose to minimize greenshoe proceeds or aim for an offer price with some minimal level of underpricing, meaning that it is not clear whether this motive would bias our results at all.[11]

[9] M&A is just one manifestation of empire-building behavior - greenshoe exercise may also be connected to other empire-building behavior such as overinvestment in operating assets. We focus on M&A activity because it provides us with a measure of project quality.

[10] We also control for relative size and deal value when analyzing acquisition returns.

[11] It should also be noted that technically the final pricing and allocation decisions are the purview of the lead underwriters (or global coordinators) rather than of management.

An indirect extension of the concern above is that manager characteristics and actions affect greenshoe exercise in a way that is correlated with future investment. For example, bad managers may be more likely to accept an IPO price that maximizes underpricing (to the benefit of the underwriter's trading clients). These managers may also be more likely to make acquisitions in the future. However, our controls for 2-month and 1-year share prices should capture differences in management quality, at least the market's updated perception of it. In addition, if managerial traits cause both underpricing and acquisitions, we should still expect to see a relationship between greenshoe exercise and acquisitions in secondary IPOs, which we do not.

Another concern could be that a forward-looking manager would already have an investment plan (*e.g.,* to acquire another company) that incorporates proceeds from the exercise of the greenshoe. This would imply that firms without greenshoe exercise become financially constrained (or at least unable to invest as planned without new outside capital), which changes the interpretation of our results. Firms are likely to be conservative in terms of proceeds in order to avoid having to raise new (costly) external equity soon after the IPO. However, more importantly, the price range presented by investment bankers to managers typically has significantly more variation than greenshoe exercise and creates significant uncertainty about total proceeds.

Other concerns

Finally, some may argue that a "successful" IPO (one with underpricing) may cause a manager to become overconfident and, as a result, overestimate the value derived from an acquisition. Our research design (*i.e.,* matching firms on two-month and one-year returns after their IPO) should alleviate this concern unless there is something special about the immediate return just after the IPO, perhaps in terms of salience. However, we observe that when matched on one-year returns, greenshoe firms are more likely to make acquisitions in years two and three, when the salience of the IPO return declines and the relevance of the one-year return increases.

3 Data

3.1 IPO Data

Our data on IPOs come from Dealogic. Our primary reason for using Dealogic is the poor reliability of greenshoe data in the SDC database (see, for example, Ellis et al. [2000]). We start our sample in 1996, when Dealogic's coverage of greenshoe exercise improves dramatically.

We start with all bookbuilt IPOs on US exchanges from 1996 to 2015. Next, we drop all IPOs by financial companies (SIC codes 60-67). Our reason for doing this is to exclude both funds (whose investment patterns are not comparable to most firms) and firms with different balance sheet structures (a typical example is banks: for most firms, short-term securities are equivalent to cash on hand, a source of liquidity. For banks, short-term securities may be investments used to reduce the duration of the bank's assets). To focus on economically meaningful offerings, we drop all offerings of less than $10 million or where the offer price is less than $5.

3.2 Greenshoe Data

Our variable of interest is the exercise of the greenshoe option. Almost all US IPOs include a greenshoe option (Jiao et al. [2017]), but our focus is on whether it is exercised or not. Due to the potential for data errors (for instance those pointed out in Ellis et al. [2000]), we hand-collect data on whether the greenshoe is exercised instead of relying on Dealogic's indicator. For each firm in our sample we use the IPO prospectus and the nearest Form 10Q or 10K filings (from the SEC's EDGAR database) to determine the primary/secondary composition of the greenshoe and whether the greenshoe is exercised i) fully, ii) partially, or iii) not at all.[12] When a "primary" greenshoe is exercised, proceeds are received by the firm, while in the case of a "secondary" greenshoe, cash is received by the selling shareholders, not by the firm.

[12]Unfortunately, in cases where the greenshoe was NOT exercised, information on the composition of the greenshoe is not always available. In these cases, we use Dealogic's data on the authorized (*i.e.,* potential) greenshoe.

3.3 Financial Data

Other financial data and stock return data come from CRSP and COMPUSTAT. We link the Dealogic IPO data to CRSP by merging on 6-digit CUSIP at the earliest date that this CUSIP exists in the CRSP database. We then compare the first date that the CUSIP appears in the CRSP database and the Dealogic provided pricing date, creating a variable called "datesdiff" which is the difference between these two dates. We exclude all IPOs where with a negative datesdiff (appears in CRSP before pricing date) and those with a datesdiff greater than 10 (appears in CRSP more than 10 days after pricing).[13] We then merge contemporaneous financial information from COMPUSTAT using the WRDS CRSP-COMPUSTAT links provided (in practice: a variable like total assets will reflect total assets at the end of the fiscal year).

We label the current fiscal year ongoing during the IPO as year 1, the fiscal year prior to that as year 0 and so on. All accounting variables are winsorized at 1% (within each calendar year) and the net income / assets ratio is also winsorized at 1%. Ratios and variables are described in the appendix.

3.4 Merger and Acquisitions Data

Data on mergers also come from Dealogic—we use data on all completed acquisitions (deal equity value $>$ \$10 million) of at least 90% of a target by US companies. We append this sample to our IPO sample by first merging the mergers to CRSP using the 6-digit CUSIP and announcement date and then using the WRDS CRSP-COMPUSTAT links to obtain a fiscal year and gvkey for each merger. These are used to append deal information to the existing IPO dataset (we treat each missing link as a fiscal year without an acquisition).

Merging via CUSIP means that we are unable to match all mergers prior to the IPO date. We therefore code the pre-IPO acquisitions dummy as 0 for all firms. We create an alternative dummy variable using the "Acquisitions" data item from COMPUSTAT,

[13]This accounts for a small minority of deals. We exclude securities that were included in the CRSP database prior to the IPO pricing date because this implies that the company was listed prior to the IPO. This could be due to a mistake by Dealogic or other reasons such as Dealogic classifying non-IPOs as IPOs (an example would be a company with a small free float of 1 or 2% which proceeds to do a larger offering, which is often classified as an IPO even though it is technically not one). We also exclude deals where the first observation in CRSP is more than 10 days after the pricing date. 10 days is an arbitrary cutoff that in our opinion allows for most common delays between pricing and trading (such as weekends, holidays, bookbuilding ending early and so on).

equally 1 if the amount of money spent on acquisitions is non-zero. We confirm (in unreported results) that our results are consistent with both measures, but that the COMPUSTAT measure of acquisitions leads to much higher acquisition rates for all firms.

We calculate the announcement return by calculating the return from the day prior to the announcement of the deal to the day after and subtract the CRSP value-weighted market return for the same days (we exclude deals that are flagged as having been rumored prior to the announcement date according to Dealogic).[14]

3.5 Executive Compensation Data

The firms in our sample are mostly small and recently IPOed firms. The most commonly used database on executive compensation, EXECUCOMP, only provides data on S&P 1500 firms, and the vast majority of the firms in our sample do not qualify. Because of this, we hand-collect data on executive compensation. Our sample starts in 2005, when as a result of IFRS 2 / ASC 123R, firms were required to expense employee stock options at fair value.

We collect, for all post-2005 IPOs, the total value of executive compensation granted in a year, as reported in either the 10K or the proxy statement. We include all reported compensation, including salary, bonus, equity/options-grants for the year and other compensation. We record the numbers as they are reported by the firm, conscious that the valuation of options for instance might be done on terms favorable to the firm. The level of compensation is usually also presented for previous years, allowing us to control for pre-IPO compensation. We also collect the name of the CEO to track changes in management.

[14]This is because estimating Betas for recently IPOed firms involves significant difficulty. It should also be noted that the average announcement return we observe is positive. This is consistent with Von Beschwitz [2018] European sample as well as the observation in Moeller, Shlingemann and Stulz (2004) that on average, acquisition returns, especially on smaller acquisitions (which make up the bulk of our sample), are positive.

4 Results

First, brief summary statistics and univariate tests are presented. We also show that the greenshoe affects cash holdings of firms, a necessary and expected condition for our analysis to work. Next we cover the main results of the paper, namely that greenshoe exercise predicts empire-building behavior. We do this by showing that greenshoe exercise is associated with more acquisitions, lower acquisition returns, and higher executive compensation. We then attempt to address the endogeneity of the greenshoe by conducting two robustness tests. First, we repeat the main analyses above with controls/matching for 2-month and 1-year returns. Second, we conduct a placebo test using secondary-only greenshoes.

All the analyses in this paper are conducted at a firm-year level, other than the analyses on acquisition returns. The summary statistics are also at the firm-year level. We follow each firm from the year ending prior to the IPO (year 0) to the third year ending after the IPO (year 3). Year 1 is the year of the IPO - that is, the IPO happens during year 1. The reason for this sample period is that the difference in cash holdings between greenshoe and non-greenshoe firms is no longer statistically significant in year 3 (though economically it is so) and continues to diminish further. As the difference in cash holdings gets smaller, the impact of other corporate policies rises relative to the impact of cash, making it difficult for us to detect any effect.

4.1 Summary Statistics and the Impact of Greenshoe Exercise on Cash Holdings

Our sample covers all bookbuilt IPOs on US exchanges from 1995 to 2015. Table 1 provides descriptive statistics at the firm-year level. Of the 1402 IPOs for which we have data, the greenshoe is exercised in 1074 IPOs. In line with the observation of cycles in IPO market (see, for example, Helwege and Liang [2004]), the exercise of greenshoe option shows cyclicality over the sample period as seen in Figure 1. The figures in Table 2 suggest that there are some economical differences between greenshoe and non-greenshoe firms prior to the IPO even though these differences are not statistically significant at 95% confidence level.

It is important to show that the exercise of the greenshoe indeed results in an increase

in cash holdings. While this is mechanical (for all non-secondary IPOs), a rough correspondence between the numbers and the expected value is a sanity check for the data. The typical cash infusion in our sample due to the exercise of the greenshoe is 15% of the IPO, with the typical IPO raising the $\frac{\text{(Cash+Cash equivalents)}}{\text{Book assets}}$ ratio from 29% to 44% (Figure 2). Hence the exercise of the greenshoe should increase cash holdings as a percentage of assets about 2.25 (=15*0.15) percentage points immediately after the IPO, or slightly less than 10% of pre-IPO cash holdings. Graphically, Figure 2 shows that greenshoe firms have roughly 8 percentage points higher $\frac{\text{(Cash+Cash equivalents)}}{\text{Book assets}}$ ratios at the end of the IPO year, suggesting that greenshoe exercise may be correlated with higher cash holdings for other reasons (greenshoe exercisers end up issuing more debt than non-exercisers, something that is discussed later). We present this result more formally in 3, where we show that the exercise of the greenshoe options leads to about 2.5 pp higher $\frac{\text{(Cash+Cash equivalents)}}{\text{Book assets}}$ ratios in the post-IPO years, regardless of the variables controlled for (we control for year, industry and industry-year fixed effects as well as fixed effects for 2-month and 1-year post-IPO return deciles and the return itself).

4.2 Main Results

We first show that firms that receive a greenshoe-related cash infusion make more acquisitions. Figure 3 presents the probability of making an acquisition and the mean total acquisition value (winsorized at the 99th percentile) in each of the post-IPO years by greenshoe and non-greenshoe firms. The univariate results suggest that firms where the greenshoe is exercised are approximately 5-6 % points more likely to make an acquisition per year, compared to a baseline of roughly 20%. It should be noted that recently IPOed firms are prolific acquirers—42% of the firms in our sample made an acquisition in the 3 years after the IPO (this is fewer than in Celikyurt et al. [2010], who examine a different sample period and larger IPOs [minimum $100 million]).

Next, we show this result in a multivariate setting. We regress the number of acquisitions made by a firm in any given year on the greenshoe dummy interacted with a post-IPO dummy. Table 4 presents these results. The dependent variable is the probability of an acquisition being made in a year.[15] Once again, the results imply that firms receiving cash through the exercise of the greenshoe make more acquisitions. The effect is economically

[15]Note that the acquisitions figure for the pre-IPO year is set to 0 due to the difficulty in matching mergers made by private firms.

highly significant, with the coefficient ranging from 0.05 to 0.06 (which can be compared to the coefficients on the post-IPO dummy which is about 0.1), an increase of about 50% (depending on the year and specification). Columns 4 and 5 introduce controls for the two-month and 1-year post-IPO returns (both decile and continuous).[16]

The interpretation of this result is that the probability of making an acquisition in *each* of the three years after the IPO is about 10%, and this rises to about 15% for greenshoe firms. This probability is a per-year probability.

It is also noteworthy that in column 6, the coefficient for pre-IPO $\frac{\text{(Cash+Cash equivalents)}}{\text{Book assets}}$ is not significant. This suggests that the overall level of cash holdings prior to the IPO is unrelated to the level of acquisition activity, highlighting the importance of the IPO as the source of funding for post-IPO acquisitions and lowering concerns that pre-IPO differences in corporate policy are driving our results.

In table 7, we break down the results by post-IPO year. That is, the year preceding the IPO is the base level and we add dummies for each post-IPO year (*e.g.,* 1, 2, 3) and interact these with greenshoe exercise. In addition, the coefficient is consistent with what we see in table 4. We see that greenshoe firms are approximately 5 percentage points more likely to make an acquisition in each post-IPO year.

To calculate the announcement return for the acquirer, we calculate the total return for the acquirer's stock from the closing price 2 days prior to the announcement to the closing price 1 day after the announcement (in effect this gives us the return from day t-1 to t+1). Then we subtract the market return for these days. We regress announcement returns on a greenshoe dummy and several controls and find that the greenshoe consistently predicts lower returns than deals without a greenshoe.

The announcement returns made by these firms are lower (near zero), suggesting that markets perceive them to be less value-enhancing than those made by non-greenshoe firms. One might argue that since the returns are still positive, the cash infusion is not associated with value-destroying behavior. However, this ignores the fact that recently IPOed firms make successful acquisitions on average (consistent with these firms typically being well-run and having incentive-aligned managers and attentive shareholders) and

[16]We set pre-IPO acquisitions to 0 for both groups of firms. This means that our identification comes entirely from differences in post-IPO acquisitions and hence the greenshoe coefficient (which captures the difference in pre-IPO acquisitions between greenshoe and non-greenshoe firms) cannot be estimated, and neither can the constant in the first column.

the question is whether the marginal acquisition (or overpayment) made because of the extra cash has positive returns. The average return for acquisitions made by greenshoe firms is 2% lower than those of non-greenshoe firms (returns falling from roughly 3% to 1%). For this to be the case with non-greenshoe firms having marginal returns of zero (i.e. the lowest possible non-value destroying return), acquisitions would have to double relative to non-greenshoe firms. Given that greenshoe firms on average make 50% more acquisitions than non-greenshoe firms (Table 4 univariate results), the returns on additional acquisitions / lower returns on existing acquisitions due to overpayment must be negative. This suggests that the *marginal* acquisitions made by greenshoe firms have negative returns (see Von Beschwitz [2018] for similar argumentation).

The results are presented in table 5. The coefficient on the greenshoe dummy is consistently negative. The magnitude of the coefficient (0.0198-0.0286 depending on specification) is as large as the mean announcement return for acquisitions in our sample, suggesting that the market perceives greenshoe-driven acquisitions as value destroying. 46 percent of acquisitions made by greenshoe firms have negative abnormal announcement returns, whereas for non-greenshoe firms this ratio is 36 percent. We show this graphically in Figure 4, where we plot the percentage of acquisitions with negative returns for greenshoe and non-greenshoe firms.

4.3 Executive Compensation

In this section, we test the impact of cash gained via greenshoe exercise on executive compensation.

In figure 6 we plot the logarithm of annual total compensation for greenshoe and non-greenshoe firms before and after their IPO. Greenshoe firms pay higher compensation to their CEO's in the year following the IPO and in the second year following the IPO, though the difference decreases over time. The difference is statistically significant at 95% confidence level. We do not observe a difference in the year of the IPO, which may be because CEO compensation has been agreed on before the IPO.

In table 6, we estimate the economic impact of greenshoe on annual executive compensation, we first regress the logarithm of total CEO compensation (hand-collected, winsorized at 1% both tails in each calendar year) on our greenshoe dummy interacted with a post-IPO dummy. As in the previous cases, we use a range of specifications, starting from

a simple specification including only the greenshoe and year dummies, then including calendar-year and industry fixed effects while finally running a full model with industry-year fixed effects and controls. We find greenshoe firms pay higher compensation to managers though the difference is not statistically significant (p_value of the interaction term is 11%). However, the size of the coefficient is economically very significant (representing an approximately 10% increase in compensation in greenshoe firms in addition to a 30% post-IPO increase) and is stable throughout our various specifications, though not statistically significant (this may be because the effect is not present in the year of the IPO - see below). As with the previous tests, columns 5 and 6 introduce controls for the 2-month and 1-year return as well as fixed effects for their decile.

Next, we regress the logarithm of CEO compensation on the greenshoe dummy interacted with each of the three years following the IPO. That is, the year preceding the IPO is the base level and we add dummies for each post-IPO year (*e.g.,* 1, 2, 3) and interact these with greenshoe exercise. We include range of controls and fixed effects progressively. Table 7 summarizes the results. The year following the IPO (*i.e., IPO Years=2* dummy in the table) CEO compensation is 32% higher for greenshoe firms. Executive compensation in year 3 is still higher (respective coefficient in regressions are higher by between 15 to 23%) for greenshoe firms but this difference is no longer statistically significant.

While these results strongly support the idea that executives benefit personally from excess cash post-IPO, we must however urge some caution in the interpretation of these results as they are estimated on a very small sample of companies. We also note that the inclusion of calendar-year FE (through the inclusion of the industry-year FE) has a significant impact on the coefficient, with the coefficient being close to 0 prior to their inclusion. This is reasonable - there has been a strong upwards trend in executive compensation which may also correlate with greenshoe exercise trends.

4.4 Ruling Out Alternative Explanations

As mentioned previously, the greenshoe may be correlated with factors that affect investment other than through the increase in cash. These may include unobservable characteristics of the firm, future returns (on their own stock) that firms "learn" from or the general market return. To address this, we do several things:

- First, in our previous tests, we control for the decile (calculated within each calendar

year) of 2-month and 1-year returns. We also include continuous controls for these variables.

- Second, we run a placebo test using secondary only greenshoes. These are greenshoe options where the firm does not receive any cash, instead it goes to the selling shareholders. In these cases, most of the issues relating to the greenshoe option should be present, but there is no cash. Therefore if factors other than cash are driving the investment, they should still be present in firms with an exercised secondary greenshoe.

We start by controlling for returns. 7 shows the relationship between greenshoe exercise and the total number of acquisitions and the sum of announcement returns (the two variables where the simple post-IPO number is relevant as opposed to the change) in different quintiles of post-IPO returns. The graphs clearly show that the relationship between greenshoe exercise and number of acquisitions in positive in almost all quintiles of 2-month returns and in all quintiles of 1-year returns. Similarly, acquisition returns are higher for non-greenshoe firms in two out of five quintiles of 2-month returns (and almost identical in two) and higher in three out of five quintiles of 1-year returns. More formally, all of our earlier tests (except for the announcement returns test, which is a merger-level test as opposed to a firm-year level analysis) include controls for 2 month and 1 year returns as well as deciles of these returns.

We then focus on firms where the greenshoe consists entirely of secondary shares ("secondary greenshoe firms"). Within these firms, the exercise of the greenshoe provides no cash to the firm. Therefore, we do not expect to see any relationship between greenshoe exercise and cash-induced agency behavior, conditional on controlling for post-IPO returns.[17] We therefore run our basic tests on acquisition activity and executive compensation on the subsample of firms where the greenshoe consists 100% of secondary shares.

Table 8 presents the results of this exercise for acquisition activity and executive compensation. The dependent variable in columns 1-3 is a dummy that takes the value of 1 if a firm has made at least one acquisition in a year. We see from the coefficient of *Post IPO* that firms conduct more acquisitions after the IPO, even when the greenshoe

[17]We may expect to see differences in unconditional behavior as firms with higher returns may perceive more investment opportunities or feel the need to reward their managers.

(and hence very likely the offering) consists entirely of secondary shares. The coefficient is very similar to the *Post IPO* coefficient in table 4, suggesting that acquisition activity of firms that do not receive greenshoe cash is very similar regardless of the composition of the offering. Our variable of interest, the interaction of *Secondary Greenshoe* and *Post IPO* is however negative and insignificant, suggesting that the exercise of the greenshoe does not affect acquisition activity for firms that do not receive cash from the greenshoe.

Columns 4-6 present a similar analysis for executive compensation. In this case the dependent variable is the winsorized (1% both tails) logarithm of total compensation, hand-collected from proxy reports. The difference between greenshoe and non-greenshoe firms does not increase after the IPO. It should be noted that the coefficient on *Secondary Greenshoe* is significant and positive, suggesting that firms with exercised secondary greenshoes pay their managers more pre-IPO than those without, meaning some caution should be taken when interpreting results in this table as the two firms may differ in fundamental ways when it comes to their policies regarding executive compensation.

5 Conclusion

Largely motivated by Jensen [1986]'s free cash flow hypothesis, a common view in the finance literature has been that "excess" cash should not be kept in the firm and rather distributed to shareholders. The reasons for this mainly apply to large and mature firms, whereas young firms are expected to have stronger monitoring and better investment opportunities which mitigate these problems. The financial media and industry experts frequently espouse similar views regarding cash holdings: large firms such as Apple and Google are often expected to distribute their "excess" cash to their shareholders (*e.g.,* Stevens [2019]) while small firms are usually encouraged to keep more cash than what is necessary for their operations (*e.g.,* Griffen [2019]).

In this paper, we find that young firms also engage in value-destroying activity after receiving quasi-random cash windfalls, suggesting that even managers of these firms are subject to similar agency problems. Our findings in this paper shows that cash-related manager-owner agency problems exist in young firms that are under intense scrutiny by the market, suggesting that these problems are prevalent in all sorts of firms instead of just the mature firms with high cash flows. While there has been evidence on the benefits of cash holdings (for example Fresard [2010]), documenting the existence of agency problems

in young firms, and their impact, may help their owners better decide on the optimal level of cash.

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Figure 1: Greenshoe Exercise Percentage by Year

This figure plots the percentage of IPOs with a greenshoe exercised by year. The main greenshoe definition (left graph) is the Dealogic greenshoe exercised dummy variable. The alternative greenshoe definition is a dummy that we hand-collect from the IPO prospectuses and post-IPO 10Q/K filings (we ignore partially exercised greenshoes).

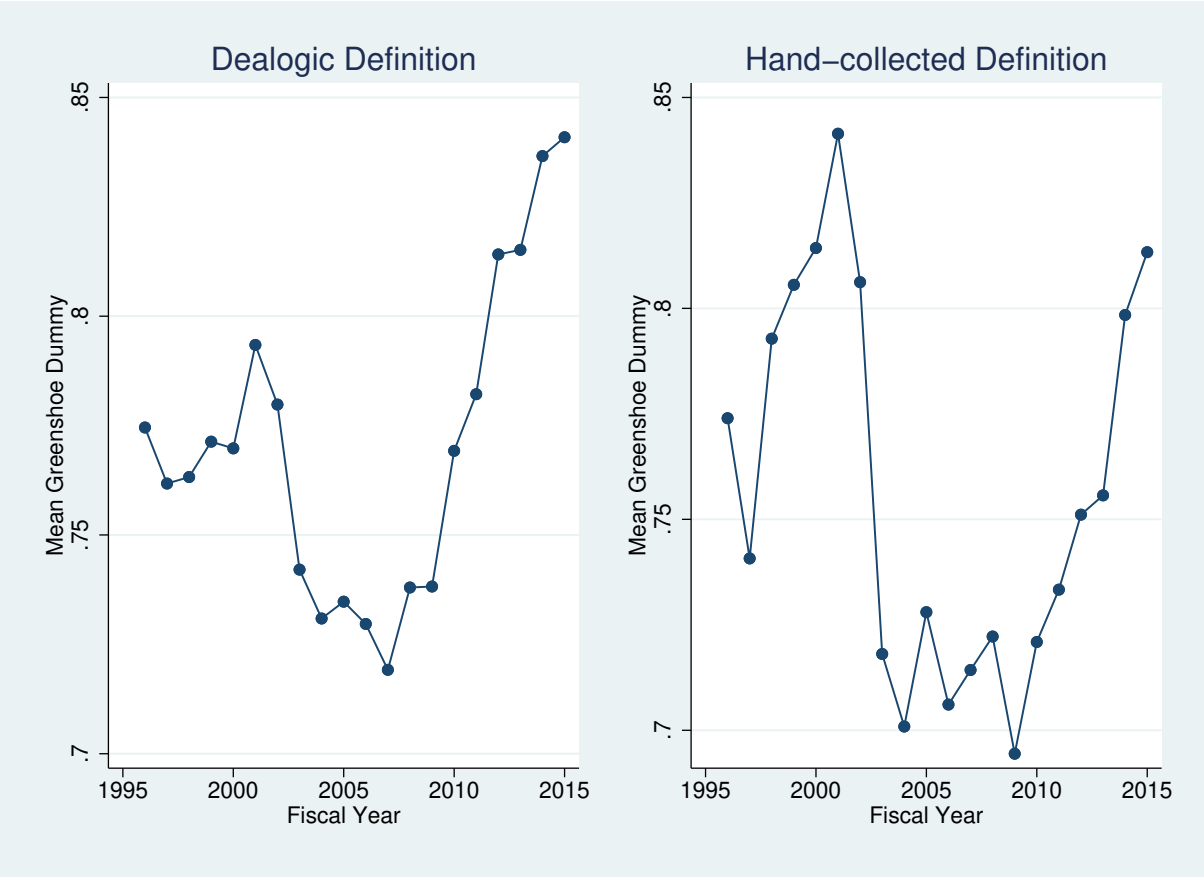

Figure 2: First Stage – Greenshoe Exercise and Cash Holdings (Univariate)

This figure plots the mean $\frac{Cash+Cash\ equivalents}{Book\ assets}$ ratios for firms before and after the IPO (year 1 is the fiscal year during which the IPO happens), split by whether the greenshoe is exercised. The red line represents the average for firms with fully exercised greenshoe options. The blue line denotes the average for firms where the greenshoe is not exercised. The error bars denote a 95% confidence interval. .

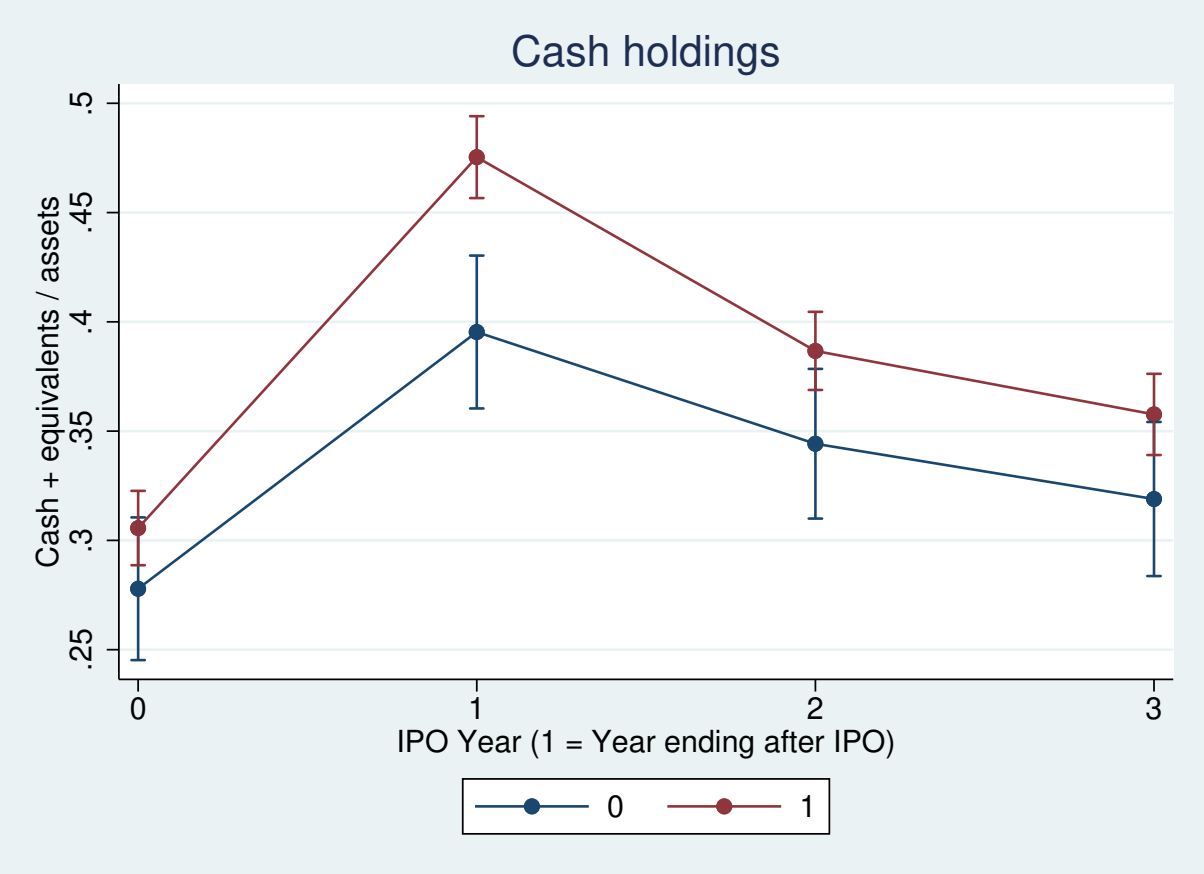

Figure 3: Greenshoe Exercise and Acquisition Probability

The figure on the left plots the mean of an acquisition dummy (takes the value of 1 if a firm made at least one acquisition in a year) and the figure on the right plots the mean spending on acquisitions per year (winsorized at the 99th percentile) before and after the IPO (year 1 is the fiscal year ending after the IPO). Year 0 acquisitions are set to zero due to difficulty in matching pre-IPO acquisitions. The red line represents the average for firms with fully exercised greenshoe options. The blue line denotes the average for firms where the greenshoe is not exercised. The error bars denote a 95% confidence interval.

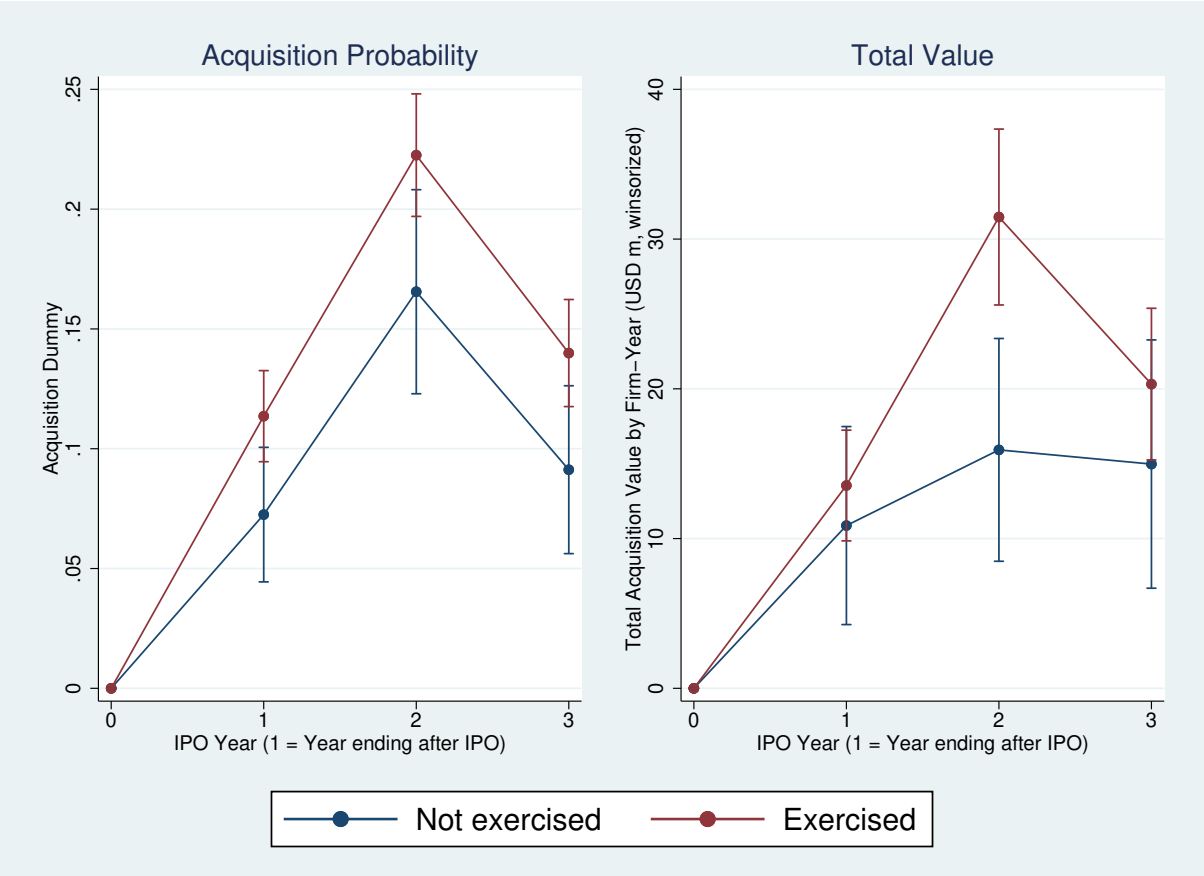

Figure 4: Greenshoe Exercise and Value Destruction

This figure plots the proportion of M&A deals with negative announcement returns. The left bar represents deals where the greenshoe was not exercised and the bar on the right deals where the greenshoe was fully exercised. The error bars denote a 95% confidence interval.

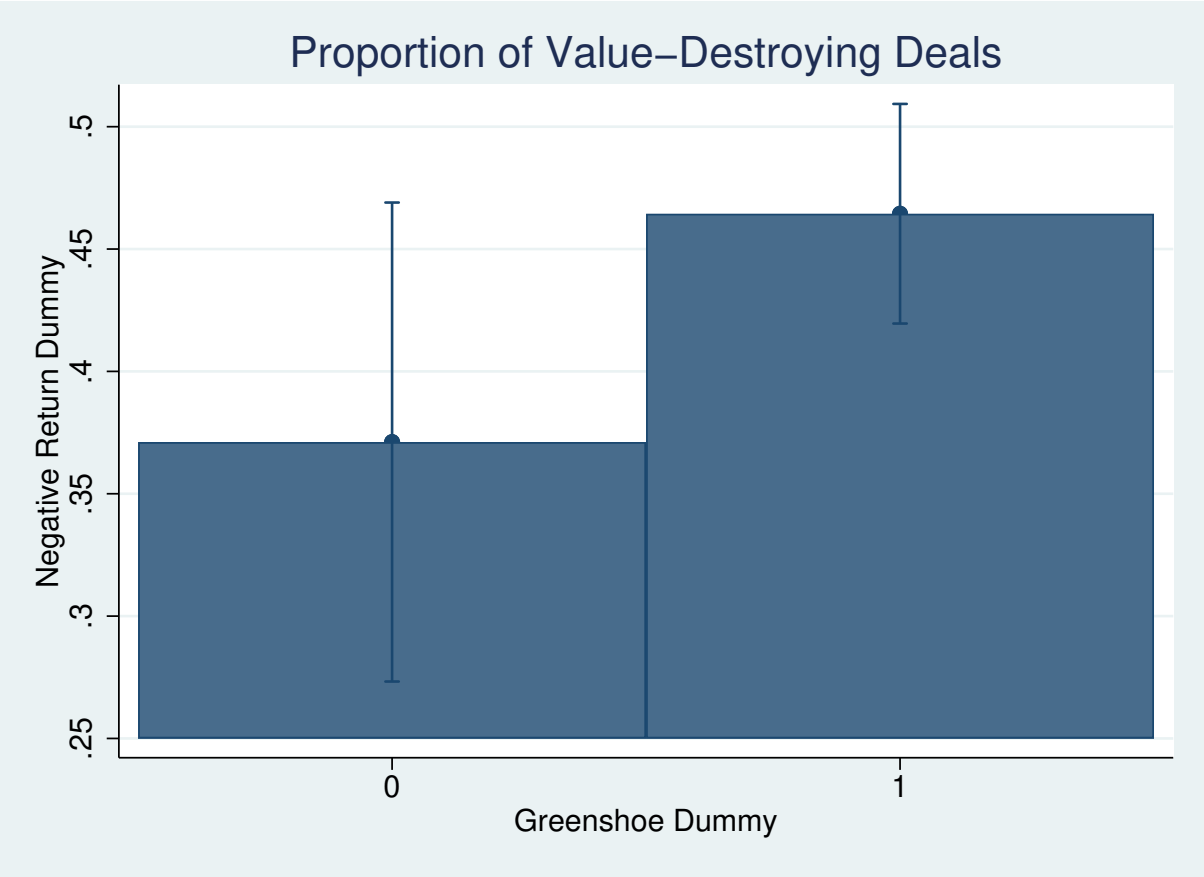

Figure 5: Greenshoe Exercise and Announcement Returns

This figure plots the mean cumulative abnormal announcement returns (-1, +1), winsorized at 1% and 99%, for acquisitions. The left bar represents deals where the greenshoe was not exercised and the bar on the right deals where the greenshoe was fully exercised. The error bars denote a 95% confidence interval.

Figure 6: Greenshoe Exercise and Executive Compensation

This figure plots the logarithm of the CEO's total compensation. The data are hand-collected from proxy statements. The red line represents the average for firms with fully exercised greenshoe options. The blue line denotes the average for firms where the greenshoe is not exercised. The error bars denote a 95% confidence interval.

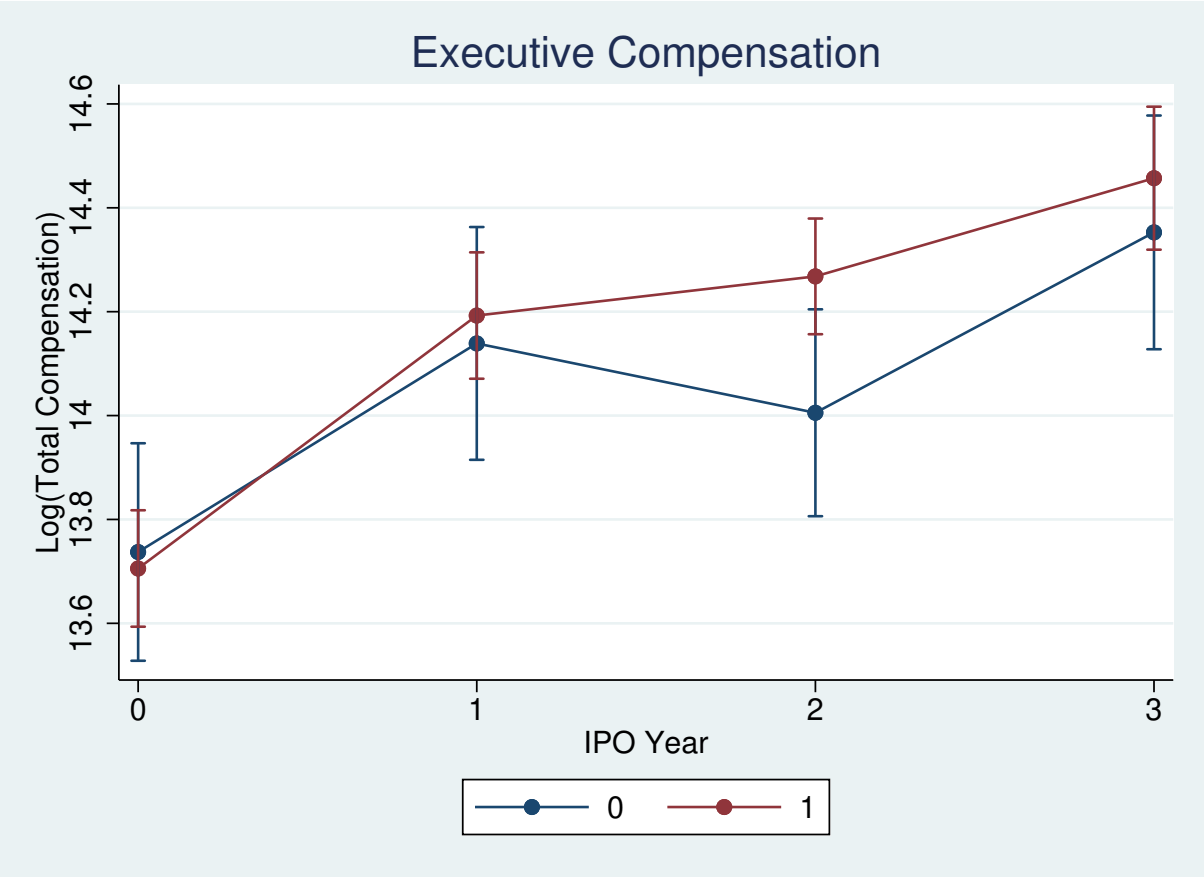

Figure 7: Robustness – Return Quintiles and Acquisitions

In these graphs we plot the number of acquisitions by company and their cumulative (sum) announcement returns sorted by the quintile of the 2-month and 1-year returns. Lines with N denote averages for firms where the greenshoe was not exercised and lines with Y denote averages for firms with an exercised greenshoe. The graphs on the top row sort by quintile of 2-month returns whereas the bottom row is sorted by quintile of 1-year return. The graphs on the left show the total number of acquisitions post-IPO by each company and the graphs on the right show the sum of announcement returns for these companies.

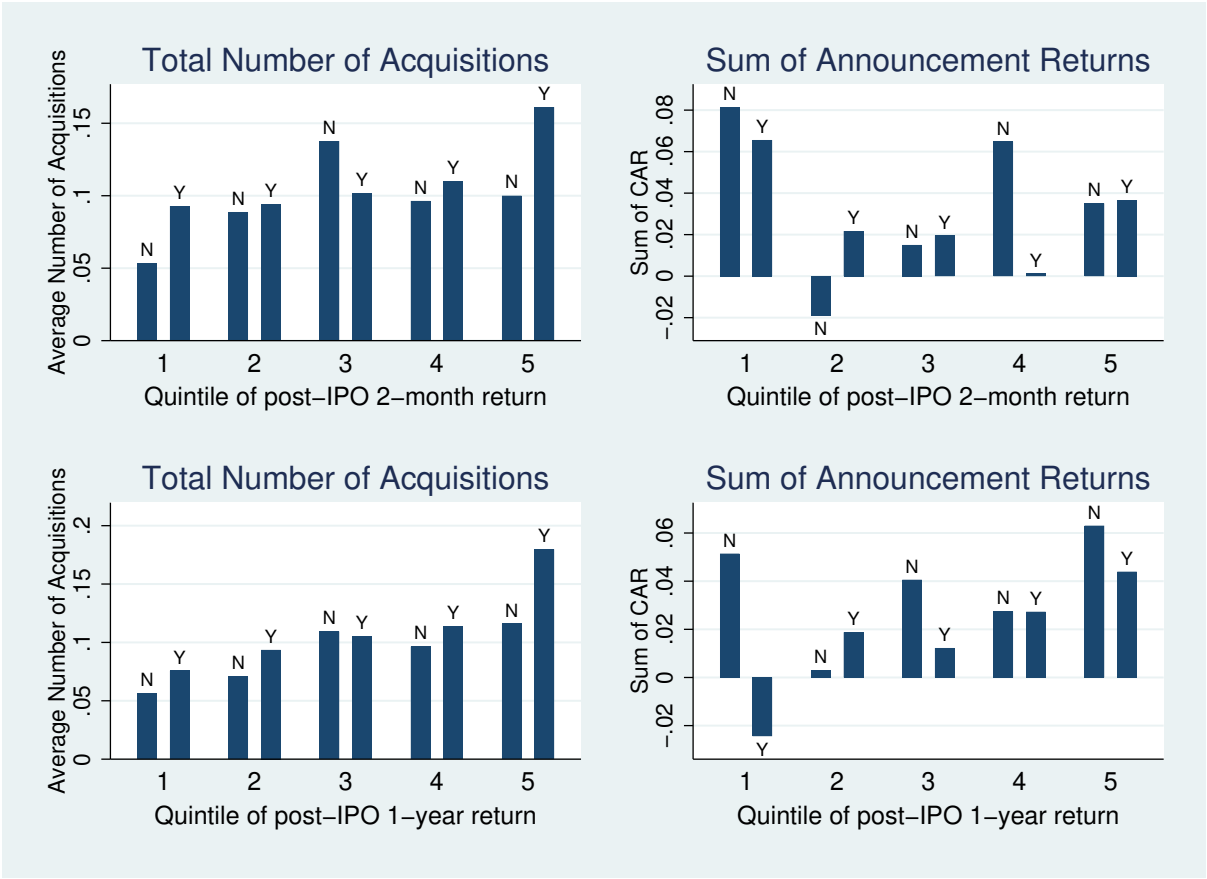

Table 1
Summary Statistics for our Sample

This table provides firm-year level summary statistics on several key variables used in our analyses. The summary statistics are split into pre-IPO and post-IPO statistics. The post-IPO statistics cover the year of the IPO (fiscal year end after the IPO) as well as two years after. The Acquisition Dummy is at the annual level and based on whether a firm has made an acquisition in the Dealogic sample. Market capitalization at IPO refers to the market capitalization at the IPO offer price. The market capitalization at IPO for post-IPO firm-years differs from the pre-IPO due to an unbalanced sample.

	Pre-IPO						Post-IPO					
	Obs	Mean	Std. Dev	p5	Median	p95	Obs	Mean	Std. Dev	p5	Median	p95
Total Assets	1402	344.90	1444.66	4.04	42.05	1449.48	3912	567.14	1716.36	28.20	157.16	2358.44
Cash + Equivalents	1402	30.70	93.15	0.12	8.50	111.00	3912	97.63	173.04	1.77	50.19	339.05
Cash + Equivalents / Assets	1402	0.30	0.29	0.00	0.19	0.87	3912	0.40	0.30	0.01	0.37	0.90
Deal Value	1402	158.17	491.11	26.00	84.25	483.00	3912	161.22	506.83	26.25	85.36	488.75
RD Spending	984	11.62	26.40	0.00	5.66	39.80	2797	22.60	39.38	0.00	12.32	78.68
Total Liabilities / Total Assets	1399	0.64	0.32	0.13	0.64	1.19	3900	0.38	0.26	0.08	0.31	0.88
Market cap at IPO	1399	687.26	1522.93	80.65	341.48	2224.98	3909	698.00	1566.81	80.65	342.61	2251.96
Adj. Net Income	1385	-4.39	59.94	-57.37	-3.44	42.96	3909	-17.32	149.93	-137.13	-5.08	79.51
Total CEO compensation (winsorized)	402	1702294.42	3190410.27	257484.00	767643.00	6032774.00	1141	2804411.91	3939401.85	314007.00	1552945.00	9588142.00
Greenshoe dummy	1402	0.76	0.42	0.00	1.00	1.00	3912	0.77	0.42	0.00	1.00	1.00
Market cap							3901	1071.78	3951.88	20.25	323.06	3796.50
Acquisition Dummy							3912	0.15	0.35	0.00	0.00	1.00

Table 2
Differences in Means

This table provides firm-year level means and differences of key variables for greenshoe and non-greenshoe firms, pre- and post-IPO. Market cap at IPO refers to the market capitalization at the IPO offer price.

	(1) Pre-IPO				(2) Post-IPO			
	Not Exercised	Exercised	Difference	Obs.	Not Exercised	Exercised	Difference	Obs.
Total Assets	473.41	305.19	168.22	1402	695.62	529.30	166.31*	3912
Cash + Equivalents	39.73	27.92	11.81	1402	90.42	99.75	-9.33	3912
Cash + Equivalents / Assets	0.28	0.31	-0.03	1402	0.36	0.41	-0.05***	3912
Deal Value	199.73	145.32	54.41	1402	204.74	148.40	56.33	3912
RD Spending	14.13	10.93	3.20	984	23.64	22.33	1.32	2797
Total Liabilities / Total Assets	0.67	0.64	0.03	1399	0.45	0.36	0.09***	3900
Market cap at IPO	736.31	672.06	64.25	1399				
Adj. Net Income	-3.99	-4.51	0.52	1385	-12.14	-18.85	6.70	3909
Total CEO compensation (winsorized)	1737833.21	1689404.07	48429.14	402	2478843.86	2915357.54	-436513.68	1141

Table 3
Cash Holdings and Greenshoe Exercise

This table shows the relationship between greenshoe exercise and firm cash holdings post-IPO. The sample period starts the year ending before the IPO and continues to the third year after the IPO and the unit of observation is a firm-year. The table presents regression estimates of cash+equivalents holdings (as a percentage of assets) on a greenshoe exercise dummy interacted with a post-IPO dummy, which takes the value of 1 from the year ending after the IPO. The dependent variable is $(cash + equivalents)_t/(totalassets)_t$. Column 2 includes calendar year fixed effects, column 3 includes industry (2-digit SIC) and year fixed effects, column 3 includes industry-year FE and columns 4 & 5 introduce return decile (2-months post-IPO and 1-year post-IPO) fixed effects. Column 6 includes controls for the log of total assets, cash+equivalents divided by assets and deal size (measured in the year ending before the IPO year). All standard errors are clustered at the 2-digit SIC-code level.

	(1)	(2)	(3)	(4)	(5)	(6)
Greenshoe × Post IPO	0.0256**	0.0239*	0.0260*	0.0264**	0.0235*	0.0268***
	(0.0110)	(0.0128)	(0.0136)	(0.0131)	(0.0137)	(0.0098)
Greenshoe	0.0271	-0.0015	0.0001	-0.0175	0.0037	-0.0071
	(0.0196)	(0.0150)	(0.0171)	(0.0154)	(0.0156)	(0.0067)
Post IPO	0.0777***	0.0666***	0.0701***	0.0721***	0.0721***	0.0755***
	(0.0104)	(0.0108)	(0.0125)	(0.0114)	(0.0137)	(0.0123)
2-month post-IPO return				0.0047		
				(0.0119)		
1-year post-IPO return					-0.0041	
					(0.0038)	
Log(Assets pre-IPO)						-0.0493***
						(0.0041)
Cash+equivs/Assets pre-IPO						0.6087***
						(0.0266)
IPO size: relative to book assets						-0.0011***
						(0.0002)
Constant	0.2786***	0.3099***	0.3188***	0.3239***	0.3214***	0.3776***
	(0.0479)	(0.0200)	(0.0220)	(0.0303)	(0.0231)	(0.0232)
Calendar year FE	No	Yes	No	No	No	No
Industry (SIC 2) FE	No	Yes	No	No	No	No
Industry-Year FE	No	No	Yes	Yes	Yes	Yes
2-Month Return Decile FE	No	No	No	Yes	No	No
1-Year Return Decile FE	No	No	No	No	Yes	No
N	5,297	5,297	5,008	5,008	4,973	5,000
R^2	0.024	0.330	0.359	0.386	0.367	0.687

Table 4
Acquisition Probability and Greenshoe Exercise

This table presents evidence that firms with an exercised greenshoe make more acquisitions. The sample period starts the year ending before the IPO and continues to the third year after the IPO and the unit of observation is a firm-year. The dependent variable is a dummy that takes the value of 1 if a firm made an acquisition in a given year (set to 0 for the pre-IPO year due to data coverage issues). Firm, calendar year and industry-year fixed effects are introduced progressively. Columns 4-5 include 2-month/1-year return decile fixed effects and a continuous control for the return. All standard errors are clustered at the 2-digit SIC-code level.
The Greenshoe-dummy drops from this table due to multicollinearity (since pre-IPO acquisitions are set to 0 for all firms, Post IPO and Greenshoe x Post IPO are perfectly collinear with it)

	(1)	(2)	(3)	(4)	(5)	(6)
Greenshoe × Post IPO	0.0513***	0.0529***	0.0619***	0.0625***	0.0606***	0.0620***
	(0.0161)	(0.0182)	(0.0171)	(0.0173)	(0.0164)	(0.0168)
Post IPO	0.1075***	0.1077***	0.0955***	0.0962***	0.0948***	0.0982***
	(0.0159)	(0.0169)	(0.0195)	(0.0195)	(0.0201)	(0.0197)
2-month post-IPO return				0.0333***		
				(0.0071)		
1-year post-IPO return					0.0154***	
					(0.0046)	
Log(Assets pre-IPO)						0.0180***
						(0.0031)
Cash+equivs/Assets pre-IPO						-0.0232
						(0.0311)
IPO size: relative to book assets						0.0018***
						(0.0002)
Constant		0.0022	0.0069	-0.0252*	-0.0021	-0.0844***
		(0.0144)	(0.0172)	(0.0144)	(0.0142)	(0.0282)
Calendar year FE	No	Yes	No	No	No	No
Industry (SIC 2) FE	No	Yes	No	No	No	No
Industry-Year FE	No	No	Yes	Yes	Yes	Yes
2-Month Return Decile FE	No	No	No	Yes	No	No
1-Year Return Decile FE	No	No	No	No	Yes	No
N	5,297	5,297	5,008	5,008	4,973	5,000
R^2	0.047	0.087	0.155	0.162	0.171	0.164

Table 5
Acquisition Returns and Greenshoe Exercise

This table presents evidence that acquisitions made by greenshoe firms have lower announcement returns. The dependent variable in all regressions is the acquirer return from the closing price prior to the announcement of the merger to the day after it minus the CRSP value-weighted index return for these dates. Deals flagged as "rumored" prior to the announcement date by Dealogic are dropped. Standard errors are clustered at the acquirer industry level (2-digic SIC code).

	(1)	(2)	(3)	(4)	(5)	(6)
Greenshoe	-0.0209*	-0.0233**	-0.0290**	-0.0199	-0.0155	-0.0297
	(0.0112)	(0.0115)	(0.0132)	(0.0147)	(0.0110)	(0.0176)
Relative size		0.0131	0.0058	-0.0110	-0.0250*	-0.0011
		(0.0240)	(0.0189)	(0.0137)	(0.0140)	(0.0165)
Log Deal Value		0.0068*	0.0080***	0.0100**	0.0137***	0.0062
		(0.0036)	(0.0028)	(0.0040)	(0.0039)	(0.0039)
Horizontal deal flag		0.0038	0.0068	0.0078	0.0104	0.0070
		(0.0163)	(0.0185)	(0.0212)	(0.0235)	(0.0246)
All Cash Dummy		0.0124	0.0108	0.0145	0.0155	0.0156
		(0.0094)	(0.0116)	(0.0180)	(0.0184)	(0.0145)
All Shares Dummy		-0.0147	-0.0147	-0.0293**	-0.0241**	-0.0297*
		(0.0115)	(0.0128)	(0.0138)	(0.0108)	(0.0148)
Log(Assets pre-IPO)		-0.0053**	-0.0036	-0.0037	-0.0044*	-0.0048*
		(0.0023)	(0.0030)	(0.0023)	(0.0022)	(0.0026)
Cash+equivs/Assets pre-IPO		-0.0031	-0.0098	-0.0150	-0.0074	-0.0250
		(0.0210)	(0.0234)	(0.0202)	(0.0247)	(0.0145)
2-month post-IPO return					-0.0139	
					(0.0086)	
1-year post-IPO return						-0.0064**
						(0.0028)
Constant	0.0324***	0.0282	0.0222	0.0148	0.0220	0.0573*
	(0.0114)	(0.0233)	(0.0291)	(0.0268)	(0.0174)	(0.0294)
Calendar year FE	No	No	Yes	No	No	No
Industry (SIC 2) FE	No	No	Yes	No	No	No
Industry-Year FE	No	No	No	Yes	Yes	Yes
2-Month Return Decile FE	No	No	No	No	Yes	No
1-Year Return Decile FE	No	No	No	No	No	Yes
N	573	561	554	451	451	449
R^2	0.004	0.014	0.083	0.174	0.197	0.196

Table 6
Executive Compensation and Greenshoe Exercise

This table presents evidence that CEOs of greenshoe firms enjoy higher executive compensation. The dependent variable in all regressions is the logarithm of annual total compensation of the CEO, winsorized at 1% in both tails. The sample consists of IPOs after 2005 as executive compensation is hand-collected. Standard errors are clustered at the industry level (2-digit SIC code).

	(1)	(2)	(3)	(4)	(5)	(6)
Greenshoe × Post IPO	0.1869	0.1608	0.1054	0.0913	0.0903	0.1167
	(0.1166)	(0.1137)	(0.1128)	(0.1123)	(0.1206)	(0.1147)
Greenshoe	-0.0431	-0.0124	0.0537	0.0252	-0.0005	0.0146
	(0.1075)	(0.1030)	(0.0926)	(0.1053)	(0.0944)	(0.1047)
Post IPO	0.3869***	0.2646**	0.2948***	0.3058***	0.2967**	0.2902***
	(0.1010)	(0.1019)	(0.0941)	(0.1002)	(0.1088)	(0.0931)
2-month post-IPO return				-0.2332		
				(0.2939)		
1-year post-IPO return					-0.1418	
					(0.1477)	
Log(Assets pre-IPO)						0.3006***
						(0.0573)
Cash+equivs/Assets pre-IPO						0.1253
						(0.1962)
IPO size: relative to book assets						0.0192***
						(0.0054)
Constant	13.7555***	13.8376***	13.7726***	14.0821***	14.0008***	11.9587***
	(0.1115)	(0.1128)	(0.1056)	(0.4074)	(0.2497)	(0.3930)
Calendar year FE	No	Yes	No	No	No	No
Industry (SIC 2) FE	No	Yes	No	No	No	No
Industry-year FE	No	No	Yes	Yes	Yes	Yes
2-Month return decile FE	No	No	No	Yes	No	No
1-Year return decile FE	No	No	No	No	Yes	No
N	1,592	1,592	1,437	1,437	1,431	1,434
R^2	0.046	0.200	0.248	0.255	0.267	0.360

Table 7
Acquisitions and Executive Compensation: Year-level Analysis

This table presents regressions of M&A activity (columns 1-3) and executive compensation (columsn 4-6) on greenshoe exercise interacted with dummies for each post-IPO year. The dependent variable is either an acquisition dummy or the logarithm of annual total compensation of the CEO, winsorized at 1% in both tails. The sample consists of IPOs after 2005 as executive compensation is hand-collected. Standard errors are clustered at the industry level (2-digit SIC code).

	Acquisitions			Total Compensation		
	(1)	(2)	(3)	(4)	(5)	(6)
Greenshoe × IPO Years=1	0.0609*	0.0590*	0.0619*	0.0058	-0.0005	0.0143
	(0.0313)	(0.0300)	(0.0309)	(0.1738)	(0.1773)	(0.1755)
Greenshoe × IPO Years=2	0.0484**	0.0455**	0.0452**	0.2837**	0.2802**	0.2868**
	(0.0208)	(0.0223)	(0.0210)	(0.1146)	(0.1211)	(0.1156)
Greenshoe × IPO Years=3	0.0670**	0.0678**	0.0679**	0.1682	0.1593	0.2268*
	(0.0269)	(0.0256)	(0.0256)	(0.1253)	(0.1492)	(0.1244)
IPO Years=1	0.0451**	0.0445**	0.0456**	0.3543***	0.3485***	0.3557***
	(0.0181)	(0.0178)	(0.0179)	(0.1146)	(0.1216)	(0.1144)
IPO Years=2	0.1764***	0.1751***	0.1796***	0.1495	0.1425	0.1631
	(0.0476)	(0.0473)	(0.0476)	(0.1248)	(0.1283)	(0.1091)
IPO Years=3	0.1058***	0.1009***	0.1111***	0.3875**	0.4002**	0.3859**
	(0.0168)	(0.0171)	(0.0176)	(0.1720)	(0.1717)	(0.1441)
2-month post-IPO return	0.0332***			-0.3489		
	(0.0070)			(0.3426)		
1-year post-IPO return		0.0142***			-0.1712	
		(0.0044)			(0.1279)	
Log(Assets pre-IPO)			0.0197***			0.3092***
			(0.0031)			(0.0549)
Cash+equivs/Assets pre-IPO			-0.0166			0.1744
			(0.0322)			(0.1614)
IPO size: relative to book assets			0.0019***			0.0201***
			(0.0002)			(0.0051)
Constant	-0.0332**	-0.0085	-0.1039***	14.2148***	14.0346***	11.8691***
	(0.0144)	(0.0151)	(0.0305)	(0.4522)	(0.2252)	(0.3508)
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
2-Month Return Decile FE	Yes	No	No	Yes	No	No
1-Year Return Decile FE	No	Yes	No	No	Yes	No
N	5,008	4,973	5,000	1,379	1,373	1,376
R^2	0.178	0.186	0.179	0.268	0.282	0.379

Table 8
Placebo test: Secondary Greenshoe Exercise

This table presents evidence that firms with exercised secondary greenshoes (*i.e.,* where the selling shareholders, not the firm, receive the proceeds) behave in a similar way to firms where greenshoe consists of secondary shares but is not exercised. The sample thus consists only of firms whose greenshoe consists only of secondary shares. The dependent variable in columns 1-3 is a dummy that takes the value of 1 if a firm made an acquisition in a given year (set to 0 for the pre-IPO year due to data coverage issues). The dependent variable in columns 4-6 is the logarithm of total compensation, winsorized at 1% at both tails. Firm, calendar year and industry-year fixed effects are introduced progressively. All standard errors are clustered at the industry (2-digit SIC code) level.

	Acquisitions			Total Compensation		
	(1)	(2)	(3)	(4)	(5)	(6)
Secondary Greenshoe× Post IPO	-0.0191	-0.0382	-0.0142	0.0120	0.0667	0.0255
	(0.0237)	(0.0360)	(0.0321)	(0.2783)	(0.2639)	(0.2704)
Secondary Greenshoe	-0.0017	-0.0694*	-0.0293	0.4293	0.2669	0.2942
	(0.0347)	(0.0329)	(0.0408)	(0.3580)	(0.3788)	(0.3480)
Post IPO	0.1291*	0.1500	0.1233	0.2511	0.2450	0.1479
	(0.0635)	(0.0891)	(0.0752)	(0.1987)	(0.2441)	(0.2033)
2-month post-IPO return	-0.0768			0.9270		
	(0.4240)			(0.9157)		
1-year post-IPO return		0.2237			-0.0985	
		(0.2592)			(0.5006)	
Log(Assets pre-IPO)			0.0108*			0.1410
			(0.0055)			(0.1248)
Cash+equivs/Assets pre-IPO			-0.1000			-2.0226***
			(0.0711)			(0.5075)
IPO size: relative to book assets			0.0133			0.0873
			(0.0113)			(0.1902)
Constant	0.0862	-0.2939	-0.0635	12.9058***	14.2770***	13.5217***
	(0.4980)	(0.3952)	(0.0709)	(1.1746)	(0.8679)	(0.8084)
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
2-Month Return Decile FE	Yes	No	No	Yes	No	No
1-Year Return Decile FE	No	Yes	No	No	Yes	No
N	230	228	230	196	196	196
R^2	0.295	0.385	0.253	0.315	0.331	0.384

Appendix: Variable Definitions

Variable	Description	Source
Greenshoe	A dummy variable. It takes the value 1 if the greenshoe option is exercised and 0 otherwise.	Hand-collected from EDGAR
Secondary greenshoe	A dummy variable. Only exists for firms with a 100% secondary greenshoe. Takes the value 1 if the greenshoe is exercised in full and 0 otherwise.	Hand-collected from EDGAR (exercised), Dealogic (authorized)
Post IPO	A dummy variable. It takes the value 1 if the observation belongs to the year of the IPO or within two years following the IPO, and 0 in the year ending prior to the IPO.	
CEO compensation	Total CEO compensation in a year (salary, bonus, other annual, restricted stock grants and LTI). Winsorized at 1% in both tails by year, used as a logarithm in regressions.	Hand-collected from EDGAR
Acquisition dummy	Dummy for whether a firm has made at least one acquisition in a year. Set to 0 for pre-IPO years due to difficulty (lack of identifier) for matching pre-IPO acquisitions.	Dealogic
Abnormal announcement return (CAR -1, 1)	Acquirer return from the closing price 2 days prior to the announcement to 1 day after (-1,+1) from the announcement date of the merger minus the return from the CRSP value-weighted index for the same period. Note that we do not use an asset pricing model due to the difficulty of calibrating one for recently IPOed firms.	CRSP
Leverage	Total liabilities / Total assets, winsorized 1% both tails by calendar year.	COMPUSTAT
$\frac{\text{Cash+Equivalents}}{\text{Assets}}$	(Cash + Equivalents) / Total assets, winsorized 1% both tails by calendar year.	COMPUSTAT
Total assets	Total assets, used as a logarithm in regressions.	COMPUSTAT
Total liabilities	Total liabilities, used as a logarithm in regressions (+1).	COMPUSTAT
IPO size	The total value of shares issued in the IPO at the IPO price, including the greenshoe.	Dealogic
1-month return	First month return for the security after the IPO. Calculated using CRSP (22 trading days after the first observation in CRSP).	CRSP
2-month return	Same as above, except 2 calendar months instead of 22 trading days.	CRSP
Announcement return	Acquirer return (including dividends *etc*) from (-1,+1) from the announcement date of the merger.	CRSP (return), Dealogic (date)
Deal value	M&A Deal Value, used as a logarithm. Total enterprise value of an M&A acquisition.	Dealogic
Horizontal deal flag	Dummy that takes the value of 1 if the target of an acquisition is in a different 2-digit SIC industry as the acquirer.	Dealogic
All cash dummy	Dummy that takes the value 1 if an acquisition is paid for entirely with cash.	Dealogic
All share dummy	Dummy that takes the value 1 if an acquisition is paid for entirely with shares.	Dealogic