SIGNALING REVISITED: THE USE OF SIGNALS IN THE MARKET FOR IPOS

U. DAVID PARK,* **ABHISHEK BORAH, and SURESH KOTHA**
Department of Management and Organization, Foster School of Business, University of Washington, Seattle, Washington, U.S.A.

Research summary: *Scholars have actively researched the initial public offering (IPO) underpricing phenomenon as it relates to the issuing firm's resource acquisition and entrepreneur's wealth retention. In this study, we attempt to replicate three studies that examine how top management and board-level characteristics impact IPO underpricing using signaling theory. Focusing on a different time period and using a new sample of 234 U.S. IPO firms, we do not find evidence for the signaling effects of top management, governance structure, and social ties on resource acquisition and wealth retention during the IPO process. We propose possible theoretical and empirical reasons for our results and discuss two major external changes that researchers should account in future research.*

Managerial summary: *Past studies on initial public offering (IPO) underpricing have systematically documented the effectiveness of signals (i.e., having seasoned CEO and top management team, director independence, and director network) that influence the amount of money entrepreneurs "leave on the table" during the IPO process. Since these studies were conducted before the ongoing information revolution, we re-examined the effectiveness of these signals in the current IPO market. Despite using similar methodological approaches that past studies used, we do not find evidence supporting the prior findings. To explain our findings, we discuss two notable recent changes—unprecedented access to information and a regulatory change—that future researchers should examine in the context of IPO underpricing research.* Copyright © 2016 John Wiley & Sons, Ltd.

INTRODUCTION

Initial public offerings (IPO) are a key milestone confronting a new venture. Based on an extensive review of the IPO literature, Ritter and Welch (2002) note that firms generally go public to raise capital for projects and create a market for inside shareholders to cash out their wealth. Although the criteria for IPO success varies, depending on the actions taken by different actors (i.e., issuing firm, underwriters of the shares, post-IPO investors), a successful IPO for the issuing firm necessitates that

the firm garners and retains as much of its financial resources as possible to minimize "money left on the table" post-IPO—representing the difference between the closing price on the first day of trading and the offer price, multiplied by the number of shares sold—in what is generally referred to as IPO underpricing (Rock, 1986).[1] The greater the difference between the closing and offer prices, the higher the profit for investors who acquire shares at the offer price, and the lower the profit for the issuing firm's management and employees.[2] The "money

---

[1] This definition of IPO underpricing is consistent with the extant IPO literature, where "underpricing" can refer to both under- and overpricing (e.g., Arthurs *et al.*, 2008; Certo, Holcomb, and Holmes, 2009; Judge *et al.*, 2015; Ritter and Welch, 2002).

[2] Unless the entrepreneurs of the issuing firm keep a high percentage of the firm's shares at the end of the first day of trading.

left on the table" indicates the wealth transfer from the shareholders of the issuing firm to public investors. As Certo *et al.* (2001: 657) noted, "Wealth creation occurs not only when entrepreneurs build their businesses but also when and if they personally lead their businesses into the public ownership domain." Thus, both entrepreneurs and issuing firms need to understand strategies that enable them to retain the wealth they create during the IPO process.

Evidence suggests that firms consistently leave money on the table more often than they intend to; from 2001 to 2014, firms experienced an average of 13.6 percent of underpricing in the United States. This 13.6 percent translates to more than $49.50 billion in lost revenue for the IPO stock issuing firms (Ritter, 2014). In other words, entrepreneurs of IPO firms missed significant opportunities to realize the full value of their ventures by leaving substantial amounts of money on the table during the IPO process.

Given the amount of capital involved and the consequences for issuing firms, scholars in multiple disciplines have investigated the IPO phenomenon, especially IPO underpricing. A review of the relevant literature reveals that more than 330 articles have been published in leading finance, accounting, and economics journals that primarily investigate IPOs.[3] Scholars of strategy, management, and entrepreneurship have shown a growing interest in the phenomenon. Since 1988, when the first research paper on this topic was published, more than 173 articles have appeared in leading strategy, management, and entrepreneurship journals.[4] Among these studies, the IPO underpricing phenomenon has received the most attention, garnering 30 different articles.[5]

Strategic management research examining the IPO underpricing phenomenon focuses primarily on signals affecting investors' perceptions about the value of the firm pursuing an IPO. Such signals represent observable characteristics of the IPO firm constructed as entrepreneurial actions undertaken by the firm at the time of the IPO (Downes and Heinkel, 1982). The IPO firm then uses these signals to decrease the information asymmetry between the IPO firm and investors (Beatty and Ritter, 1986; Rock, 1986). Decreasing information asymmetry enables firms to decrease underpricing, thereby reducing the amount of money left on the table.

The signals scholars have examined include the composition and structure of top management, corporate governance mechanisms at the time of the IPO, and the firm's social ties (see Certo *et al.* [2009] for an extensive review).[6] Scholars argue that the composition and structure of the top management team, including the CEO, serve as important signals to investors about the IPO firm's potential value (Cohen and Dean, 2005; Lester *et al.*, 2006; Nelson, 2003). Some scholars have suggested that corporate governance mechanisms manifested in board characteristics at the time of IPO may serve as an important signal regarding firm's value (Certo, 2003; Filatotchev and Bishop, 2002). Finally, the network of social ties assembled by IPO firms is often seen as a signal of a firm's quality and legitimacy, informing investors about the firm's potential value (Filatotchev and Bishop, 2002; Pollock, Porac, and Wade, 2004; Stuart, Hoang, and Hybels, 1999).

Given growing interest in the IPO underpricing topic and the concomitant use of signaling theory, with information asymmetry as its underlying mechanism, to explain this phenomenon, we believe it is appropriate, even necessary, to replicate past studies on signaling in the IPO process to ensure the validity and reliability of prior findings (Bettis *et al.*, 2016).[7] These studies may contain Type I

---

[3] The leading journals searched were *Accounting Review, Journal of Accounting and Economics, Journal of Accounting Research, Journal of Finance, Journal of Financial Economics*, and *Review of Financial Studies*.

[4] Following Certo and his colleagues (2009), we searched Thompson Corporation's Web of Science database for articles containing the terms *initial public offering(s)* or *IPO(s)* in their titles, abstracts, and key words through September 2014. The 12 journals searched include *Academy of Management Journal, Academy of Management Review, Administrative Science Quarterly, Entrepreneurship Theory and Practice, Journal of Business Venturing, Journal of Management, Journal of Management Studies, Journal of Small Business Management, Management Science, Organization Science, Strategic Management Journal*, and *Strategic Entrepreneurship Journal*, which has become one of the leading entrepreneurship journals.

[5] In 2014, there were six articles on IPOs and three specifically focusing on IPO underpricing in *Strategic Management Journal*,

suggesting that IPO underpricing is an important issue in strategic management research.

[6] One recent study has examined the role played by innovation (operationalized as patents held by the firm pursuing an IPO) as a signaling mechanism (i.e., Hsu and Ziedonis, 2013). However, as the number of patent-holding new ventures pursuing an IPO is quite small, the generalizability of such results is rather limited.

[7] Technically our study is a "replication with extension" that departs from the original studies we examine in several aspects while largely repeating the original studies and their generalizability (Singh, Ang, and Leong, 2003).

errors since many focus on controlling for or minimizing Type II errors. Type I errors are caused by an erroneous rejection of the null hypothesis (Hubbard, Vetter, and Little, 1998). Such replication should foster greater scientific knowledge and extend our understanding of how signaling affects the IPO phenomenon (Hubbard *et al.*, 1998; Singh *et al.*, 2003). Given our interest in strategic management, we have focused on empirical studies published in the *Strategic Management Journal* (*SMJ*).

Based on a literature review of the articles published in *SMJ* through 2013, we identified three studies—Certo *et al.* (2001), Filatotchev and Bishop (2002), and Cohen and Dean (2005)—that use signaling theory to examine IPO underpricing with information asymmetry as its underlying theoretical mechanism. We chose these studies to replicate for the following reasons. First, each used signaling theory, albeit different aspects, to examine the IPO underpricing phenomenon, which enabled us to ask whether the findings were generalizable to a different sample of firms. Second, all three studies were conducted prior to the emergence of social media and the availability of powerful Internet-based information technologies (see Discussion section). This altered context provided an opportunity to validate prior findings using a time period where information about IPO firms is readily available and social media channels have proliferated, making it easier for potential investors to communicate with both the firm and each other. Third, one study, Filatotchev and Bishop (2002), took place in the United Kingdom, allowing us to examine whether findings were replicable across a different geographical setting.

By closely following each study and using the same exclusion and inclusion criteria for constructing a sample, left and right side variables, and statistical methods (Raffiee and Feng, 2014), we revisited prior studies with a sample of firms that went public between 2010 and 2013. We also used different empirical tests to ensure the robustness of findings, including a state-of-the-art model of IPO underpricing, and accounting for Type I errors when controlling for or minimizing Type II errors (see Appendix S1).

The results of our replication were surprising because we did not find support for any of the major assertions of the studies we attempted to reproduce. Instead, we found that the signals shown to influence IPO underpricing no longer seemed to apply in the present context. To interpret our results, we focused our explanations on one or a combination of three possible interpretations: theory, empirics, and changed-boundary conditions. Below we elaborate on each study.

REPLICATED STUDIES

Study No. 1: Certo *et al.* (2001)

Certo *et al.*'s (2001) study was one of the first to examine IPO underpricing from a strategic management perspective. Drawing on founder management and corporate governance perspectives, the authors investigated the effects of founder management on wealth creation and retention during the IPO process since, according to them, wealth creation and retention are the defining objectives of the entrepreneurial process. Due to differing opinions between underwriters and investors on whether a founding CEO's presence at the time of IPO adds value, Certo *et al.* noted that the presence of founder management may pose managerial uncertainty, leading in turn to lower firm valuation by underwriters at the time of IPO. They hypothesized that the presence of a founder CEO may increase IPO underpricing, in effect decreasing wealth retention for the firm's initial shareholders. In other words, "if the value of the equity sold to the investment banker increases during the first day of the public trading, the appreciation in the value benefits the first-day investors rather than the initial shareholders who sold their equity to the investment banker" (p. 641). Further, they posited that the IPO market share of the investment banker (a proxy for the underwriters' credibility and bargaining power) and/or proportion of insiders on the IPO firm's board of directors could moderate their main hypothesis. They empirically validated their hypotheses by using a sample of 368 U.S. IPOs (10 years old or less) between 1990 and 1998. Their findings demonstrated that the presence of a founder CEO at the time of IPO can serve as an important signal of value during the IPO process.

Study No. 2: Filatotchev and Bishop (2002)

Filatotchev and Bishop (2002) examined how specific characteristics in corporate governance affect IPO underpricing. Using agency theory, they suggested that certain governance characteristics or indicators such as share ownership by the IPO's

executive directors and non-executive directors, proportion of non-executives, and presence of a non-executive chairman may have an impact on IPO underpricing. They claimed that these governance indicators may provide a positive signal that managerial and shareholder interests are closely aligned and that strong monitoring mechanisms are in place to ensure an alignment of interests.

In addition, they suggested that the benefits of social ties with members of other boards may lead to a decrease in underpricing. Such ties would provide a positive signal about the IPO's value because they signify the venture may have bargaining power against underwriters and investors. After analyzing a sample of 251 IPOs offered in the United Kingdom from 1999 to 2000, they found that a high proportion of non-executive directors and external directorships held by non-executive directors did indeed reduce IPO underpricing, supporting their hypothesis. This study demonstrated that corporate governance indicators manifested in board characteristics and directors' ties at the time of IPO may serve as important signals of value.

Study No. 3: Cohen and Dean (2005)

Cohen and Dean (2005) investigated how the composition of a venture's top management team (TMT) can influence IPO underpricing. Using Rock's (1986) theory of information asymmetry between current owners and potential investors, they posited that "the legitimacy of the top management team may serve as a valid signal of value to potential investors" (p. 683). Using a legitimacy index comprised of prior TMT experience, industry experience, TMT age, and education, they analyzed 121 U.S. IPO firms (15 years old or less) that went public between 1998 and 1999. They found that TMT legitimacy was negatively associated with post-IPO stock value run-up.[8] Unpacking the TMT legitimacy index measure further suggested that prior TMT experience, industry experience, and TMT age may decrease IPO stock value run-up, while education of top management had no effect on IPO pricing. This study demonstrated that TMT characteristics at the time of IPO also serve as an important signal of value.

Using a strategic management perspective, these three studies focus on firm-specific signals affecting investor perception of the value of firms pursuing an IPO. We provide a detailed summary of each study in Table 1. While Certo *et al.,* and Cohen and Dean focused on founder status or top management composition, Filatochev and Bishop examined board-level and corporate governance characteristics as signals of firm value in the presence of uncertainty and information asymmetry. Despite the differences in unit of analysis, all three build on Rock's (1986) information-asymmetry hypothesis, which argues that underpricing is a product of information disparities between informed and uninformed investors regarding value.

APPROACH AND RESULTS

Approach

We replicated each study discussed above using a sample of U.S. IPO firms that submitted registration (S-1) documents to the Securities and Exchange Commission (SEC) between January 2010 and May 2013. We chose this time period since post-2009 marked a new era in terms of how firms, consumers, and investors share and gather information. Almost all investors (not just resource-rich institutional investors) now have unprecedented access to press releases and firm information via social media channels, Internet search engines such as Google and Bing, and websites such as Wikipedia, Investopedia, and CrunchBase. Moreover, firms can now directly connect to investors using Twitter or Facebook. Potential investors can "follow" firms of their choosing with minimal effort using social media tools. Thus, this period may represent a new era in how firms signal value to potential investors.

Following the literature on IPO underpricing, and consistent with the studies we replicated, we excluded reverse leveraged buyouts, closed-end mutual funds, real estate investment trusts (REITs), spin-offs, and "demutualizations" of savings banks and insurance companies (e.g., Loughran and McDonald, 2013; Pollock and Rindova, 2003; Ritter, 1991). In accordance with other IPO studies, we included only those IPO firms with offer prices over $5 a share and IPO proceeds above $5 million. Five firms were dropped because of missing data, leaving us with a sample of 234 IPO firms for which we hand-collected complete data. More than

---

[8] Unlike the first two studies, Cohen and Dean (2005) took Carter and Manaster's (1990) IPO price run-up for their measure of IPO underpricing, which is calculated as the rate of price appreciation between the offer price and market trading price occurring two weeks later.

Table 1.   Summary details of the studies we replicate

Article	Theory	Sample	Main findings
Certo *et al.* (2001)	1. Information asymmetry between underwriter and investors increases with founder bias discount of underwriter and pro-entrepreneurship bias of investors when firms have founder CEO 2. Bargaining power imbalance between issuer and underwriter would increase founder bias discount 3. Increased number of inside directors complements founder CEO while having more outside directors positively signals for firms with nonfounder CEO	368 IPOs listed on the U.S. Stock Exchange (1990–1998)	The presence of Founder CEOs increases IPO underpricing The founder CEO effect on IPO underpricing increases when having powerful underwriters, while it decreases when having more inside directors
Filatotchev and Bishop (2002)	Information asymmetry between underwriter and investors would decrease when firms signal their quality through structuring incentive alignment, board diversity, CEO-chairmain non-duality and directors with outside board ties	251 IPOs listed on the London Stock Exchange and Alternative Investment Market (1999–2000)	Certain governance characters (i.e., the high proportion of non-executive directors) and social ties of board members (i.e., the number of outside directorships per non-executive) reduce IPO underpricing Share ownership of directors do not have an impact on IPO underpricing
Cohen and Dean (2005)	IPO firms signal their quality through the legitimacy of top management team to decrease information asymmetry	121 IPOs listed on the U.S. Stock Exchange (1998–1999)	Legitimacy of a new venture's top management team decreases IPO underpricing

2,000 man hours were spent collecting and coding the data.

Each variable used in the studies we sought to replicate were measured as closely as possible, using multiple data sources, including Securities Data Company (SDC) Global New Issues Databases, SDC VentureXpert, IPOScoop.com, Compustat, Center for Research in Security Prices (CRSP), LexisNexis, prospectus documents, Thomson Reuters 13(f), and Loughran and Ritter's (2004) underwriter rankings. Table 2 lists the variables for each study, the source of the data, and how we measured them for replication. Each study was followed as closely as possible, using the same exclusion and inclusion criteria for constructing sample, left, and right side variables (Raffiee and Feng, 2014).

Given the nature of our sample and our inability to access past databases, we omitted or modified our approach for the following variables. First,

we used Loughran and Ritter's (2004) updated version of underwriter rankings to capture their reputation rank; Cohen and Dean (2005) used the underwriter reputation rankings provided by Carter and Manaster (1990). We made this choice because updated reputation ranking measures include data through the end of 2011, making these new rankings more relevant to our sample and chosen time frame.

In order to replicate the study by Certo *et al.* (2001), we substituted investment bankers' (underwriters') market share measure with underwriter reputation rankings because we were unable to access the database used by Certo *et al.* (2001), and because theoretically an underwriter's market share would be highly correlated with reputation rankings. We also omitted the *IPOs before April 2000* variable from Filatotchev and Bishop's (2002) study, as this variable fell outside our time frame. With the exception of these changes, we followed

Table 2.   A summary of methodological details of the three studies we replicate

Article	Type	Variable	Operationalization	Source
Certo et al. (2001)	DV	IPO underpricing	$(Price_{end} - Price_{offered})/Price_{offered}$	SDC and IPOScoop.com
	IV	Founder CEO	Dummy variable if CEO is the founder	S-1 document
	MVs	Investment banker market share (underwriter reputation)	Underwriter rankings: 2 (low) to 9 (high)	Loughran and Ritter's underwriter rankings
	CVs	Proportion of inside director	# of inside directors / # of outside directors	S-1 document
		Firm size	Logged firm's sales	Compustat
		Firm age	# of years from founding	Ritter's firm age data, webpage
		CEO retained equity percentage	% of CEO share ownership after IPO	424b document
		Number of risk factors	# of risk factors listed in S-1 document	S-1 document
		Additional directorship held by board insiders CEO age	Total # of outside directorship of inside directors	
		Industry	Computer hardware, computer software, semiconductor and printed circuits, biotech, telecommunications, pharma, specialty chemicals, and aerospace	SIC code
Filatchev and Bishop (2002)	DV	IPO underpricing	$(Price_{end} - Price_{offered})/Price_{offered} \times 100$	SDC and IPOScoop.com
	IVs	Director share ownership	Summed share ownership % after IPO	S-1, 424b document
		Outside directorship	Total # of outside directorship of non-executives directors	
		Proportion of non-executive directors	Dummy variable if they have more than 33%	
		Outside directorship per non-executive	Average # of outside directorship per non-executive directors	
		Non-executive share ownership	Summed share ownership % after IPO	
		Non-executive chairman	Dummy variable if chairman is non-executive director	
	CVs	Capitalization (IPO size at offer price)	# of offered share × offer price	Compustat
		Firm age	# of years from founding	Ritter's firm age data, webpage
		Industry (finance, IT and others)		SIC code
		IPO before April 2000	Not applicable	
Cohen and Dean (2005)	DV	IPO underpricing run-up	$(Price_{end}$ (two weeks after IPO)$ - Price_{offered})/Price_{offered} \times 100$	SDC, IPOScoop.com, CRSP
	IVs	TMT Legitimacy	Logged sum of below four independent variables	S-1 document
		TMT experience	# of top managers with industry experience	
		TMT industry experience	# of top managers with prior top management experience	
		TMT age	# of top managers aged 40 or over	
		TMT education	# of top managers with advanced degrees (master or above)	
	CVs	Industry dummy	Manufacturing, transportation, wholesale, retail and finance	SIC code
		Firm age	# of years from founding	Ritter's firm age data, webpage
		Insider shares after the offer	Summed executive share ownership % after IPO	424b document
		Underwriter reputation	Underwriter rankings: 2 (low) to 9 (high)	Loughran and Ritter's underwriter rankings
		Offer size	Logged total proceeds raised at IPO	424b document
		Net income after tax		Compustat

DV: Dependent variable; IV: Independent variable; MV: Moderating variable; CV: Control variable.

Table 3. Comparisons of means and standard deviations between our samples versus the studies we replicate

Variables	Certo *et al.* (2001)		New sample	
	Mean	S.D.	Mean	S.D.
Dependent variable				
Unretained wealth (underpricing)	0.17	0.23	0.14	0.24
Control variables				
Firm size (log of sales revenue)	67.00	164.00	183.61	544.76
Firm age	5.31	2.80	5.57	2.80
CEO retained equity (%)	13.50	17.26	8.84	13.29
Risk factors	17.79	4.63	50.51	10.50
Insider additional directorship	1.25	1.91	0.47	0.60
CEO age	47.07	8.04	50.26	8.52
Industry dummy	0.50	0.50	0.65	0.48
Independent/moderating variables				
CEO founder status dummy	0.48 (48%)	0.50	0.23 (23%)	0.42
Investment banker market share	0.04	0.04	8.26	1.65
Proportion of insiders	0.39 (39%)	0.18	0.24 (24%)	0.20

Variables	Filatotchev and Bishop (2002)		New Sample	
	Mean	S.D.	Mean	S.D.
Dependent variable				
Underpricing	29.61 (%)	87.40	14.58 (%)	22.57
Control variables				
IPO before April 2000	0.29	0.52		
Capitalization	1.41	0.71	2.46	1.06
Age	5.44	13.83	15.53	20.02
Financial sector	0.30	0.40	0.01	0.11
Information technology	0.22	0.42	0.26	0.44
Independent variables				
Executive share ownership	25.74	21.71	8.79	13.09
Outside directorship, total	17.91	16.92	11.40	8.97
Proportion of non-executives >33%	0.84	0.41	0.96	0.19
Outside directorship per non-executive	8.42	6.82	1.91	1.34
Non-executive chairman	0.63	0.53	0.42	0.49
Non-executives' share ownership	7.47	12.43	25.78	21.75

Cohen and Dean (2005) do not provide descriptive statistics.

the variables and approaches used by the studies we sought to replicate.

All researchers used multiple regression analysis to test their hypotheses; we used the same statistical methods and approach in replicating each study.

Results

Descriptive statistics

Table 3 compares the descriptive statistics from our sample with the replication studies. In terms of Certo *et al.*'s (2001) study, there were some similarities and differences in the descriptive statistics. Following the original study, we limited the sample to firms that were less than 10 years old. The mean and standard deviation of the dependent variable,

underpricing, are similar (0.14 and 0.24 for our sample versus 0.17 and 0.23 for the Certo *et al.* sample). For independent variables, the number of founder CEOs in our sample is much smaller (23% compared to 48%). The number of insiders on the board also decreased from 39 to 24 percent.

We saw changes in control variables as well. For example, *firm size*, *risk factors in S-1 documents*, and *CEO age* all increased, while *CEO-retained equity (%)* and *insiders' additional directorships* of other firms decreased. *Investment banker market share* has a different mean and standard deviation since we substituted underwriter reputation rankings for the *investment banker market share* measure, both serving as proxies for the bargaining power of the banker.

A comparison of the descriptive statistics of our sample with those of Filatotchev and Bishop (2002) highlights a few differences, which may be partially due to the difference in geographical context. Overall, the mean underpricing and the variation around the mean is greater in the United Kingdom sample (mean = 29.61 and S.D. = 87.4) than our sample (14.58 and 22.57).[9] On average, *executives' share ownership* (25.74 in Filatotchev and Bishop's study versus 8.79 in our sample), *total outside directorship* (17.91 versus 11.4 in our sample), *outside directorship per non-executive director* (8.42 versus 1.91 in our sample), and *non-executive chairmanship* (0.63 compared with 0.42 in our sample) are higher in Filatotchev and Bishop's data, whereas the *proportion of non-executive directors* (0.96 in our sample versus 0.84) and *non-executives' share ownership* (25.78 in our sample versus 7.47) are higher in our sample of U.S. IPO firms. The mean and standard deviations of control variables are also different. The mean values of *capitalization* and *firm age* are higher in our sample. Unfortunately, the descriptive statistics information for Cohen and Dean's study was not available for comparison.

Table 4 provides correlation tables for each study we replicated. None of the variables for Certo *et al.* (2001) are highly correlated. For Filatotchev and Bishop's (2002) study, we found *total outside directorships* and those involving non-executive directors are correlated at 0.86. However, when we checked for multicollinearity issues by examining variance inflation factors (VIFs), the values for each variable are below 5. The legitimacy index and TMT age variables in Cohen and Dean's (2005) study are also highly correlated at 0.84, but these variables were not analyzed in the same model in the original study. Thus, we are not concerned with multicollinearity affecting the findings of our replication.

Replication results for study No. 1: Certo et al. *(2001)*

Table 5 (see Models 1–4 for original results, Models 5–8 for replication results) compares Certo *et al.*'s (2001) results with our findings. We report the exact p−values in parentheses. As noted, Certo and colleagues examined the effect of founder CEO on underpricing and how the underwriter's market

share and inside directors may moderate this relationship. We limited our sample by dropping firms older than 10 years, per Certo *et al.*'s sample selection. While the Certo study found strong support for their hypotheses (i.e., for *founder status*, $\beta = 0.056$, $p = 0.02$ in Model 2; for *Founder × Banker market share*, $\beta = 1.098$, $p = 0.003$ in Model 3; for *Founder × Proportion of insiders*, $\beta = -0.269$, $p = 0.03$ in Model 4), our evidence did not support the original results. Our results show that the presence of a founder CEO had no impact on IPO underpricing, and neither of the moderator variables were significant in our analysis.

Interestingly, none of the control variables significantly influenced IPO underpricing in our results. In the main models (Models 6−8), *firm size*, *firm age*, *risk factors*, *proportion of insiders*, *insider additional directorship*, and *CEO age* are consistently insignificant compared with the original results. The significance of *investment banker market share*, *CEO retained equity*, and *high-tech industry* disappeared from our models. Firm age is significant only for the control model ($\beta = 0.020$, $p = 0.01$ in Model 5), while *risk factors* is marginally significant in Models 5−8 ($\beta = -0.004$, $p = 0.10$).

Since Certo *et al.*'s (2001) sampled firms were 10 years old or less at the time of IPO, we ran additional analyses by expanding the sample to include all IPO firms during the 2010−2013 time frame. The results of this robustness check are consistent with those provided in Table 5. Once again, our evidence did not support the original results.[10]

Replication results for study No. 2: Filatotchev and Bishop (2002)

In Table 6 (see Models 1–5 for original results, Models 6–10 for our replication results), we compare Filatotchev and Bishop's analyses with our replicated efforts. The original study used standardized beta coefficients, which we replicated. We report the exact p−values in parentheses for the replicated models. We were unable to reproduce the exact p−values for the original results as the original study did not report the standard errors. Recall that Filatotchev and Bishop (2002) focused on the signaling effects of board characteristics on IPO underpricing. They used six variables (*executive share ownership*, *total outside*

---

[9] Filatotchev and Bishop measured underpricing in terms of percentage whereas Certo *et al.* used the raw underpricing value (see Table 2).

[10] The results of these additional analyses are available on request from the authors.

Table 4.   Correlation tables for each of our replication studies

Following Certo *et al.* (2001)	1	2	3	4	5	6	7	8	9	10
1. IPO underpricing (unretained wealth)										
2. Firm size (sales revenue)	0.219									
3. Firm age	0.298	0.124								
4.Underwriter reputation (investment banker market share)	0.198	0.432	0.109							
5. CEO retained equity (%)	0.099	0.041	0.046	−0.236						
6. Risk factors	−0.126	0.166	−0.246	0.240	−0.073					
7. Proportion of insiders	−0.060	−0.045	−0.174	−0.359	0.274	0.002				
8. Insider additional directorships	−0.017	−0.110	−0.202	0.055	−0.035	0.335	0.054			
9. CEO age	−0.163	−0.159	−0.157	−0.244	−0.051	0.038	0.231	0.285		
10. Industry dummy	−0.005	−0.154	0.030	−0.190	0.108	−0.190	0.191	0.043	0.150	
11. CEO founder status dummy	0.038	−0.150	0.052	−0.113	0.343	−0.053	−0.040	0.028	−0.094	0.138

Following Filatotchev and Bishop (2002)										
1. Underpricing										
2. Capitalization	−0.044									
3. Age	−0.059	0.014								
4. Financial sector	−0.017	−0.011	0.035							
5. Information technology	0.346	0.084	−0.168	−0.068						
6. Executives' share ownership	0.134	−0.045	−0.081	−0.044	0.020					
7. Outside directorship, total	−0.120	0.071	−0.052	−0.073	−0.132	−0.267				
8. Proportion non-executives >33%	0.047	0.022	−0.014	0.023	−0.031	−0.213	0.255			
9. Outside directorships per non-executive director	−0.149	0.049	−0.111	−0.071	−0.146	−0.250	0.857	0.285		
10. Non-executive chairman	−0.063	−0.074	0.099	0.057	−0.117	−0.251	0.156	0.170	0.124	
11. Non-executives' share ownership	0.255	−0.021	−0.166	−0.003	0.091	−0.109	0.216	0.238	0.191	0.228

Following Cohen and Dean (2005)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. IPO underpricing (run-up)															
2. Manufacturing	−0.074														
3. Transportation	0.024	−0.189													
4. Wholesale	0.007	−0.132	−0.042												
5. Retail	0.065	−0.209	−0.067	−0.047											
6. Finance	−0.011	−0.058	−0.019	−0.013	−0.021										
7. Firm age	0.175	−0.025	0.019	0.018	0.013	0.069									
8. Insider share	0.143	−0.088	0.064	0.121	−0.082	−0.028	0.026								
9. Underwriter reputation	0.073	0.040	0.058	0.064	0.035	0.033	0.156	−0.314							
10. Offer size	0.016	0.092	0.007	0.031	0.022	−0.039	−0.080	−0.222	0.596						
11. Net income	−0.070	−0.043	−0.149	−0.025	0.032	0.007	0.040	−0.013	0.002	0.241					
12. Legitimacy	0.196	0.033	−0.037	−0.002	0.128	0.016	0.225	−0.181	0.231	0.079	−0.051				
13. Prior TMT experience	0.191	−0.011	−0.033	−0.132	−0.001	−0.010	−0.043	0.123	−0.048	−0.005	0.002	0.439			
14. Industry experience	0.172	−0.042	−0.014	−0.009	−0.030	−0.029	−0.072	0.130	−0.006	0.072	0.079	0.462	0.649		
15. Age	0.138	0.054	−0.036	0.000	0.177	−0.007	0.259	−0.298	0.269	0.086	−0.068	0.837	0.068	0.120	
16. Education	0.045	0.064	−0.089	0.048	−0.011	0.118	0.076	−0.131	0.119	0.060	−0.029	0.184	0.077	0.078	−0.010

directorships, *proportion of non-executives*, *outside directorships per non-executive*, *non-executive chairman*, and *non-executives' share ownership*) and found two of these variables (i.e., the *proportion of non-executive directors* ($\beta = -0.13$, $p < 0.05$ in Model 5) and *outside directorships per non-executive* ($\beta = -0.26$, $p < 0.01$ in Model 5) were

statistically significant. However, our replication results do not support the original findings, in that none of these two significant variables is statistically significant in our replicated models (see *Replication Results*, Model 10).

The three remaining variables in Filatotchev and Bishop's (2002) study (*executive share ownership*,

Table 5.   Replication results for Certo *et al.*'s (2001) study (*p*-value in parentheses)

Variables	Original results				Replication results			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Control variables								
Constant	0.083	0.039	0.087	0.087	0.056	0.052	0.043	0.055
	(0.48)	(0.74)	(0.46)	(0.47)	(0.80)	(0.82)	(0.85)	(0.81)
Firm size (log sale)	0.000	0.001	0.001	0.001	0.017	0.018	0.018	0.018
	(1.00)	(0.74)	(0.74)	(0.74)	(0.13)	(0.13)	(0.13)	(0.14)
Firm age	−0.035	−0.039	−0.04	−0.034	0.020	0.020	0.020	0.020
	(0.10)	(0.05)	(0.05)	(0.09)	(0.01)	(0.01)	(0.01)	(0.01)
Investment banker market share[a]	1.949	1.965	1.098	1.919	0.022	0.022	0.025	0.021
	(0.00)	(0.00)	(0.00)	(0.00)	(0.16)	(0.16)	(0.17)	(0.18)
CEO retained equity (%)	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002
	(0.32)	(0.32)	(0.32)	(0.32)	(0.28)	(0.34)	(0.37)	(0.32)
Risk factors	0.003	0.003	0.002	0.003	−0.004	−0.004	−0.004	−0.004
	(0.32)	(0.32)	(0.51)	(0.32)	(0.10)	(0.10)	(0.10)	(0.10)
Proportion of insiders	0.011	0.017	0.03	0.141	0.038	0.041	0.041	0.055
	(0.87)	(0.80)	(0.64)	(0.11)	(0.74)	(0.73)	(0.73)	(0.65)
Insider additional directorship	0.000	0.001	0.002	0.000	0.049	0.049	0.050	0.048
	(1.00)	(0.87)	(0.74)	(1.00)	(0.20)	(0.21)	(0.20)	(0.22)
CEO age	0.000	0.000	0.000	0.000	−0.003	−0.003	−0.003	−0.003
	(1.00)	(1.00)	(1.00)	(1.00)	(0.30)	(0.31)	(0.29)	(0.33)
Industry dummy (high-tech)	0.083	0.08	0.079	0.081	0.001	0.000	0.001	−0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.98)	(1.00)	(0.98)	(0.99)
Indpendent variables								
Founder status		0.056	−0.011	0.158		0.008	0.070	0.034
		(0.02)	(0.72)	(0.003)		(0.88)	(0.76)	(0.68)
Founder × banker market share			1.098				−0.008	
			(0.003)				(0.78)	
Founder × proportion of insiders				−0.269				−0.119
				(0.03)				(0.67)
N	368	368	368	368	130	130	130	130
R^2	0.182	0.195	0.221	0.205	0.173	0.173	0.174	0.175
Adj R^2	NA	NA	NA	NA	0.111	0.104	0.097	0.098
F	8.855	8.624	9.158	8.347	2.79	2.50	2.26	2.27
Prob > F	0.001	0.001	0.001	0.001	0.005	0.009	0.016	0.015

[a] Underwriter reputation; *p*-value in parentheses.

non-executive chairman, and *non-executives' share ownership*) did not reach statistical significance (see *Original Results*, Model 5). In contrast, we found *executive share ownership* ($\beta = 0.126$, $p = 0.05$) and *non-executives' share ownership* ($\beta = 0.267$, $p < 0.001$) to be both statistically significant and positively related to IPO underpricing (see *Replication Results*, Model 10). In other words, they reduce the firm's ability to retain the wealth created during the IPO process. Consistent with the original study, we found the *non-executive chairman* variable to be statistically insignificant. Thus, we are unable to generalize the U.K. findings to a U.S. setting, but instead find results that contradict prior findings.

Finally, in the original study, two control variables had a positive effect on IPO underpricing: *IT industry* ($\beta = 0.15$, $p < 0.05$) and IPOs before the

Internet bubble burst ($\beta = 0.35$, $p < 0.001$). In our replication attempt, we did find a positive IT industry effect ($\beta = 0.307$, $p < 0.001$ in Model 10), but we did not include an *IPO before April 2000* variable in our models since our sample focused on IPOs from 2010 to 2013. In the original study, *capitalization* is significant in three of the five models ($p < 0.05$ in Models 2–4). However, we did not find a significant effect for *capitalization* on underpricing. Other control variables such as *firm age* and *financial sector* are consistently insignificant.

Replication results for study No. 3: Cohen and Dean (2005)

Table 7 (see Models 1–6 for original results, Models 7–12 for replication results) provides the results

Table 6.   Replication results for Filatotchev and Bishop's (2002) study (p-value in parentheses)

Variables	Original results					Replication results				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control variables										
Capitalization	−0.12	−0.14*	−0.13*	−0.14*	−0.12	−0.068 (0.27)	−0.065 (0.29)	−0.066 (0.28)	−0.067 (0.28)	−0.059 (0.32)
Age	−0.07	−0.07	−0.07	−0.09	−0.07	0.011 (0.87)	0.008 (0.89)	−0.003 (0.96)	−0.003 (0.96)	0.040 (0.53)
Financial Sector	0.10	0.12	0.11	0.10	0.10	0.012 (0.85)	0.005 (0.94)	0.003 (0.97)	0.003 (0.96)	0.001 (0.98)
Information technology	0.12*	0.15*	0.14*	0.14*	0.15*	0.351 (0.00)	0.345 (0.00)	0.338 (0.00)	0.337 (0.00)	0.307 (0.00)
IPO before April 2000	0.34***	0.34***	0.34***	0.35***	0.35***					
Independent variables										
Executive share ownership	−0.09	−0.10	−0.10	−0.10	−0.11	0.125 (0.04)	0.131 (0.04)	0.127 (0.05)	0.126 (0.06)	0.126 (0.05)
Outside directorship, total		0.21**	0.21*	0.21*	0.19		−0.061 (0.36)	0.066 (0.58)	0.067 (0.58)	0.018 (0.88)
Proportion of non-executives >33%		−0.11	−0.13*	−0.13*	−0.13*		0.103 (0.11)	0.114 (0.08)	0.114 (0.08)	0.069 (0.28)
Outside directorship per non-executive			−0.23**	−0.23**	−0.26**			−0.154 (0.21)	−0.155 (0.21)	−0.144 (0.22)
Non-executive chairman				0.07	−0.07				−0.007 (0.91)	−0.062 (0.34)
Non-executives' share ownership					0.02					0.267 (0.00)
N	251	251	251	251	251	234	234	234	234	234
R^2	NA	NA	NA	NA	NA	0.141	0.151	0.158	0.158	0.218
Adj R^2	0.13	0.164	0.175	0.18	0.183	0.122	0.125	0.128	0.124	0.183
F	NA	2.45[a]	2.13[a]	1.29[a]	0.711[a]	7.45	5.76	5.26	4.66	6.21
Prob > F						0.0001	0.0001	0.0001	0.0001	0.0001

[a] *F*-statistics significance not available; Standardized beta coefficients; *p*-value in parentheses.
* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

from Cohen and Dean's original study and results using our sample. Again, we report the exact p−values for the replicated models but not for the orginal models as the original study only reported the standardized beta coefficients. As noted, Cohen and Dean examined the signaling effect of top management teams on IPO underpricing. We followed their sampling procedure by including only firms that were less than 15 years old at the time of IPO. We used their definition of underpricing (closing stock price two weeks after IPO) in our analyses,[11] and adopted their format showing standardized beta coefficients in our replication models.

Cohen and Dean (2005) found that the *TMT legitimacy index* (operationalized as a composite

variable consisting of *prior TMT experience*, *industry experience*, *age*, and *education*) tended to reduce IPO underpricing (see *Original Results*, Model 2), and three of the four variables (i.e., *TMT legitimacy index* [$\beta = -0.214$, $p < 0.01$], *prior TMT experience* [$\beta = -0.152$, $p < 0.05$], *industry experience* [$\beta = -0.185$, $p < 0.05$], *age* [$\beta = -0.199$, $p < 0.05$]) that comprised the composite variable were negatively related to underpricing (see *Original Results*, Models 3–6). However, our results contradict these findings (see *Replication Results,* Models 8–12). We found that the effects of the TMT legitimacy index ($\beta = 0.18$, $p = 0.02$), *prior TMT experience* ($\beta = 0.183$, $p = 0.02$), and *industry experience* ($\beta = 0.17$, $p = 0.03$) are all positive and statistically significant. *TMT age* is not significant in our replication model (Model 11). However, Models 8–10 are significant at $p = 0.07$, $p = 0.06$, and $p = 0.07$, respectively, while Models 7, 11, and 12

[11] We also tested Cohen and Dean's models using the standard one-day window. We found that none of the "top management" variables is significant.

Table 7.   Replication results for Cohen and Dean's (2005) study (p−value in parentheses)

Variables	Original results						Replication results					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Control variables												
Manufacturing	−0.051	−0.048	−0.032	−0.045	−0.040	−0.057	−0.063	−0.070	−0.056	−0.054	−0.072	−0.066
							(0.43)	(0.38)	(0.48)	(0.50)	(0.37)	(0.42)
Transportation	−0.058	−0.084	−0.062	−0.071	−0.084	−0.076	−0.019	−0.013	−0.008	−0.014	−0.016	−0.015
							(0.81)	(0.87)	(0.91)	(0.86)	(0.84)	(0.85)
Wholesale	−0.023	−0.037	−0.036	−0.035	−0.030	−0.021	−0.033	−0.034	−0.004	−0.027	−0.037	−0.036
							(0.67)	(0.65)	(0.96)	(0.73)	(0.63)	(0.64)
Retail	−0.072	−0.076	−0.073	−0.070	−0.081	−0.082	0.060	0.039	0.061	0.066	0.037	0.061
							(0.44)	(0.62)	(0.43)	(0.39)	(0.63)	(0.44)
Finance	−0.042	0.013	−0.027	0.014	0.018	−0.044	−0.021	−0.020	−0.019	−0.017	−0.016	−0.026
							(0.79)	(0.79)	(0.80)	(0.82)	(0.83)	(0.73)
Firm age	−0.060	−0.073	−0.094	−0.077	−0.040	−0.065	0.166	0.130	0.173	0.178	0.133	0.163
							(0.04)	(0.10)	(0.03)	(0.02)	(0.10)	(0.04)
Insider share	0.167	0.130	0.172	0.140	0.146	0.140	0.177	0.199	0.149	0.151	0.211	0.182
							(0.03)	(0.01)	(0.07)	(0.06)	(0.01)	(0.03)
Underwriter reputation	−0.043	−0.047	−0.020	−0.053	−0.046	−0.048	0.078	0.047	0.079	0.077	0.054	0.075
							(0.45)	(0.64)	(0.43)	(0.45)	(0.60)	(0.47)
Offer size	0.365**	0.411***	0.345**	0.406**	0.418***	0.391**	0.049	0.054	0.042	0.034	0.056	0.048
							(0.63)	(0.59)	(0.68)	(0.74)	(0.58)	(0.63)
Net income	−0.110	−0.114	−0.090	−0.124	−0.104	−0.124	−0.095	−0.084	−0.092	−0.105	−0.085	−0.093
							(0.24)	(0.29)	(0.25)	(0.19)	(0.29)	(0.25)
Independent variables												
Legitimacy index		−0.214**						0.180				
								(0.02)				
Prior TMT experience			−0.152*						0.183			
									(0.02)			
Industry experience				−0.185*						0.170		
										(0.03)		
Age					−0.199*						0.138	
											(0.10)	
Education						−0.122						0.050
												(0.52)
N	121	121	121	121	121	121	175	175	175	175	175	175
R²	0.218	0.259	0.239	0.248	0.252	0.232	0.076	0.104	0.108	0.104	0.091	0.078
Adj R²	0.147	0.184	0.163	0.172	0.177	0.154	0.019	0.044	0.047	0.043	0.029	0.016
F	NA	NA	NA	NA	NA	NA	1.34	1.72	1.79	1.71	1.48	1.26
Prob > F	0.01	0.001	0.001	0.001	0.001	0.01	0.2116	0.0727	0.0599	0.0747	0.1447	0.2550

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.
Models 2, 8, and 14 are the main models; Underpricing is closing stock price two weeks after the IPO; Standardized beta coefficients; p-value in parentheses.

are not significant, based on the F-statistic. Thus, the results of replication models using these specifications should be interpreted with caution, since Cohen and Dean did not report the F-Statistic in their results.

A comparison of the control variables between the original and replicated studies shows more consistent results. *Industry*, *underwriter reputation* and *net income* variables do not affect IPO underpricing in the original or replicated model. However, we did find some differences: *firm age* and *insider share*

ownership significantly increase underpricing in our replication, while *IPO offer size* is not significant in the replication results but significantly increases underpricing in the original study. For robustness, we included firms older than 15 years and repeated the analyses. The results for the independent variables are similar to the replication results.[12]

---

[12] The results of these additional analyses are available on request from the authors.

We conducted three additional analyses to check the robustness of the replication results. First, we ran additional tests to rule out any omitted variable bias concerns. We also adopted a method called optimal α approach to account for various levels of Type I and II errors. As noted, Type I errors may result in the erroneous rejection of the null hypotheses in our replication. Finally, we checked to see whether outliers in our sample may have influenced our results. The details of these analyses and results are provided in the Appendix S1.

DISCUSSION AND CONCLUSIONS

Discussion

We attempted to replicate three studies that examined the impact of firm's use of leadership structures and board social ties as signals of IPO value. By focusing on a more recent period and using a large sample of U.S. IPOs, we closely followed each study, using the same exclusion and inclusion criteria for constructing the sample and the variables of interest to replicate them to our best ability.

Interpreting replication results for each study

Study No. 1

Certo *et al.* (2001), the first study examined, is based on the theoretical premise that the presence of a founder CEO may pose managerial uncertainty, which in turn can influence IPO valuations. Certo *et al.* found that the presence of a founder CEO during an IPO can serve as an important signal of value and negatively influence IPO underpricing. Despite best efforts, our evidence did not support the original results.

We offer two potential interpretations for our results. First, our sample frame consisted of firms that went public between 2010 and 2013, whereas Certo *et al.* (2001) examined firms that went public nearly two decades earlier (between 1990 and 1998). Nearly half (48%) of firms analyzed had a founder CEO. In contrast, significantly fewer, only 23 percent, of our sample firms had founder CEOs. It is possible that having an experienced CEO sends a strong signal of quality to underwriters, and that firms are systematically replacing founder CEOs who could be viewed unfavorably. In other words, having qualified CEOs at the helm may have become the expected norm. Underwriters, the

issuing firm, and private-equity holders may have adapted their practices over time.

Second, Certo *et al.* (2001) operationalized CEO founder status using a dummy variable, which is a coarse proxy at best for signaling untested management. It is possible that dummy variables may fail to capture any heterogeneity among the founders in our sample, and that more fine-grained measures of founder experience may be needed to capture this measure. Moreover, today's investors are more sophisticated, thanks to freely available founder information. This interpretation, along with the fact that the number of founder CEOs have declined dramatically over the past two decades, suggests that the presence or absence of founder management per se is unlikely to provide a useful signal of value. Future research may identify other relevant and significant signals more appropriate to the present information-rich environment.

Study No. 2

The second study, Filatotchev and Bishop (2002), found that board characteristics during an IPO can serve as an important signal regarding IPO underpricing. Their assertions were based on incentive alignment concerns, drawn from agency theory. Here, too, we are unable to substantiate their major findings. This could be due to different geographical context, as Filatotchev and Bishop studied U.K firms while we focused on U.S. IPOs. Many of the variables of interest across geographical contexts differed significantly (see Table 3). Compared with the U.K. firms, American IPOs experienced significantly less underpricing (14.58% versus 29.6%), a smaller concentration of financial sector firms (1% versus 33%), less executive share ownership on average (8.79% versus 25.74%), and more non-executive directors shared ownership in general (25.78% versus 7.47%). Given these differences, it is not unreasonable to expect that results based on agency theory may differ. For instance, agency considerations could be a first-order concern for financial start-ups whereas this might be a lesser concern for nonfinancial start-ups that have non-executive directors (i.e., venture capitalists) who own significant shares in the United States. This interpretation is consistent with the few studies that have highlighted differences between U.K. and U.S. markets in terms of the mechanisms guiding IPO pricing and control (e.g., Chahine *et al.*, 2012;

see Ritter [2003] for a broader discussion of the differences between American and European IPO markets).

Study No. 3

Cohen and Dean (2005), whose study is the third one examined, drew on information asymmetry arguments to posit that top management characteristics may increase perceived legitimacy, resulting in less IPO underpricing. Interestingly, Cohen and Dean used IPO "stock price run-up" (the price measured two weeks post-IPO) as their dependent variable for measuring IPO underpricing. Our replication results do not lend evidence to their assertions, and our results for prior TMT and industry experience are in the opposite direction of Cohen and Dean's hypothesis.[13]

In terms of theory, more than 300 studies suggest that IPO underpricing is a uniquely "opening day" phenomenon. Information asymmetry explanations that underpin this work suggest that, given the information asymmetry between informed and uninformed investors, underwriters likely discount (underprice) IPOs in order to induce retail investors to participate in the market for IPOs when the stock opens for trading. Therefore, it would follow that by the end of the first day of trading, the market provides a "true" value for the shares traded. Theoretically this "IPO effect" would have little influence on shares prices, post-IPO. Since Cohen and Dean's (2005) study did not justify their choice of a two-week window to measure underpricing, their reasoning for this approach is theoretically unclear.

Considering their empirical approach, it was surprising that their study did little to control for firm-provided or market-related IPO information (e.g., media coverage and information provided by stock analysts) following first-day trading. We suspect that such information disclosure and other extraneous factors may materially influence firm valuation after the first day of trading, and that without considering and controlling for post-IPO information, it would be hard to interpret Cohen and Dean's or our replications attempts in any meaningful way.[14]

Interpreting replication results across the studies

It is possible that the lack of evidence that supports the original findings across the three studies may be due to several potential reasons. First, IPO underpricing is a complex phenomenon, with multiple participants who have differing objectives (i.e., issuing firm, underwriters, informed investors, and uninformed investors). Thus, it is possible all three studies may suffer from causal identification issues (e.g., omitted variables bias). Although we do not address this issue directly here for the purpose of this article, our additional analyses hint us that this could be a possible reason. In our robustness checks with additional control variables, the adjusted R-square values are much higher than the prior models (see Appendix S1). We found that oversubscription, a proxy that captures investors' appetite for an IPO (Derrien, 2005), consistently increased underpricing across the studies (Appendix S1, Tables 2–4). In fact, oversubscription may capture manifested demand, primarily driven by the availability of IPO-related information from sources discussed below. Interestingly, many of the control variables in the studies we examined did not significantly influence underpricing, and should perhaps be dropped from future studies.

A more speculative, but perhaps interesting, interpretation of our lack of support for the original results stems from two external changes: advances in information technology, and regulatory changes concerning the quiet period leading to IPOs. We suggest that advances in information technology are resulting in the democratization of IPO and IPO-related information. First, the media coverage of IPOs has increased dramatically. Dedicated television channels such as CNBC and Bloomberg, and business-related websites have proliferated over the past decade. Second, fine-grained information on IPO firms can be readily accessed from company websites, media websites (e.g., Yahoo Finance and TechCrunch), start-up databases (e.g., CrunchBase), and social media platforms, such as Twitter and Facebook, using computers and

---

[13] Note that Cohen and Dean's sample was bigger than ours, and thus, our findings may be due to the relatively lower power in our study.

[14] To examine the impact of TMT variables in our sample for the first day of trading, we ran an additional test but found that

none of the variables are statistically significant (these results, not reported here, are available on request). If Cohen and Dean's results are valid for the standard one-day underpricing measure, given our results, some of the interpretations used to explain the replication results for Certo *et al.*'s study may apply here as well. In this context, it is possible that those firms, which are uncertain about how investors may perceive the legitimacy of the TMT, will replace them before seeking public funds.

mobile devices. Third, investors have direct access to SEC filings through its EDGAR service, which began in May 2000 to host all IPO filings.[15] Hence, there is a plethora of sources and abundance of quality information for investors, both informed and uninformed.

In 2005, an important SEC regulation was revised pertaining to the quiet period leading up to an IPO, once S-1 filings are accepted by regulatory agencies.[16] Firms seeking to go public can now communicate with potential investors via press releases, interviews with media intermediaries, and social media channels. The general public can watch IPO road shows on YouTube, and other channels; for the first time, all potential initial (institutional) and secondary (retail) investors have access to relevant IPO information unavailable just a few years ago.

Potential investors are also turning to social media and Internet-based financial services platforms such as StockTwits to voice their opinions. Hundreds of tweets about IPOs are shared among other investor communities instantaneously and daily. Potential investors and analysts can monitor and revise their expectations about public firms online (Chen, Liu, and Zhang, 2012; Duckworth, Golz, and Trayner, 2009). Such chatter often leads to more passionate discussion than traditional media. Indeed, Bloomberg now provides Twitter feeds to its subscribers (Alden, 2013).

In sum, perhaps access to rich fine-grained information and the sources of such information along with the regulatory changes may have potentially diminished the significant signaling value observed in past studies. If such changes are responsible for our results, information asymmetry-based explanations can be less useful going forward. Given that investor sentiment influences retail investors' demand for IPO shares (Dorn, 2009), increased information availability should also influence investor sentiment and/or behavior in the market for IPOs. On one hand, information availability may reduce information asymmetry between informed and uninformed investors,

while on the other hand, it may increase the hype surrounding an IPO, making it difficult to estimate demand, and thus, impacting how IPO shares are priced prior to the opening day of trading. Given the changing environment, we encourage scholars to explore alternative theoretical mechanisms in addition to information asymmetry explainations to explain IPO underpricing going forward.

Conclusions

Reproducibility of prior findings is essential to building scientific knowledge (Galtung, 1967; Hubbard *et al.*, 1998). Following this dictum, we attempted to replicate three studies that examine the impact of top management, governance indicators, and social ties on IPO underpricing, a measure that captures the amount of wealth retained by entrepreneurs, and a topic of significant interest to strategy, management, and entrepreneurship scholars. Not only were we unable to find evidence that supports the original results for scholars interested in replication results as they pertain to IPO underpricing, our findings offer little consolation, suggesting that our understanding of wealth retained by entrepreneurs during the IPO process is unlikely to be of significant use in terms of practical advice. While we have suggested possible directions to further our understanding of IPO underpricing, we encourage future researchers to incorporate the contingencies and speculations cited above.

ACKNOWLEDGEMENTS

REFERENCES

Alden W. 2013. Twitter arrives on Wall Street, via Bloomberg. *New York Times* 4 April. Available at: http://dealbook.nytimes.com/2013/04/04/twitter-arrives-on-wall-street-via-bloomberg/?_r=0 (accessed 2 December 2015).

Arthurs JD, Hoskisson RE, Busenitz LW, Johnson RA. 2008. Mnagerial agents watching other agents: multiple agency conflicts regarding underpricing in IPO firms. *Academy of Management Journal* **51**(2): 277–294.

---

[15] Evidence suggests investors often do access these documents to obtain financial information about firms (Drake, Roulstone, and Thornock, 2015).

[16] Section 5 of the United States Securities Act of 1933 limits what information a company and related parties can release to the general public from the time a company files a registration statement with the SEC until the agency declares the registration statement effective. This period is unofficially called the "quiet period."

Beatty RP, Ritter JR. 1986. Investment banking, reputation, and the underpricing of initial public offerings. *Journal of Financial Economics* **15**(1–2): 213–232.

Bettis RA, Ethiraj S, Gambardella A, Helfat C, Mitchell W. 2016. Creating repeatable cumulative knowledge in strategic management. *Strategic Management Journal* **37**(2): 257–261.

Carter R, Manaster S. 1990. Initial public offerings and underwriter reputation. *Journal of Finance* **45**(4): 1045–1067.

Certo ST. 2003. Influencing initial public offering investors with prestige: signaling with board structures. *Academy of Management Review* **28**(3): 432–446.

Certo ST, Covin JG, Daily CM, Dalton DR. 2001. Wealth and the effects of founder management among IPO-stage new ventures. *Strategic Management Journal* **22**(6–7): 641–658.

Certo ST, Holcomb TR, Holmes RM. 2009. IPO research in management and entrepreneurship: moving the agenda forward. *Journal of Management* **35**: 1340–1378.

Chahine S, Arthurs JD, Filatotchev I, Hoskisson RE. 2012. The effects of venture capital syndicate diversity on earnings management and performance of IPOs in the US and UK: an institutional perspective. *Journal of Corporate Finance* **18**(1): 179–192.

Chen Y, Liu Y, Zhang J. 2012. When do third-party product reviews affect firm value and what can firms do? The case of media. *Journal of Marketing* **76**(2): 116–134.

Cohen BD, Dean TJ. 2005. Information asymmetry and investor valuation of IPOs: top management team legitimacy as a capital market signal. *Strategic Management Journal* **26**(7): 683–690.

Derrien F. 2005. IPO pricing in "HOT" market conditions: who leaves money on the table? *Journal of Finance* **60**(1): 487–521.

Dorn D. 2009. Does sentiment drive the retail demand for IPOs? *Journal of Financial and Quantitative Analysis* **44**(1): 85–108.

Downes DH, Heinkel R. 1982. Signaling and the valuation of unseasoned new issues. *Journal of Finance* **37**(1): 1–10.

Drake MS, Roulstone DT, Thornock JR. 2015. The determinants and consequences of information acquisition via EDGAR. *Contemporary Accounting Research* **32**(2): 1128–1161.

Duckworth A, Golz J, Trayner G. 2009. Are analysts and investors engaging with new media? *Brunswick Review*. Available at: http://www.brunswickgroup.com (accessed 24 November 2014).

Filatotchev I, Bishop K. 2002. Board composition, share ownership, and "underpricing" of U.K. IPO firms. *Strategic Management Journal* **23**(10): 941–955.

Galtung J. 1967. *Theory and Methods of Social Research*. Columbia University Press: New York.

Hubbard R, Vetter DE, Little EL. 1998. Replication in strategic management: scientific testing for validity, generalizability, and usefulness. *Strategic Management Journal* **19**(3): 243–254.

Judge WQ, Witt MA, Zattoni A, Talaulicar T, Chen JJ, Lewellyn K, Hu HW, Shukla D, Bell RG, Gabrielsson J,

Lopez F, Yamak S, Fassin Y, McCarthy D, Rivas J, Fainshmidt S,, Van Ees H. 2015. Corporate governance and IPO underpricing in a cross-national sample: a multilevel knowledge-based view. *Strategic Management Journal* **36**(8): 1174–1185.

Lester RH, Certo ST, Dalton CM, Dalton DR, Cannella AA. 2006. Initial public offering investor valuations: an examination of top management team prestige and environmental uncertainty. *Journal of Small Business Management* **44**(1): 1–26.

Loughran T, McDonald B. 2013. IPO first-day returns, offer price revisions, volatility, and form S-1 language. *Journal of Financial Economics* **109**(2): 307–326.

Loughran T, Ritter J. 2004. Why has IPO underpricing changed over time? *Financial Management* **33**(3): 5–37.

Mudge JF, Baker LF, Edge CB, Houlahan JE. 2012. Setting an optimal *a* that minimizes errors in null hypothesis significance tests. *PLoS ONE* **7**(2): 1–7.

Nelson T. 2003. The persistence of founder influence: management, ownership, and performance effects at initial public offering. *Strategic Management Journal* **24**(8): 707–724.

Pollock TG, Porac JF, Wade JB. 2004. Constructing deal networks: brokers as network "architects" in the U.S. IPO market and other examples. *Academy of Management Review* **29**(1): 50–72.

Pollock TG, Rindova VP. 2003. Media legitimation effects in the market for initial public offerings. *Academy of Management Journal* **46**(5): 631–642.

Raffiee J, Feng J. 2014. Should I quit my day job?: A hybrid path to entrepreneurship. *Academy of Management Journal* **57**(4): 936–963.

Ritter JR. 1991. The long-run performance of initial public offerings. *Journal of Finance* **46**(1): 3–27.

Ritter JR. 2003. Differences between European and American IPO markets. *European Financial Management* **9**(4): 421–434.

Ritter JR. 2014. Initial public offering: Updated statistics. Available at: http://bear.warrington.ufl.edu/ritter/IPOs2013Statistics.pdf (accessed 20 December 2014).

Ritter JR, Welch I. 2002. A review of IPO activity, pricing, and allocations. *Journal of Finance* **57**(4): 1795–1828.

Rock K. 1986. Why new issues are underpriced. *Journal of Financial Economics* **15**: 187–212.

Singh K, Ang SH, Leong SM. 2003. Increasing replication for knowledge accumulation in strategy research. *Journal of Management* **29**(4): 533–549.

Stuart TE, Hoang H, Hybels RC. 1999. Interorganizational endorsements and the performance of entrepreneurial ventures. *Administrative Science Quarterly* **44**(2): 315–349.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix S1. Additional analyses checking for robustness.