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SIGNALING THROUGH INSIDER OWNERHIP:AN ANALYSIS OF TIME AND MODERATION EFFECTS IN ACADEMIC SPIN-OFF ACQUISITIONS

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INTRODUCTION

Signaling theory suggests that insider ownership, i.e., *the percentage of a firm owned by a firm's top management or founding team,* is an important signal in environments with high information asymmetries, such as new venture contexts (Connelly, Certo, Ireland, & Reutzel, 2011). So far, however, empirical studies attempting to link insider ownership to firm outcomes have produced equivocal results. Indeed, some studies found a positive relation between insider ownership and specific firm outcomes, including time-to-profitability after initial public offering (IPO) (Jain, Jayaraman, & Kini, 2008) and IPO firm valuation (Sanders & Boivie, 2004), while others found relations no different from zero (e.g. Busenitz, Fiet, & Moesel, 2005; Filatotchev & Bishop, 2002; Sheu & Yang, 2005), and still others found the impact of insider ownership to be negative (Sanders, 2001).

In this study, we argue that a lack of consideration of time, other owners (professional investors), and certain non-linear relations have prevented prior research from identifying the impact of insider ownership on firm outcomes. Our main research objective is to address these gaps by providing a more nuanced understanding of the role of insider ownership as a signal in environments characterized by high levels of information asymmetry. In pursuing this research objective, we build on a stream of research that advocates a more fine-grained consideration of the impact of insider ownership, particularly the contingency factors making ownership-related signals stronger or weaker (Wu, Reuer, & Ragozzino, 2013), or varying in strength over time (Janney & Folta, 2006). Specifically, we study the relation between insider ownership and the acquisitions of academic spin-offs (ASOs), hereby arguing that this relation is curvilinear, and conditional on both professional investor ownership and passage of time.

THEORY AND HYPOTHESES

Signaling Theory and Firm Acquisitions

Signaling theory is concerned with understanding how decision makers can use signals to reduce the uncertainty associated with making selections in situations characterized by

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incomplete and asymmetrically dispersed information (Bergh, Connelly, Ketchen, & Shannon, 2014). This core focus makes signaling theory highly relevant to research of acquisitions (Ragozzino & Blevins, 2016; Reuer, Tong, & Wu, 2012). In the acquisition context, large information asymmetries exist between buyers and sellers, with sellers typically holding superior information about the intrinsic quality of their firm and the behavioral intentions of key firm insiders (e.g., members of the founding team, key employees etc.). The imbalance in the distribution of information held by buyers and sellers in private acquisition markets makes it difficult for buyers to select high-quality acquisition targets and gives rise to considerable uncertainty about target value, the transferability of target capabilities, and potential synergies (Coff, 1999; Ranft & Lord, 2000).

According to signaling theory, buyers can attempt to reduce these uncertainties by seeking out signals that help close the gap between what insiders know about the firm and what they would like to know (Bergh et al., 2014). Conversely, sellers can attempt to deliberately convey signals to reduce the information asymmetry that obstructs prospective buyers' ability to select high-quality targets. To be effective, such signals need to be easily observable to outsiders for whom they are intended; reliable enough for these outsiders to trust information contained in them; and costly enough to prevent other senders from gratuitous imitation (Connelly et al., 2011). In this paper, building on signaling theory, we present a theoretical framework for studying the signaling value of ownership held by insiders whose firms are potential acquisition targets. Our overall conceptual model and specific hypotheses are summarized in Figure 1.

Figure 1 about here

Insider Ownership as a Signal in Acquisition Events

Insider ownership has been suggested as conducive to convey meaningful information about both firm quality and managerial intent to external parties (Connelly et al., 2011), such as venture capitalists (Busenitz et al., 2005) and stock market investors (Sanders & Boivie, 2004). So far, insider ownership has been considered a positive signal (e.g. Filatotchev & Bishop, 2002; Jain et al., 2008), in line with the signaling literature in which the primary focus has been on *positive* signals sent *intentionally* by insiders for the purpose of reducing uncertainty about latent and unobservable *quality* (Alsos & Ljunggren, 2016; Connelly et al., 2011). While we agree that insider ownership may provide a positive signal to, in our case, acquirers, we anticipate that both very low and high insider ownership in ASOs will convey negative signals to prospective buyers and thus reduce the likelihood of acquisition. We argue that low and high levels of insider ownership may signal problems in terms of the quality of the firm's technological resources and/or the behavioral intent of firm insiders, therefore representing a negative signal to potential acquirers. By contrast, we anticipate that moderate insider ownership may signal satisfactory quality of the firm's technological resources, alongside a functional control motive and an adequate commitment by the firm's insiders toward the firm's future, thus presenting a positive signal.

Hypothesis 1: The relation between insider ownership and acquisition event is inverse U-shaped.

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Signal Strength Over Time

While insider ownership may convey negative or positive signals to potential acquirers, we argue that the extent to which this occurs is contingent on time (firm age). For instance, high insider ownership represents a potentially negative signals to prospective buyers because it could signal a strong control motive by the NVT (Wasserman, 2017), indicating that collaboration with the target firm's managers will be difficult during the critical integration phase. In a young firm, however, high insider ownership will likely constitute a weak signal of the presence of a strong control motive because most entrepreneurial ventures will tend to exhibit relatively high insider ownership in the early stages of their development (DeTienne, 2010). However, we anticipate that this signal will gain in strength over time. Specifically, whereas insiders with strong control motives are likely to try to retain as much equity as possible throughout the development of their venture, insiders more motivated by other concerns, such as rapidly developing their promising technologies, will tend to relinquish more equity in exchange for external financing with the passing of time (Wasserman, 2017). Thus, as time goes by, the signal reliability of high insider ownership, indicating a strong control motive by the NVT, should increase. Building on this, and other arguments, we offer the following hypothesis:

Hypothesis 2: The relation between insider ownership and acquisition events strengthens over time.

Insider Ownership Signaling and the Contingency Effect of Professional Investor Ownership

If insider ownership is to effectively function as a signal, then it first has to be observed by prospective buyers (Connelly et al., 2011). In many cases, insider ownership may not always be readily detectable as buyers face a large choice set of potential acquisition targets, and may neither have the time nor the capacity to gather and process all available information. The strength of insider ownership as a signal may therefore depend on the simultaneous presence of other visibility-enhancing signals that help attract the buyers' attention to the venture, and thus "unlocks" the potential of insider ownership as a signal (Plummer, Allison, & Connelly, 2016). We argue the presence of professional investors in the firm is such an unlocking mechanism. Furthermore, the focal venture's affiliation with professional investors may also increase the credibility of insider ownership as a signal. For example, buyers may attach more credibility to insider ownership as a signal of firm quality when confirmed through professional ownership-related signals, because buyers assume professional investors have a superior ability to select promising ventures (Amit, Brander, & Zott, 1998), and typically engage in firms which are considered a rich source of technological innovation (Graebner, Eisenhardt, & Roundy, 2010; Kortum & Lerner, 2000)

Hypothesis 3: The relation between insider ownership and acquisition events strengthens with professional investor ownership.

Time-variant Effects of Professional Investor Ownership as a Contingency Factor

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The involvement of professional investors in an entrepreneurial venture, as indicated by their ownership in the venture, may enhance the observability and credibility of the insider ownership signal. However, the extent to which this occurs will likely depend on the venture's stage of development. First, buyers who are evaluating young targets will likely discount value-enhancing potential of the professional ownership signal because they know that these investors had to screen and assess the potential value under extremely uncertain circumstances. However, the certification effect of professional investor ownership over the focal insider ownership signal will likely become more pronounced over time when the likelihood of professional investors making good assessment increases. Second, as the ventures develop over time, it will become clearer where the technologies under development can be commercially applied. Thus, with the passing of time, it will be easier for professional investors to target relevant potential buyers, and to ensure that the venture falls within these buyers' consideration sets, as such unlocking the potential of the insider ownership signal in a more effective way. This leads to the following hypothesis:

> *Hypothesis 4: The relation between insider ownership and acquisition events strengthens with both professional investor ownership and time.*

METHOD

Sample and Data

The empirical context chosen to test our hypotheses is the Norwegian national population of ASOs established at universities and public research organizations (PROs) between 1999 and 2011 (Rasmussen & Mathisen, 2017). The final sample totaled 370 ASOs, and we collected the relevant data on these firms from 1999 to 2015. The data is not left-side biased as we follow all firms from founding. Further, all established ASOs where reported by the universities and PROs to a governmental funding program (called FORNY; for more details see (Rasmussen & Gulbrandsen, 2012; Spilling, Borlaug, Iversen, Rasmussen, & Solberg, 2015) on a continuous basis, helping to avoid survivorship bias which tend to be a problem with retrospective entrepreneurship studies (Townsend & Busenitz, 2015).

We adopted a longitudinal research design, systematically collecting data on the ASOs from several sources. Archival quantitative data included detailed financial statements (including ownership data) and official corporate announcements (mandatory notifications to creditors and the general public on major events, e.g. mergers, capital changes and dissolutions) obtained from national business register (www.brreg.no). Further, we had privileged access to the records of the FORNY program, which included the original business plans written by the ASOs at founding, and a comprehensive news archive with all press releases and all print and online news bulletin referencing the firm. These sources were combined, structured and coded into a database outlining the historical development of the firm on a range of levels.

Measures

The *dependent variable* is the occurrence of an acquisition event, coded 1 for the year the event and 0 otherwise. Of the 32 acquisitions in our sample, 25 transferred full ownership to the acquirer, 4 sold the majority ownership and 3 were sales of all productive assets.

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The *independent variables* are insider ownership, professional investor ownership and time. Insider ownership is a time-varying continuous covariate representing the share ownership controlled by individuals directly involved in the management of the firm. Professional investor ownership is similarly defined, representing venture capital (VC) investors, including seed, corporate VC, private equity and family investment offices. Firm age and calendar time are two complementary facets of the main effect of time on the acquisition event. Firm age is a proxy for maturation in the firm that is not taken into account by specifically measured variables. To account for the sensitivity of acquisitions to macroeconomic conditions, we control for the *calendar year* (Sears & Hoetker, 2014).

The control variables evaluated as important to rule out alternative explanations include firm size (revenue and employment), patents applied for, industry and type of parent academic institution.

Analysis

We use discrete time event history analysis to specify and estimate the regression model in which the conditional probability of an acquisition event in a one-year period is determined by several time-varying and time-invariant variables. Event history analysis takes care of both the occurrence and timing of an event in estimating the effects of the explanatory variables. Unlike repeated events absorbing events such as acquisition simplify the analysis considerably because 'once-off' events are independent and do not need to be modeled using random effects. We performed all analyses using the logit command in Stata (StataCorp, 2015).

RESULTS

Four models were developed to test hypotheses 1-4, in addition to a control model serving as the baseline to evaluate our hypotheses (including control and time variables). Model 1 tests hypothesis H1 that the *focal* relation between *insider ownership* and *acquisition events* is curvilinear (inverted-U shape). Model 1 is a significant improvement to the control model, and provides support for H1.

Model 2 tests whether the focal relation in H1 is conditional on firm age (time), where the relation *becomes stronger* over time. Model 2 is a weakly significant improvement over Model 1, and thus only provides marginal support for H2.

Model 3 tests whether the focal relation in H1 is conditional on professional investor ownership, where the relation *becomes stronger* with more professional investor ownership. While both the main and interaction effects for professional investor ownership are *positive* and in the hypothesized direction, the improvement in Model 3 compared to the control model is not significant. H3 is thus not supported.

Model 4 integrates all elements from the previous hypothesized models, and turns out to be the best fitting model overall. Model 4 tests whether the focal relation in H1 is contingent on both firm age (time) and professional investor ownership, where the relation both *becomes stronger* over time (H2) and is *amplified* by more professional investor ownership (H3). We test hypothesis (H4) using a three-way interaction between insider ownership, professional ownership, and firm age (time). Model 4 provides considerable support to H4.

More detailed analysis using plots and contrasts indicate that high insider ownership is a stronger negative signal than low insider ownership. Further, while the signal strength of

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professional ownership is less pronounced (and even negative in certain situations) when ASOs are young, it sends a strong signal when the ASOs mature.

DISCUSSION

This study offers several major contributions. First, we contribute specifically to calls to study the complexity of insider ownership as a signal (Busenitz et al., 2005). Importantly, we use appropriately fine-grained measurement of ownership to model more nuanced relations than “on” or “off” between different types of ownership and specific firm outcomes (Busenitz et al., 2005). By doing so, we also consider non-linear relationships alongside negative signals (Jia & Zhang, 2014) that are typically sent unintentionally (Connelly et al., 2011). Second, our study answers calls in the signaling literature to study the contingency and time effects of signals (Janney & Folta, 2006). Our findings point to the fact that parties engaging in important transactions, such as acquisitions, do not attend to one signal at the time but combine different signals when considering potential transactions, hereby attaching more or less value to specific signals depending on the moment at which the signal is received. Third, by providing insights into the combined effect of ownership-related signals, this paper adds to studies on firm ownership, which have typically assessed the impact of insider and professional investor ownership separately from each other. Finally, we contribute to the entrepreneurship literature by shedding light on the role of ownership structure in important transactions such as acquisitions (Clarysse, Bobelyn, & Aguirre, 2013).

REFERENCES AVAILABLE FROM THE AUTHORS

Figure 1: Conceptual Model