

OWNERSHIP TRANSITION, MANAGERIAL SHORT-TERMISM, AND EXPLORATORY VERSUS EXPLOITATIVE INNOVATION STRATEGY

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INTRODUCTION

Management scholars have identified two distinct innovation strategies: exploratory innovation and exploitative innovation (Levinthal & March, 1993; March, 1991). They have also shown different effects of exploratory and exploitative innovation on performance such as new product development and revenue growth (He & Wong, 2004; Katila & Ahuja, 2002). However, “there has been little attempt to uncover why some organizations emphasize exploration while others mostly pursue exploitation” (Lavie, Stettner, & Tushman, 2010: 118). Our paper aims to fill a gap in the literature by examining how the transition from private to public ownership influences a firm’s choice between exploratory and exploitative innovation strategy.

Private firms become public after the initial public offering (IPO) process. While benefiting from greater visibility and increased liquidity, firms after IPOs are under great pressure to deliver near-term results (Ritter & Welch, 2002; Stein, 1989). Although exploratory innovation may have the potential to shape future technological landscape, it takes more time with less certainty and its payoff is organizationally more distant from a firm’s current technological focus (March, 1991). In contrast, exploitative innovation tends to rely on a firm’s current technologies and resources to achieve efficiency benefit, and it takes less time with more certainty and its pay-off is more proximal. We argue that, because of the pressure of public equity market that makes firms and their managers to become short-term oriented, firms after IPOs are more likely to engage in low-risk innovation strategy—exploitative innovation—and less likely to engage in exploratory innovation.

We further explore the underlying mechanisms of managerial short-termism by studying whether and how the baseline relation varies in contexts where managers are more likely to be myopic or short-term oriented. Prior literature suggests that firms are biased towards short-term projects due to concerns about near-term stock prices when their CEOs exhibit short-term orientation (e.g., Stein, 1989), when there exist takeover threats (e.g., Jarrell, Brickley, & Netter, 1988), and when their investors are less patient and more short-term oriented (e.g., Bushee, 1998). Thus, if our theory holds, we would expect the relation between public ownership and a focus on exploitative innovation is strengthened in those contexts. We test our hypotheses with a dataset consisting of both private and newly public firms’ patent and financial data. Based on a difference-in-differences specification, we find strong support for our theoretical arguments.

THEORY AND HYPOTHESES

Private versus public firms and exploratory versus exploitative innovation strategy

In his seminal work, March (1991: 71) defines exploration as including “things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation.” In contrast, exploitation includes “such things as refinement, choice, production, efficiency, selection, implementation, execution.” In the innovation domain, exploratory strategy highlights new technology development beyond existing expertise, while exploitative strategy focuses on path-dependence and deepening existing expertise. Prior research suggests that in general, both exploration and exploitation are essential for organizational survival and propensity (Levinthal & March, 1993; March, 1991), and a balance of these two approaches will deliver optimal performance (Benner & Tushman, 2003). However, scholars also recognize inherent contradictions between these two approaches, and pursuing these two approaches simultaneously is not a trivial endeavor. While some scholars have suggested several potential balancing models (e.g., Jansen, Simsek, & Cao, 2012), other scholars raise the question whether it is possible for firms to simultaneously pursue both approaches (Abernathy, 1978), or at least, for a specific subunit, at a given point in time, firms may have different focuses on exploration versus exploitation. Given the challenge in pursuing the optimal innovation approach, it is important to understand the determinants of a firm’s emphasis on exploratory versus exploitative innovation strategy.

Firms go public for various strategic and/or financial reasons. As corporate innovation is costly, prior research argues and finds that public firms are more innovative—in terms of the quantity and quality of innovation output (Acharya & Xu, 2015; Bernstein, 2015). What prior work has not examined is how public firms differ from their private peer firms in terms of exploration versus exploitation innovation strategy. Drawing from prior literature, we argue that, compared to private peer firms, public firms are more likely to exhibit managerial short-termism and tend to emphasize short-term performance (Graham *et al.*, 2005; Porter, 1992) for the following reasons.

First, information disclosure and quarterly reports imposed by public equity market is likely to increase managerial short-termism. Due to their focus on short-term earnings, managers will not have time and energy to consider important strategies and may thus neglect exploratory innovation. Second, stock liquidity increases after the IPO (Ritter & Welch, 2002). Public firm managers’ ability to take advantage of short-term price fluctuations to profit from equity sales may encourage them to pursue short-term projects at the expense of long-term fundamental value (Stein, 1989). In contrast, private firm managers have few ways to cash out and have to hold their equity stakes for a long period of time, and are therefore more long-term oriented. Third, a temporary undervaluation may increase the likelihood for a public firm to be taken over at an unfavorable price (Jarrell *et al.*, 1988; Stein, 1988). In contrast, private firms with their non-publicly-traded stocks face very little threat of hostile takeovers. As a result, public firm managers are more willing to cut risky long-term investments to meet short-term performance targets. Finally, after the IPO, public firms may draw different types of investors who have different time horizons in their investment strategy. Short-term oriented shareholders tend to put pressure on managers to sacrifice long-term investments in order to meet short-term earnings targets (Bushee, 1998, 2001; Connelly *et al.*, 2010). Such short-term pressure is much weaker in

private firms because the lack of stock liquidity forces private firm shareholders to take a long investment horizon (Ferreira, Manso, & Silva, 2014).

The above discussions suggest that public firms are more likely to exhibit managerial short-termism. Given that exploitative innovation largely builds on prior technology, it has less uncertainty and more likely to result in immediate performance outcome (Levinthal & March, 1993). In contrast, exploratory innovation tends to be outside a firm's technology domain, and is more experimental and more likely to take a long time to materialize. Because of the different nature and implications of these two types of innovation strategy, we propose that firms after IPOs (becoming publicly-listed firms), exhibiting greater managerial short-termism, are more likely to adopt exploitative innovation strategy, and are less likely to engage in exploratory innovation.

Hypothesis 1: Firms after IPOs are more (less) likely to adopt exploitative (exploratory) innovation strategy.

Moderating effects

The above discussion suggests that the relation between private-to-public ownership transition and firms' emphasis on exploitative innovation is due to managerial short-termism after IPOs. We also point out that several factors, such as CEO stock sales, hostile takeovers, and transient institutional investors, exacerbate managerial short-termism for public firms. If our theory holds, we would expect that firms with more presence of those factors are even more (less) likely to engage in exploitative (exploratory) innovation strategy.

Hypothesis 2: The effect of IPOs on firms' innovation strategy (i.e., more exploitation and less exploration) is stronger for those firms whose CEOs sell more shares on personal account.

Hypothesis 3: The effect of IPOs on firms' innovation strategy (i.e., more exploitation and less exploration) is stronger for those firms facing greater takeover threats.

Hypothesis 4: The effect of IPOs on firms' innovation strategy (i.e., more exploitation and less exploration) is stronger for those firms with a higher proportion of transient institutional investors.

METHODS

Sample

We start with a list of IPO firms for the period 1997-2008. Our main hypothesis suggests that firms after IPOs are more (less) likely to implement exploitative (exploratory) innovation strategy. To pin down the exact effect of the IPO event, we use a difference-in-differences specification (henceforth, DID) where we not only compare the differences in innovation strategy between the IPO firms (i.e., the treatment group) and matched private peer firms (i.e., the control group), but also compare such differences between the pre-IPO period and the post-IPO period (Bertrand & Mullainathan, 2003). Thus, we need to identify a sample of private firms

that are similar to the IPO firms before the IPO event and stay private during our sample period. The detailed matching process is as follows. For each IPO firm, we require that (a) its control private firm is in the same industry, (b) implements similar innovation strategy, and (c) has the closest patent stock in $t-1$. Our final sample consists of 291 IPO firms and 291 matched private firms. We track both the IPO firms and matched private firms (up to) three years prior to and (up to) three years after the IPO (i.e., from $t-3$ to $t+3$ around the IPO). The final sample has 2,437 firm-year observations.

Dependent variables

A patent is categorized as “exploratory” if 60% or more of its citations are based on new knowledge outside of a firm’s existing expertise (i.e., not citing the firm’s existing patents or the citations made by those patents); while a patent is categorized as “exploitative” if 60% or more of its citations are based on a firm’s existing expertise (i.e., the firm’s existing patents and the citations made by those patents). At the firm level, the variable *Explore* at a point in time is the number of exploratory patents applied for over a three-year period up to that point divided by the total number of patents applied for in the same three-year period. The variable *Exploit* at a point in time is the number of exploitative patents applied for over a three-year period up to that point divided by the total number of patents applied for in the same three-year period. Both variables range between zero and one.

Independent variables

Our DID specification includes industry and year fixed effects and employs two indicator variables to test the differences in the dependent variables (*Exploit* versus *Explore*) between the treatment group (i.e., the IPO firms) and the control group (i.e., the matched private firms) as well as between the pre-IPO period and the post-IPO period. The first indicator variable *Public* takes a value of one if a firm is an IPO firm, and zero otherwise. The second indicator variable *PostIPO_all* takes a value of one for both the treatment and control groups in the post-IPO period (i.e., from $t+1$ to $t+3$), and zero otherwise. Following prior DID research (Meyer, 1995), we use the interaction term $Public \times PostIPO_all$ to test our Hypothesis 1.

Moderating variables

Insider sales: This variable is measured by the CEO’s net sales of shares as a fraction of the firm’s total shares outstanding. *Takeover threats*: To construct this variable, we obtain a sample of announced hostile bids from the Thomson Reuters SDC Platinum Database over the period 1997-2008. We then follow prior literature to estimate a firm’s predicted probability of becoming a hostile takeover target by running a probit regression with the following explanatory variables: M/B, firm size, ROA, leverage, cash holdings, sales growth, and industry times year fixed effects (Cremers, Nair, & John, 2009; Fang, Tian, & Tice, 2014). *Transient institutional investors*: We measure this variable as the percentage of shares owned by transient institutional investors normalized by total shares outstanding (Bushee, 1998, 2001). Transient institutional investors are characterized by high portfolio turnover and diversification.

Control variables

We include a list of control variables which may influence a firm's exploratory versus exploitative innovation strategy. $\ln(\text{Patent stock})$ is the logarithm of the total number of granted patents at the end of year $t-1$. $\ln(\text{Total assets})$ is the logarithm of total assets. **Leverage** is the ratio of total debt to total assets. **ROA** is return on assets capturing the influence of profitability on innovation strategy. **Sales growth** is the growth rate of sales. **Capex** is the ratio of capital expenditures to total assets. **R&D** is the ratio of R&D expenditures to total assets. **PPE** is the ratio of net property, plant, and equipment to total assets. **Acquisition** is the sum of the transaction values of all acquisition deals a firm makes in year $t-1$ normalized by its total assets. $\ln(\text{Firm age})$ is the logarithm of the number of years since incorporation. **VC-backed** is an indicator variable, which takes the value of one if the firm is backed by venture capital (VC), and zero otherwise.

RESULTS

We first conduct univariate analysis. For exploratory innovation strategy, in the pre-IPO period, there is no significant difference in exploratory innovation between the IPO firms (*Explore* = 84.64%) and matched private firms (*Explore* = 84.93%). In the post-IPO, the matched private firms are more exploratory than the IPO firms (t -statistic = -3.89 , p -value < 0.01) as the mean of *Explore* for the IPO firms is 54.73% which is substantially lower than that of the matched private firms at 69.03%. Univariate DID analysis results further suggest that newly public firms after the IPO become less exploratory, compared to their matched private peer firms (t -statistic = -3.59 , p -value < 0.01). Similarly, for exploitative innovation strategy, in the pre-IPO period, there is no statistical difference between the IPO firms (*Exploit* = 12.30%) and matched private firms (*Exploit* = 11.90%). In the post-IPO period, the IPO firms are more exploitative than the matched private firms (t -statistics = 3.13 , p -value < 0.01) as the mean of *Exploit* for the IPO firms is 33.86% which is substantially higher than that of the matched private firms at 25.16%. Univariate DID analysis results further suggest that newly public firms after the IPO become more exploitative, compared to their matched private peer firms (t -statistic = 2.81 , p -value < 0.01). These two sets of univariate analysis provide preliminary evidence supporting our Hypothesis 1.

We then conduct multivariate analysis results. Detailed results are available upon request. After controlling for the effects of the control variables and industry and year fixed effects, we find that the coefficient of the interaction term $Public \times PostIPO_all$, which captures the DID estimate, is negatively significant ($\beta = -0.107$, $p < 0.01$) in predicting exploratory innovation, and positively significant in predicting exploitative innovation ($\beta = 0.106$, $p < 0.01$). Consistent with our Hypothesis 1, newly public firms after the IPO are more likely to emphasize exploitation, and become less exploratory in their innovation strategy.

Next we add the three-way interaction term $Public \times PostIPO_all \times Insider\ sales$ to test Hypothesis 2. Results show that it is negatively significant in predicting exploratory innovation ($\beta = -0.052$, $p < 0.01$), and positively significant in predicting exploitative innovation ($\beta = 0.060$, $p < 0.01$). Therefore, we find evidence supporting Hypothesis 2. Newly public firms after the IPO are even more (less) likely to adopt exploitative (exploratory) innovation if their CEOs do not have a long-term view and actively sell their own shares. Then we further add the three-way interaction term $Public \times PostIPO_all \times Takeover\ threats$ to test Hypothesis 3. Results show that it is negatively significant in predicting exploratory innovation ($\beta = -0.150$, $p < 0.01$), and positively significant in predicting exploitative innovation ($\beta = 0.178$, $p < 0.01$). Thus we also

find evidence supporting Hypothesis 3: Newly public firms after the IPO are even more (less) likely to adopt exploitative (exploratory) innovation if they face greater takeover threats. Finally, we add the three-way interaction term $Public \times PostIPO_all \times Transient\ institutional\ investors$ to test Hypothesis 4. Results show that it is negatively significant in predicting exploratory innovation ($\beta = -0.200$, $p < 0.01$), and positively significant in predicting exploitative innovation ($\beta = 0.228$, $p < 0.01$). Thus we also find evidence supporting Hypothesis 4. Newly public firms after the IPO are even more (less) likely to adopt exploitative (exploratory) innovation if they have a higher proportion of transient institutional investors.

We perform a number of robustness checks on the model specifications and measures of innovation strategy. First, we implement another DID specification including firm fixed effects and obtain very consistent results. Second, our results also remain unchanged when we use 80% as the cut-off to measure exploratory and exploitative innovation. Third, we use propensity score matching (PSM) to generate matched control firms with which we also find empirical support for our hypotheses. Fourth, we obtain similar results with longer observation window periods (extending three years (-3,+3) to five years (-5, +5) before and after the IPO). Finally, we follow Katila & Ahuja (2002) to employ two alternative measures for innovation strategy - *Scope* and *Depth*, and we find consistent results.

CONCLUSION

Our paper answers the recent call by Lavie *et al.* (2010: 142) that future research should “systematically study the antecedents to exploration-exploitation tendencies.” We focus on one critical phase in many firms’ growth trajectory—the decision to go public—and try to understand how the transition from private to public ownership influences a firm’s different emphasis on exploratory versus exploitative innovation strategy. Based on a sample of 291 IPO firms and their matched private firms over the period 1997-2008, we hypothesize and find that newly public firms, compared to their private peer firms, become more (less) exploitative (exploratory) in their innovation strategy. We argue and find that such a relation is due to managerial short-termism associated with public equity market as the relation becomes stronger when there are more insider sales, greater takeover threats, and more transient institutional investors, all of which exacerbate managerial short-termism (Bushee, 1998; Dechow & Sloan, 1991; Stein, 1989). Further, these results remain unchanged using a comprehensive set of control variables, different DID estimates, propensity score matching, and different measures for exploratory and exploitative innovation strategy.

REFERENCES AVAILABLE FROM THE AUTHORS