GOING PUBLIC: HOW STOCK MARKET LISTING

CHANGES FIRM INNOVATION BEHAVIOR

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Abstract

While going public allows firms access to more financial capital that can fuel innovation, it also exposes firms to a set of myopic incentives and disclosure requirements that may constrain innovation. We predict this tension produces a unique pattern of innovation strategies among firms going public with firms increasing their innovation levels but reducing their innovation riskiness. Specifically, we predict that after going public, firms innovate at higher levels and introduce higher levels of variety with each innovation while also introducing less risky innovation, characterized by fewer breakthrough innovations and fewer innovations into new-to-the-firm categories. We test our predictions by examining 40,000 product introductions from 1980-2011 in a sample of consumer packaged goods' firms that go public compared to a benchmark sample of firms that remain private. The results support our predictions. Utilizing tests to resolve questions about endogeneity, including self-selection, reverse causality, and competing explanations, we demonstrate that IPO selection and IPO dynamics are not driving this going-public effect. Finally, we uncover a set of industry factors that mitigate the drop in breakthrough innovation by offering product-market incentives that counterbalance the documented stock market incentives.

INTRODUCTION

The process of bringing new products and services to the market is of high strategic relevance (e.g., Chandy and Tellis 2000; Hauser, Tellis, and Griffin 2006). A long tradition across disciplines documents the positive stock market returns to R&D expenditures and patents (e.g., Erickson and Jacobson 1992; Griliches 1981). Investors value R&D expenditures and patents because these inputs are expected to convert into innovations that will generate future cash flows. New products increase sales and profits (Bayus, Erickson, and Jacobson 2003; Pauwels *et al.* 2004), and thereby firm value (Chaney, Devinney, and Winer 1991; Sood and Tellis 2009; Sorescu and Spanjol 2008).

Considering its importance to organizational prosperity, firms have an incentive to invest in innovation. However, the high costs, the uncertain payoffs, and the difficulty of adequately measuring returns to innovation create challenges for firms (Sood and Tellis 2009). This applies in particular to publicly-listed firms that are prone to suffer from agency conflicts and in which managers are exposed to stock market incentives. While such firms enjoy improved access to financial capital, their strategic choices are constrained because they have to meet short-term stock market expectations and disclosure requests. This tension translates into opposing impacts on firm innovation. On the one hand, improved financing from going public should encourage innovation. On the other hand, disclosure requirements and short-term stock market incentives may have a detrimental effect on innovation. Scholarly work has not yet determined the net effect of going public on firm innovation activity.

Anecdotal evidence illustrates how going public can reduce managerial discretion to innovate. Ingvar Kamprad, founder of IKEA, notes, "Keeping companies like IKEA in private hands would secure the freedom to have a long term view on investments and in business

development" (Kamprad 2011). Recently, Dell announced a leveraged buyout to reinvent its business strategy. Commentators suggest that as a private firm, Dell "…can make decisions that aren't just based on profits and revenues in the next quarter, but with a longer-term focus" (Devaney 2013, p. 8). Echoing this, business periodicals point out that successful privately-held companies want to remain private in order to avoid "…Wall Street's obsession with quarterly earnings expectations" (Woo and Reifman 2003, p. 174) and to enjoy the "…freedom from reduced obligations to Sarbanes-Oxley reporting requirements" (Murphy 2012). Tellis (2013, p. 239) refers to the negative effect of stock markets on managerial decisions as the "Wall Street curse" and specifies that "…pressure from investors on Wall Street causes managers to cut investments in innovation to boost current earnings and stock prices, at the cost of future innovation, growth, and long-term market cap."

Previous academic literature has explored how stock market incentives constrain public firms' innovation investment decisions. Graham, Harvey, and Rajgopal (2005) find that 80% of managers are willing to decrease R&D spending and 55% are willing to delay starting a positive NPV project in order to meet current earnings projections. Referred to as "marketing myopia," Mizik (2010) observes that firms cut marketing and R&D spending to improve short-term stock valuations despite the negative long-term firm value consequences of these cuts. Likewise, Chakravarty and Grewal (2011) find that past stock return level and volatility increase the likelihood that managers cut R&D budgets to avoid unexpected earnings shortfalls.

Other innovation research explores stock market effects beyond earnings management. For example, Markovitch, Steckel, and Yeung (2005) find that firms alter the risk profiles of innovation projects conditional on their prior period's industry-adjusted stock returns. Moorman *et al.* (2012) observe that stock market incentives drive firms to time their innovation strategies

through a ratcheting strategy which sacrifices revenues in product markets but reaps benefits in financial markets. Research contemporaneous to our study shows that firm patent quality declines after firms access public stock markets (e.g., Bernstein forthcoming).

Table 1 summarizes empirical research examining how firms manage innovation in response to stock market incentives. We organize papers according to how innovation is operationalized—R&D spending, patents, or new product introductions. The columns account for whether studies have focused on publicly-listed firms or on how firms change their innovation actions upon accessing public stock markets. The majority of papers have two properties—a focus on public firms and a focus on R&D and patents.

[Insert Table 1 here]

Our paper offers a unique view of how firms manipulate innovation in response to stock market incentives by studying the effect of stock market listing on new product introductions. In doing so, we offer the following contributions. First, new product introductions are a more valid measure of firm innovation. Research has found that R&D expenditures are not deterministically related to product introduction level or timing (e.g., Lerner, Sorensen, and Strömberg 2011) and accounting rules make R&D expenditures a noisy measure of innovation (Hall and Lerner 2010). Likewise, patents are an unreliable indicator of innovation given many patents are not exploited commercially (Cohen and Levin 1989); firms do not patent all innovations given time delays, administrative costs, disclosure requirements, and the availability of alternative ways to protect innovation. Indeed, the consumer packaged goods (CPG) firms in our sample patent only 8.7% of new products. Contributing to this noisy measure, Lerner, Sorensen, and Strömberg (2011) observe that employees often file marginal patents unlikely to produce innovations or file bundled claims as separate patents to receive company rewards. Given these challenges,

examining new product introductions should allow stronger inferences about the effect of going public on firm innovation.

Second, using new product introductions offers an opportunity to examine an array of different dimensions of risk important to firm innovation strategy, including whether the innovation has breakthrough product features or whether it reflects the firm's market entry into new categories. The latter allows us to examine the going-public effect on both product and market forms of innovation—while the literature had tended to focus on qualities of the offering as denoted in a patent. We also examine the tendency for public firms to minimize risk by offering variations of the same product—a strategy known as SKU proliferation in the CPG industry.

Third, studying firms in the CPG sector offers broader insights into a sector of considerable economic significance and one in which innovation plays an important role. Existing literature has focused on industries, in general, or on firms in the technology sector—a sector that has more volatile and herd-like demand fluctuations, fragmented competitive environments, and contentious intellectual property conditions. Firms in the CPG sector face different regimes to appropriate value from innovations that may influence their innovation strategies upon going public. Fourth, while the majority of papers examine public firms, we utilize the quasi-experimental IPO context to study stock market effects. Together with tests to rule out selection concerns, reverse causality, and competing firm dynamics, this allows us to observe a shift in innovation associated with being a publicly-listed firm. A small set of recent papers use similar empirical strategies. We add to the generalizability of the going-public effect not only by studying firms in the CPG sector, but also by studying firms across a longer time

series—up to 30 years before and after the IPO. This prolonged observation period ensures that our results reflect a stock market regime shift and not only short-term dynamics around the IPO.

Using this approach we observe that the net effect of a stock market listing on innovation is an increase in the level of innovations and a decrease in the riskiness of those innovations. Specifically, after going public, firms introduce a larger number of innovations and a larger variety of each innovation (i.e., different flavors, package sizes, etc.). At the same time, firms introduce fewer breakthrough innovations and fewer innovations into categories in which they do not have experience.

Given these results, we offer a final contribution to the literature—initial insights on the question of why some firms do not succumb to the going-public effect and continue to introduce risky innovations. Specifically, we offer preliminary ideas about a set of industry factors which offer product-market incentives that dominate stock market incentives.

The remainder of our paper is organized as follows. We begin by surveying prior literature that provides the theory underlining our predictions. This is followed by a set of predictions about the effect of going public on firm innovation. We then describe our empirical strategy and results, followed by a set of exploratory analyses that seek to enlarge our contribution and a set of robustness tests to resolve questions about endogeneity. We finish with a discussion of our results with an emphasis on implications for theory and practice.

GOING PUBLIC AND INNOVATION ACTIVITY

Going Public and Firm Investment Behavior

Going public is a critical event that "forever transforms how a company goes about doing business" (PricewaterhouseCoopers 2012, p. 23). Surprisingly, despite improved financing conditions from accessing public stock markets, research indicates that firms experience declines

in operating performance, sales growth, and overall factor productivity post-IPO (e.g.,

Mikkelson, Partch, and Shah 1997; Chemmanur, He, and Nandy 2010). Importantly, this post-

IPO decline in performance is not an artifact of accounting choices, but instead appears to be

related to firms becoming less responsive to investment opportunities after they go public

(Asker, Farre-Mensa, and Ljungqvist forthcoming).

Going Public and Firm Innovation Behavior

A substantial part of investment in the consumer packaged goods sector flows into

product innovation. In an industry in which 22% of consumers are "…always looking for new

products" (Symphony IRI 2012, p. 1), innovation is a key driver of growth. In 2012 alone, this

sector introduced more than 1,900 new products in the U.S. (Symphony IRI 2013).

Affordable financing is critical to developing and marketing these new products.

However, our survey of existing work on the impact of stock market financing on innovation

uncovers both positive and negative effects. On the one hand, going public may have a positive

impact on innovation activity. The immediate cash inflow following an IPO relieves firm

financial constraints that are widely accepted as a major bottleneck for innovation (e.g., Hall and

Lerner 2010; Tellis, Prabhu, and Chandy 2009). Furthermore, public firms also benefit from

lower-cost equity financing in the future (e.g., Maksimovic and Pichler 2001) and from improved

access to nonfinancial resources that help them compete in product markets. For example, CFOs

report that public status enhances firm recognition and reputation (Brau and Fawcett 2006),

which can be leveraged to attract employees, to strengthen bargaining power with suppliers, and

to signal quality to customers, all of which should facilitate innovation.

On the other hand, going public may have a negative impact on innovation activity for

two reasons. First, compared to privately-held firms, public firms experience stronger disclosure

incentives. This stems from both mandatory stock exchange disclosure rules and from investors demanding information to properly value the firm. Disclosures increase the spillover of sensitive information to competitors, thereby reducing the rents firms extract from innovation (Brau and Fawcett 2006; Spiegel and Tookes 2008). Given these spillovers, going public should dampen firm innovation, especially in industries with low protection mechanisms, such as the CPG sector. Consistent with this view, Guo, Lev, and Zhou (2004) show that firms are more willing to disclose information about innovative products if they are protected by patents or are in the late stage of a development cycle.

Second, going public imposes myopic performance incentives on the firm. Specifically, managers of public firms face incentives that lead to an overemphasis on current financial results and the current stock price (Stein 1989). High stock liquidity associated with a stock market listing accentuates this pressure because investors can penalize firms at the slightest sign of underperformance by selling the stock. As such, managers feel pressure to meet short-term earnings projections and to invest in projects with immediate and less risky payoffs that are easily valued (Ferreira, Manso, and Silva 2014). These pressures are compounded by the fact that investors lack information and hence have difficulty properly valuing innovation (e.g., Cohen, Diether, and Malloy 2013).

PREDICTIONS

The tension arising between capital inflows versus stock market incentives begs the empirical question of whether and how private firms change their innovation strategies after they go public. Consistent with our theory, we argue that improved access to resources will increase firm *innovation levels*, while stock market incentives will decrease the *riskiness of innovation*. The next sections develop formal predictions about this tradeoff.

Does Going Public Change the Level of Innovation?

Does going public increase the overall number of innovations? The overriding goal of going public is to ensure continued growth (Brau and Fawcett 2006), and innovation, especially in the CPG sector, is a pivotal part of achieving that goal. As discussed before, innovation is likely to be more sensitive to financing constraints than other forms of investments (e.g., Hall and Lerner 2010). Hence, an immediate inflow of financial capital and improved access to future capital should be positively related to overall *number of innovations*. We predict:

H1:   After going public, firms introduce a larger number of innovations.

Does going public increase innovation variety? In general, CPG firms do not introduce a single version of a new product. Instead, they introduce *innovation variety*, defined as the number of different versions of the same product that differ by package size, color, formulation, or taste. Offering a larger variety of the same innovation is a popular strategy to generate sales for several reasons. First, a greater assortment satisfies customer variety seeking within a segment and appeals to different customer segments. Second, more variety increases the firm's share of shelf space which prevents competitive offerings from seizing the space. Third, the coordinated packaging and labeling across the different SKUs can achieve a sort of "billboard effect" on the store shelf (Quelch and Kenny 1994, p. 154), which increases brand awareness and brand reputation. The inflow of immediate cash and improved access to future capital should enable firms to scale up their innovation variety. We predict:

H2:   After going public, firms introduce a higher level of variety per innovation.

Does Going Public Change the Riskiness of Innovation?

While an increase in financial resources may lead to an increase in innovation levels, stock market incentives are predicted to have a dampening effect on the riskiness of innovation.

We expect that managers become less willing to take the risks associated with bolder and more discontinuous innovations and instead focus more on incremental and familiar innovations that translate into profits more quickly.

Does going public decrease the level of breakthrough innovations? *Breakthrough innovations* offer substantially new consumer benefits to the market (Sorescu and Spanjol 2008; Chandy and Tellis 1998) as compared to incremental innovations that offer only minor new consumer benefits. As discussed before, stock market disclosure requirements and investors' informational demands can discourage firms from conducting breakthrough research because they prevent firms from appropriating monopolistic rents on breakthrough innovations. Myopic stock market incentives likewise dissuade managers from choosing long-term breakthrough research projects. Instead, managers are more likely to choose incremental projects with short-term and lower-risk payoffs. Incremental innovations are less complex for customers and are more compatible with complementary products currently used by customers. As a result, faster customer adoption is likely (Rogers 2003), which motivates retailers to designate more shelf space to such offerings, and promises earlier firm revenue streams. Furthermore, choosing conventional projects helps managers communicate the project's prospects, which in turn will be more positively and instantaneously reflected in the current stock price from which managers derive utility (Cohen, Diether, and Malloy 2013). We predict:

H3: After going public, firms decrease the level of breakthrough innovations.

Does going public decrease innovations in new-to-the-firm categories? The high failure rate of new products introduced in the CPG industry has been well documented (Steenkamp and Gielens 2003). To reduce the likelihood of failure, managers may seek to introduce innovations into familiar categories as opposed to *new-to-the-firm categories*, defined as markets in which

the firm does not have any existing brands. Innovating within familiar categories is a less risky strategy as the firm can exploit its category-specific knowledge and leverage integrated operations along the value chain. This strategy also allows the firm to leverage its brand equity as well as its existing customer and channel relationships to generate faster market penetration. Finally, staying in familiar terrain requires fewer explanatory firm disclosures and makes it easier for investors to interpret and value firm innovations. For these reasons, we predict:

H4:   After going public, firms are less likely to introduce innovations into new-to-the-firm categories.

METHOD

Data Sources

The empirical setting for our study is the CPG sector—a key economic sector in the U.S. in terms of employment and GDP contribution. The sector has demonstrated extraordinary stock market performance as evinced by an average annual increase in total returns to shareholders of 10% over the past 25 years, outperforming the S&P 500 index as well as high-growth industries such as information technology, telecommunication, and energy (McKinsey & Company 2011). Despite its economic importance, the sector has been underrepresented in empirical innovation research (e.g., Bayus, Erickson, and Jacobson 2003). Importantly for our study, the sector heavily relies on product innovation as a growth strategy (Sorescu and Spanjol 2008).

To test our predictions, we assemble a data set based on several archival sources: (i) Datamonitor's ProductLaunch Analytics for information about U.S. firm product introductions into U.S. food, drug, and mass retailers; (ii) EDGAR and SDC Platinum for information on IPOs (Global New Issues Database) and mergers and acquisitions (Mergers & Acquisitions Database); (iii) Compustat annual firm databases for financial and accounting data; (iv) ReferenceUSA and

the Center for Research in Security Prices (CRSP) database for firm public status and firm age;

(iv) Factiva newspaper database for firm press coverage; and (v) IRI's *Marketing Factbook* for

industry-level (defined as category-level in these data) and firm-level controls.

Sample

The sample begins with the population of U.S. firms tracked by ProductLaunch Analytics

that introduce CPG products into the U.S. market (n = 215,668). We eliminated firms for which

we could not locate a company name or that have incomplete product data such as category or

breakthrough rating *(n = 434)*. We dropped firms that introduced only one product during the

observation period given it is unreliable to study changes in introductions for these firms (n =

28,709). We then looked up each of the remaining firms in ReferenceUSA to determine whether

they went public between 1980 and 2011. If so, we searched SEC Form S-1 filings to determine

the exact date of the IPO. We deleted those firms that were not incorporated in the U.S., firms we

could not unambiguously locate in Compustat, firms that were all-private or all-public during the

observation period, and firm-year observations after firms delist from public stock markets (total

n = 145,798). Using the SDC Platinum Mergers & Acquisitions Database, we identified firms

involved in M&A and ensured product introductions were assigned to the correct firm.

This left a final sample of 40,724 new product introductions by 207 firms undergoing an

IPO during the observation period. This sample, referred to as "changeover firms," involves

3,954 firm-year observations. It reflects an unbalanced number of years before and after the IPO

in order to capture the widest time series possible. However, we have at least three years of data

pre-IPO and post-IPO.[1]

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[1] If the IPO was completed after March 2009, we dropped the firm to ensure we have at least three years of post-IPO data. In unreported analyses, we repeat our models for firms including IPO years up until 2010 and results replicate.

In the process of building the changeover sample, we also identified firms that remain private throughout the observation period. We retained these firms and built a private benchmark sample, which comprises 158 firms that introduce 18,160 new product introductions between 1980 and 2011. We have 3,433 firm-year observations for this sample of private firms.

Measures

Our predictions examine four dimensions of firm innovation activity—all derived from ProductLaunch Analytics, which is an established data source in CPG studies (Moorman *et al.* 2012; Sorescu and Spanjol 2008). ProductLaunch Analytics counts each new product introduction as an innovation. We measure the number of *firm innovations* by counting the firm's total new products introduced in a given year. Since the yearly number of innovations is highly skewed, we follow Chemmanur and Tian (2013) and use the natural logarithm of the count. To avoid losing firm-year observations in which zero products were introduced, we add one to the actual number when calculating the natural logarithm. As the measure of *firm innovation variety*, we collect the number of stock-keeping units (SKUs) associated with each firm innovation and use the natural logarithm of SKUs per firm innovation.

To capture *firm breakthrough innovation*, we follow Sorescu and Spanjol (2008) and count the number of new products that target a new market and/or offer a substantially new consumer benefit through product positioning, merchandising, packaging, formulation, or technology. These classifications are drawn from the ProductLaunch Analytics database and we use the natural logarithm of the firm's breakthrough innovation count.

Lastly, we measure innovation in a *new-to-the-firm category* as equal to 1 if the firm introduces an innovation into a category for which the firm has no experience in a given year and 0 otherwise. We construct a binary variable instead of a count variable because firms rarely

introduce new products into more than one new category in a given year (3% of the cases). To measure new-to-the-firm category, two research assistants used the product description in ProductLaunch Analytics to classify each innovation into its corresponding IRI *Marketing Factbook* category. This was a straightforward task with 99% agreement (e.g., ProductLaunch's "shampoos" were classified into IRI's "shampoo and conditioner" category). We then compared the coded category of the firm's innovation to the firm's history of categories during the observation period to determine whether or not it represents a new category for the firm.

Our focal predictor is the binary post-IPO variable *Public*. This variable equals 1 if the firm-year observation occurs when the firm is in public state and 0 if the firm is in private state. We capture the going-public effect by comparing the post-IPO innovation outcomes to the same firm's pre-IPO innovation outcomes (i.e., a within-firm effect) and to firms that remain private throughout the observation period (i.e., a between-firm effect). This approach, which corresponds to the difference-in-difference identification strategy used by Chemmanur, He, and Nandy (2010), controls for firm-specific effects over time as well as cross-sectional effects stemming from unobserved time-specific variation.

Lastly, we control for several variables. We include *firm age* to control for firm life cycle effects. To measure firm age, we collect firm founding dates from the ReferenceUSA database. If no entry was found, we use the first entry in the CRSP database as the founding date. Previous research suggests that *firm size* influences innovation efforts (e.g., Chandy and Tellis 2000). We lack time-series data to compute conventional measures of firm size, such as firm sales or number of employees, given that such data are not available for private firms. Therefore, we resort to *firm press coverage* as a proxy for firm size, operationalized as yearly-weighted number of articles found about the focal firm in the Factiva newspaper database. Previous literature

documents strong correlations between media coverage and traditional firm size metrics (Fang

and Peress 2009). For our public-state observations, we find correlations of firm press coverage

with firm sales ($\rho = 0.51$, $p<0.01$), firm total assets ($\rho = 0.47$, $p<0.01$), and firm number of

employees ($\rho = 0.32$, $p<0.01$).[2] To control for the fact that innovations might generate press

coverage and thereby distort our size proxy, we regress press coverage on firm innovations

(controlling for year fixed and firm fixed effects) and use the residual as an alternative measure

of firm size. We replicate our results.

We also include a variable to control for the demand frequency of firm innovation efforts,

measured as *industry purchasing frequency*. Purchasing frequency is defined as the number of

times the average buying household purchases products in a given category over a year. We

calculate purchasing frequency averages from the IRI *Marketing Factbook* for each IRI category

and year and match it with firm data for the firm's dominant industry as determined by

Compustat. We also include *industry concentration*, to control for the impact of a firm's

competitive situation on its innovation strategies. Our measure is the Herfindahl-Hirschman

index, which is the sum of squared market shares of firms in a firm's industry.

Modeling and Estimation Approach

This section describes our four core models in detail. We begin by testing our predictions

with these models. Following this, we offer a set of tests to rule out questions related to

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[2] In an effort to circumvent these data limitations, we utilized the following strategy to collect firm revenue data. First, to gauge data availability, we looked up each firm in archived versions of Wards Business Directory and Dun & Bradstreet Million Dollar Directory in five-year increments across the thirty-year observation period (e.g., 1980, 1985, 1990, 1995, 2000, 2005, and 2010). We were able to locate each firm in at least one of these five-year intervals at the following rates—55% of the private firms and 70% of the changeover firms. Unfortunately, the time-series of firms was incomplete for many years, meaning that most firms do not appear in the majority of time periods in these volumes. In the end, we were only able to retrieve 24% of the firm-year observations, making it untenable to use this measure in our analysis. Despite this, we observe a correlation of $\rho = 0.53$ ($p<0.01$) between the collected firm sales data and firm press coverage, thus increasing confidence in our current measure of firm size.

endogeneity, including alternative explanations for our observed effects associated with IPO selection, reverse causality, and firm dynamics.

Does going public increase the overall number of innovations? We predict that the number of innovations will increase after the IPO and build the following model to test this prediction:

$$(1) \quad Innovations_{i,t} = \beta_0 + \beta_1 Public_{i,t} + \beta_{2\text{-}5}Controls_{i,t} + \delta_t Years_t + \alpha_i + \varepsilon_{i,t}$$

where $Innovations_{i,t}$ is the natural logarithm of the number of innovations introduced by firm i in year t, and $Public_{i,t}$ is a dummy variable that indicates whether firm i is public (1) or private (0) in year t. $Controls_{i,t}$ captures the vector of control variables (i.e., firm age, purchasing frequency, industry concentration, and press coverage). $Years_t$ is the vector of year dummies, α_i are firm fixed effects to control for unobserved heterogeneity, and $\varepsilon_{i,t}$ is an error term $\sim N(0,\sigma)$. We use cluster-robust standard errors to estimate Equations 1-4 to control for heteroskedasticity and serial correlation in the error terms.

Our focus is on β_1 which indicates whether a firm changes its overall innovation level after going public. In a semilogarithmic model, the percentage change in the level of the dependent variable is not equal to the coefficient of the binary variable multiplied by 100. We correct for this by transforming the coefficient ($\exp(\widehat{\beta_1})$-1) (Halvorsen and Palmquist 1980) in Equations 1-3. A positive (negative) coefficient denotes that firms increase (decrease) the overall number of innovations post-IPO.

Does going public increase innovation variety? We examine how the number of different SKUs associated with an innovation changes after the firm's IPO with the following model:

$$(2) \quad InnovationVariety_{j,i,t} = \beta_0 + \beta_1 Public_{i,t} + \beta_{2\text{-}6}Controls_{i,t} + \delta_t Years_t + \alpha_i + \varepsilon_{i,t}$$

where *InnovationVariety$_{j,i,t}$* is the natural logarithm of the number of SKUs of innovation *j* for firm *i* in year *t*. As before, *Public$_{i,t}$* indicates firm public status, and *Controls$_{i,t}$* measures the set of control variables firm age, industry purchasing frequency, industry concentration, firm press coverage, and firm total innovations. *Years$_t$*, α_i, and $\varepsilon_{i,t}$ share the same interpretation as in Equation 1. A positive (negative) β_1 coefficient implies that firms introduce a larger (smaller) number of different SKUs per innovation after going public.

Does going public decrease the level of breakthrough innovations? To answer this question, we model:

$$(3) \quad Breakthrough_{i,t} = \beta_0 + \beta_1 Public_{i,t} + \beta_{2\text{-}6} Controls_{i,t} + \delta_t Years_t + \alpha_i + \varepsilon_{i,t}$$

where *Breakthrough$_{i,t}$* is the natural logarithm of the number of breakthrough innovations by firm *i* in year *t*. The right-hand side variables have the same interpretation as in Equation 2. A positive (negative) β_1 coefficient implies that, after going public, firms introduce a larger (smaller) number of breakthrough innovations, controlling for overall innovation level.

Does going public decrease innovations in new-to-the-firm categories? Finally, H4 predicts that post-IPO firms are more likely to introduce their innovations into familiar categories instead of expanding into new-to-the-firm categories. We estimate the following Probit model to test this prediction:

$$(4) \quad Pr(NewCat_{i,t}=1|x_{i,t},\beta,v_{i,t}) = \Phi(\beta_0 + \beta_1 Public_{i,t} + \beta_{2\text{-}6} Controls_{i,t} + \delta_t Years_t + v_{i,t})$$

where *NewCat$_{i,t}$* is a binary variable equal to 1 if the firm introduces any of its innovation in year *t* into a new-to-the-firm category, and 0 otherwise. *Public$_{i,t}$*, *Controls$_{i,t}$*, and *Years$_t$* share the same interpretation as in Equation 2, $v_{i,t}$ is an error term $\sim N(0,\sigma)$, and Φ is the standard normal cumulative distribution function. We only retain firm-year observations in which firms introduce at least one innovation given we are not able to determine category choices if no introductions

are made. A positive (negative) coefficient provides evidence that firms are more (less) likely to introduce their innovations into new-to-the-firm categories after going public.

RESULTS

Table 2 presents summary statistics for our sample. Firms introduce an average of 5.5 innovations per year. Most of these innovations are incremental (only 0.32 are breakthrough), which is in line with prior research on innovation in the CPG sector (e.g., Steenkamp and Gielens 2003). Firms introduce an average of 2.30 different SKUs per innovation and tend to innovate in familiar categories.

Figure 1 depicts the time series of IPO activity in our sample. Confirming previous literature, we observe a high number of IPOs in the mid-1990s.[3] A clustering of IPOs in the midst of our time series fits well with our research set-up and ensures a balanced number of pre- and post-IPO year observations.

[Insert Table 2 and Figure 1 here]

Does Going Public Increase the Overall Number of Firm Innovations?

Table 3 presents Equation 1 regression results. Results indicate that the overall model is significant ($F(31) = 7.35$, $p<0.01$). In support of H1, we find that that β_1 is positive and significant ($\beta_1 = 0.1167$, $p<0.01$), suggesting that going public is positively related to the number of innovations the firm generates subsequently. Specifically, compared to private and controlling for other firm characteristics, public firms introduce 12% more innovations, on average. Figure 2a plots the actual number of innovations +5 years to -5 years around the time of the IPO for the

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[3] Firms go public in waves and IPO climate conditions are a main driver of the decision to go public (e.g., Brau and Fawcett 2006). We compare our sample distribution of IPOs to the population distribution of all IPOs in the U.S. from Jay Ritter's IPO data (see http://bear.warrington.ufl.edu/ritter/ipodata.htm) and find an almost identical pattern.

sample of changeover firms. The graph shows a stable level of innovations before going public followed by an increase in the years following the IPO.

[Insert Table 3 and Figure 2a here]

We test the robustness of Equation 1 results by using untransformed innovation data instead of the logged innovation data. Since the untransformed innovation data takes on only non-negative and integer values, we follow traditional patent literature in economics and find that the results remain unchanged when estimated with a negative binomial model (Bernstein forthcoming).

Does Going Public Increase Firm Innovation Variety?

Figure 2b depicts the actual number of SKUs per innovation for the changeover sample. As can be seen there, the number of SKUs increases at the time of the IPO and then levels off. Equation 2 in Table 3 reports our regression results. The overall model is significant ($F(31) = 21.20$, $p<0.01$). Confirming H2, going public increases the number of SKUs that firms launch for each innovation ($\beta_1 = 0.0353$, $p<0.01$). As an aside, we also observe that an increase in the number of innovations is associated with a lower number of SKUs per innovation. We suspect this reflects financing constraints firms face when trading off the number of new products and the number of varieties for each new product.

[Insert Figure 2b here]

Does Going Public Decrease the Degree of Breakthrough Innovations?

We plot the cross-sectional proportion of breakthrough innovations to total innovations for the changeover firms in Figure 2c. In line with theoretical models (see Spiegel and Tookes 2008), we find a spike of breakthrough innovations in the year prior to the IPO and a gradual

decrease following the IPO. We present a formal test of Equation 3 in Table 3.[4] The overall

model is significant ($F(32) = 8.56$, $p<0.01$) and, consistent with H3, going public decreases the

number of breakthrough innovations ($\beta_1 = -0.0360$, $p<0.05$). Unreported robustness checks show

that the number of incremental innovations (defined as firm total innovations minus

breakthrough innovations in a given year) increases after going public. That is, while introducing

an overall larger number of innovations, firms introduce more incremental innovations and fewer

breakthrough innovations.

[Insert Figure 2c here]

Does Going Public Decrease Innovations in New-to-the-Firm Categories?

As depicted in Figure 2d, the number of new-to-the-firm categories drops rapidly after the

IPO. This is supported by the binary regression results of Equation 4 in Table 3.[5] The model is

statistically significant ($\chi^2(32) = 171.59$, $p<0.01$). After going public, firms are less likely to

expand into new-to-the-firm categories ($\beta_1 = -0.4879$, $p<0.01$), controlling for the total number of

innovations. This supports H4. In unreported tests, we also control for the cumulative number of

categories the firm has introduced products in and find the going public effect to be even

stronger ($\beta_1 = -0.5205$, $p<0.01$).

[Insert Figure 2d here]

Summary

Our findings indicate that when a CPG firm goes public, it increases the number and

variety of innovations it introduces but reduces the riskiness of those innovations (measured as

number of breakthrough innovations and new-to-the-firm categories). Given the importance of

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[4] To mitigate concerns that Equation 3 becomes endogenous when we control for the number of innovations, we follow Sorescu and Spanjol (2008) which instruments the number of innovations in year t by the number of innovations in year t-1. Our results replicate.

[5] We re-estimate Equation 4 including firm-year observations with zero innovations and find our results replicate.

our findings, the next two sections offer follow-up analyses and a set of endogeneity checks. The first section begins by offering an exploratory examination of whether firms can beat the going-public effect. This is followed by two corroborating analyses. Specifically, if the stock market has the effect of influencing innovations for firms that go public, does going private have the opposite effect and does the degree of exposure to the stock market strengthen the effect? The second section examines questions related to endogeneity, including alternative explanations for our observed effects associated with IPO selection, reverse causality, and firm dynamics.

FOLLOW-UP AND CORROBORATING ANALYSES

Can Firms Beat the Going-Public Effect?

Our results demonstrate that going public reduces the riskiness of firm innovations, including breakthrough innovations and innovations into new-to-firm categories. Given these effects, we now consider whether some firms continue to introduce risky innovations despite going public and if so, what factors differentiate these firms. We focus our attention on whether firms continue to introduce breakthrough innovations given breakthrough innovations have a clear positive effect on firm performance (e.g., Sorescu and Spanjol 2004). The choice to introduce products into new categories has a more equivocal effect, with some research observing a negative effect on firm performance due to the costs of diversification (e.g., Campa and Kedia 2002; Wernerfelt and Montgomery 1988) and other research pointing to a positive effect due to risk diversification (e.g., Villalonga 2004).

Given our focus on stock market incentives, we examine two types of countervailing product-market incentives that should tip the public firm's calculus toward continuing to introduce breakthrough innovations. First, there must be demand-side opportunity, meaning a strong likelihood that customers will purchase the firm's breakthrough innovation. Second, there

must be appropriability opportunities that protect the firm's ability to extract profits from its breakthrough innovation.

We examine these moderating forces at the industry level given they are product-market variables. This industry-level view offers two additional empirical advantages. We are able to retain the same empirical approach used in our hypotheses testing given we can measure these industry factors when the firm is in a private and a public state. A focus on industry factors also minimizes endogeneity concerns as these factors are independent of firm strategy.

Beginning with demand-side opportunities in product markets, we theorize that public firms operating in industries with higher *industry sales growth* will make higher investments in risky innovation given the expectation of an increasing pie and potentially a larger piece of that pie (McDougall *et al.* 1994). Similarly, we expect that *industry demand instability* will weaken firm incentives to engage in risky innovation given it jeopardizes innovation returns, which puts public firms at risk of under-delivering against investors' earnings projections.

Public firms are more likely to invest in risky innovation when they have increased opportunity to extract or appropriate the returns from doing so (Cohen and Levin 1989). Given this, we focus on two industry factors that should heighten this opportunity. First, we expect that higher *industry value appropriation emphasis* will increase this opportunity. Firms may appropriate value from innovation by protecting returns with patents or by advertising (which builds brands and customer relationships), both of which may protect the firm from imitators. Given its low patent rate, the CPG sector appears to use advertising for this purpose. If, as Mizik and Jacobson (2003, p. 66) argue, company "…resources end up concentrated in the areas of the greatest perceived importance," it follows that an industry emphasis on value appropriation will support firms investing in breakthrough innovations. Although conceptualized as a firm trait, we

argue that industries also vary on this emphasis.[6] Second, we expect that higher *industry concentration* will increase opportunities to extract value from innovation. This is the case because higher levels of industry concentration typically reduce the entry of new competitors and the intensity of competition among existing firms in the industry.

To test these predictions, we construct interaction terms with each product market contingency and the public state dummy, add them to our breakthrough innovation model (Equation 3), and estimate the resulting model:

$$(5) \quad Breakthrough_{i,t} = \beta_0 + \beta_1 Public_{i,t} + \beta_{2-5}Controls_{i,t} + \beta_{6-9}ProductMarketFactors_{i,k,t}$$
$$+ \beta_{10-13}Public_{i,t}*ProductMarketFactors_{i,k,t} + \delta_t Years_t + \alpha_i + \varepsilon_{i,t,}$$

where $Breakthrough_{i,t}$, $Public_{i,t}$, $Years_t$, and α_i share the same interpretation as in Equation 3, $Controls_{i,t}$, is the same vector of control variables except for firm industry concentration which is now in the $ProductMarketFactors_{i,k,t}$ vector. $ProductMarketFactors_{i,k,t}$ is the vector of product market contingencies for firm i in industry k. We mean center all continuous variables to facilitate interpretation of the public main effect. As before, we use cluster-robust standard errors to estimate Equation 5, and $\varepsilon_{i,t}$ is an error term $\sim N(0,\sigma)$.

We measure industry sales growth as the compounded annual sales growth rate over the previous three years (Luo and Donthu 2006) and industry demand instability as the standard deviation of the industry sales growth (Gruca and Rego 2005). Following Mizik and Jacobson (2003), we measure industry appropriation emphasis as firm advertising expenditures minus firm R&D expenditures, scaled by total assets, averaged over all firms per year in a given industry.[7]

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[6] Mizik and Jacobson (2003) also highlight industry differences in these emphases in their paper.
[7] While three of our four moderators can only be measured at the industry level, value appropriation emphasis can also be measured at the firm level. We remain at the industry level for theoretical reasons and also so we can observe the firm in both its public and private states—a feature that is important to our quasi-experimental design.

As before, industry concentration is measured by the Herfindahl-Hirschman index. Web Appendix A contains a correlation matrix of all variables in this model.

The overall model is significant ($F(39) = 6.03$, $p<0.01$) and our public main effect remains negative and significant ($\beta_1 = -0.0310$, $p<0.05$). Industry sales growth positively moderates the going-public effect ($\beta_{10} = 0.3146$, $p<0.05$), while industry demand instability does not have a significant impact, although the sign is in the expected direction ($\beta_{11} = -0.0139$, *n.s.*). Industry strategic emphasis *($\beta_{12} = 1.1167$, $p<0.01$)* and industry concentration ($\beta_{13} = 0.1421$, $p<0.05$) positively moderate the going-public effect. That is, in industries in which firms can more easily protect their innovation rents, firms are less likely to reduce their breakthrough innovations after going public. Web Appendix B provides a complete set of model results. Examining these results, we conclude that the industry in which a public firm operates can offer product-market incentives that counterbalance stock market pressures. In particular, both demand opportunities and innovation-appropriability opportunities can counteract stock market pressures faced by public firms.

Does Going Private Influence Level and Riskiness of Innovations?

If our theory holds, we should observe the reverse of the going-public effect when firms delist from public stock markets. Specifically, after going private, there should be a drop in innovation level and an increase in the riskiness of innovations. To examine this question, we identify a new sample of 90 public CPG firms from Compustat that delist from public stock markets within our observation period. Excluding those firms that lack data for at least three years before and after the delisting (Lerner, Sorensen, and Strömberg 2011) reduces the sample

size to 77 firms.[8]

Block (2004) observes that the ratio of firms going private to going public is in the 20-30% range, which compares well to our sample ratio of 36%. We then test Equations 1-4 and capture the going private effect by the reversed sign of the *public* variable.

Confirming the counterfactual implied in H1 and H2, firms significantly decrease their level of innovations (β_1 = -0.2256, $p<0.05$) and marginally decrease their innovation variety (β_1 = -0.6688, $p<0.10$) after going private. We also find that firms are more likely to introduce products into new-to-the-firm categories (β_1 = 0.4515, $p<0.05$) after delisting (H4). Our results do not, however, provide evidence that firms increase their number of breakthrough innovations after going private (β_1 = -0.0066, *n.s.*) (H3).

How do SEOs Continue to Influence Firm Innovation?

Another follow-up question involves whether firms that are more exposed to the stock market experience similar changes in innovation. Specifically, we analyze the innovation strategies of firms that offer seasoned equity after the initial IPO. We collect information on seasoned equity offerings of the changeover firms from the SDC Platinum Global New Issues database and create a variable that cumulatively counts the number of SEOs for each firm. The maximum number of SEOs observed per firm in our sample is 9 (M = 0.61, SD = 1.40). Interacting the SEO count variable with the public state dummy and including it in our earlier models has a significant effect only for the number of breakthrough innovations (β_1 = -0.030, $p<0.05$). Thus, offering more equity to public firms increases their exposure to stock market incentives and leads firms to reduce breakthrough innovation levels.

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[8] Lerner, Sorensen, and Strömberg use three years before and five years after in their paper. To maximize our sample size, we adopt the three-year frame before and after.

ENDOGENEITY ANALYSES

Our empirical identification strategy lacks randomized assignment into the going public

or staying private firm conditions. Hence, we cannot rule out that the going-public decision is

correlated with the firm's innovation activity. We address this potential endogeneity problem, in

part, given we use a fixed-effects estimator which rules out time-invariant unobservable firm

characteristics that may be confounded with both the decision to go public and firm innovation

strategies (e.g., Chemmanur, He, and Nandy 2010; Mikkelson, Partch, and Shah 1997). In this

section, we describe three additional strategies to mitigate endogeneity concerns, including self-

selection, reverse causality, and alternative explanations involving firm dynamics.

Ruling Out Self-Selection

Heckman self-selection correction. To perform the Heckman two-step estimation, we

begin by estimating a first-stage binary regression to predict the probability of being a publicly-

listed firm using a latent index function $IPO^* = \beta'X + u$, with $IPO = 1$ if $IPO^* > 0$ and $IPO = 0$ if

$IPO^* < 0$. We follow Xiong and Bharadwaj (2011) and include a measure of firm size (press

coverage proxy), firm location (state of firm headquarter), firm age, and industry dummies as

predictors of the going-public decision.[9] The dependent variable—going public—is equal to 0

for all private firms. For public firms, it is 0 in all years prior to the IPO, 1 in the year of the IPO,

and set to missing in the years when the firm is public.[10] Results indicate that the overall model

is significant (LR $\chi^2(54) = 93.82$, $p<0.01$) with firm size predicting the decision to go public ($\beta =$

8.42, $p<0.01$), but not firm age ($\beta = -0.001$, *n.s.*). We then compute the inverse Mills ratio

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[9] We tested the sensitivity of the two-stage estimation by including different sets of predictors in the first-stage
regression. Following recent work in finance, we also included the annual return on the S&P 500 index, number of
firms listed in CRSP, standard deviation of analyst forecasts, and number of analysts (Chemmanur, He, and Nandy
2010). Our second-stage results replicate under these specifications.

[10] If we instead retain the years when the firm is public and set these years to a value of 1, our results replicate.

derived from the Probit model as $\lambda = \varphi(\beta'X) / \Phi(\beta'X)$, where φ and Φ are the probability density function and cumulative density function of the normal distribution, and add it as a predictor to correct for self-selection in Equations 1-4. We bootstrap the standard errors and observe that the inverse Mills ratio is not significant in any of the models and that our results replicate.

Magnitude measure self-selection correction. Li and Prabhala (2007) propose an alternative technique to address the endogenous selection problem. Specifically, they suggest using a variable that indicates the magnitude of the selection, conditional on the selection itself, as a correction term. Consistent with this idea, we can observe the firm going public and the size of its equity offering. Retrieving these data from SDC Platinum for 104 of the 207 changeover firms, we re-estimate Equations 1-4 and include an additional regressor—the size of the equity offer—to correct for selection. Results indicate that this magnitude variable does not have a significant effect on our innovation outcomes and our results hold.

Entropy balancing and matching self-selection correction. To eliminate bias arising from having qualitatively different treatment (changeover) and control (private) groups, we control for observable differences between public and private firms by employing both balancing and matching corrections. First, we use a probability weighting procedure to complement traditional OLS estimation by confining estimation to a balanced sample of firm observations with similar covariate propensities. Weighting prevents sample loss that might occur in matching procedures—a feature attractive when using continuous covariates (Hainmueller 2012). Following Hainmueller (2012), we use entropy balancing, a generalized propensity score weighting technique, to determine the influence of the going-public decision on firm innovation. Our predictors for selection into the changeover group (treatment) that goes public are the firm covariates from our earlier model. Following balancing, the descriptives for the sample do not

differ between treatment and control groups. Weighting on these variables, we replicate our results. Second, we also match observables on propensity scores associated with these same covariates and replicate our results (Rosenbaum and Rubin 1983).

Ruling Out Reverse Causality

A second endogeneity concern is that the innovation pattern we observe is not a function of the IPO; instead, the IPO is a function of the firm's past innovation and future innovation expectations. To resolve this concern, first, we use the prediction model we applied in our earlier Heckman selection specification to forecast the probability that a firm will go public. We then identify firms that only have a low probability of going public in a particular year but still pursue an IPO.[11] We build a dummy variable *UIPO*—unanticipated IPO—that is equal to 1 if firm i unexpectedly goes public in year t and 0 otherwise. We regress the lagged number of innovations and breakthrough innovations on *UIPO*. Neither is significant, suggesting that prior levels of innovation do not induce firms to pursue an IPO. This is consistent with prior literature that suggests market conditions motivate if and when firms go public (Brau and Fawcett 2006).

As a second step, we explore managers' expectations of future firm performance. As a proxy for managerial confidence in future firm competitiveness, we study insider trading behavior after the firm goes public. We collect insider transaction data from Thomson Reuters Insider Filing Data Feed for all firms in our changeover sample and add a randomly-drawn sample of 223 public CPG firms for which insider transaction data are available. Summing the number of transactions among firm executives for each firm-year, we do not find a significant difference in share-purchasing ($t = -1.01$, *n.s.*), share-selling ($t = 0.74$, *n.s.*), or net share purchasing-selling ($t = -0.59$, *n.s.*) between the newly public changeover firms and the randomly-

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[11] We define these firms as those that have a probability of 0.4 or lower of going public in year t but still pursue an IPO in year t, $t-1$ or $t+1$. Results replicate with different cut-off points of 0.5, 0.3 and 0.2.

drawn public firms. This suggests that managers of the changeover firms were not pessimistic about firm prospects and supports the view that our results are not driven by reverse causality.

Ruling Out Alternative Firm Dynamics

Ruling out IPO dynamics. One alternative explanation is that our results are a short-term effect due to pre-IPO window dressing and not a persistent transformation in firm strategy. Although our thirty-year time series before and after the IPO is an important reason to doubt this concern, we offer three additional tests to rule it out. First, we exclude the IPO year, as well as one or two years prior to and after the IPO, and replicate our results. We also build a binary variable equal to 1 if the observation comes from one or two years prior to the IPO and 0 if it comes from any other firm-year. Regressing this variable on our innovation outcomes yields no significant effects indicating that it is not the years around the IPO driving our findings. Second, we remove the public dummy predictor and use a continuous variable that counts firm-event years (where firm IPO year = 0). We find that the predictor is significant and in the same direction as the public dummy, indicating that the more years after the IPO, the more firms increase innovation levels and reduce risky innovation. Third, we control for a potential over-time trend toward less innovative products by including a within-firm trend variable in our earlier models. We replicate our public effect in all four models.

Ruling out firm life-cycle dynamics. A second alternative explanation is that the firm's own life cycle produces the observed innovation outcomes (Bernstein forthcoming). Specifically, as the firm evolves over time, it exhibits different strategies. We control for age, which partials out substantial life-cycle effects. In a further robustness check, we test our models on a new sample of firms that planned but did not complete an IPO and are at the same stage in their life cycle as the firms in our sample. We were able to identify 36 firms that registered with the SEC

to go public but withdrew their filings. We collect information on the planned IPO date from SDC Platinum Global New Issues Database. Comparing the pre-planned-IPO observations to the post-planned-IPO observations, we do not find any change over the planned IPO date for any of our four innovation outcomes. Although instructive, the small sample makes it challenging to detect significant patterns, and therefore we interpret these results with caution.

Ruling out management-team dynamics. A third alternative explanation for our findings is that firms change their management teams when going public and that this change leads to the observed innovation strategy changes. We do not expect this to explain our results for three reasons. First, prior literature finds that going public does not lead to high management turnover (Mikkelson, Partch, and Shah 1993). Second, even if turnover does occur at the IPO, to explain our results, firms would systematically have to choose managers who adopt the innovation pattern we uncover. While we cannot exclude this possibility, it seems unlikely. Third, we collect evidence from ExecuComp to study CEO tenure for a sample of our changeover firms for which data are available. For a total of 247 CEOs ($n = 90$ firms) from 1992- 2011, a new CEO was appointed when the firm went public in only 15 cases (16.6%).

DISCUSSION

Summary of Key Contributions

Our findings contribute to the literature in the following ways. First, by examining new product introductions instead of R&D spending and patents, we offer the first investigation of the going-public effect that relies on actual innovations introduced to the market. As such, we argue that our empirical approach offers a more valid test of the going-public effect. Second, the use of actual new product introductions allows us to include new market entry as a type of innovation

that might be influenced by firms going public. Specifically, we demonstrate that both product-level and market-level forms of risky innovation may be influenced by stock market incentives.

Third, while existing literature using a quasi-experimental approach has focused on technology sectors, we focus on firms in the CPG sector which face unique regimes to appropriate value from innovations. By showing that the going-public effect does occur in this sector and that it does so over a thirty-year period, we add to the generalizability of the going-public effect. Examining this industry also allows us to offer the risk-reduction prong of the going-public effect as a reason CPG firms may use an SKU-proliferation strategy. This extends literature which has viewed it as a strategy to deter entry (Kekre and Srinivasan 1990) or to signal quality (Draganaska and Jain 2005).

Fourth, our empirical strategy examining firms before and after stock market listing is among a small number of studies adopting this quasi-experimental set-up. With a range of tests to rule out endogeneity concerns, reverse causality, and competing explanations, we increase confidence in the going-public effect by demonstrating that IPO selection and IPO dynamics are not driving its operation.

Finally, we attempt to understand if firms can defy the going-public effect and continue to introduce breakthrough innovations after going public. We identified a set of industry factors that might shift the public firm's calculus away from stock market incentives and toward product-market incentives. Industry factors can also be measured before and after the IPO, which is consistent with our quasi-experimental approach, and suffer from fewer endogeneity concerns. We outline directions for future research on this topic in the next section.

Influencing the Firm's Post-IPO Innovation Behavior

Future research examining other industry factors might consider the strategic flexibility of competitors and how firm marketing spending compares to industry averages given that research has identified both as factors influencing the stock market's response to the firm (Kurt and Hulland 2013). Future research should also consider a broader array of firm and policy variables that facilitate resistance to the going-public effect. To that end, we offer an initial research agenda.

The role of firm factors in the going-public effect. First, firms with a stronger history of breakthrough innovation prior to the IPO may exhibit a smaller drop off once they go public because their capabilities may continue to operate to the post-IPO period (Argote 1999). Second, the presence of a Chief Marketing Officer (CMO) or a CEO with a marketing background may facilitate a stronger focus on product-market incentives, given the documented relationship between presence of a CMO and firm innovation investments (Nath and Mahajan 2008).

Third, research has shown that family firms are more likely to invest in value appropriation (Kashmiri and Mahajan 2010) and less likely to decrease their new product introductions during recessions (Kashmiri and Mahajan 2014). Given this, family-name presence in the firm name and family ownership both may influence whether firms resist the going-public effect. Research arguing that entrepreneurs are signaling confidence in firm quality when they include their own name in the firm name (Belenzon, Chatterji, and Daley 2014) support the view that family name is likely to be related to investments in breakthrough innovation.

Fourth, company incentive systems may encourage post-IPO innovation. These include performance control systems that reward risk-taking, corporate governance structures that include risk-seeking compensation schemes (Currim, Lim, and Kim 2013), and the use of non-

financial controls in management performance evaluation. Fifth organizational culture and structure bolster radical innovation levels. We recommend examining whether willingness to cannibalize successful products (Chandy and Tellis 1998), focus on the future (Yadav, Prabhu, and Chandy 2007), and risk tolerance and product champions (Tellis, Prabhu, and Chandy 2009) also attenuate the going-public effect.

Sixth, given external partnerships influence firm access to novel information and resources (Rindfleisch and Moorman 2001), these relationships may support the newly-public firm's breakthrough innovation. Furthermore, contractual arrangements with partners for new products may buffer some of the risk and make it difficult to alter strategies after the IPO.

Whether alone or in combination, it is important to note that most firm factors cannot be modified quickly and are in place before the firm offers its shares to the public. Given this, researchers will need to resolve concerns about endogeneity, including whether the aforementioned firm factors attract certain types of investor clientele that reward innovation (see Homburg *et al.* 2014; Saboo and Grewal 2013). Separating out such selection effects will be important in future research on this interesting topic.

The role of policy in the going-public effect. If our underlying theory about the role of stock market disclosures is correct, the passage of the Sarbanes-Oxley Act should worsen the going-public effect given that the law increases the amount of information companies must disclose to shareholders. Research should also examine if regulation that protects managers from stock market pressures, such as antitakeover laws, weakens the going-public effect.

Post-IPO Innovation Behavior and Firm Performance

Breakthrough innovations generate stock returns seven times larger than those to incremental innovations (Srinivasan *et al.* 2009) and have a higher impact on Tobin's q and

abnormal stock returns than incremental innovations (Sorescu and Spanjol 2008). Breakthrough innovations are also more likely to grow markets and to create loyal customers. Incremental innovations, on the other hand, are more likely to cannibalize existing products in the firm's portfolio, which, depending on margins, may reduce firm profits.

Given this evidence, our documented shift in innovation behavior may have important consequences for the long-run performance of public firms. As Tellis, Prabhu, and Chandy (2009) observe, capital availability is not sufficient to ensure returns to innovation. Instead, firm performance is conditional on managers making the right kinds of innovation investments.

Examining the effect of innovation strategies on performance is important because breakthrough and new-to-firm category innovations have risks, often fail, and are associated with a higher firm cash flow discount rate than incremental innovations (Sorescu and Spanjol 2008). Hence, unlike investments in other marketing assets such as customer satisfaction that appear to exhibit lower risk while generating higher cash flows (Fornell *et al.* 2006), investments in innovation have substantial downside risk when it comes to financial performance. Given this, investors are likely to demand a price premium to compensate for this increased risk, especially in the immediate period after the IPO when newly-listed firms lack prior public performance history. Investments into complementary assets, such as marketing, around the IPO can help firms mitigate such risks (cf. Kurt and Hulland 2013).

Limitations and Additional Future Research

This study represents an early inquiry into the stock market's impact on firm innovation. Hence, we acknowledge several limitations that we hope will form the basis of future research. We focus on how the going-public effect influences one aspect of firm marketing strategy—its innovation strategy. Future research should consider how stock market incentives influence other

strategic behaviors, such as a firm's channel or communications strategy. Does a public firm's channel strategy reflect less risk, such as the use of more indirect channels or the use of more channel partners? Furthermore, will public firms shift to the use of promotion over advertising given it offers shorter-term pay-offs (e.g., Pauwels *et al.* 2004)?

Stock markets offer the firm more resources while also imposing shorter-term incentives and disclosure requirements. Our study does not separate the stock market incentive mechanism from the financing mechanism. To do so, future research should build a sample of firms that went public but only offered existing shares (i.e., conducted a secondary IPO). While these firms do not raise new capital, they do experience stock market incentives. Unfortunately, we were only able to identify two such firms with complete data for our variables of interest.

CONCLUSION

This paper investigates how the stock market impacts firm innovation behavior. In a quasi-experimental research design around firm IPO, we theorize and empirically document that going public affects both the level and riskiness of firm innovation. First, after going public, firms innovate at higher levels and introduce more variety with each innovation. This result appears to be driven by increased access to financial and strategic resources after the IPO. Second, firms introduce less risky innovations after the IPO, characterized by fewer breakthrough innovations and fewer innovations into unfamiliar categories. We attribute this finding to the effect of stock market incentives on the public firm. Third, a set of industry factors associated with a strong focus on appropriability and sales growth weaken the negative effect of going public on firm breakthrough innovation. Taken together, results suggest that the stock market not only absorbs information, but also generates an incentive structure that impacts managerial decision-making regarding innovation.

REFERENCES

Aghion, Philippe, John Van Reenen, and Luigi Zingales (2013), "Innovation and Institutional

Ownership," *American Economic Review*, 103 (1), 277-304.

Aggarwal, Vikas A. and David H. Hsu (2013), "Entrepreneurial Exits and Innovation,"

Management Science, 60 (4), 867-87.

Argote, Linda (1999), *Organizational Learning: Creating, Retaining and Transferring

Knowledge*. Boston, MA: Kluwer Academic Press.

Asker, John, Joan Farre-Mensa, and Alexander Ljungqvist (forthcoming), "Corporate Investment

and Stock Market Listing: A Puzzle?," *Review of Financial Studies*.

Bayus, Barry L., Gary Erickson, and Robert Jacobson (2003), "The Financial Rewards of New

Product Introductions in the Personal Computer Industry," *Management Science,* 49 (2), 197-

210.

Belenzon, Sharon, Aaron K. Chatterji, and Brendan Daley (2014), "Eponymous Entrepreneurs,"

working paper, Duke University Fuqua School of Business.

Bernstein, Shai (forthcoming), "Does Going Public Affect Innovation?," *Journal of Finance*.

Block, Stanley B. (2004), "The Latest Movement to Going Private: An Empirical Study,"

Journal of Applied Finance, 14 (1), 30-41.

Brau, James C. and Stanley E. Fawcett (2006), "Initial Public Offerings: An Analysis of Theory

and Practice," *Journal of Finance,* 61 (1), 399-436.

Bushee, Brian J. (1998), "The Influence of Institutional Investors on Myopic R&D Investment

Behavior," *The Accounting Review,* 73 (3), 305-33.

Campa, Jose Manuel and Simi Kedia (2002), "Explaining the Diversification Discount," *Journal

of Finance*, 57 (1), 1731-62.

Chakravarty, Anindita and Rajdeep Grewal (2011), "The Stock Market in the Driver's Seat: Implications for R&D and Marketing," *Management Science,* 57 (9), 1594-1610.

Chandy, Rajesh K. and Gerard J. Tellis (2000), "The Incumbent's Curse? Incumbency, Size, and Radical Product Innovation," *Journal of Marketing*, 64 (3), 1-17.

⸺ and ⸺ (1998), "Organizing for Radical Product Innovation: The Overlooked Role of Willingness to Cannibalize," *Journal of Marketing Research*, 35 (4), 474-87.

Chaney, Paul K., Timothy M. Devinney, and Russell S. Winer (1991), "The Impact of New Product Introductions on the Market Value of Firms," *Journal of Business,* 64 (4), 573-610.

Chemmanur, Thomas J., Shan He, and Debarshi K. Nandy (2010), "The Going-Public Decision and the Product Market," *Review of Financial Studies,* 23 (5), 1855-1908.

⸺ and Xuan Tian (2013), "Do Anti-Takeover Provisions Spur Corporate Innovation?" working paper, Boston College.

Cohen, Lauren, Karl Diether, and Christopher Malloy (2013), "Misvaluing Innovation," *Review of Financial Studies,* 26 (3), 635-66.

Cohen, Wesley M. and Richard C. Levin (1989), "Empirical Studies of Innovation and Market Structure," in *Handbook of Industrial Organization*, Richard Schmalensee and Robert Willig, eds. Oxford: North-Holland, 2-18.

Currim, Imram S., Jooseop Lim, and Joung W. Kim (2013), "You Get What You Pay For: The Effect of Top Executives' Compensation on Advertising and R&D Spending Decisions and Stock Market Return," *Journal of Marketing,* 76 (5), 33-48.

Devaney, Tim (2013), "Dell Going Private to Reinvent Itself," *The Washington Times*, Feb. 6.

Draganska, Michaela and Dipak C. Jain (2005), "Product-Line Length as a Competitive Tool," *Journal of Economics & Management Strategy*, 14 (1), 1-28.

Erickson, Gary and Robert Jacobson (1992), "Gaining Comparative Advantage Through Discretionary Expenditures: The Returns to R&D and Advertising," *Management Science,* 38 (9), 1264-79.

Fang, Lily and Joel Peress (2009), "Media Coverage and the Cross-section of Stock Returns," *Journal of Finance*, 64 (5), 2023-52.

Fang, Vivian W., Xuan Tian, and Sheri Tice (2014), "Does Stock Liquidity Enhance or Impede Firm Innovation?" *Journal of Finance*, 69 (5), 2085-125.

Ferreira, Daniel, Gustavo Manso, and André Silva (2014), "Incentives to Innovate and the Decision to Go Public or Private," *Review of Financial Studies*, 27 (1), 256-300.

Fornell, Claes, Sunil Mithas, Forrest V. Morgeson III, and M.S. Krishnan (2006), "Customer Satisfaction and Stock Prices: High Returns, Low Risk," *Journal of Marketing,* 70 (1), 3-14.

Graham, John R., Campbell R. Harvey, and Shiva Rajgopal (2005), "The Economic Implications of Corporate Financial Reporting," *Journal of Accounting and Economics,* 40 (1), 3-73.

Griliches, Zvi (1981), "Market Value, R&D, and Patents," *Economics Letters,* 7 (2), 183-87.

Gruca, Tomas S. and Lopo L. Rego (2005), "Customer Satisfaction, Cash Flow, and Shareholder Value," *Journal of Marketing*, 69 (3), 1-13.

Guo, Re-Jin, Baruch Lev, and Nan Zhou (2004), "Competitive Costs of Disclosure by Biotech IPOs," *Journal of Accounting Research,* 42 (2), 319-55.

Hainmueller, Jens (2012), "Entropy Balancing for Causal Effects: A Multivariate Reweighting Method to Produce Balanced Samples in Observational Studies," *Political Analysis*, 20 (1), 25-46.

Hall, Bronwyn H. and Josh Lerner (2010), "The Financing of R&D and Innovation," in *Handbook of the Economics of Innovation*, B. H. Hall and N. Rosenberg, eds. Oxford:

Elsevier-North Holland, 609-639.

Halvorsen, Robert and Raymond Palmquist (1980), "The Interpretation of Dummy Variables in Semilogarithmic Equations," *American Economic Review,* 70 (3), 474-75.

Hauser, John, Gerard J. Tellis, and Abbie Griffin (2006), "Research on Innovation: A Review and Agenda for Marketing Science," *Marketing Science*, 25 (6), 687-717.

He, Jie and Xuan Tian (2013), "The Dark Side of Analyst Coverage: The Case of Innovation," *Journal of Financial Economics*, 109 (3), 856-78.

Hirschler, Ben and Caroline Humer (2012), "FDA New Drug Approvals Hit 16-Year High in 2012," (December 31), (accessed June 13, 2013), [available at http://www.reuters.com/article/2012/12/31/us-pharmaceuticals-fda-approvals-idUSBRE8BU0EK20121231].

Homburg, Christian, Alexander Hahn, Torsten Bornemann and Philipp Sandner (2014), "The Role of Chief Marketing Officers for Venture Capital Funding: Endowing New Ventures with Marketing Legitimacy," *Journal of Marketing Research*, 51 (5), 625-644.

Kamprad, Ingvar (2011), "Ingvar Kamprad Comments: We Are Open About the Way We Are Structured," (January 11), (accessed February 11, 2013), [available at http://www.ikea.com/at/de/about_ikea/newsitem/statement_Ingvar_Kamprad_comments#].

Kashmiri, Saim and Vijay Mahajan (2014), "Beating the Recession Blues: Exploring the Link Between Family Ownership, Strategic Marketing Behavior and Firm Performance During Recessions," *International Journal of Research in Marketing*, 31 (1), 78-93.

—— and —— (2010), "What's in a Name? An Analysis of the Strategic Behavior of Family Firms," *International Journal of Research in Marketing*, 27 (3), 271-80.

Kekre, Sunder and Kannan Srinivasan (1990), "Broader Product Line: A Necessity to Achieve

Success?," *Management Science*, 36 (10), 1216-32.

Kurt, Didem and John Hulland (2013), "Aggressive Marketing Strategy Following Equity Offerings and Firm Value: The Role of Relative Strategic Flexibility," *Journal of Marketing*, 77 (5), 57-74.

Lerner, Josh, Morten Sorensen, and Per Strömberg (2011), "Private Equity and Long-Run Investment: The Case of Innovation," *Journal of Finance,* 66 (2), 445-77.

Li, Kai and Nagpurnanand R. Prabhala (2007), "Self-Selection Models in Finance," in *Handbook of Corporate Finance*, E. Espen Eckbo, ed. Oxford: North-Holland, 37-85.

Luo, Xueming and Naveen Donthu (2006), "Marketing's Credibility: A Longitudinal Investigation of Marketing Communication Productivity and Shareholder Value," *Journal of Marketing*, 70 (4), 70-91.

Maksimovic, Vojislav and Pegaret Pichler (2001), "Technological Innovation and Initial Public Offerings," *Review of Financial Studies,* 14 (2), 459-94.

Markovitch, Dmitri, Joel H. Steckel, and Bernard Yeung (2005), "Using Capital Markets as Market Intelligence: Evidence from the Pharmaceutical Industry," *Management Science,* 51 (10), 1467-80.

McDougall, Patricia P., Jeffrey G. Covin, Richard B. Robinson Jr., and Lanny Herron (1994), "The Effects of Industry Growth and Strategic Breadth on New Venture Performance and Strategy Content," *Strategic Management Journal*, 15 (7), 537-554.

McKinsey & Company (2011), *The Decade Ahead: Trends That Will Shape the Consumer Goods Industry.* Chicago: McKinsey & Company.

Mikkelson, Wayne H., M. Megan Partch, and Kshitij Shah (1997), "Ownership and Operating Performance of Companies that Go Public," *Journal of Financial Economics,* 44 (3), 281-307.

Mizik, Natalie (2010), "The Theory and Practice of Myopic Management," *Journal of Marketing Research,* 47 (3), 594-611.

——— and Robert Jacobson (2007), "Myopic Marketing Management: Evidence of the Phenomenon and its Long-Term Performance Consequences in the SEO Context," *Marketing Science*, 26 (May-June), 361-79.

——— and ——— (2007), "Trading Off Between Value Creation and Value Appropriation: The Financial Implications of Shifts in Strategic Emphasis," *Journal of Marketing*, 67 (1), 63-76.

Moorman, Christine, Simone Wies, Natalie Mizik, and Fredrika Spencer (2012), "Firm Innovation and the Ratchet Effect Among Consumer Packaged Goods Firms," *Marketing Science,* 31 (6), 934-51.

Murphy, Andrea (2012), "America's Largest Private Companies 2012," (November 28), (accessed April 1, 2013), [available at http://www.forbes.com/sites/andreamurphy/2012/11/28/americas-largest-private-companies-2012/]

Nath, Pravin and Vijay Mahajan (2008), "Chief Marketing Officers: A Study of Their Presence in Firms' Top Management Teams," *Journal of Marketing*, 72 (January), 65-81.

Pauwels, Koen, Jorge Silva-Risso, Shuba Srinivasan, and Dominique M. Hanssens (2004), "New Products, Sales Promotions, and Firm Value: The Case of the Automobile Industry," *Journal of Marketing,* 68 (4), 142-156.

PricewaterhouseCoopers (2012), *2011 U.S. IPO Watch.* New York: PricewaterhourseCoopers.

Quelch, John A. and David Kenny (1994), "Extend Profits, not Product Lines," *Harvard Business Review,* 72 (5), 153-160.

Rindfleisch, Aric and Christine Moorman (2001), "The Acquisition and Utilization of

Information in New Product Alliances: A Strength-of-Ties Perspective," *Journal of Marketing*, 65 (2), 1-18.

Rogers, Everett M. (2003), *Diffusion of Innovations* (5th ed.). New York: Free Press.

Rosenbaum, Paul R. and Donald B. Rubin (1983), "The Central Role of the Propensity Score in Observational Studies for Causal Effects," *Biometrika*, 70 (1), 41-55.

Saboo, Alok R. and Rajdeep Grewal (2013), "Stock Market Reactions to Customer and Competitor Orientations: The Case of Initial Public Offerings," *Marketing Science*, 32 (1), 70-88.

Sood, Ashish and Gerard J. Tellis (2009), "Do Innovations Really Pay Off? Total Stock Market Returns to Innovation," *Marketing Science,* 28 (3), 442-56.

Sorescu, Alina and Jelena Spanjol (2008), "Innovation's Effect on Firm Value and Risk: Insights From Consumer Packaged Goods," *Journal of Marketing,* 72 (2), 114-32.

Spiegel, Matthew and Heather Tookes (2008), "Dynamic Competition, Innovation and Strategic Financing," working paper, Yale University.

Srinivasan, Shuba and Dominique M. Hanssens (2009), "Marketing and Firm Value: Metrics, Methods, Findings, and Future Directions," *Journal of Marketing Research*, 46 (2), 293-312.

——, Koen Pauwels, Jorge Silva-Risso, and Dominique M. Hanssens (2009), "Product Innovation, Advertising, and Stock Returns," *Journal of Marketing*, 73 (1), 24-43.

Steenkamp, Jan-Benedict E. M. and Katrijn Gielens (2003), "Consumer and Market Drivers of the Trial Probability of New Consumer Packaged Goods," *Journal of Consumer Research,* 30 (3), 368-84.

Stein, Jeremy C. (1989), "Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behavior," *The Quarterly Journal of Economics,* 104 (4), 655-69.

Symphony IRI (2012), *Symphony IRI New Product Pacesetters Report.* Chicago: Symphony IRI.

––– (2013), "IRI Announces Most Successful Consumer Packaged Goods Brands of 2012,"

   (April 17), (accessed October 1, 2014), [available at

   http://www.iriworldwide.com/newsevents/pressreleases/itemid/1706/view/details.aspx]

Tian, Xuan and Tracy Wang (2014), "Tolerance for Failure and Corporate Innovation," *Review*

   of Financial Studies, 27 (1), 211-55.

Tellis, Gerard J. (2013), *Unrelenting Innovation: How to Create a Culture of Market*

   Dominance. San Francisco: Jossey-Bass.

–––, Jaideep C. Prabhu, and Rajesh K. Chandy (2009), "Radical Innovation Across Nations: The

   Preeminence of Corporate Culture," *Journal of Marketing*, 73 (1), 3-23.

Villalonga, Belen (2004), "Diversification Discount or Premium? New Evidence from the

   Business Information Tracking Series," *Journal of Finance*, 59 (2), 479-506.

Wernerfelt, Birger and Cynthia Montgomery (1988), "Tobin's *q* and the Importance of Focus in

   Firm Performance," *American Economic Review*, 78 (March), 246-50.

Woo, Vivian and Shlomo Reifman (2003), "Private Business," (November 24), (accessed

   January 10, 2013), [available at http://www.forbes.com/free_forbes/2003/1124/174.html].

Wu, Geraldine A. (2012), "The Effect of Going Public on Innovative Productivity and

   Exploratory Search," *Organization Science*, 23 (4), 928-50.

Xiong, Guiyang and Sundar Bharadwaj (2011), "Social Capital of Young Technology Firms and

   Their IPO Values: The Complementary Role of Relevant Absorptive Capacity," *Journal of*

   Marketing, 75 (4), 87-104.

Yadav, Manjit S., Jaideep C. Prabhu, and Rajesh K. Chandy (2007), "Managing the Future: CEO

   Attention and Innovation Outcomes," *Journal of Marketing*, 71 (4), 84-101.

TABLE 1. THE STOCK MARKET AND INNOVATION OUTCOMES:

A REVIEW OF EMPIRICAL LITERATURE[a]

	Firms in Public State	**Firms Changing from Private to Public State**
R&D Spending	- CFOs report a willingness to reduce R&D spending or to delay starting a new project, even if such a delay led to a sacrifice in value in order to meet earnings targets (Graham, Harvey, & Rajgopal 2005) - Managers are less likely to cut R&D to reverse an earnings decline when institutional ownership is high (Bushee 1998) - Cuts in R&D spending temporarily inflate short-term earnings and valuations. However, firm value declines in the subsequent five years (Mizik 2010) - In response to past increases in stock returns and stock volatility, high-tech manufacturing firms cut R&D budgets to avoid unexpected earnings shortfalls in the immediate future (Chakravarty & Grewal 2011) - An increase in the equity-to-bonus compensation ratio is positively related to R&D expenditures (Currim, Lim, & Kim 2013)	
Patents	- High stock liquidity leads to lower patent output, especially with less entrenched management and lower profit levels (Fang, Tian, and Tice 2014) - High institutional ownership is positively related to patent output (Aghion, Van Reenen, & Zingales 2013) - Adoption of anti-takeover provisions increases patent output (Chemmanur &Tian 2013) - High analyst coverage impedes firm patent productivity and investments in long-term innovative projects (He & Tian 2013) - Firms backed by more failure-tolerant venture capital investors produce a larger number of patents and patents with larger impact (Tian and Wang 2014).	- IPO leads to a decline in patent levels and patent quality due to short-term performance pressures among biotech firms (Aggarwal & Hsu 2013) - The quality of internally-generated patents declines following an IPO (Bernstein forthcoming) - After going public, medical device firms produce a larger number of patents but a larger proportion of these patents rely on the firm's prior patents (Wu 2012)
New Product Introductions	- Pharmaceutical firms with recent underperforming stock implement more high-risk innovation strategies than firms outperforming industry peers (Markovitch, Steckel, & Yeung 2005) - Consumer packaged goods firms time the introduction of new products in order to reap stock market benefits, although this comes at the expense of product market sales (Moorman *et al.* 2012)	The current paper

[a] Research examines firm innovation across industries unless otherwise noted.

TABLE 2. DESCRIPTIVES

Variable	M	SD	Min	Max
Firm Innovations	5.513	19.668	0	295
Firm Innovation Variety	2.296	3.106	1	99
Firm Breakthrough Innovations	0.324	1.343	0	28
Firm Innovation in New-to-the-Firm Category	0.078	0.268	0	1
Firm Public Status	0.282	0.451	0	1
Firm Age	41.040	41.038	2	205
Industry Purchasing Frequency	3.930	1.801	0.917	15.873
Industry Concentration	0.249	0.259	0	1
Firm Press Coverage	0.003	0.012	0	0.189

Notes: All variables are reported in original units and before logarithmic transformation. Apart from innovation variety, all variables are measured on firm-year level; innovation variety is measured at the firm-innovation level.

TABLE 3. FIRM INNOVATION OUTCOMES

	(1) Firm Innovations	(2) Firm Innovation Variety	(3) Firm Breakthrough Innovations	(4) Firm Innovation in New-to-the-Firm Category[a]
Public (β_1)	0.1167***	0.0353***	-0.0360**	-0.4879***
	(0.042)	(0.013)	(0.015)	(0.098)
Firm Age (β_2)	0.0257***	0.0181***	-0.0012**	-0.0032***
	(0.003)	(0.001)	(0.001)	(0.001)
Firm Industry Purchasing Frequency (β_3)	0.0087	-0.0105**	0.0028	-0.0035
	(0.009)	(0.005)	(0.002)	(0.025)
Firm Industry Concentration (β_4)	-0.0805	-0.0189	-0.0372	0.0909
	(0.115)	(0.050)	(0.031)	(0.177)
Firm Press Coverage (β_5)	4.6230*	-7.6290	-0.6703	-0.9353
	(2.617)	(9.003)	(0.978)	(3.097)
Firm Innovations (β_6)	-	-0.0269***	0.1593***	-0.5886***
		(0.008)	(0.013)	(0.074)
Intercept (β_0)	-0.8931***	0.0683*	0.0147	-1.0080**
	(0.165)	(0.040)	(0.021)	(0.491)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	No
Observations	7,387	40,731	7,387	2,848
Adjusted R-squared	0.107	0.090	0.152	0.165
F-statistic (DF)	7.35*** (31)	21.20*** (31)	8.56*** (32)	171.59*** (32)

***$p<0.01$, **$p<0.05$, *$p<0.10$.
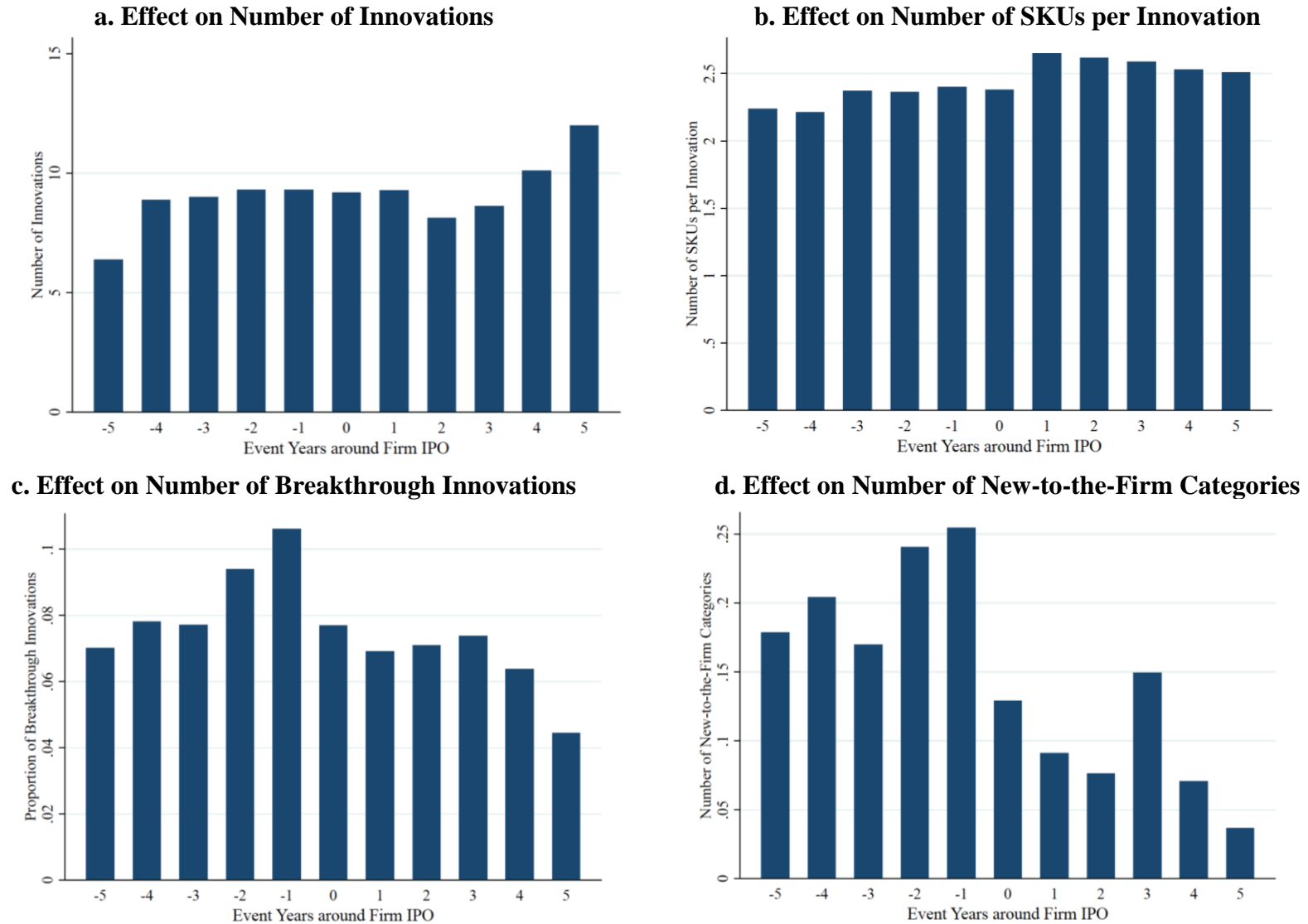
[a] Given Equation 4 is estimated as a nonlinear Probit model, we report the Pseudo R-squared (instead of the Adjusted R-squared), as well as the Wald Chi-square statistic (instead of the F-statistic). We omit the model log-likelihood which is -651.

Notes: Robust standard errors clustered by firm in parentheses. Equations 1 and 3 are estimated at the firm-year level, Equation 2 is estimated at the firm-innovation level, and Equation 4 is estimated at the firm-year but only for firms that introduce at least one innovation.

FIGURE 1. TIME SERIES OF SAMPLE IPO ACTIVITY

FIGURE 2. INNOVATION OUTCOMES FOR FIRMS UNDERGOING AN IPO*

a. Effect on Number of Innovations

b. Effect on Number of SKUs per Innovation

c. Effect on Number of Breakthrough Innovations

d. Effect on Number of New-to-the-Firm Categories

WEB APPENDIX A

CORRELATION MATRIX OF INTERACTION MODEL VARIABLES

		1	2	3	4	5	6	7	8	9	10
1	Firm Breakthrough Innovations	1									
2	Public	.1237	1								
3	Firm Age	.2999	.1327	1							
4	Firm Industry Purchasing Frequency	.0362	.0069	.0083	1						
5	Firm Industry Concentration	-.1370	-.0800	-.1675	.0402	1					
6	Firm Press Coverage	.3374	.1719	.2917	.0170	.0656	1				
7	Firm Innovations	.7173	.2531	.3404	.0254	-.1883	.3351	1			
8	Industry Strategic Emphasis	-.0790	-.1573	-.1359	-.1481	.1516	-.0300	-.1319	1		
9	Industry Demand Instability	-.0983	-.0364	-.1190	-.0687	.6341	.0761	-.1191	.0938	1	
10	Industry Sales Growth	.0500	.0475	-.0120	.1945	-.1045	.0224	.0385	.0790	.0508	1

Note: All continuous variables are mean centered.

WEB APPENDIX B

INTERACTION MODELS PREDICTING FIRM BREAKTHROUGH INNOVATIONS

	(1)[a]	(2)	(3)
Public (β_1)	-0.1343***	-0.0384**	-0.0310**
	(0.031)	(0.016)	(0.015)
Firm Age (β_2)	-0.0060***	-0.0060***	-0.0060***
	(0.001)	(0.001)	(0.0014)
Firm Industry Purchasing Frequency (β_3)	0.0006	0.0016	0.0006
	(0.002)	(0.002)	(0.002)
Firm Press Coverage (β_4)	-0.3130	-0.2760	-0.3130
	(1.058)	(1.051)	(1.058)
Firm Innovations (β_5)	0.1440***	0.1430***	0.1440***
	(0.012)	(0.012)	(0.012)
Industry Concentration (β_6)	-0.0121	0.0041	-0.0121
	(0.035)	(0.032)	(0.035)
Industry Strategic Emphasis (β_7)	-0.6090***	-0.4020***	-0.6090***
	(0.169)	(0.145)	(0.169)
Industry Demand Instability (β_8)	-0.0116**	-0.0154**	-0.0116**
	(0.006)	(0.007)	(0.006)
Industry Sales Growth (β_9)	-0.1430*	-0.0615	-0.1430*
	(0.083)	(0.086)	(0.083)
Public*Industry Sales Growth (β_{10})	0.3146**		0.3146**
	(0.132)		(0.132)
Public*Industry Demand Instability (β_{11})	-0.0139		-0.0139
	(0.012)		(0.012)
Public*Industry Strategic Emphasis (β_{12})	1.1167***		1.1167***
	(0.362)		(0.362)
Public*Industry Concentration (β_{13})	0.1421**		0.1421**
	(0.062)		(0.062)
Intercept (β_0)	0.3320***	0.1230***	0.1270***
	(0.070)	(0.015)	(0.015)
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Observations	7,173	7,173	7,173
Adjusted R-squared	0.122	0.119	0.122
F-statistic (DF)	6.09*** (39)	6.26*** (35)	6.09*** (39)

***$p<0.01$, **$p<0.05$, *$p<0.10$.
[a] Estimation using data that are not mean centered.
Notes: The dependent variable for all models is firm breakthrough innovations. Robust standard errors clustered by firm in parentheses. The interaction models use a sample of 7,173 observations given data is missing for 214 observations for these variables in Compustat. Column 1 contains our interaction model using data that are not mean centered. Column 2 contains the main effect model and Column 3 contains the full interaction model using the mean-centered data.