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The Fruits of Legitimacy: Why Some New Ventures Gain More from Innovation Than Others

This article examines rewards to product introduction by new ventures. The authors argue that the new ventures that gain the most from innovation are those that adopt strategies that give them legitimacy in the eyes of stakeholders. New ventures can gain legitimacy by creating associations with established entities; such associations can be internal or external to the firm. The authors test these ideas by examining the stock market gains of all products introduced between 1982 and 2002 by all public firms in the U.S. biotechnology industry. The results show that new ventures that acquire legitimacy externally by forming alliances with established firms gain more from their new products than new ventures that do not form such alliances. Among new ventures that do not form alliances, those that acquire legitimacy internally by creating a history of product launches or by hiring reputed executives or scientists gain more from their new products than those that do not. In relative terms, it pays more to have introduced a new drug before than to have a reputed executive on the firm's board; in turn, adding a reputed executive pays more than adding a reputed scientist to the firm's board. Finally, although new ventures can gain from either external or internal legitimacy, pursuit of external legitimacy by firms that already have internal legitimacy leads to lower rewards to innovation.

Keywords: innovation, stock market returns, legitimacy, biotechnology, alliances, entrepreneurship

New ventures play a crucial role in driving economic growth (Schumpeter 1934). Economies with a higher proportion of new ventures grow faster than others (Schmitz 1989). The actions of new ventures may even spur large, incumbent firms into action, thus accelerating the pace of technological change (Sorescu, Chandy, and Prabhu 2003). For consumers, the creative energies of new ventures yield a bountiful variety of new products put forth by these firms as they maneuver for success and survival.

Indeed, the ability to introduce successful new products is critical to the survival and growth of new ventures in emerging industries (Dowell and Swaminathan 2000). Product introductions generate revenue, reduce mortality, and help predict future success (Mata and Portugal 1994). However, the rewards to product introductions are not distributed equally across firms. Competitors with seemingly similar products nevertheless meet wildly different fates. At this very moment, labs (or garages) of inventors around the world are buzzing with activities that embody their hopes and dreams. However, history suggests that only a few of these dreams are likely to be fulfilled (Klepper 2002). Why do some new ventures reap the rewards from their new products while others fail to do so? This is the question we attempt to answer in this research.

As in previous studies (Deeds, Mang, and Frandsen 2004), we define an emerging industry as one that is created around new technologies. Recent examples of such industries include biotechnology and Web retailing. In line with previous studies (e.g., Van de Ven, Hudson, and Schroeder 1984), we define a new venture as one whose primary business is in an emerging industry.

Much research on the differential gains from product introduction has studied firms in mature industries (see, e.g., Datar and Jordon 1997; Song and Parry 1997). Prior research has examined the impact on gains from product introduction due to variables such as firm size (Chaney, Devinney, and Winer 1991), resources (Sorescu, Chandy, and Prabhu 2003), the nature of product offerings (Calantone, Schmidt, and Song 1996), and industry characteristics (Chaney, Devinney, and Winer 1991). Although these variables are important in the context of mature industries, it is less clear how their importance transfers to a new venture context. Within emerging industries, firms are often similar in size and resources; they are mostly small and have limited financial resources. Although differences among products exist, many new products in emerging industries are, almost by definition, all breakthroughs in nature. As we show subsequently, variables that are traditionally examined in the literature (e.g., firm size, resources, the nature of the product itself) play a less prominent role in

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separating winners from losers in the new product game in emerging industries (see Shane 2001).

A particularly vexing challenge for firms in emerging industries is the "liability of newness" they face (Stinchcombe 1965). Potential stakeholders view firms in these industries with skepticism (Hannan and Freeman 1984). For example, venture capitalists keenly observe the actions of new ventures and choke off funds if new products do not show promise at the earliest stages of introduction. This skepticism makes it difficult for such firms to gain access to the funds they crucially need for survival and growth. Indeed, this leads to a Catch-22 situation: To overcome stakeholder skepticism, new ventures need successful new products, but to have successful products, they must overcome stakeholder skepticism in the first place. An important way that new ventures can overcome the liability of newness and increase their gains from new products is by taking actions that provide them with legitimacy in the eyes of stakeholders (Deeds, Mang, and Frandsen 2004; Dowling and Pfeffer 1975). We argue that new ventures can gain legitimacy by creating associations with more established entities, either external or internal to the firm. In turn, this legitimacy pays off by raising the rewards to such firms from their product introductions.

We address the following research questions in the context of new ventures:

- What are the means by which new ventures can gain legitimacy?
- How do the different types of legitimacy affect the rewards to new product introduction?
- What are the financial consequences of concurrently pursuing internal and external legitimacy?

This is the first study to examine and empirically test the effects of legitimacy on the rewards to product introduction. We argue that the impact of legitimacy may not be straightforward. Although legitimacy can have beneficial effects, duplication of legitimacy leads to lowered marginal returns to product introductions by new ventures. We test our arguments by examining the stock market gains of all products introduced by public firms in the U.S. biotechnology industry in its emergent phase (1982–2002).

This article makes the following contributions: First, our study outlines several managerially controllable factors that drive the rewards associated with new ventures' product introductions. By outlining key drivers of rewards to product introduction, we provide a framework that managers of such firms can use to manage product launch.

Second, we measure the rewards to product introduction in terms of the value new products create for firms through the stock market. By examining the impact of product-related actions on stock market performance, we contribute to the research on the marketing–finance interface. In particular, we respond to calls to adopt measures that link marketing activities to firm performance and shareholder value (Srivastava, Shervani, and Fahey 1999).

Finally, we highlight the crucial role of marketing in entrepreneurial settings. The vast literature on entrepreneurship draws on economics, sociology, and management but rarely on marketing. Moreover, the marketing literature is itself mostly silent on marketing's influence on the performance of new ventures (see Matsuno, Mentzer, and Ozsomer 2002). This article fills this gap by emphasizing the unique role of product innovation and legitimizing strategies in driving the growth of new ventures.

Theory

What Is Legitimacy?

> At the height of his wealth and success, the financier Baron de Rothschild was petitioned for a loan by an acquaintance. Reputedly, the great man replied, "I won't give you a loan myself, but I will walk arm-in-arm with you across the floor of the Stock Exchange, and soon you shall have willing lenders to spare." (Cialdini 1989, p. 45)

Legitimacy is "a generalized perception or assumption that the actions of an entity are desirable" (Suchman 1995, p. 574; see also Higgins and Gulati 2006). In emerging industries, all firms, but especially new ventures, suffer from a lack of legitimacy in the eyes of important stakeholders, such as venture capitalists, stock market analysts, and consumers (DiMaggio 1988). This lack of legitimacy is partly what creates a liability of newness for such firms (Stuart, Hoang, and Hybels 1999). However, not all new ventures suffer equally from this liability. Some manage to prevail, whereas others are crushed by it. Recent research indicates that actions, both substantive and symbolic, on the part of new ventures can help overcome this liability (Ashforth and Gibbs 1990; Suchman 1995; Van de Ven, Hudson, and Schroeder 1984; Zajac and Westphal 2004).

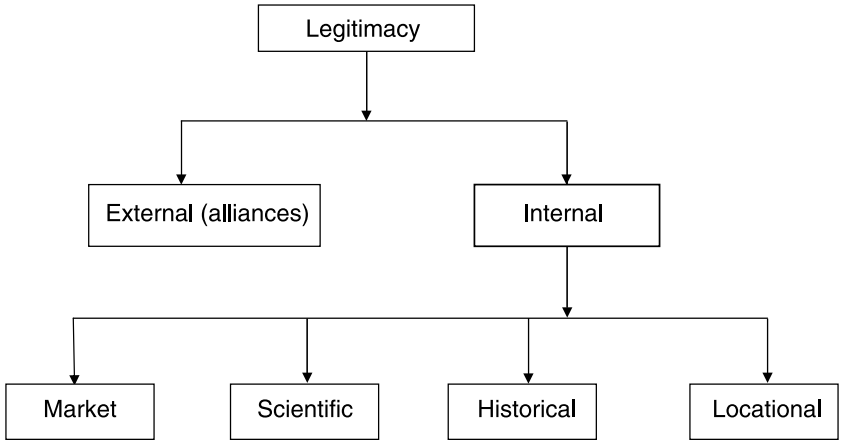
On the basis of this recent research, we argue that an important means by which new ventures gain legitimacy is by engaging in actions that convey associations with reputed entities (see also Higgins and Gulati 2006). Such actions affect stakeholder confidence in new ventures, in particular in their ability to introduce products successfully. By linking legitimacy to stakeholders' perceptions of the value of firms' new products, we explain why some new ventures gain more from their product introductions than others.

Although there is much theorizing on the topic of legitimacy, empirical research is rare. Moreover, many researchers have noted that existing studies tend to employ a narrow, unidimensional view of legitimacy and to examine the construct using relatively crude measures (see Deeds, Mang, and Frandsen 2004). In this study, we highlight and empirically test the role of a variety of legitimizing actions. We also show that these legitimizing actions may not always work together; some may actually work at cross-purposes with others.

Types of Legitimizing Actions

We identify two broad means—external and internal—through which new ventures can gain legitimacy in the eyes of stakeholders (see Figure 1). Among internal means of gaining legitimacy, we propose four types of actions: historical, scientific, market, and locational. Actions associated with historical legitimacy convey to stakeholders information about the new ventures' past business performance and, by inference, their prospects for future performance. A new

FIGURE 1
Dimensions of Legitimacy



venture may convey this through, for example, a record of product introductions, which speaks to its understanding of the relevant technology and market. Note that this type of legitimacy is rare, given that, by definition, few new ventures have successfully introduced new products in the past. Actions associated with scientific legitimacy convey to stakeholders that the new ventures in question have the technological capabilities needed to operate in their industry successfully. New ventures may achieve this type of legitimacy by, for example, recruiting eminent scientists to serve on their boards. Actions associated with market legitimacy convey to stakeholders that the new ventures in question have the market-based capabilities needed to operate in their industry effectively. New ventures may achieve this type of legitimacy by, for example, placing on their boards executives who have experience in more established industries. Actions associated with locational legitimacy convey to stakeholders that the new ventures in question derive differential advantage as a result of their geographic location. For example, a new software venture may do so by locating itself in a geographic "cluster" of firms in the same specialized industry—for example, Silicon Valley (Porter 1998).

In contrast to the several ways new ventures may gain internal legitimacy, we identify one major way they can gain external legitimacy—namely, through their association with successful and established external entities (see Rao, Qu, and Ruekert 1999).[1] For example, a new venture may acquire this type of legitimacy by forming an alliance with a firm in a related but established industry, thus gaining immediate access to the internal legitimacy that the established firm already possesses. We now develop hypotheses that link the dimensions of legitimacy to the rewards to product introduction.

[1]We do so in part because of empirical considerations. In our empirical analysis, we use alliances with large pharmaceutical firms as our measure of external legitimacy. Such firms tend to possess all four types of internal legitimacy. Therefore, a new venture's association with such firms provides it with legitimacy on all these types. As such, although we highlight multiple dimensions of internal legitimacy, we focus here on a single dimension of external legitimacy.

Hypotheses

External Legitimacy: Reflecting the Glory of the Partner

A seemingly easy way for new ventures to gain external legitimacy is through a formal alliance with an established entity (Gans and Stern 2003). However, alliances have downsides too. An alliance could result in the loss of decision-making control and flexibility for the fledgling venture (Das and Teng 2000). An alliance may also lead to lower rewards to the new venture from its product introductions as a result of sharing collaborative gains (Gulati 1998). Because the new venture is likely to be smaller than the alliance partner and thus have less bargaining power, a larger share of the gains from product introduction may go to the latter (Lerner and Merges 1998).

Nevertheless, an alliance with an established player can confer benefits on new ventures in at least two ways. First, an alliance can suggest that through its partner, the new venture has access to the capabilities and resources needed for successful product introduction. These would include marketing, scientific, and financial resources, as well as shared learning and skills (Swaminathan and Moorman 2002). Therefore, an alliance with a successful partner helps the new venture overcome stakeholder uncertainty about its capabilities and its inexperience in launching similar products. Second, the mere existence of the alliance carries its own endorsement. That the new venture was successful in attracting a larger, more established player in the first place suggests that the new venture and its new product have potential.

For these reasons, alliances can serve as a legitimizing force that is powerful enough to overcome the negative effects that ensue from the loss of decision-making control and the dilution of rewards due to gain sharing. Thus, we hypothesize the following:

H_1: New ventures that introduce products in alliance with established firms gain more from these product introductions than new ventures that do so without such alliances.

Internal Legitimacy, External Legitimacy, or Both?

Although we identify both external and internal means of gaining legitimacy, we posit that firms that already have internal legitimacy will gain fewer marginal benefits from also acquiring external legitimacy. We do so for two reasons. First, as we stated previously, alliances are not cost free. Despite the benefits of alliances, new ventures in emerging industries that create alliances may lose control over their products and end up diluting future rewards due to gain sharing (Gulati 1998; Lerner and Merges 1998; McGarry et al. 2001). Second, new ventures that already possess internal legitimacy may find that alliances with established firms can lead to duplication in sources of legitimacy. For a new venture with internal legitimacy to form an alliance would be akin to a manufacturer using two substitutes in a production process and paying for both when using just one would suffice.

For the reasons we noted previously, we argue that new ventures that possess internal legitimacy will gain more from their products by going alone than by forming alliances. We also note that though having both internal and external legitimacy yields decreasing marginal benefits, the different types of internal legitimacy actually complement one another because they convey distinct capabilities (e.g., scientific legitimacy conveys technological capability, market legitimacy conveys market knowledge). We now develop hypotheses about how each means of gaining internal legitimacy affects the rewards to product introduction in the presence or absence of alliances with established firms.

Historical Legitimacy: Success Speaks for Itself

Perhaps the most convincing way a new venture can gain internal legitimacy is by developing a history of successful product launches. This historical legitimacy confers at least two benefits to the new venture. First, it suggests that the new venture has prior experience with product launch, thus increasing the likelihood of its success with future products. Second, the large literature on "learning by doing" and adaptive learning shows that there are clear gains to learning through a process of trial and error (Van de Ven and Polley 1992).

Thus, new ventures with historical legitimacy can gain more from new product introduction. However, this effect will be moderated by whether new ventures with historical legitimacy also form alliances with established firms to introduce new products. Firms without internal historical legitimacy have few other means of gaining such legitimacy than by forming alliances; for these new ventures, alliances, though costly, may confer benefits that they would not have otherwise. However, for new ventures that already possess historical legitimacy, forming an alliance is likely to (1) confer fewer marginal benefits beyond those that its experience and knowledge already provide and (2) do so at considerable additional cost. Thus, new ventures that already possess historical legitimacy are likely to be better off not forming alliances with established firms.

H_2: The greater a new venture's historical legitimacy, the larger are its gains from introducing a product on its own than from doing so through an alliance with an established firm.

Scientific Legitimacy: Being on the Cutting Edge

New ventures in emerging industries must convey to stakeholders that they understand and can work with the latest scientific ideas in the field. One way for new ventures to achieve this scientific legitimacy is by assigning leadership roles to scientists and academics (Stuart, Hoang, and Hybels 1999). Not only do scientists help invent new products, but their presence in leadership roles in the new venture also confers at least three other benefits to the firm: (1) technical credibility, suggesting that the new venture has the ability within itself to develop successful new products (Zucker, Darby, and Brewer 1998); (2) access to outside knowledge the firm does not possess and cannot develop on its own; and (3) some assurance that the firm has the ability to absorb and leverage new knowledge acquired from outside entities (Cohen and Levinthal 1990).

As with historical legitimacy, the preceding arguments suggest that actions associated with scientific legitimacy can yield a substantial financial payoff for new ventures that introduce new products. However, again, we expect that this effect will be moderated by whether the new venture forms an alliance with an established firm for new product introduction. New ventures that do not have internal scientific legitimacy have relatively few options to gain such legitimacy other than through alliances. Thus, though costly, alliances can confer legitimacy on such new ventures that they would not otherwise have; in turn, this would manifest greater gains from new product introduction. In contrast, for new ventures that already possess scientific legitimacy, also forming an alliance would result in decreasing marginal benefits at considerable additional cost. Thus, we hypothesize the following:

H_3: The greater a new venture's scientific legitimacy, the larger are its gains from introducing a product on its own than from doing so through an alliance with an established firm.

Market Legitimacy: Knowing the Market

In addition to communicating their scientific capabilities, new ventures in emerging industries must convey their ability to market new products. A way for new ventures to acquire such market legitimacy is by hiring executives with marketing and management experience in established, related fields (Gulati and Higgins 2003). The presence in top management positions of experienced professionals from related fields confers three benefits on new ventures. First, their presence suggests to important stakeholders that the new venture understands customers well and that the firm is market oriented in its approach. Important stakeholders will recognize this and positively view the new ventures that are market oriented. Second, because of their past experience with commercializing new products, experienced executives will provide new ventures with this important capability, thus improving stakeholder perceptions of the firm's likely success with its own products. Finally, such

executives will be able to draw on their experience with picking market winners, again increasing the new venture's potential performance with its new products. Greater market knowledge confers a greater probability of success with new products (Li and Calantone 1998).

As with historical and scientific legitimacy, we expect that the positive impact of actions associated with market legitimacy will be moderated by whether new ventures that possess it enter into alliances with established firms for new product introduction. New ventures without market legitimacy will gain such legitimacy from forming alliances with established firms; these benefits are likely to outweigh the additional costs due to gain sharing and result in higher returns to product introduction. Conversely, new ventures that possess market legitimacy will gain little additional legitimacy from forming alliances and will incur the additional costs due to gain sharing and loss of control. Consequently, such firms will be better off not forming alliances for their new product introductions. Thus, we hypothesize the following:

H_4: The greater a new venture's market legitimacy, the larger are its gains from introducing a product on its own than from doing so through an alliance with an established firm.

Locational Legitimacy: Where Does the Firm Come From?

There has been considerable interest recently in the role of "clusters" or "hot spots" in the growth of firms in emerging industries. The research on clusters suggests that new ventures in emerging industries can gain legitimacy by locating themselves in areas with large numbers of related firms (Pouder and St. John 1996). The presence of related firms can help new ventures in these clusters gain such legitimacy in three ways. First, their presence in the cluster indicates to stakeholders that they have access through the cluster to specialized inputs and a skilled labor pool (Porter 1998). Second, it suggests that the new ventures have access to new technical and market knowledge as well as resources that can be shared (e.g., through access to university research developed in the area). Third, it suggests that the new ventures can potentially gain from any complementarities that may result from working with or in the presence of related firms.

There is some evidence that being in a cluster may also convey negative information about firms located there. For example, with time, inertia tends to set in among firms in clusters, resulting in groupthink, nonreceptivity to external ideas, and the suppression of innovation (Pouder and St. John 1996). All this leads to a negative perception about such firms and, in the process, creates an unfavorable impression about the products these firms introduce (Ganesan, Malter, and Rindfleisch 2005). However, because such decline usually sets in over time and tends to afflict more stable industries, we argue that new ventures in emerging industries are likely to benefit rather than suffer from their presence in clusters.

For reasons identical to those we noted for the other forms of internal legitimacy, we expect that the positive impact of locational legitimacy will be moderated by whether new ventures that possess it enter into alliances with established firms for new product introduction. Thus:

H_5: The greater a new venture's locational legitimacy, the larger are its gains from introducing a product on its own than from doing so through an alliance with an established firm.

Method

Empirical Context

A proper test of our hypotheses requires us to investigate an emerging industry with (1) multiple comparable product introductions by multiple new ventures, (2) accurate details on these product introductions, and (3) adequate variation in the sources of internal and external legitimacy. The U.S. biotechnology industry is an ideal industry to study for several reasons. First, it is a truly important industry, with applications in health care, agriculture, and industrial products. Biotechnology has made enormous strides in the last two decades, with dramatic growth, considerable entry, and equally astonishing exit rates.

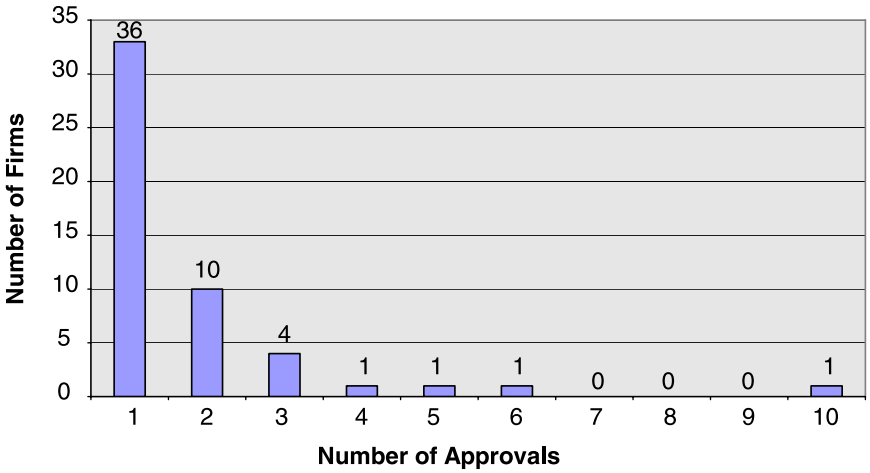
Second, new products are of central importance to the industry. In the pharmaceutical context, biotechnology represents an entirely new way of discovering drugs. As of 2002, the Food and Drug Administration (FDA) has approved 165 products for launch, and each product has its own unique date of introduction. Moreover, multiple firms that fit our definition of new ventures in an emerging industry have introduced these drugs. For an illustration of the highly fragmented nature of the industry, with few clearly dominant players in terms of product introductions to date, see Figure 2.

Finally, as with all emerging industries, the biotechnology industry in its early years involved much uncertainty about its potential. This created a liability of newness for new ventures in the industry, which in turn made it crucial for these firms to gain legitimacy through various means in the eyes of stakeholders. Our data show that there is sufficient variation among biotech firms in the types of approaches they adopted to gain such legitimacy (see Table 1). In summary, the industry provides a unique setting in which to address our research questions.

Variables and Data

The stock market–based, event study method we adopt (Brown and Warner 1985) offers an attractive approach to estimating the gains from new products due to various legitimizing strategies. The method provides a quantitative measure of how the market views a particular event (e.g., a new product launch) by computing the abnormal returns to the firm's stock price generated as a result of the event. We then use this abnormal-returns measure to compute the change in market capitalization (ΔMktCap) associated with the expected rewards to product introductions by new biotech ventures. Because stakeholders have already incorporated information on various types of legitimacy before the event under study (i.e., the product launch), any significant association between these variables and the ΔMktCap of product launch provides an appropriate test of our hypotheses.

FIGURE 2
Distribution of Product Approvals Among Biotech Firms



We take a census of all biotech drugs approved by the FDA until 2002, starting with the first approval in 1982 for the insulin drug Novolin.[2] We focus exclusively on human drugs for the sake of comparability and internal consistency. Because our focus is on new ventures, we only use products introduced by biotechnology firms and do not include biotech drugs introduced by pharmaceutical firms. In addition, because we use stock market data to infer the rewards associated with product introductions, we drop private biotech firms and subsidiaries of pharmaceutical firms from our data. Doing so yields 93 product introductions, and we use data on these drugs in all our analyses. We now describe each of the empirical measures we use to test our hypotheses (see Table 1).

Dependent variable: rewards to product introduction. We use abnormal stock market returns to infer the value that stakeholders expect a new product will add to the new venture introducing it. We calculate abnormal returns over a three-day window and use these to compute a measure of ΔMktCap based on the total gains to the firm's market capital relative to any gains to the overall market (Fama 1970) (see Appendix A). The abnormal returns are constructed as the difference between the return on the stock of the firm in question and the return on the market index; this difference controls for general movement in the market. In other words, an event is deemed to have positive abnormal returns if and only if the returns to it are larger than those to the market index. Our dependent variable calculates the absolute dollar value for rewards to product introduction using abnormal returns. In doing so, we follow other researchers who have also compared across many firms the gains (or losses) that accrue to the firm from an important event (Dowdell, Govindaraj, and Jain 1992; Hendricks and Singhal 1997; Sorescu, Chandy, and Prabhu 2003).

Independent variables: external and internal legitimacy. To construct measures of our independent variables, we use publicly available information, including annual reports, company Web sites, and trade journals. We explain these measures and their sources in detail subsequently.

To measure actions associated with external legitimacy, we use data on alliances between biotech firms in our sample and established pharmaceutical firms. We collect these data from trade journals such as *Pharma Business Week* and press reports. We code a dummy variable on the basis of whether the new venture introduced the product in alliance with an established pharmaceutical firm. Established pharmaceutical firms are those that had a sizable presence in the pharmaceutical business before 1976 (a year widely regarded as the birth of the first biotechnology firm Genentech). In practice, these firms are mostly members of "big pharma," the largest pharmaceutical firms worldwide.

Because our hypotheses on internal legitimacy (H_2–H_5) are interactions between the lack of an alliance and the different sources of internal legitimacy, we reverse-code the alliance variable for easier interpretation. We code the variable as 1 if the biotech firm has no alliance with a pharmaceutical firm (i.e., the new venture "goes alone") and 0 if the firm has such an alliance.

We measure internal legitimacy in terms of four components: historical, scientific, market, and locational legitimacy. We measure actions associated with historical legitimacy by identifying the number of drug approvals the biotech firm obtained before the focal approval.[3] Drug approval in the pharmaceutical industry is a long and expensive process. The presence of one or more approved drugs in a biotech new venture's portfolio provides immedi-

[2]For reasons of comparability, our sample includes only biotech drugs and not other products, such as biotech-related medical devices.

[3]An alternative measure of historical legitimacy would be the entrepreneurial history of the top managers of the firm. However, only 9.79% of top managers or board members in our sample had any history of entrepreneurship. We reestimate our models using this measure but find that its coefficients are not significantly different from zero in any of the models.

TABLE 1
Variables and Data Sources

Conceptual Variable	Notation	Measured Variable	Data Sources
Rewards to product introduction	$\Delta MktCap_{it}$	Net present value in 1987 dollars ($ millions)	•Center for Research in Security Prices •Dow Jones/Reuters
External legitimacy	$(1 - GoAlone_{ijt})$	Alliance with established pharmaceutical firms	•*Pharma Business Week* •*Med Ad News* •www.bio.org
Historical legitimacy	$Hist_{it}$	The number of previous product approvals	•*Pharma Business Week* •*Med Ad News* •www.bio.org
Scientific legitimacy	Sci_{it}	Fraction of board consisting of academicians	•LexisNexis •SEC filings
Market legitimacy	Mkt_{it}	Fraction of board consisting of ex-pharmaceutical executives	•LexisNexis •SEC filings
Locational legitimacy	Loc_{it}	The number of biotech firms in the city area	•CorpTech database
Technology know-how	$KnowHow_{it}$	The stock of patents for focal firm on approval date	•Delphion
Firm size	$Size_{it}$	Log of number of employees	•COMPUSTAT
Age	Age_{it}	Age of the firm	•Annual reports •Company Web sites
Consumer benefits	$Priority_{jt}$	Priority status granted by FDA	•Pharmaprojects •www.fda.gov
Niche product	$Orphan_{jt}$	Orphan status granted by FDA	•Pharmaprojects •www.fda.gov
Market potential	$MktPot_{jt}$	Estimated market potential of the therapeutic category	•Pharmaprojects
Competitive intensity	$Comp_{jt}$	Number of existing players in the therapeutic category	•Pharmaprojects
Alliance dates		Date of formation of product alliance	•Recap database

ate testimony to stakeholders of its ability to use resources effectively and of its experience in developing and marketing drugs. This testimony is particularly strong given that there were just 165 approved biotech drugs on the market as of 2002; the number of biotech firms at that time was more than 1500. Having an approved drug in its portfolio, therefore, places a biotech new venture in an exclusive club. As Figure 2 shows, a few firms have one or more prior product introductions, though most firms do not. Only one firm—Genentech—has as many as 10 products approved, 4 more than its nearest rival, Amgen.[4]

We measure actions associated with scientific legitimacy by computing the ratio of academic scientists on the biotech firm's board to the total size of the board. We count as an academic scientist anyone who holds an appointment in a university as a researcher or a faculty member. A high ratio of academic scientists on the board conveys to stakeholders that the firm has the technical capabilities needed for successful product introduction (Dacin 1997). Stakeholders are likely to respond to the prominence of scientists on the firm's board. Thus, two scientists on a four-member board will convey more scientific legitimacy than two scientists on a ten-member board. We obtain data on the composition of corporate boards and on board members' affilia-

[4]This may suggest that Genentech is an outlier in our model. However, an outlier analysis indicates that this is not the case. In addition, when we include a dummy variable for Genentech to capture its fixed effects in our subsequent analyses, we find that its coefficient is not significantly different from zero, and the other results remain essentially unchanged.

tions with research institutions from Securities and Exchange Commission (SEC) filings.

We measure actions associated with market legitimacy by computing the ratio of former or current executives of established pharmaceutical firms on the biotech firm's board to the total size of the board. A high ratio of such executives on the board conveys to stakeholders that the firm has the market capabilities needed for successful product introduction (Aldrich and Baker 2001). We obtain information on board members' biographies and prior affiliations from SEC filings.

We measure actions associated with locational legitimacy by calculating the number of biotech firms in the metropolitan statistical area in which the focal firm is located. The higher the number of such firms in the city area, the closer it resembles a cluster. We also construct two alternative measures of locational legitimacy. First, we compute a dummy variable and assign new ventures in well-known biotech "hot spots" (i.e., California, Massachusetts, Maryland, and New York/New Jersey) a value of 1 and new ventures in other areas a value of 0. Second, we develop a statewise measure of "clustering" by computing the ratio of biotech firms in the state of the focal firm divided by the total number of firms in the United States.[5] As we report subsequently, our results are robust to the use of all these measures of locational legitimacy.

Control variables. Although our theory predicts a significant relationship between the legitimacy variables and the rewards to product introduction, several other firm- and product-specific factors are also likely to influence the ΔMktCap of new products. We obtain measures of these control variables as follows.

For firm-specific controls, we consider firm size, firm age, and technological know-how. First, larger firms are likely to have greater resources that they can leverage to introduce products more successfully. Although the evidence on this is mixed (see Sorescu, Chandy, and Prabhu 2003), we control for size to capture the heterogeneity among firms in our sample. We construct a measure of firm size using the natural log of the number of employees in the firm in the year of approval. Second, we control for the age of the firm to tease out the effect of legitimacy from the pure time effect; that is, as firms get older, they might become more established, and this might influence the returns associated with a product launch (Hannan and Freeman 1984). Accordingly, we control for firm age, measured as the number of years since the focal firm's incorporation. Third, because some of our measures of legitimacy might be considered merely proxies for the technological know-how of new ventures, we explicitly account for technological know-how by including as a control variable the stock of patents for the new venture on the date of product introduction. This measure has been frequently used in prior studies to measure technological know-how (see Prabhu, Chandy, and Ellis 2005).[6]

To estimate the effects of legitimacy on the rewards to product innovation, we need to account for the inherent quality of each product and the market context in which it is introduced. We do so by controlling for the following factors: consumer benefits relative to existing products, a priori market potential, niche products, and competitive intensity. First, we code whether the FDA deemed the drug to provide substantially higher therapeutic benefits relative to existing drugs and therefore granted it priority review status (Sorescu, Chandy, and Prabhu 2003). Second, we obtain an estimate of market potential (in billions of dollars) for each therapeutic category from the Pharmaprojects database. This variable accounts for the notion that, for example, an AIDS drug faces inherently different demand conditions than a dermatology drug. Third, as an additional measure of market potential, we code whether the focal drug is an orphan (i.e., a drug for which the target population is limited or for which the disease it treats occurs only rarely). Granting of orphan status by the FDA confers exclusive access to the market for the drug. Fourth, we account for competitive intensity by counting the number of competitors that are already in the therapeutic category.

Model

Our unit of analysis is the individual product introduction (i.e., FDA approval for market launch). We use the ΔMktCap associated with each product approval as the dependent variable. Each ΔMktCap is associated with a firm and a time period. However, because there are few multiproduct biotech firms (see Figure 2), applying a panel specification to the data is difficult. Instead, we attempt to parcel out alternative sources of variance in the data by including a large number of control variables in our model specification.

We specify the following model for testing our hypotheses using the ΔMktCap generated on the stock market as the dependent variable and the legitimacy measures as the independent variables, along with the firm- and product-specific control variables described previously:

$$
\begin{aligned}
(1)\quad \Delta\text{MktCap}_{it} = {} & \beta_0 + \beta_g \text{GoAlone}_{ijt} + \beta_{gh}\text{Hist}_{it} \times \text{GoAlone}_{ijt} \\
& + \beta_{gs}\text{Sci}_{it} \times \text{GoAlone}_{ijt} + \beta_{gm}\text{Mkt}_{it} \times \text{GoAlone}_{ijt} \\
& + \beta_{gl}\text{Loc}_{it} \times \text{GoAlone}_{ijt} \\
& + \beta_{gk}\text{KnowHow}_{it} \times \text{GoAlone}_{ijt} \\
& + \beta_{ah}\text{Hist}_{it} \times (1 - \text{GoAlone}_{ijt}) \\
& + \beta_{as}\text{Sci}_{it} \times (1 - \text{GoAlone}_{ijt}) \\
& + \beta_{am}\text{Mkt}_{it} \times (1 - \text{GoAlone}_{ijt}) \\
& + \beta_{al}\text{Loc}_{it} \times (1 - \text{GoAlone}_{ijt})
\end{aligned}
$$

[5]Ideally, we would have a time-varying measure of this variable. Because of data availability constraints, however, we construct this variable for 1994 and use this measure for each period thereafter with the assumption that relative cluster density remains the same for preceding and succeeding years.

[6]We also performed the analysis using an alternative measure of technological know-how—the number of patents weighted by citation counts. Our hypothesis tests yield the same results.

$$+ \beta_{ak}\text{KnowHow}_{it} \times (1 - \text{GoAlone}_{ijt})$$
$$+ \gamma_{1g}\text{Age}_{it} \times \text{GoAlone}_{ijt}$$
$$+ \gamma_{2g}\text{Size}_{it} \times \text{GoAlone}_{ijt}$$
$$+ \gamma_{3g}\text{MktPot}_{jt} \times \text{GoAlone}_{ijt}$$
$$+ \gamma_{4g}\text{Comp}_{jt} \times \text{GoAlone}_{ijt}$$
$$+ \gamma_{5g}\text{Orphan}_{jt} \times \text{GoAlone}_{ijt}$$
$$+ \gamma_{6g}\text{Priority}_{jt} \times \text{GoAlone}_{ijt}$$
$$+ \gamma_{1a}\text{Age}_{it} \times (1 - \text{GoAlone}_{ijt})$$
$$+ \gamma_{2a}\text{ Size}_{it} \times (1 - \text{GoAlone}_{ijt})$$
$$+ \gamma_{3a}\text{MktPot}_{jt} \times (1 - \text{GoAlone}_{ijt})$$
$$+ \gamma_{4a}\text{Comp}_{jt} \times (1 - \text{GoAlone}_{ijt})$$
$$+ \gamma_{5a}\text{Orphan}_{jt} \times (1 - \text{GoAlone}_{ijt})$$
$$+ \gamma_{6a}\text{Priority}_{jt} \times (1 - \text{GoAlone}_{ijt}) + \varepsilon_{ijt},$$

where i, j, and t are subscripts for firm, product, and time, respectively, and the other variables are defined in Table 1. We expect β_g to be negative and β_{gh}, β_{gs}, β_{gm}, and β_{gl} to be positive per hypotheses H_1, H_2, H_3, H_4, and H_5, and $(1 - \text{GoAlone}_{ijt})$ is 1 when a firm has an alliance (i.e., it does not go alone). The model is interactive in the sense that each of the independent variables can affect the dependent variable differently, depending on whether the product in question involves an alliance (i.e., the regression coefficients are different under each regime).

The specification in Equation 1 can be estimated using standard ordinary least squares (OLS) regression. However, doing so could be problematic because a firm's decision to go alone or form an alliance is a self-selected variable. For example, a firm might decide to go alone because the product it is seeking approval for has a quality advantage; therefore, the firm might expect a large revenue stream to accrue from the product and thus might not be willing to share the revenue with an alliance partner. Nevertheless, this unobserved quality advantage (possibly observed by the market but not by the econometrician) might also affect the ΔMktCap returns to the firm from product introduction. Therefore, we have a classic case of endogeneity in which an independent variable is correlated with the error term, and thus estimation using OLS would violate the fundamental OLS assumption of independent errors (Greene 2003).[7]

Econometrically, the way to correct for endogenous regressors is to use an instrumental variables approach. In our case, the endogenous variable—the choice to go alone or to form an alliance—is a dummy variable. Therefore, we need to use a slightly different approach to correct for enodogeneity than the standard instrumental variables approach.

In our case, the decision of whether to form an alliance is similar to what applied economists call assignment to a "treatment" (for a review, see Angrist 2001). The decision to form an alliance or go alone in launching a product is undertaken with some expectations regarding the outcome of the decision. A common class of econometric models termed "treatment effect" models has been developed to overcome the bias introduced by self-selected (endogenous) dummy variables. In these models, the endogenous variable is a dummy defined by whether a person was assigned to a "treatment" (Angrist 2001; Greene 2003; Maddala 1983). In our case, however, we cannot directly apply a treatment model because the treatment (i.e., the decision to go alone) also appears in the interaction terms in Equation 1. To overcome this problem, we employ the following estimation strategy: We run two separate regressions—one for firms that introduce products in an alliance and one for firms that choose to go alone. For firms that go alone, Equation 1 reduces to the following:

$$\begin{aligned}(2)\quad \Delta\text{MktCap}_{it} = (\beta_0 + \beta_g) &+ \beta_{gh}\text{Hist}_{it} + \beta_{gs}\text{Sci}_{it} + \beta_{gm}\text{Mkt}_{it} \\ &+ \beta_{gl}\text{Loc}_{it} + \beta_{gk}\text{KnowHow}_{it} + \gamma_{1g}\text{Age}_{it} \\ &+ \gamma_{2g}\text{Size}_{it} + \gamma_{3g}\text{MktPot}_{jt} + \gamma_{4g}\text{Comp}_{jt} \\ &+ \gamma_{5g}\text{Orphan}_{jt} + \gamma_{6g}\text{Priority}_{jt} + \varepsilon_{ijt}.\end{aligned}$$

For firms that form an alliance, Equation 1 reduces to the following:

$$\begin{aligned}(3)\quad \Delta\text{MktCap}_{it} = \beta_0 &+ \beta_{ah}\text{Hist}_{it} + \beta_{as}\text{Sci}_{it} + \beta_{am}\text{Mkt}_{it} + \beta_{al}\text{Loc}_{it} \\ &+ \beta_{ak}\text{KnowHow}_{it} + \gamma_{1a}\text{Age}_{it} + \gamma_{2a}\text{Size}_{it} \\ &+ \gamma_{3a}\text{MktPot}_{jt} + \gamma_{4a}\text{Comp}_{jt} + \gamma_{5a}\text{Orphan}_{jt} \\ &+ \gamma_{6a}\text{Priority}_{jt} + \varepsilon_{ijt}.\end{aligned}$$

Now, the estimation of parameters of interest is made easier. The difference in the estimated intercepts of Equations 2 and 3 gives an estimate of β_g, the difference in the estimated coefficient of Hist in Equations 2 and 3 gives an estimate of $\beta_{gh} - \beta_{ah}$, and so on.

However, note that an OLS-only estimation of Equations 2 and 3 would not solve the problem of self-selection (Shaver 1998).[8] To obtain unbiased estimates of Equations 2 and 3, we run each regression separately and correct for the self-selection problem (Heckman 1979; Shaver 1998). We assume that all the variables that drive ΔMktCap also drive firms' decision to go alone or form an alliance. For example, the firms with greater internal legitimacy might be less likely to form an alliance because they will have greater confidence in their ability to go alone (Eisenhardt and Schoonhoven 1996; Lerner and Merges 1998). The under-

[7]It could be argued that the other legitimacy variables in Equation 1 are also endogenous. We focus on the alliance variable only and consider other variables exogenous because these are not product-specific decisions, whereas an alliance is. Thus, although the alliance decision might be driven in part by the unobserved quality of the product and thus might be correlated with it, this is not likely to be the case for the other measures of legitimacy, because these are more long-term, firm-related (rather than product-related) measures. We address this issue in detail subsequently.

[8]Despite this, we also estimate these equations using OLS and find that, in general, the OLS results are similar to the results from the models we report and discuss subsequently.

lying equations that drive the selection (i.e., to go alone or form an alliance) in Equations 2 and 3 are as follows:

$$\text{(4a)}\quad \text{GoAlone}_{ijt} = \mu_0 + \mu_1\text{Hist}_{it} + \mu_2\text{Sci}_{it} + \mu_3\text{Mkt}_{it} + \mu_4\text{Loc}_{it} + \mu_5\text{KnowHow}_{it} + \mu_5\text{Age}_{it} + \mu_7\text{Size}_{it} + \mu_8\text{MktPot}_{jt} + \mu_9\text{Comp}_{jt} + \mu_{10}\text{Orphan}_{jt} + \mu_{11}\text{Priority}_{jt} + \kappa_{ijt}, \text{ and}$$

$$\text{(4b)}\quad \text{Alliance}_{ijt} = \mu_0' + \mu_1'\text{Hist}_{it} + \mu_2'\text{Sci}_{it} + \mu_3'\text{Mkt}_{it} + \mu_4'\text{Loc}_{it} + \mu_5'\text{KnowHow}_{it} + \mu_5'\text{Age}_{it} + \mu_7'\text{Size}_{it} + \mu_8'\text{MktPot}_{jt} + \mu_9'\text{Comp}_{jt} + \mu_{10}'\text{Orphan}_{jt} + \mu_{11}'\text{Priority}_{jt} + \kappa_{ijt}'.$$

To test our hypotheses formally, we use maximum likelihood estimation to jointly estimate Equations 2 and 4a and Equations 3 and 4b, respectively, while accounting for the dichotomous nature of the dependent variables in Equations 4a and 4b (see Appendix B). Note that the dependent variable in Equation 4a is coded as 1 when a firm goes alone and as 0 when it has an alliance. Conversely, the dependent variable in Equation 4b is coded as 0 when a firm goes alone and as 1 when it has an alliance. To clarify this point, consider the joint estimation procedure for Equations 2 and 4a. When these two equations are estimated jointly, the ΔMktCap values for all firms that go alone are treated as observed, whereas those for firms that form alliances are treated as censored. Likewise, when Equations 3 and 4b are estimated jointly, the ΔMktCap values for all firms that form alliances are treated as observed, whereas those for firms that go alone are treated as censored.

Results

Table 2 presents descriptive statistics for our data. Note that the average ΔMktCap across all firms is $62 million (in 1987 dollars); given that the average market capitalization across all firms before the FDA approval is $1.47 billion, this represents an average gain of approximately 4.2%. Table 3 exhibits the parameter estimates for the models. Detailed analyses of the influence of outliers, nonnormality, and multicollinearity indicate that these do not affect the results of the estimation. As we mentioned previously, a simple OLS specification of our model provides results consistent with our key hypotheses. However, Table 3 shows that the estimated coefficient (λ) for the selection correction term (Mills ratio) is significantly different from zero in both the go-alone and the alliance regimes (–837.77, $p < .01$, and 189.27, $p < .01$, respectively). These results imply that there is indeed an underlying selection process in firms' decisions to go alone or to form an alliance, and thus a model that accounts for the underlying selection process provides more consistent and unbiased results than OLS. The difference between the relevant estimates of the two models provides parameters that show how the various types of actions associated with legitimacy differentially affect the ΔMktCap in the GoAlone versus Alliance cases, respectively.[9] Table 4 lists these values.[10]

Effects of External Legitimacy: Do Alliances Matter?

H_1 predicts that new ventures that introduce products in alliance with established firms gain more from these product introductions than new ventures that do so without such alliances. As Table 4 shows, the coefficient of the GoAlone dummy is negative and significant ($\beta_g = -300.95$, $p < .1$), in support of H_1. Thus, we find support for the positive effects of external legitimacy on rewards to product introduction by new ventures in an emerging industry.

Effects of Internal Legitimacy

Historical legitimacy. H_2 predicts that, all else being equal, the greater a new venture's historical legitimacy, the larger are its gains from introducing a product without an alliance than through an alliance with an established firm. The positive, significant coefficient of $\beta_{gh} - \beta_{ah}$ (287.61, $p < .01$; see Table 4) strongly supports this hypothesis. The coefficients in Table 3 provide additional details regarding this result. As Model 1 in Table 3 shows, for firms that go alone, greater historical legitimacy results in greater gains from new product introductions ($\beta_{gh} = 295.37$, $p < .01$). In contrast, Model 2 shows that for firms that form alliances, historical legitimacy has a nonsignificant effect on gains from product introductions. These results suggest that when a firm forms an alliance, the marginal benefits of historical legitimacy are absent.

Scientific legitimacy. H_3 predicts that, all else being equal, the greater a new venture's scientific legitimacy, the larger are its gains from introducing a product without an alliance than through an alliance with an established firm. The positive, significant coefficient of $\beta_{gs} - \beta_{as}$ (1070.52, $p < .1$; see Table 4) supports this hypothesis. Again, the coefficients in Table 3 provide details regarding this result. As Model 1 in Table 3 shows, for firms that go alone, greater scientific legitimacy results in greater gains from new product introductions ($\beta_{gs} = 1369.51$, $p < .1$). In contrast, Model 2 shows that for firms that form alliances, sci-

[9]Specifically, if we denote the estimates for the go-alone model as 1 and those for the alliance model as 2, then $\beta_{new} = \beta_{n1} - \beta_{n2}$, $\sigma_{new} = \sqrt{\sigma^2_{n1} + \sigma^2_{n2}}$, and $DF_{new} = (\sigma^2_{n1} + \sigma^2_{n2})^2/(\sigma^4_{n1}/DF_{n1} + \sigma^4_{n2}/DF_{n2})$, where the first equation represents the difference in coefficients obtained in the individual regressions, the second equation represents the standard error of the coefficient obtained after differencing, and the third equation represents the degrees of freedom used to calculate the t-statistics of the differenced coefficients (Moore and McCabe 1998; Satterthwaite 1946).

[10]To test whether the underlying model of Equation 1 with interaction effects is indeed the "true model," we run a simple main-effects version of Equation 1 with no interaction terms. We then run a Chow test using the parameters from this model and the parameters from Equations 2 and 3 in Table 3. The Chow test reveals that the coefficients of the two models in Table 3 are indeed different ($F = 20.86$, $p < .01$), confirming that interaction effects exist.

TABLE 2
Descriptive Statistics and Correlation Matrix

	M	SD	ΔMktCap	Alliance	Hist	Sci	Mkt	Loc	KnowHow	Age	MktPot	Comp	Size	Priority	Orphan
ΔMktCap	62.13	398.24	1.00												
Alliance	.42	.50	–.05	1.00											
Hist	1.08	1.68	.39*	.05	1.00										
Sci	.20	.15	.18*	.09	.07	1.00									
Mkt	.21	.17	.11	.04	–1.07	–.03	1.00								
Loc	12.17	13.8	.17	.09	.06	.17	.04	1.00							
KnowHow	139.04	195.9	.29*	–.12	.42*	.04	–.03	–.08	1.00						
Age	15.39	7.94	.07	–.12	.23*	–.06	–.11	–.08	.73*	1.00					
MktPot	2.54	2.20	–.02	.12	.08	–.09	–.32*	.18	.03	.09	1.00				
Comp	23.06	14.28	–.004	–.06	.11	.03	.21*	.03	.34*	.16	–.04	1.00			
Size	6.31	1.51	.18*	–.02	.59*	.10	–.28*	.06	.65*	.44*	.17	.29*	1.00		
Priority	.548	.500	–.101	–.017	–.156	–.091	–.099	–.023	–.106	–.032	–.051	–.045	–.073	1.00	
Orphan	.333	.474	–.013	–.000	.071	.251*	.008	.269*	–.200	–.191	–.038	–.143	–.018	–.137	1.00

*$p < .05$.

TABLE 3
Results of Selection Models

Variable	Model 1 (GoAlone Firms Only)	Selection (for Model 1)	Model 2 (Alliance Firms Only)	Selection (for Model 2)
Intercept	–473.32**	.99	–172.37	–.315
	(211.15)	(1.41)	(127.23)	(.915)
Hist	295.37***	.055	7.76	.087
	(78.44)	(.121)	(17.73)	(.115)
Sci	1369.51*	–1.28	299.33**	1.04
	(753.87)	(.88)	(160.14)	(.878)
Mkt	1605.65***	–1.95*	88.96	.221
	(647.40)	(.98)	(156.82)	(.872)
Loc	–8.87	.004	3.06*	.018*
	(8.09)	(.009)	(1.80)	(.011)
KnowHow	–.575	.0029*	–.100	–.0006
	(1.00)	(.0017)	(.222)	(.001)
Priority	180.01	.007	–45.82	–.321
	(212.23)	(.257)	(59.24)	(.297)
Orphan	2.84	–.089	26.21	–.069
	(238.63)	(.276)	(66.91)	(.368)
Size	–114.86	–.063	164.46	–.046
	(95.00)	(.178)	(199.59)	(.150)
MktPot	129.42***	–.147**	23.59**	.078
	(49.33)	(.060)	(11.70)	(.071)
Age	–19.75	.008	–3.06	–.010
	(19.59)	(.031)	(5.63)	(.028)
Comp	5.01	–.0006	–1.59	–.0016
	(7.31)	(.009)	(1.89)	(.0099)
N: total	93		93	
N: uncensored	54		39	
Correction: self-selection (λ)	–837.77***		189.27***	
Log-likelihood	–466.71		–287.88	

*$p < .1$.
**$p < .05$.
***$p < .01$.
Notes: Standard errors are in parentheses.

TABLE 4
Estimated Coefficient Differences

		Expected Sign	Implication
GoAlone (β_g)	–300.95*	Negative	H_1 supported
	(238.74)		
$\beta_{gh} - \beta_{ah}$ (historical legitimacy)	287.61**	Positive	H_2 supported
	(80.41)		
$\beta_{gs} - \beta_{as}$ (scientific legitimacy)	1070.52*	Positive	H_3 supported
	(770.69)		
$\beta_{gm} - \beta_{am}$ (market legitimacy)	1516.69**	Positive	H_4 supported
	(666.12)		
$\beta_{gl} - \beta_{al}$ (locational legitimacy)	–11.93*	Positive	H_5 not supported
	(8.28)		

*$p < .1$.
**$p < .01$.
Notes: Standard errors are in parentheses. Calculation of *p*-values is as per n. 9.

entific legitimacy has a positive but significantly lower effect on gains from product introductions (β_{as} = 299.33, $p < .05$).

Market legitimacy. H_4 predicts that, all else being equal, the greater a new venture's market legitimacy, the larger are its gains from introducing a product without an alliance than through an alliance with an established firm. As Table 4 shows, $\beta_{gm} - \beta_{am}$ is positive and significant (1516.69, $p < .01$), in support of H_4.

Locational legitimacy. Finally, H_5 predicts that, all else being equal, the greater a new venture's locational legitimacy, the larger are its gains from introducing a product without an alliance than through an alliance with an established firm. Contrary to H_5, the coefficient of $\beta_{gl} - \beta_{al}$ is negative and significant (–11.93, $p < .1$). This unexpected result suggests that the much-researched "cluster effect" does not yield higher financial returns to product introductions in the biotechnology industry. Nevertheless, though

negative, the overall effect size is small, suggesting that being in a cluster does not have too negative an impact on ΔMktCap.

Internal Versus External Legitimacy

Figure 3 describes the impact of forming an alliance compared with going alone for firms with different levels of internal legitimacy. We plot the estimated difference in ΔMktCap (calculated using the coefficients in Table 3) between firms with high internal legitimacy that form alliances and those with high internal legitimacy that go alone. High-legitimacy firms are those with each internal legitimacy variable set to one standard deviation above the mean value in the sample. Similarly, we calculate the estimated difference in ΔMktCap (again using the coefficients in Table 3) between firms with low internal legitimacy that form alliances and those with low legitimacy that go alone. Low-legitimacy firms are those with each internal legitimacy variable set to one standard deviation below the mean value in the sample. We find that a firm with low internal legitimacy that goes alone gains $367 million less in ΔMktCap than one that introduces the product in alliance with an established firm. In contrast, a firm with high internal legitimacy that goes alone gains $497 million more in ΔMktCap than one that introduces the product in alliance with an established firm (see Figure 3).

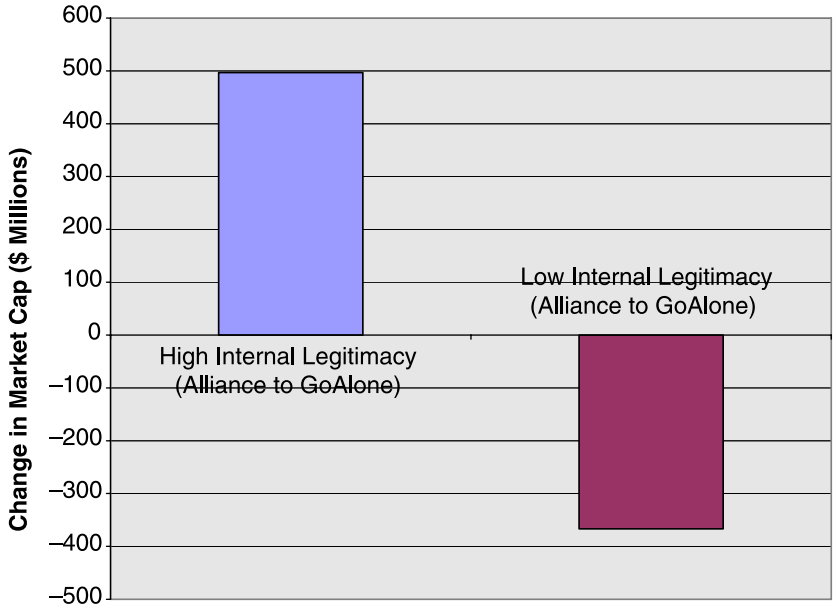
Additional Analyses

Do gains from alliances occur before product introduction? A key result is that new ventures with high internal legitimacy gain more from going alone than from forming alliances. It might be argued that an alternative explanation exists for this result. Specifically, firms with high levels of internal legitimacy may be able to cut better deals when forming a product-specific alliance before the product is approved. For example, a firm with reputed scientists on its board might enter alliance negotiations with greater bargaining power, resulting in higher abnormal gains at the time of alliance formation. Consequently, the ΔMktCaps on product approval for firms with high internal legitimacy that form alliances might be low simply because the market has already incorporated the potential gains from product introduction at the time the alliance was announced.

To examine this possibility, we obtain the announcement dates of all product-specific alliances of firms in our data set. We use these dates to calculate the ΔMktCaps due to alliance announcements. We then regress these alliance-specific ΔMktCaps against the measures of internal legitimacy. We do not find a significant, positive association between the legitimacy variables and the alliance-specific ΔMktCaps. Furthermore, we do not find a significant correlation between the ΔMktCaps at the time of alliance formation and the ΔMktCaps at product approval (pairwise correlation = –.0002, $p = .3$). Thus, we reject the alternative explanation that our results are driven by not taking into account the increase in firm value at the time of alliance formation. Finally, although we find that internal legitimacy has no effect on alliance ΔMktCaps, we find that the specific details of alliances (e.g., royalty terms, property rights–sharing agreements) do have a significant effect on them.

Does the exclusion of failed new product introductions affect our results? Given our emphasis on the returns to new product introductions, the results we report focus only on

FIGURE 3
Impact of Internal Versus External Legitimacy



products that are actually introduced into the marketplace. Nevertheless, does legitimacy help or hurt the odds of products under development making it to launch in the first place? To address this question, we obtain additional data on all products—both successes and failures—that entered the FDA drug pipeline during our study period (1982–2002). These data cover products that were approved, discontinued, or remained in the product development pipeline. In all, we have 530 observations with 93 approvals, 187 rejections, and 250 with right truncation. As such, we analyze these data using a competing risk Cox proportional hazard model (see Lunn and McNeil 1995). This analysis suggests that legitimacy is actually associated with lowered odds of failure in the FDA approval process, even after we account for investments in research and development (R&D) and priority status in clinical trials. Specifically, a firm with historical legitimacy obtained through a previous product introduction improves its chances of being approved (relative to being discontinued) by approximately 26% ($e^{.231} \approx 1.26$). A firm that has an external alliance with an established firm improves its chances of being approved (relative to being discontinued) by approximately 63% ($e^{.492} \approx 1.63$). Locational legitimacy also pays off in terms of increased probability of approval; a one standard deviation improvement in locational legitimacy leads to an increased hazard of being approved (relative to being discontinued) of approximately 47%. In contrast, a high market potential decreases the chances of being approved, perhaps because of greater regulatory scrutiny for more important drugs. Investments in R&D also pay off, by yielding better odds of approval (or correspondingly lower odds of failure). Similarly, receiving priority review status from the FDA dramatically improves a drug's chance of approval. The results of this analysis suggest that legitimacy is actually associated with lowered odds of failure in the FDA approval process, even after we account for investments in R&D. In other words, legitimacy actually helps products under development make it to launch in the first place. These results further highlight the importance of legitimacy in driving the success of innovations by new ventures.

Are our results robust to alternative estimation methods? We estimate the results in Table 3 using maximum likelihood. To check for the robustness of our results to the estimation method, we also estimate the model using (1) an OLS specification, (2) a Cox proportional hazard model, and (3) a Heckman two-stage procedure. The results from these analyses are consistent with those from the maximum likelihood estimation procedure we report here. The consistency of our results across these methods reinforces the robustness of the results.

Do the legitimacy variables act as proxies for quality? If the legitimacy variables we examine simply act as proxies for product quality, they would not play the suggested conceptual role in explaining returns to product introduction. Moreover, they would cause concerns about additional endogeneity in our model and raise questions about our results regarding the effects of legitimacy on the rewards to product introduction because it would be unclear whether the results reflect the true effects of legitimacy or simply the indirect effects of product quality.

We address these concerns both conceptually and empirically. Conceptually, a firm with a high-quality product might be able to attract high-quality scientific and market talent, thus increasing its scientific and market legitimacy. In contrast to scientific and market legitimacy, however, locational and historical legitimacy are both largely tied to the origins of each firm. In general, they are established long before the introduction of a particular product and are not easily changed in response to a high-quality product. As such, locational and historical legitimacy do not serve as proxies for the quality of a particular product.

To address the empirical concern that scientific and market legitimacy might simply be proxies for product quality, we run OLS regressions with scientific and market legitimacy measures as dependent variables and various product-, market-, and firm-specific measures of quality as independent variables. Specifically, we include the following independent variables: a priori market potential, relative consumer benefits, whether the product was a niche product, competitive intensity in the market, and a quality-adjusted metric of each firm's know-how that weights the patent stock of each firm by the citations received by each patent. The results from this analysis indicate that most of these measures have no significant effect on either scientific or market legitimacy.[11] These results provide some reassurance that our measures of internal legitimacy do not simply serve as proxies for quality.

Which sources of internal legitimacy matter more? The estimates of the internal legitimacy variables (in Table 3) provide dollar measures of the impact of the improvements in various legitimizing strategies. For example, a one-standard-deviation increase in historical, scientific, and market legitimacy decreases the negative impact of going alone by $495 million, $205 million, and $272 million, respectively. We also estimate standardized coefficients (from Table 3) for the internal legitimacy variables to assess the relative impact of these variables on ΔMktCap when firms go alone. We find that historical legitimacy and market legitimacy have the greatest impact on payoffs ($z = 3.77$, $p < .01$, and $z = 2.48$, $p < .01$, respectively), followed by scientific ($z = 1.82$, $p < .1$) legitimacy. As we reported previously, the impact of geographical legitimacy is negative ($z = 1.10$, $p < .3$). These results have many implications, as we discuss next.

Discussion and Implications

We show that new ventures can overcome the liability of newness by adopting strategies that give them legitimacy in the eyes of stakeholders. New ventures can gain legitimacy

[11]None of the quality measures have a significant effect on scientific legitimacy, and none of the quality measures except for the a priori market potential measure have a significant effect on market legitimacy.

through the associations they form with other, more established and reputed entities. We find that this legitimacy pays off by directly raising the rewards to such firms from their product introductions.

All else being equal, we find that new ventures that acquire external legitimacy by forming alliances with established firms in related industries gain more from their new products than new ventures that do not form such alliances. Among new ventures that do not form alliances, those that acquire internal legitimacy by creating a history of successful product introduction or by hiring reputed scientists and managers gain more from their new products than those that do not. Finally, although new ventures can gain from either external or internal legitimacy, we find that pursuit of external legitimacy by firms that already have internal legitimacy leads to lower rewards to innovation.

Implications for Research

Our findings have three major implications for research. First, we show that legitimacy explains the differential gains to new ventures from new product launch. Prior research on the issue of why some firms gain more from their new products than others suggests that this is due to variables such as firm size, know-how, resources, or the attributes of the product launched. Although these explanations are relevant to mature industries, they are less applicable to emerging industries in which firms are roughly the same size and new products are all more or less breakthrough in nature. We show that product gains vary greatly between firms that adopt legitimizing strategies and those than do not. The literature has traditionally emphasized how a desire for legitimacy pushes firms toward conformity with each other. Our results stress the need for more research on how managers use legitimizing strategies to differentiate their firms from others.

Second, this article is one of the first in marketing to incorporate the role of legitimizing forces in determining the outcomes of marketing actions (see Grewal and Dharwadkar 2002). The effects of legitimacy have been studied in other contexts, linking it to firm survival rates (Ruef and Scott 1998), new venture growth (Zimmerman and Zeitz 2002), and initial public offering success (Higgins and Gulati 2003). Our results are consistent with these previous studies. However, we go beyond these studies and outline a typology of legitimizing strategies in the context of product introduction. The role of legitimizing strategies in other marketing contexts is a topic that merits additional research.

Third, in contrast to much of the literature on the benefits of locating new ventures in industrial clusters, we find that firms seeking this form of legitimacy actually lose out compared with those that do not. This finding suggests that location is not as important as is implied in the literature, specifically in the context of product launches by new ventures.

Implications for Practice

Our findings provide fresh insights into how new ventures in emerging industries can improve their new product launch. We show that to introduce products successfully, new ventures must engage in active legitimizing strategies. These strategies provide new ventures with credibility in the eyes of stakeholders and, in the process, bring them greater rewards from product introduction. These rewards provide much-needed revenues that, in turn, help new ventures survive and grow.

A key implication of our study for managers of new ventures is that they need not and should not duplicate the legitimacy gained through internal means with that gained through alliances. The markets view such duplication as unnecessary and costly. Thus, if new ventures do not have internal legitimacy, they should form alliances. Conversely, if they have internal legitimacy, they should bring their products to market themselves. Moreover, we find that not all forms of internal legitimacy are equal. A history of successful product launches (historical legitimacy) has the greatest impact on gains from product introduction, followed by the presence of executives (market legitimacy) and respected academics (scientific legitimacy) on the board. Therefore, all else being equal, for firms that go alone, it pays more to have introduced a new drug before, followed by adding a reputed executive and then a reputed scientist to the firm's board.[12]

Our analysis of product failures in addition to successes shows that legitimacy is associated with lowered odds of failure in the FDA approval process. These results further highlight that investments in legitimacy help firms not only reap greater financial rewards from their products but also bring these products to market in the first place.

Marketers have extensively studied the positioning of products. Our research suggests that new ventures in emerging industries also need to position themselves to gain more from their new products. Given two products of the same quality, the product introduced by the more legitimate firm gains more. For new ventures facing intense competitive pressures and serious resource constraints, these gains could make the difference between life and death.

Limitations and Further Research

As with many early studies in an area, this research suffers from several limitations, some of which offer fruitful avenues for further research. First, we highlight four types of internal legitimizing actions: historical, scientific, market, and locational. These four dimensions may not be exhaustive. Further research that examines additional dimensions of legitimacy would be helpful. Second, because of data limitations, we assume that all alliances provide external legitimacy, and thus we do not examine whether certain types of alliances with certain established firms provide certain types of legitimacy or whether some alliances provide greater external legitimacy than others. Third, we examine the effects of legitimizing strategies on new ventures that actually introduce new products. Further research might study the effects of such strategies on new

[12]That market legitimacy matters more than scientific legitimacy is consistent with literature on new product development that posits that market risk matters more than technical risk (Li and Calantone 1998; Moorman 1995; Song and Montoya-Weiss 2001).

ventures that do not introduce products or those whose products are not approved. Fourth, given our interest in rewards to new ventures, we do not examine the returns to the introduction of biotech products by established pharmaceutical firms. Rather, we focus on the stock market–based returns to new products introduced by biotechnology firms. It would be useful to examine whether the findings from this industry generalize to other contexts and whether the stock market effects we find hold for other performance metrics, such as revenues and profits.

Appendix A: Measuring Change in Market Capitalization

We measure $\Delta MktCap_{it}$ by employing a market-adjusted model (Brown and Warner 1985). Thus:

$$\Delta MktCap_{it} = \left[\sum_{T=t-1}^{t+1}\left(\underbrace{\underbrace{R_{iT}}_{\text{Return on stock i}} - \underbrace{R_{mT}}_{\text{Return on market index}}}_{\text{Abnormal return}}\right)\right] \times P_{it-2} \times N_{it-2}, \quad \text{(A1)}$$

where

$\Delta MktCap_{it}$ = market capitalization change due to the event at date t for stock i (FDA approval date),
R_{iT} = return on stock i at date T,
R_{mT} = return on market index m at date T,
P_{it-2} = price of stock i at date t – 2, and
N_{it-2} = number of outstanding shares of stock i at date t – 2.[13]

First, our measure of change in market capitalization calculates the absolute dollar value for rewards to product introduction using abnormal returns. Thus, we follow other researchers who have also attempted to compare across many firms the gains (or losses) that accrue from an important event (Dowdell, Govindaraj, and Jain 1992; Hendricks and Singhal 1997; Sorescu, Chandy, and Prabhu 2003). Although some empirical work using the event study method employs percentage abnormal returns as the measure of interest, such work is typically concerned with whether an event results in abnormal returns and not with comparing the absolute gains that accrue across several firms. In using a dollar measure, we are also consistent with most research on the performance impact of marketing actions. For example, research on advertising effectiveness highlights the dollar revenues or dollar profits obtained as a result of advertising and not whether these revenues had a greater impact on the overall value of one firm versus another based on percentage gains.

Second, by choosing the date of product introduction as the event date, we can assess the impact of legitimacy on the stock market gains to product introduction. Note that by the time a product is introduced, the market is already aware of the legitimacy variables (e.g., external, product specific alliances) and has incorporated these into the valuation of the firm as a whole. Therefore, if we were to find a significant association between our measures of legitimacy at the time of product introduction, all else being equal, these associations would be a measure of how the valuation of the particular product being introduced is affected by the presence of various types of legitimacy.

Furthermore, whenever we refer to the date of "product introduction," we are referring to the FDA approval event. The FDA approval virtually ensures that the new drug will be launched in the near future, and thus the market reaction to the FDA approval practically incorporates all the gains associated with actual introduction. As such, this is the correct date to be used in event studies of returns to new product introduction in the pharmaceutical industry (Sorescu, Chandy, and Prabhu 2003).

In computing abnormal returns, it is crucial to ensure that the event date is accurately noted. We obtain and cross-check product introduction dates from multiple sources, including FDA announcements, trade press tabulations, and Dow Jones and Reuters wire services.[14] The $\Delta MktCaps$ we compute are reported in millions of dollars, adjusted using a consumer price index deflator to reflect constant 1987 dollars.

Appendix B: Estimation Procedure

We rewrite Equation 2 for the firms that go alone in the following succinct form:

$$\Delta MktCap_i = \mathbf{X}_i\boldsymbol{\beta} + u_i. \quad \text{(B1)}$$

A firm's decision to go alone is based on the underlying selection Equation 4a, which can be summarized as follows:

$$GoAlone_i^* = \mathbf{Z}_i\boldsymbol{\gamma} + \varepsilon_i, \quad \text{(B2)}$$

where $GoAlone_i^*$ is the net benefit of going alone and $GoAlone_i = 1$ iff $GoAlone_i^* > 0$ and 0 if otherwise.

To estimate consistent parameters for Equations B1 and B2, we use sample selection estimation methods (Heckman

[13]We use the window (–1, +1) to be consistent with most prior research. Nevertheless, we check for robustness by also doing the analysis for the windows (0, 2), (–1, +2), and (–2, +2). Our results remain qualitatively unchanged. To check for robustness, we also create alternative dependent variables using period-adjusted and market-adjusted models. The results using these variables are consistent with the findings reported here and are available on request.

[14]It might be argued that there is information leakage about the new product before final FDA approval. For example, an FDA advisory panel might approve the product, in which case the final approval may be a mere formality. In such cases, relying only on net present values (NPVs) generated at final approval might not capture the "true" NPV associated with the product. To test for this, we construct an alternative two-window dependent measure. We do so by summing the NPV generated at the time of final FDA approval and the NPV generated at the time of FDA advisory panel approval, if any, for each product. We run regressions using this alternative dependent variable and find that our results are qualitatively unchanged. These results are available on request.

1979) that employ maximum likelihood. In the estimation procedure, we account for the dichotomous nature of the selection variable ($GoAlone_i = 1$ for firms that go alone, and $GoAlone_i = 0$ for firms that form alliances) and jointly estimate Equations B1 and B2. The dependent variable in Equation B2 is "observed" for $GoAlone_i = 1$ and "censored" for $GoAlone_i = 0$. In other words, for $GoAlone_i = 1$, we observe $\mathbf{Z}_i$, $\mathbf{X}_i$, and $\Delta MktCap_i$, but for $GoAlone_i = 0$, we observe only $\mathbf{Z}_i$ and $\mathbf{X}_i$, and $\Delta MktCap_i$ is censored. We estimate Equations B1 and B2 jointly using maximum likelihood. We adopt a similar procedure for the alliance case. In the case of firms that form an alliance, the formulation is reversed, and the dependent variable is observed when firms form an alliance and is censored when firms go alone. For a discussion of the details of the likelihood function, its large-sample properties, and its comparison to the two-stage procedure, see Maddala (1983).

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