Risky Business

Uncertain Access to Specialized Complementary Assets, Vertical Integration, and the Commercial Performance of New Products

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Abstract

The present study explores the antecedents and consequences of vertical integration choices in the context of new product development using project-level data from the motion picture industry. I show that uncertain access to specialized complementary assets can generate market failures for high-cost projects, which drive the owners of these assets to vertically integrate into upstream innovation. Furthermore, I explore whether vertical integration affects downstream investments in specialized complementary resources and ultimately, the commercial performance of new products. I find that vertical integration promotes greater commercial success and that this effect is completely mediated by enhanced downstream investments.

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Introduction

The determinants of firm boundary decisions have been a central concern to strategy scholars for several decades. Core to this work is the notion that under certain conditions, a transaction may expose the parties involved to significant hazards that increase the cost of using the market (Williamson, 1973). To this end, scholars have highlighted how several sources of market costs can drive transacting parties to vertically integrate – the increased risk of opportunistic behavior arising from relationship-specific investments (Williamson, 1985), adaptation failures in the face increased transaction complexity and volatile exchange conditions (Tadelis, 2002; Gulati, Lawrence, and Puranam, 2005), and the risk of poor coordination stemming from inefficient information exchange between actors (Monteverde, 1995; Baldwin and Clark, 2000). While scholarly work has made considerable progress uncovering the sources of market costs, a key source remains under-examined – the hazard posed by uncertain access to specialized complementary assets (Teece, 1986).

Complementary assets represent capabilities or assets that are required to successfully commercialize a product or innovation (Teece, 1986). These assets play a critical role towards appropriating value from product development, particularly when these assets are *specialized*. Unlike *generic* complementary assets, *specialized* complementary assets are not available in competitive supply and are typically specialized to a particular industry, with limited use or value in alternative industrial settings (Rothaermel, 2000; Helfat and Lieberman, 2002). Nevertheless, specialized complementary assets need not be 'specific' to individual innovators within the industry (Williamson, 1985). Despite little opportunity for lock-in between upstream innovators and downstream owners of specialized complementary assets, innovators who rely on the market may face considerable uncertainty in their ability to secure a downstream contract ex-post. When downstream access to specialized complementary assets is uncertain ex-ante, the hazard associated with upstream investments in new product development increases considerably. The present

study explores whether market failures generated by uncertain downstream access drive the owners of specialized complementary assets to vertically integrate into upstream innovation. Furthermore, conditional on securing access to complementary assets, this paper examines the effect of vertical integration on the resource allocations made by the downstream owner and ultimately, the commercial performance of the product developed.

Prior work on complementary assets has highlighted their importance to a range of innovation outcomes (Teece, 2006). For instance, ownership of complementary assets has been found to drive larger investments in upstream R&D in response to environmental shocks (Helfat, 1997). In addition, decisions regarding entry into new product markets are significantly influenced by a firm's prior cache of complementary assets (Scott Morton, 1999). More recently, the literature has indicated that owners of complementary assets are less likely to source technology from the external market when the assets and the technology are co-specialized (Ceccagnoli et al., 2010). As informative as such studies have been, the literature to date has paid less attention to the fact that in certain settings, securing downstream access to complementary assets may be fraught with significant uncertainty ex-ante for the upstream innovator. As a result, it remains an open question how this uncertainty affects the make-buy choices of those firms that control the complementary assets.

To this end, I examine make-buy decisions in the context of the motion picture industry – a setting where uncertainty and concerns regarding ex-post access to specialized complementary resources are significant and ubiquitous. Specifically, this paper focuses on the market interface between movie production and movie distribution and examines the decisions of the major movie distributors to vertically integrate upstream into movie production over a 15-year period, from 1994-2008. In this setting, distribution channels, which promote films and distribute prints to theatre operators, represent

specialized complementary assets whose services are required to bring movies produced upstream to the consumer (Caves, 2000). Securing access to movie distribution is highly uncertain ex-ante because of limited marketing resources and the uncertain commercial prospects of any movie project. Since distributors commit scarce resources only after viewing a print of the final product, securing downstream access is subject to producing a product of high quality, both in absolute terms and relative to the other movies developed by upstream competitors. However, the quality and commercial potential of a project is highly variable and is extremely difficult to predict ex-ante i.e., before it is produced (De Vany, 2006). As Oscar-winning screenwriter William Goldman famously noted, "Nobody knows anything" (Caves, 2000). As a result, movie producers who use the market to access downstream assets face considerable ex-ante uncertainty concerning their ability to secure a distribution contract ex-post, making the motion picture industry an ideal setting for my analysis.

In addition to investigating an under-examined motive for vertical integration, this study makes several contributions to the small but emerging empirical literature that examines the performance consequences of vertical integration (Macher and Richman, 2008). While prior work in this domain has examined the impact of vertical integration on new product development, the outcomes examined have focused on the technological performance of new products (Leiblein, Reuer, and Dalsace, 2002), the efficiency with which they are manufactured (Macher, 2006), firm-level market share following periods of technological change (Adner and Kapoor, 2010), and the time-to-market of firms in new product generations (Kapoor and Adner, 2010). Consequently, to my knowledge, the literature-to-date has not assessed the direct impact of vertical integration on the commercial performance (sales) of individual products – a focus of the present study[1]. Furthermore, several arguments from the domain of agency

[1] In a recent working paper, Gil and Warzynski (2010) examine vertical integration decisions in the video game industry and find that vertical integration is correlated with higher game revenues. The present paper extends this

theory note that vertical integration should increase downstream investments in specialized complementary resources (Alchian and Demsetz, 1972; Jensen and Meckling, 1976). However, this effect has been subject to little empirical validation. I empirically examine the effect of vertical integration on downstream investments in a complementary resource that has been the focus of much theoretical work – downstream product marketing (e.g., Klein, 1995). Finally, I examine whether the effect of vertical integration on the commercial performance of new products is in fact mediated by the level of downstream investments in specialized complementary resources. Now, in the section that follows, I provide a brief literature review and develop the hypotheses that I will then empirically test in the remainder of this article.

Theory and Hypothesis Development

Scholarly work on firm boundaries began with Coase's (1937) fundamental insight "that there is a cost of using the price mechanism" and that firms vertically integrate when the cost of using the market exceeds the cost of pursuing a transaction in-house. As seminal as this observation was, Coase was relatively vague about the sources of transaction costs, and the few he provided were largely "unconvincing" (Hart, 2008). Nevertheless, *The Nature of the Firm* launched a significant inquiry into the sources of transaction costs. Subsequent scholars have noted that pursuing transactions through the market can expose actors to significant hazards, which increase the costs of using the price mechanism. Perhaps most prominently, Williamson (1985) highlighted the downside risk associated with transactions that entail relationship-specific investments. When parties are forced to make investments that are specific to the focal transaction, it raises the risk of opportunistic behavior that can increase the cost of market exchange. Other scholars point out that market exchange may enhance the risk of

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work by examining whether vertical integration has a causal effect on commercial outcomes and whether the effect is mediated by downstream investments in specialized complementary resources.

coordination failures between participants, particularly when the tasks involved grow more interdependent and put a premium on efficient information exchange (Arrow, 1974; Monteverde, 1995; Baldwin and Clark, 2000). The cost associated with information exchange is also the focus of the Knowledge Based Theory of the firm, which highlights the elevated costs of knowledge transfer between firms that transact through the market (Kogut and Zander, 1992; Grant, 1996). Another emerging strand of the literature focuses on the increased risk of adaptation failures associated with market transactions (Tadelis, 2002; Gulati, Lawrence, and Puranam, 2005; Forbes and Lederman, 2009). Failures of adaptation occur even in the absence of incentive conflict "because autonomous parties read and react to signals differently, even though their purpose is to achieve a timely and compatible combined response" (Williamson, 1991). Finally, several scholars highlight the presence of "dynamic" transaction costs when environmental change occurs (Langlois and Robertson, 1989; Langlois, 1992; Baldwin, 2008). These refer to the costs of persuading, negotiating with, coordinating among, and teaching outside suppliers in the face of economic change or organizational innovation. Thus, while it is clear that the literature-to-date has investigated several significant costs of market exchange, many unidentified and under-examined sources of transaction costs remain (Holmstrom and Roberts, 1998). To this end, the present study explores the increased hazard associated with upstream product development, when downstream access to specialized complementary assets is uncertain.

To do so, this study takes as given several features that are characteristic of many product development contexts. First, consistent with the standard setup in the firm boundaries literature, the setting consists of two distinct stages – an upstream activity and a downstream activity (Williamson, 1985; Baker, Gibbons, and Murphy, 2002). With financial resources and creative talent, new product development is conducted upstream, while specialized complementary assets are employed downstream to commercialize the products developed. Moreover, the ultimate commercial potential of a product is

very volatile and difficult to predict ex-ante. Consequently, market contracts between upstream innovators and downstream owners of specialized complementary assets entail revenue sharing provisions to accommodate the volatility in commercial performance (De Vany 2006). Furthermore, the interface between the upstream and downstream stages is characterized by minimal task interdependence and relationship-specific investments. As a result, coordination demands across stages are minimal, and there is little opportunity for lock-in between a product developed upstream and the specialized complementary assets of a particular downstream party (Baldwin, 2008; Williamson, 1985). Finally, the present study focuses on a partial equilibrium context where the number of products developed upstream is so large that the demand for specialized complementary resources exceeds their downstream supply. This is consistent with the concepts of a "design space" and "development funnel" in the innovation literature (Simon, 1981; Hayes, Wheelwright, and Clark, 1988; Baldwin and Clark, 2000), where the range of possible product designs far exceeds the set of those that can actually be commercialized. In the following section, I explore the hazard associated with upstream product development in light of this market imbalance.

The Hazard of Uncertain Access to Specialized Complementary Assets

As noted earlier, complementary assets refer to those assets and capabilities that are required to commercialize a product or innovation (Teece, 1986). A complementary asset is specialized when there is unilateral dependence between an innovation and the asset in question. When the innovation is dependent on the asset, Teece (1986) highlights the enhanced risk that upstream innovators face from having to make capital commitments that may be valueless if market relationships with downstream asset owners break down. While Teece is primarily focused on the potential for opportunistic behavior by downstream parties in the case of contractual exchange (Williamson, 1985), such concern overlooks the potentially greater hazard associated with securing a downstream contract in the first place. When

the demand for specialized complementary assets exceed their limited supply, some upstream innovators are curtailed from gaining downstream access altogether. Downstream owners are put in a position to choose which upstream innovations receive commitments for scarce complementary resources – limiting the commercialization prospects of those left without such agreements.

The reality is that the ex-post quality and commercial prospects of new products are often difficult to predict at the start of the innovation process (Nelson, 1959; Caves, 2000). This quality uncertainty significantly increases the risk associated with ex-ante commitments of downstream complementary resources. Downstream owners will instead choose to commit these contracts ex-post, once the quality of the product has been revealed to a greater extent. Specifically, when contracts between upstream innovators and downstream asset owners entail revenue sharing provisions, downstream parties would commit contracts ex-post to those products with the greatest commercial potential. However, since the commercial potential of a product is highly uncertain ex-ante, it is difficult for an innovator to predict whether its product will out-compete the other products on the market for a downstream contract. Thus, as a result of limited downstream resources and volatile product quality, upstream innovators relying on the market may face considerable uncertainty regarding ex-post access to specialized complementary assets. Teece (1986) acknowledges this hazard, highlighting the risks that manufacturers of computer hardware face concerning access to specialized distribution channels. Quoting one industry observer:

> *There are a huge numbers of computer manufacturers, companies that make peripherals (e.g. printers, hard disk drives, floppy disk drives), and software companies. They are all trying to get marketing distributors because they cannot afford to call on all of the US companies directly. They need to go through retail distribution channels, such as Businessland, in order to reach the marketplace. The problem today, however, is that many of these companies are not able to get shelf space and thus are having a very difficult time marketing their products. (Norman (1986) as quoted in Teece (1986))*

The focus of uncertainty in this study is distinct from its typical treatment in the literature on Transaction Cost Economics (TCE). TCE emphasizes opportunism between parties as the primary source of transaction costs in market contracts (Williamson, 1975). In the presence of relationship-specific investments, conditions of uncertainty present greater opportunities for transacting parties to haggle and act in an opportunistic manner during the phases of contract execution and renewal (Williamson, 1985; Mahoney, 2005). Therefore, uncertainty increases transaction costs because it facilities greater opportunistic behavior in cases where a formal contract is already in place. In contrast, the present study focuses on the uncertainty associated with securing a contract to begin with. Uncertainty here increases transaction costs because it increases the likelihood that an innovator will fail to secure ex-post access to specialized complementary resources, limiting the commercialization prospects of the innovation. Thus, while the literature on TCE focuses on the role of uncertainty in exacerbating opportunism, the focus here is on the elevated hazard it promotes from restricted downstream access to complementary resources.

Scholarly work examining the effects of uncertain access to specialized complementary assets can be traced to the historical observations of Chandler (1977). Chronicling the evolution of American business enterprises in the 19th and early part of the 20th century, Chandler described changes in organizational form that resulted from the adoption of new capital-intensive technologies, permitting the mass production of goods. Chandler observed that the technologies of mass production put a premium on securing downstream distribution capabilities, which were required to market and sell upstream products in the volume at which they could be produced (Chandler, 1977, 1990). Downstream distribution for mass-produced goods represented a specialized complementary resource for upstream manufacturers. However, downstream distribution was far from assured in many cases, increasing the

downside risk associated with upstream investments in mass-production. As a result, Chandler noted that many high-volume manufacturers forward integrated into downstream distribution:

> *The most important motivation for forward integration was to assure a more certain outlet for the new high-volume technologies of production. Where existing intermediaries failed to provide the necessary scheduling, advertising, and market services, the manufacturers moved into distribution. (Alfred Chandler as quoted in McCraw, 1991)*

While forward integration would indeed ensure access to specialized complementary assets, doing so is not always possible – particularly when upstream innovators are financially constrained or lack the time to do so (Teece, 1986, 2006). As a result, innovators may continue to face significant ex-ante uncertainty regarding their ability to secure downstream access to specialized complementary assets ex-post.

More recent work has also highlighted how Arrow's (1962) 'paradox of disclosure' may also curtail downstream access to specialized complementary resources (Gans and Stern, 2003). When intellectual property right protection is poor, downstream firms may steal a product idea presented by an upstream innovator and commercialize it themselves (Anton and Yao, 1994). When this occurs, innovators may not only face restricted downstream access, but may also lose the rents of their efforts to the downstream party that stole the idea. As a result, upstream innovators can also face considerable uncertainty regarding downstream access due to expropriation concerns.

The present study focuses on uncertain access to specialized complementary assets that stems from limited downstream supply relative to its demand and the highly variable quality of products developed upstream (Chandler, 1990; Caves, 2000). I argue that this uncertainty affects ex-ante product development choices and in turn, the commercial outcomes of products developed. Specifically, uncertain access to specialized complementary assets creates market failures in the supply of certain

products, prompting vertical integration by the downstream owners of these assets. Vertical integration consequently gives rise to second and third order effects. Specifically, vertical integration influences the level of downstream investments made on behalf of a product, which in turn affects its commercial performance in the end-market. In the next section, I begin my examination of these effects by first describing the effect of uncertain downstream access on vertical integration choices.

The Effect of Downstream Uncertainty on Vertical Integration Decisions

When an upstream innovator is unable to secure access to downstream complementary assets ex-post, it will suffer losses since the product developed cannot be brought to market. The risk of these significant ex-post losses will in turn affect the ex-ante project choices of upstream innovators i.e., the types of products they choose to develop[2]. Specifically, the significant uncertainty regarding downstream access reduces the expected value associated with investments in upstream innovation (relative to innovators for whom this uncertainty is absent). Therefore, *ceteris paribus*, upstream innovators who rely on the market will choose to pursue projects with lower up-front investments (assuming innovators exhibit risk-neutral preferences). Consequently, downstream owners of specialized complementary assets can rely on the market to source those products that entail lower upstream investments.

On the other hand, 'transactional failures' occur in the market for those upstream products that entail greater up-front investments (Williamson, 1971). For these projects, the upstream innovator would face particularly high losses if downstream access was restricted, increasing the hazard and thus the cost associated with the transaction. With guaranteed access to specialized complementary assets, a

[2] This logic is similar to that used by scholars of Property Rights Theory (Grossman and Hart, 1986; Hart, 1995). In the Property Rights literature, expected ex-post outcomes from haggling between transacting parties can adversely affect the level of relationship-specific investments they choose to make ex-ante.

downstream party could reduce these costs by vertically integrating and financing the project itself, instead of the upstream innovator. However, in light of limited specialized complementary resources, downstream parties will only be able to finance a subset of the high-cost projects that upstream innovators present (Hayes, Wheelwright, and Clark, 1988). If downstream parties choose not to vertically integrate into a particular high-cost project, the upstream innovator may still pursue the project by financing it itself. However, the innovator will pursue a lower-cost version of the original high-cost project for two reasons. First, as noted earlier, the innovator will reduce its investment in response to the lower expected value of projects pursued through the market. Second, a negative signal may be sent when downstream parties refuse to vertically integrate, which may limit the innovator's ability to raise independent funds for the high-cost project (Spence, 2002). As a result, downstream parties can source lower-cost projects through the market from upstream innovators, but will vertically integrate to source the more expensive innovation projects.

H1: In settings where downstream access to specialized complementary assets is uncertain ex-ante, downstream owners of such assets will vertically integrate into upstream innovation to source the more expensive projects

Agency Costs and Downstream Investment

Once upstream producers secure access to specialized complementary assets, either through market exchange with downstream parties or by virtue of controlling the required assets in-house, investment decisions must be made downstream concerning the allocation of complementary resources. Prior theoretical work suggests that investment decisions regarding specialized complementary resources may in turn depend on whether the product was sourced through the market, or produced in a vertically integrated manner. Specifically, Alchian and Demsetz (1972) highlight the potential for 'shirking' or

underinvestment in contexts where the benefits of one actor's investments are shared by many. While Alchian and Demsetz (1972) focus on the agency costs that arise under joint input or team production within the firm, Jensen and Meckling (1976) extend the scope of agency costs to contractual relationships more generally:

> *Contractual relations are the essence of the firm, not only with employees but with suppliers, customers, creditors, etc. The problem of agency costs and monitoring exists for all of these contracts, independent of whether there is joint production in their [Alchian and Demsetz's] sense. (Jensen and Meckling, 1976)*

Formally, an agency relationship is defined as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent (Jensen and Meckling, 1976). Typically, there will be some divergence between the agent's decisions and those decisions which maximize the welfare of the principal. The dollar equivalent of this reduction in welfare in addition to any monitoring and bonding expenditures (incurred by the principal and agent respectively) represent the total agency costs of the relationship (ibid.).

Scholars have applied the principal-agent framework to the study of vertical relationships, particularly in the context of franchising and retail contracting (Lafontaine and Slade, 2007). In this domain, the downstream retailer (the agent) makes costly downstream investments (e.g., marketing expenditures), which increases the overall demand for the manufacturer's (the principal's) product (Klein, 1995). When a retailer does not realize the full benefits to downstream investments, prior theoretical work has argued that the retailer might 'free ride' and reduce downstream investments in order to maximize its private utility (Williamson, 1979, 1991). This is often the case when franchisees incur private costs to maintain the national brand reputation of a franchisor, or when the retailer's contract entails revenue-

sharing provisions with the upstream manufacturer (Mathewson and Winter, 1985; Lal, 1990; Desai, 1997). However, when the manufacturer and retailer are vertically integrated, all the benefits to downstream investments are internalized within the firm (Lafontaine and Slade, 2007). As a result, vertical integration prompts the retailer to make investment decisions that maximize the joint surplus of both upstream and downstream stages. Consequently, an independent retailer may under-invest relative to a retailer who is vertically integrated with an upstream manufacturer (Klein, 1995).

The above argument suggests that downstream owners of specialized complementary assets may pursue greater investments for products produced in-house, than for products sourced through the external market. Initial evidence along this line been provided by Gil (2009), who examined vertical integration decisions between movie distributors and theatre owners in the Spanish motion picture industry. He found that integrated theaters run their own movies for a longer period than other movies, and longer than nonintegrated theaters do. The present study builds upon Gil (2009) by examining whether vertical integration affects downstream investments in another complementary resource – product marketing – which has been a focus of much of the aforementioned literature on franchising and distribution.

H2: Vertical integration by the owners of specialized complementary assets will increase the level of downstream investments in specialized complementary resources

Vertical integration and Commercial Performance

While vertical integration may affect downstream investments in complementary resources, its ultimate effect on product development outcomes may be more significant. Despite a growing literature that examines the performance consequences of vertical integration choices (Macher and Richman, 2008),

gaps continue to exist in our understanding of this topic – particularly in the context of new product development. First, we have limited evidence on whether vertical integration does indeed affect the commercial outcomes of new products. Second, despite increased interest in the performance consequences of vertical integration decisions, the empirical literature has ignored the potential mediating role played by downstream investments in specialized complementary resources.

Of the studies that have examined the causal effect of vertical integration on transaction performance, only a few have analyzed make-buy choices in the context of new product development – all using the context of the semiconductor industry. Leiblein, Reuer, and Dalsace (2002) examine the decision of semiconductor chip designers to vertically integrate into downstream production and its effect on the technological performance of the chip produced. Macher (2006) analyses how vertical integration between chip design and manufacturing affects the efficiency of the manufacturing process. Finally, Adner and Kapoor examine how vertical integration choices influence firm-level market share and time-to-market following periods of technological change in the DRAM chip industry (Adner and Kapoor 2010; Kapoor and Adner 2010). Thus, the literature to date has not explored the direct effect of vertical integration on the revenues of individual new products. While the technological and firm-level outcomes examined in these prior studies are likely correlated with the commercial performance of a new product, the focus on these outcomes has its disadvantages. First, results based on technical outcomes cannot capture the economic effect of vertical integration on product sales. Second, in contrast to commercial performance, technical measures of performance or firm-level outcomes following technological change may limit the applicability of empirical findings to high technology settings and those that experience rapid technological lifecycles. As a result, the present study chooses to directly examine the effect of vertical integration on the commercial performance of new products (in a context where technological change in product development has been a limited concern).

The mechanisms that drive the effect of vertical integration on transaction outcomes have been a core focus for empirical scholars in this domain. Prior empirical work has attributed improvements in performance to a host of factors: more efficient problem solving (Macher, 2006), adaptation advantages (Gulati, Lawrence, and Puranam, 2005; Forbes and Lederman, 2009), and reduced opportunistic behavior in the face of relationship-specific investments (Leiblein, Reuer, and Dalsace, 2002). However, to date, empirical scholars of firm boundaries have largely ignored the fact that vertical integration may improve performance through superior downstream investments in specialized complementary resources.

At the same time, work on complementary assets has highlighted the critical role that they can play in aiding incumbent survival in the face of technological discontinuities (Rothaermel and Hill, 2005). For example, Tripsas (1997) illustrates how control over complementary assets in the typesetter industry ensured the survival of incumbent firms when computer technology began to take on a key role. Similarly, Rothaermel (2001) highlights how control over specialized complementary assets in the pharmaceutical industry allowed incumbents to enhance their rate of new product development through alliances with entrants, who possessed superior R&D capabilities with respect to biotechnology. The focus of such studies is on firm-level and industry-level outcomes, and not the performance of individual products developed upstream. As a result, these studies are less helpful in understanding how vertical integration by owners of specialized complementary assets into upstream innovation may affect the commercial outcomes of individual products.

The previous section illustrated how vertical integration by owners of specialized complementary assets into upstream innovation may enhance downstream investments in complementary resources. Since

specialized complementary assets play a critical role in the commercialization of an innovation (Teece, 1986), increased investments in specialized complementary resources are likely to promote greater levels of commercial performance for the product. Therefore, vertical integration between upstream innovation and downstream control over specialized complementary assets should result in superior commercial performance for the product, where the effect is mediated by increased downstream investments in specialized complementary resources.

H3: Vertical integration by downstream owners of specialized complementary assets will increase the commercial performance of the products produced upstream

H4: The effect of vertical integration on a product's commercial performance is mediated by downstream investments in specialized complementary resources

Empirical Setting – The Motion Picture Industry

The motion picture industry represents an ideal setting for my empirical analysis for two reasons. First, the industry is of considerable economic importance – sales of theatrical movie tickets totaled $9 billion in the United States and close to $11 billion internationally in 2004, with revenues from ancillary markets several times higher (Eliashberg, Elberse, and Leenders, 2006). Moreover, movies represent a key driver of the market for entertainment products – the number-one export market for the United States (ibid.). Second, the industry provides a context with a rapid product development cycle that is widely covered by trade press. As a result, data exist on a number of products that have been developed and brought to market, including the choices made by upstream innovators as well as the levels of downstream investment in specialized complementary resources.

The value chain of the industry consists of three stages – production, distribution, and exhibition. Production refers to the activities needed to produce one copy or 'print' of a movie (ibid.). This stage actually entails three distinct steps. The first is pre-production or development, which begins when a producer procures or 'options' a film script from a literary agent. The producer then makes choices regarding the film's budget, its director, and the composition of its cast. Once the producer has assembled a project with a principal cast and projected budget, she must then seek financing for the film – either from a 'studio' or from independent sources. A 'studio' is the industry term for the six major movie distributors in Hollywood – Paramount Pictures, Universal Studios, Warner Bros. Pictures, Sony Pictures, Twentieth Century Fox, and Disney. Films that are financed by a studio are referred to as 'studio films' and those that secure financing from alternative sources are termed 'independent films' (Martin, 2009). Once a project has been approved and has secured financing, it marks the end of the pre-production phase. The actual production phase then begins when the movie is filmed, typically over the course of a few months. Once the film has been shot, the project enters the post-production phase, when the material filmed is edited and the musical score is added. At the end of this process, a print of the film has been produced.

Once a movie has been produced, it must be distributed to theaters, both domestically and internationally. In Hollywood, the large majority of the movies distributed are done so by the six major distributors, or 'studios' as mentioned earlier. Distribution entails both the physical distribution of prints to theaters as well as marketing the movie in each territory in which it is released (Eliashberg, Elberse, and Leenders, 2006). A number of key decisions are made by distributors concerning the marketing strategy for the film. These include the amount of marketing expenditures that they should invest to promote the film, and which media to use in the advertising campaign (ibid.). Furthermore, distributors negotiate with theater operators over the number of screens that movies will be allocated in their

opening weeks. In return for their effort and investments, distributors typically keep 30 percent of all domestic revenue and 40 percent of all foreign proceeds of the movie as a distribution fee (Sorenson and Waguespack, 2006; De Vany, 2006). The capabilities of distributors to negotiate and secure theatrical screens and to market films to the public represent a resource critical to the commercial performance of any film. As a result, theatrical distribution represents a specialized complementary asset (Teece, 1986) – any movie produced upstream must secure access to these distribution resources in order to succeed commercially. If a movie cannot secure theatrical distribution, it may still be released directly on DVD. However, the commercial upside is limited in this case, as theatrical release and the marketing that accompanies it represent a significant driver of DVD sales (Ravid, 1999; Sorenson and Waguespack, 2006).

Once the film has been promoted and prints have been released to theater operators, or 'exhibitors', the stage of exhibition begins. Exhibition refers to the activities performed by theater chains and individual theater sites (Eliashberg, Elberse, and Leenders, 2006). These include the actual screening of movies, selecting which movies to screen, advertising on-site, and managing the floor space at theaters.

The present study is focused on the decision of the major distributors to vertically integrate into upstream movie production. Distributors vertically integrate when they decide to finance upstream productions. I focus on this interface for a number of reasons. First, as the following section will illustrate, there is significant uncertainty regarding the ability of movies produced upstream to secure distribution contracts via the market. Second, this interface provides natural controls for a couple of alternative rationales for vertical integration – namely, opportunism stemming from relationship-specific investments and increased coordination demands. According to the literature on Transaction Cost Economics (Williamson, 1979, 1985), a distributor may vertically integrate into production if a

movie requires relationship-specific investments, which would lock-in its producer to a particular distributor. However, this is never the case – a movie can be distributed using any distributor's platform and a distributor can distribute movies produced upstream by any producer. Alternatively, the literature on modularity theory notes that distributors may vertically integrate into upstream production if the level of task interdependence between these stages is significant (Baldwin and Clark, 2000; Baldwin, 2008). However, the level of interdependence between these stages is fairly low, representing sequential rather than reciprocal interdependence (Thompson, 1967; Negro and Sorenson, 2006). As a result, rationales for vertical integration based on relationship-specific investments and task interdependence do not apply in this setting. Instead, I argue that distributors vertically integrate to source those projects that entail considerable downside risk for upstream producers, who face uncertain access to theatrical distribution. The following section explores the market for theatrical distribution, highlighting the considerable uncertainty that independent producers (i.e., producers of 'independent' films) face.

The Uncertainty of Ex-Post Distribution

The harsh reality facing independent producers is that most will fail to secure a distribution contract necessary to being their film to theatre screens. Of the 9,000 independent films completed each year, only 5 percent are able to obtain access to theatrical distribution (IndieVest, 2006). In contrast, over 93 percent of films produced in-house by the major distributors receive theatrical distribution[3]. The lower rate for independent producers is the result of the digital revolution in filmmaking and stringent filters that limit the path to theatrical distribution. First, since the mid-1990s, digital technologies enabled filmmakers to shoot and edit their films in a more cost-effective manner (Parks, 2007). As a result, the

[3] The remaining 7% are released directly on home video (DVD) either because their quality was extremely poor, or because of a deliberate attempt to produce a film for the home entertainment market.

supply of independently produced films increased vastly, raising the level of competition for scarce distribution resources. Second, it is common for independently produced films to strike theatrical distribution deals at prestigious film festivals like the Sundance Film Festival, Cannes, and the Toronto International Film Festival. Such festivals essentially represent organized markets for the 'acquisition' of independent films by downstream distributors. However, competition for festival slots is intense – Sundance received 3,661 film submissions in 2009 for 120 slots, up from 3,624 submissions in 2008 (Martin, 2009). The 3.3 percent acceptance rate at Sundance is indicative of the challenges faced by independent producers in gaining entry to the marketplace at prestigious festivals. However, filmmakers continue to face considerable uncertainty even when their films are fortunate enough to be accepted. In fact, only a subset of films screened at a festival go on to secure distribution contracts. In the case of the Sundance Film Festival, around 25 percent of the films screened leave the festival with distribution agreements for theatrical release (Barnes, 2010). As a result, independently produced films, even those of 'worthy' quality, face considerable uncertainty regarding their ability to gain access to downstream distribution. This has lead Geoff Gilmore, the director of the Sundance Film Festival, to recently declare that "the biggest issue facing independent film is the theatrical distribution bottleneck" (Gilmore, 2009).

The effect of uncertain ex-post distribution on the downside risk of upstream production is highlighted by one financier of independent productions. Commenting on the market for theatrical distribution:

> *It's tight and it's competitive, because there are a limited number of distribution firms and there is a limited amount of marketing money. Even if you have some terrific talent, you may not be able to secure the distribution deal that you need. That's one of the big risks when you go into a venture to produce a film, where you have millions of dollars on the line and you are hoping the film is going to connect … but a smaller and smaller number of films achieve that target every year. (IndieVest, 2006)*

Summing up, since the ex-post quality of a film is difficult to predict ex-ante, there is significant uncertainty concerning its ability to compete for a festival slot, and in turn, its ability to secure a distribution contract.

Data

The present study is based on a sample of movies distributed by the six major studios – Paramount Pictures, Universal Studios, Warner Bros. Pictures, Sony Pictures, Twentieth Century Fox, and Disney – over a 15 year period, from January 1, 1994 to December 31, 2008. The start of this period was chosen to coincide with rise of the marketplace for American independent film. As noted earlier, by the mid-1990s, the advent of digital technology lowered the barriers to entry for many independent filmmakers. Furthermore, at this point in time, there were increased sources of financing for independent producers, which allowed them to pursue projects without resorting to studio financing (Levy, 1999). Perhaps most importantly, the early-1990s represented a surge in recognition for the commercial potential and quality available in the independent film marketplace. In 1992, independent films *Howards End*, *The Crying Game*, and *The Player*, were not only box-office smashes, but also received more Oscar nominations than any of the movies produced by the major distributors (ibid.). At this time, Quentin Tarantino's 1992 film *Reservoir Dogs* was also sweeping through the film festival circuit, garnering significant attention and acclaim in Cannes, Toronto, and Sundance. By 1994, the studios had realized that the distribution of independently produced films could represent a lucrative source of profits. As a result, they significantly increased their downstream demand for these films to complement their in-house productions.

To examine the make-buy choices of the major distributors over the following 15-year period, I identified the movies they released theatrically using *Variety* magazine's weekly box-office reports. These box-office reports provide detail on the commercial performance of all domestic theatrical

releases for a given week, including the number of screens on which the movie played and its distributor. For each film released by a major distributor, I gathered project-level details on its genre, director, cast, budget, producer, etc. from three main sources – *IMDB* (the Internet Movie Database at www.imdb.com), *Box Office Mojo* (www.boxofficemojo.com), and *The Hollywood Reporter* (www.hollywoodreporter.com). I restricted the sample to English language films that were not sequels and that were not released on a 'limited' basis in their first week of release[4]. Foreign language films may have been developed with different audience tastes in mind and theatrical revenue from U.S. distribution may not represent a critical determinant of success. Furthermore, independent films typically give up the rights to sequels when they secure a theatrical distribution contract. As a result, because independent films are largely restricted from pursuing sequels to past projects, I exclude sequels from the overall sample. In addition, as described in the following section, I exclude 'limited' release films from my overall sample due to the difficulty of measuring marketing investments for this sub-sample. While 2016 movies meeting these criteria were distributed over this period, the sample is limited to the 1520 movies for which I have complete financial and project-level data. The drop in observations is largely the result of missing film budget information for 24% of the population. As noted in earlier studies that use the motion picture industry, there is no source of data that maintains budget information for all films, and there is no law that compels producers to disclose the production costs of their projects (Sorenson and Waguespack, 2006; Natividad, 2010). While 21.2% of studio-financed films lack budget information, 30.8% lack this information in the case of independently produced projects. For both independently produced and studio-financed films, univariate tests reveal that the films with missing budget data received significantly lower marketing investments and achieved significantly poorer commercial performance, than those films in each category with valid budget information. As a

[4] Films that are released in a 'limited' manner are exhibited on a few screens (under 20) during their first week but are then taken 'wide' to a few hundred or thousand screens in the several weeks following its initial release. Typically, this alternative release strategy is used to generate some initial word-of-mouth for a film or to qualify it for an Academy Award nomination.

result, the missing observations correspond to the poorer quality films within both the vertically integrated and independently produced sub-samples. Due to these similarities in the missing observations across both sub-samples, I do not believe the limited sample would bias my results concerning vertical integration in any systematic way.

Measures

Dependent Variables

The first part of my analysis involves modeling the vertical integration choices of downstream distributors. *Vertical Integration* is constructed as a binary variable that takes the value one when the theatrical distributor of a film also was listed as a production company on the project, and zero otherwise. Of the 1,520 films in my sample, 1,092 (71.84%) were produced in a vertically integrated manner, while 428 (28.16%) were sourced through the market from independent producers.

The present study examines the effect of vertical integration on two particular outcomes – the level of downstream investments in specialized complementary resources, and the commercial performance of the product produced. As noted earlier, I measure downstream investments in specialized complementary resources by focusing on the level of marketing expenditures incurred to promote a film. *Marketing Investments* is measured as the logarithm of the number of screens on which the movie is released in its first week[5]. Distributors negotiate screen allocations with exhibitors and secure screens by committing to spend a certain minimum amount to promote the film. As a result, the number of screens a movie is released on its opening week is intimately tied to the marketing budget for the film.

[5] In the sample, 7.6% of the films were released in a 'limited' manner. For such films, the number of opening screens is not a good indicator of the marketing investments made by the distributor. As a result, I exclude these films from the analysis.

Prior work has found that the number of opening screens for a movie is correlated with actual advertising expenditures at the 0.90 level (Sorenson and Waguespack, 2006).

The *Commercial Performance* of a film is measured as the logarithm of the gross revenue it earned through theatrical release i.e., its gross box-office receipts in 1994 dollars. Apart from representing a critical source of revenue, a film's theatrical performance is also considered the primary driver of revenue from ancillary sources, such as DVD sales, television broadcast licenses, and film merchandising (Epstein, 2005).

Explanatory Variables

The key independent variable of this study is the *Production Cost* associated with a film, which is measured as the logarithm of its budget. The budget of a film includes the salaries of the director, producer, cast and crew, as well the production costs associated with film sets, special effects, and post-production editing. As noted earlier, budget information is extracted from multiple sources, including the *Internet Movie Database*, *Box office Mojo*, and *The Hollywood Reporter*. I adjust film budgets for inflation after 1994 and record budgets in 1994 dollar equivalents.

Control Variables

I include a number of control variables in the analyses of vertical integration choices and their effect on performance. First, I control for a number of project characteristics such as the *Genre* of the film (comedy, drama, action, etc.), the *MPAA Rating* category for the film (G, PG, and R), and the *Duration* of the movie. Furthermore, I control for the quality of talent involved in the project. I measure the *Star Power* of the project by taking the logarithm of the average box-office performance of the principal creative participants of the project, over their prior three films. The principal creative participants consist

of the film's director and the top five cast members billed for the project. Moreover, I include a control for the quality of the scriptwriter(s), *Writer Performance*, which is measured as the logarithm of the average commercial performance of the writers' previous three projects. Past work has also found that independently produced projects are more likely to involve greater *Artistic Stake*, where the director of the film is also its producer and writer (Fee, 2003).

Additionally, in the analyses of downstream investments in marketing and commercial performance, I also control for the *Season* in which the film is released, whether the film was produced within the United States, the size of the distributor, and the movie's *Critical Rating*. Prior work in the motion picture industry has documented that movie attendance is quite seasonal, where attendance spikes during holiday weekends and the summer months (Einav, 2007). To measure seasonality, I use the continuous seasonality index (ranging from 0 to 1) developed by Vogel (2001), who analyzed aggregate weekly U.S. box office revenues from 1969 to 1984. Furthermore, films produced outside the United States may reflect different cultural tastes and hence may receive less promotion and underperform U.S. produced films (Sorenson and Waguespack, 2006). As a result, I include a control, *U.S. Production*, which indicates whether the production of the film took place entirely within the United States. In addition, the size of the distributor is also likely to affect the amount resources it can invest to promote the film. An indicator *Minor Label* represents whether the distributor of a film was a smaller division or 'label' within the larger distributor. Finally, the critical reviews a movie receives has been found to significantly influence the number of screens on which it is opens and its overall box office performance (Ravid, 1999; Elberse and Eliashberg, 2003). As a result, I also control for the movie's *Critical Rating* in the analyses of marketing investments and commercial performance. I derive this measure from the movie's rating on the *Rotten Tomatoes* website (www.rottentomatoes.com). Rotten tomatoes aggregates the opinions of movie critics who reviewed the film and produces an overall critical score

(ranging from 0-100%), reflecting the percentage of critics who recommend watching the movie. Table 1 reports the summary statistics and pairwise correlations between variables described above.

Analytical Approach

In order to evaluate Hypotheses 1, I use a probit model to analyze the vertical integration decisions of movie distributors into upstream production. However, in order to evaluate Hypotheses 2, 3, and 4, a multi-staged approach is required. To examine the effect of vertical integration on the level of downstream investments in complementary resources (H2) and its overall effect on commercial performance (H3), one cannot simply regress these outcomes on an indicator for vertical integration. The analysis must account for the fact that vertical integration is endogenously determined and that there may be unobserved features of the transaction that simultaneously influence the choice of vertical integration and the outcomes of interest (Shaver, 1998; Gulati, Lawrence, and Puranam, 2005). To this end, I estimate the treatment effect of vertical integration using a variant of Heckman's two-staged approach (Heckman, 1979), where the stages are estimated simultaneously using maximum likelihood. The first stage involves modeling the vertical integration decision through a probit, while the second stage models the effect of vertical integration on the outcome of interest. The execution of this approach requires at least one instrumental variable i.e., a variable that is correlated with vertical integration, but that is not correlated with the error term of the second stage. Instrumental variables are included in the first stage, but are excluded from the second stage of the model.

For instrumental variables, I turn to two characteristics of the movie's producer(s). First, I measure the recent experience of the movie's producers securing financing from sources outside the major distributors. Specifically, I use an indicator, *Producer Independent Experience*, that denotes whether the movie's producers financed at least one of their previous three projects in an independent manner (i.e.,

without funds from a distributor) and secured theatrical release for it. When this is the case, the film's producers are likely to have stronger relationships with investors outside the major studios in order to independently fund new projects. As a result, they may be less inclined to pitch the new project to a major studio, reducing the studios' chance to vertically integrate and finance the film. Therefore, prior experience producing independently financed films will likely increase the probability that a future project will be produced in an independent, rather than a vertically integrated manner. The second characteristic of the producers that I use as an instrumental variable is their past commercial performance. *Producer Past Success* is measured as the logarithm of the average box-office performance of the producers of the project, over their prior three films. Greater past commercial success is likely to be result in greater connections and visibility within the industry in order to secure meetings with distributors to pitch them future projects. The greater visibility is also likely to result in distributors seeking these producers to shepherd future projects that the distributors are looking to develop. As a result, the past commercial success of the producers of a film is likely to be strongly correlated with a film being produced in a vertically integrated manner.

In order to establish the relevance of the instruments *Producer Independent Experience* and *Producer Past Success,* I find that the joint F-statistic of these instruments in the first stage probit is 18, surpassing the conventional threshold of 10 used to designate instruments as relevant (Stock and Yogo 2002). Turning to the exogeneity of the instruments, unlike the director and principal cast, a film's producers are primarily focused on the non-creative tasks involved in the filmmaking process (Crouch, 2009). Producers primarily influence movie outcomes through their ability to raise funds for the project, through their recruitment of the director and cast for the film, and securing theatrical distribution (in the case of independent films). Thus, after controlling for the observable characteristics of the film and distributor, I would not expect any direct effect of *Producer Independent Experience* and *Producer Past Success* on my outcomes of interest.

Supporting this point, an over-identification test performed to test the exogeneity of the instruments cannot reject the null hypothesis that the instruments are indeed exogenous (Wooldridge 2002).

While a two-staged approach is used to estimate the treatment effects of vertical integration on downstream investments and commercial outcomes, an additional stage is required to determine whether downstream investments in specialized complementary resources mediate the relationship between vertical integration and commercial performance (H4). As highlighted by Shaver (2005), estimates of mediation effects can be biased when the different steps of the mediation model are estimated independently of one another. This is because the error term of the equation modeling the mediating variable is often correlated with the error term of the equation modeling the outcome of interest (where the mediating variable is included as an additional explanatory variable). To account for this interdependence, Shaver notes that mediation effects should be estimated using a system of equations, where the equations are estimated simultaneously. For the system of equations to be identified, I must exclude one strong predictor of the potential mediating variable (i.e., marketing investments) from the final stage modeling commercial performance. This variable should not have a direct effect on commercial outcomes after accounting for its effect on the mediating variable. For this variable, I use the indicator, *Minor Label*, which denotes whether the distributor that released the film was a smaller division within the larger studio. As I noted earlier, smaller labels are likely to have fewer resources with which to market their films compared to the larger divisions within the studio. However, its smaller size is unlikely to have a direct influence on the commercial performance of the film after accounting for reduced marketing expenditures and the lower production costs of the films they distribute. The partial correlation between *Minor Label* and *Commercial Performance* conditional on marketing expenditures and the budget of the film is 0.01 and is highly insignificant.

The present study implements this three-staged approach (e.g., Gulati and Nickerson, 2008) to examine whether the effect of vertical integration on commercial performance is mediated by downstream investments in complementary resources. While the first stage models the vertical integration decision, the second stage models the effect of vertical integration on the downstream investments in specialized complementary resources. Finally, the third stage models commercial performance, where vertical integration and downstream investments are present as additional explanatory variables. The full system of equations is specified below:

$$\begin{aligned}\text{Vertical Integration}_i = {} & \alpha_0 + \alpha_1 * \text{Production Cost} + \alpha_2 * \text{Star Power} \\ & + \alpha_3 * \text{U.S. Production} + \alpha_4 * \text{Genre} + \alpha_5 * \text{MPAA Rating} \\ & + \alpha_6 * \text{Duration} + \alpha_7 * \text{Writer Performance} + \alpha_8 * \text{Artistic Stake} \\ & + \alpha_9 * \text{Season} + \alpha_{10} * \text{Critical Rating} \\ & + \alpha_{11} * \text{Distributor Fixed Effects} + \alpha_{12} * \text{Year Fixed Effects} \\ & + \alpha_{13} * \text{Minor Label} + \alpha_{14} * \text{Producer Independent Experience} \\ & + \alpha_{15} * \text{Producer Past Success} + \varepsilon_{1i}\end{aligned}$$

$$\begin{aligned}\text{Marketing Investments}_i = {} & \beta_0 + \beta_1 * \text{Vertical Integration} \\ & + \beta_2 * \text{Production Cost} + \beta_3 * \text{Star Power} \\ & + \beta_4 * \text{U.S. Production} + \beta_5 * \text{Genre} + \beta_6 * \text{MPAA Rating} \\ & + \beta_7 * \text{Duration} + \beta_8 * \text{Writer Performance} + \beta_9 * \text{Artistic Stake} \\ & + \beta_{10} * \text{Season} + \beta_{11} * \text{Critical Rating} \\ & + \beta_{12} * \text{Distributor Fixed Effects} + \beta_{13} * \text{Year Fixed Effects} \\ & + \beta_{14} * \text{Minor Label} + \varepsilon_{2i}\end{aligned}$$

$$\begin{aligned}\text{Commercial Performance}_i = {} & \gamma_0 + \gamma_1 * \text{Vertical Integration} + \gamma_2 * \text{Marketing Investments} \\ & + \gamma_3 * \text{Production Cost} + \gamma_4 * \text{Star Power} \\ & + \gamma_5 * \text{U.S. Production} + \gamma_6 * \text{Genre} + \gamma_7 * \text{MPAA Rating} \\ & + \gamma_8 * \text{Duration} + \gamma_9 * \text{Writer Performance} + \gamma_{10} * \text{Artistic Stake} \\ & + \gamma_{11} * \text{Season} + \gamma_{12} * \text{Critical Rating} \\ & + \gamma_{13} * \text{Distributor Fixed Effects} + \gamma_{14} * \text{Year Fixed Effects} + \varepsilon_{3i}\end{aligned}$$

It should be noted that the variables *Minor Label*, *U.S. Production*, *Season* and *Critical Rating* are included in the first stage equation (modeling vertical integration) since they are explanatory variables in

the second or third stages of the system. Furthermore, this system of equations is estimated simultaneously using maximum likelihood and thus, the standard error estimates are consistent across the different stages[6].

Results

In order to determine whether downstream owners of specialized assets vertically integrate into upstream production for more expensive projects, we look to Table 2. This table presents the results of the probit where vertical integration was modeled as a function of project-level attributes. Model (1) is the base model with only control variables, while Model (2) is the full model where I include the key independent variable *Production Cost*. It appears that including this variable in the second model increases its explanatory power, raising the pseudo R^2 from 0.147 to 0.194. We see that the coefficient on *Production Cost* is positive and significant at the 1% level, indicating that movie distributors integrate into upstream production for the more expensive projects, providing support for H1.

While distributors are more likely to vertically integrate into production for more expensive projects, it remains to be seen what impact vertical integration actually has on downstream investments in specialized complementary resources. Table 3 shows the results of both the OLS analysis as well as the two-stage treatment effects model used to estimate the effect of vertical integration on downstream investments in marketing, after accounting for the heterogeneity of projects selected in the first stage. However, I focus my discussion on the results of the two-staged treatment effects model. The results of the first stage indicate that the instrumental variables *Producer Independent Experience* and *Producer Past Success* are both significant at the 1% level, with negative and positive coefficients respectively. As

[6] I use the *cmp* command in STATA to estimate the system of equations jointly by maximum likelihood estimation (Roodman, 2009). This command accommodates recursive mixed-process models where the outcome of the first stage is binary, while the outcomes of the second and third stage are continuous variables.

expected, if the producer has prior experience producing an independent project that attains theatrical distribution, the current project is less likely to be produced in a vertically integrated manner. Additionally, producers with greater past commercial success are significantly more likely to develop projects in a vertically integrated manner. The negative and significant (at the 1% level) coefficient on *Minor Label* indicates that the smaller labels within the major studio are less likely to vertically integrate into upstream production

Turning to the second stage of the treatment effects model, we first see that *Critical Rating* has a negative and significant effect (at the 1% level) on downstream investments in marketing. Elberse and Eliashberg (2003) found the same result and attribute it to two possible factors. First, poor critical reviews indicate a low quality film that will generate negative word-of-mouth in the week following its release. Therefore, distributors may choose a more intensive marketing campaign to recoup a large share of the movie's production costs in its opening week. Alternatively, positive critical reviews may serve as a substitute for marketing investments. Well-received films are likely to have positive word-of-mouth sustain its performance in the weeks following its initial release. As a result, distributors may take advantage of this positive word-of-mouth and choose to spend less marketing films of higher quality. Apart from the effect of *Critical Rating*, I also find that both *Production Cost* and *U.S. Production* have positive and significant effects on downstream investment (at the 1% level). This indicates that the more expensive projects and those produced within the United States receive a significantly greater marketing push downstream. Finally, *Minor Label* has a negative coefficient and is significant at the 1% level, showing that the smaller divisions of the major distributors do indeed have fewer resources with which to market their films.

Focusing now on the effect of *Vertical Integration* on *Marketing Investment*, we see that its treatment effect is positive and significant at the 1% level. Therefore, movie distributors are found to invest greater marketing resources on behalf of films that they produced in-house, compared to those sourced through the market. As a result, I have support for H2 which notes that vertical integration should enhance downstream investments in specialized complementary resources. Furthermore, we see that Rho is negative and significant at the 5% level, which indicates that self-selection was indeed a concern in estimating the treatment effect of vertical integration on marketing investments.

Table 4 presents the results of the analysis undertaken to examine the effect of *Vertical Integration* on C*ommercial Performance*. As I did in the analysis of *Marketing Investments*, I present the results of both the OLS analysis, as well as the two-staged treatment effects model. Furthermore, since *Minor Label* is excluded from the equation modeling *Commercial Performance* in the three-staged mediation model presented later, Table 4 also shows the results of the present analysis with *Minor Label* excluded from the OLS and two-staged models (Models 2 and 4 respectively). I focus my discussion of Table 4 on the on the two-staged analysis presented in Model 4.

I first note that several control variables have a significant effect on commercial outcomes. As expected, I find that movies perform significantly better if they are released during a favorable *Season*. Furthermore, both the *Critical Rating* of a film and its *Production Cost* have a positive and significant effect on commercial performance, at the 1% level. In addition, longer movies (*Duration*) and those that were produced within the United States (*U.S. Production*) also perform significantly better at the box office. Conversely, *Artistic Stake* is found to have negative and significant effect on commercial outcomes.

I now focus on the treatment effect of *Vertical Integration* on *Commercial Performance*. While Rho was negative and significant in the analysis of *Marketing Investments*, Rho is only weakly significant in the treatment effects model for *Commercial Performance*. As a result, self-selection of projects appears to be a weaker factor in the analysis of commercial outcomes. Nevertheless, we see that *Vertical Integration* has a positive coefficient, which is significant at the 1% level. Therefore, when movie distributors integrate into upstream production, it increases the commercial performance of the film. This provides support for H3, which suggests that vertical integration by the owners of specialized complementary assets would increase the commercial performance of new products.

While vertical integration increases the commercial performance of new products, I now look to examine whether the increased investment in specialized complementary resources drives that effect. As outlined earlier, this entails a three-staged process where both *Vertical Integration* and *Marketing Investments* are endogenously determined. Table 5 displays the results of this approach (along with the OLS analysis), with each column representing a different equation of the system. As before, we see that *Producer Independent Experience* and *Producer Past Success* have significant correlations with the likelihood of vertical integration. Consistent with the earlier result from Table 3, I again find that *Vertical Integration* has a positive and significant (1% level) treatment effect on *Marketing Investment*. Furthermore, as before, *Minor Label* has a negative coefficient and is significant at the 1% level. I now turn to the third stage of this system in the final column of Table 5. In this stage, *Commercial Performance* is modeled as a function of both *Vertical Integration* and *Marketing Investment*, along with other control variables. While *Marketing Investment* has a positive and significant effect (at the 1% level) on commercial outcomes, *Vertical Integration* no longer has a significant effect, as it did in the case of Table 4. As a result, accounting for the increased downstream investment in marketing eliminates the direct effect of vertical integration on commercial performance. This result, coupled with

the positive treatment effects of vertical integration on marketing investments and commercial performance found earlier (from Tables 3 and 4 respectively), shows that the effect of vertical integration on commercial performance is fully mediated by downstream investments in marketing (Shaver 2005; Baron and Kenny 1986). Thus, I have support for H4, which argues that the effect of vertical integration on commercial performance would be mediated by downstream investments in specialized complementary resources.

Discussion

The present study has two primary objectives. First, it explores how uncertain access to specialized complementary assets influences vertical integration choices. In settings where there is considerable uncertainty regarding ex-post access to specialized complementary assets, the uncertainty increases the hazard associated with the innovation process. I empirically examined whether market failures generated by this increased downside risk drive the owners of specialized complementary assets to vertically integrate into upstream innovation. Second, this study sought to examine whether vertical integration affects the commercial performance of new products and if so, understand the mechanism through which it does.

My empirical analysis is focused on make-buy choices in context of the motion picture industry, where upstream producers face considerable uncertainty regarding ex-post access to theatrical distribution through the market. I find that distributors, who control the specialized complementary assets required to promote and distribute films to theatres, are more likely to vertically integrate into movie production for higher budget projects. In support of H1, this result shows that in settings where access to specialized complementary assets is uncertain ex-ante, downstream owners of such assets will vertically integrate into upstream innovation to source the more expensive projects. Expensive projects can result

in particularly high losses for its participants if access to complementary assets cannot be secured ex-post. As a result, upstream innovators, who do not control downstream assets, will choose to minimize their downside risk by pursuing less expensive projects, reflecting the lower expected value associated with their projects. Consequently, firms who control specialized complementary assets cannot rely on the market to source expensive products and so must vertically integrate in order to source them themselves.

A concern regarding the analysis of vertical integration decisions is the possibility that the result supporting H1 may be driven by large cost increases that occurred during the production process, once the decision to vertically integrate and produce the film had already been made. This is a concern since measures of film budgets reflect final costs, rather than the costs at the green-lighting stage. Accounts from studio executives highlight that on average, final budget figures deviate from projected film estimates by less than 10% (Persse, 2008). Nevertheless, significant cost overruns do occur. For example, James Cameron's *Titanic* was initially estimated to cost $120 million, but cost overruns during filming resulted in a final budget of $200 million (Parisi, 1998). Therefore, as a robustness test, I searched the archives of Hollywood's trade journals – *Variety Magazine* and *The Hollywood Reporter* – for all mentions of cost overruns. Thirty-three such films from the sample were identified and the probit analysis was run with these films removed from the analysis. The result supporting H1 was robust to removing these films from the sample.

This empirical finding contributes to the literature that highlights the transaction costs associated with market exchange between upstream innovators and the downstream owners of specialized or co-specialized complementary assets. While prior work examining such assets has detailed the risk of opportunistic behavior when transactions are conducted through contract (Teece, 1986, 2006;

Jacobides, Knudsen, and Augier, 2006; Ceccagnoli et al., 2010), the literature has paid much less attention to the hazards associated with finding and securing a downstream contract in the first place. Drawing upon the earlier insights of Chandler (1977) and Teece (1986), who noted the existence of this hazard, the present study provides empirical evidence on how the uncertainty concerning downstream access influences the vertical integration choices of downstream asset owners. In the process, this study contributes to the growing literature on firm boundaries that looks beyond incentive conflict and opportunism rationales to explain vertical integration decisions (e.g., Baldwin and Clark, 2000; Gulati, Lawrence, and Puranam, 2005).

The second goal of this study was to examine the effect of vertical integration on the commercial performance of new products, conditional on securing downstream access. As noted earlier, prior studies that have examined the effect of vertical integration on product development outcomes have typically focused on technical measures of performance (Leiblein, Reuer, and Dalsace, 2002; Macher, 2006) or firm-level outcomes following technological change (Adner and Kapoor 2010; Kapoor and Adner 2010). In the present study, I determine whether vertical integration also has an effect of the sales of new products and quantify its effect. I find that vertical integration does indeed have a positive and significant effect on commercial outcomes, which in economic terms, corresponds to an increase of 98.5% in commercial performance (H3). Moreover, I investigate the mechanism through which vertical integration influences commercial outcomes. Drawing upon the theoretical literature on the agency costs of market relationships (Alchian and Demsetz, 1972; Jensen and Meckling, 1976; Klein, 1995), the empirical analysis shows that vertical integration significantly increases downstream investments in specialized complementary resources (H2). In doing so, this study provides empirical evidence for a relationship that has been much discussed in the theoretical work on vertical integration, but has received little empirical validation. Importantly, these downstream investments in complementary

resources *fully* mediate the aforementioned effect of vertical integration on commercial performance (H4). As a result, vertical integration increases the commercial performance of new products, *because* it results in greater commitments of specialized complementary resources, which are needed to commercialize the new product. This analysis represents the first attempt in the empirical literature on vertical integration to identify the precise mechanism through which vertical integration affects transaction performance.

In order to estimate the effect of vertical integration on downstream investments and commercial performance, the empirical analysis employed two-staged and three-staged models that relied on instrumental variables. While an over-identification test failed to reject the null hypothesis that the instrumental variables are indeed exogenous, concerns may remain regarding the exogeneity of these instruments. Therefore, as a robustness test, I estimated the treatment effect of vertical integration on downstream investments and commercial performance using matching estimators (Rosenbaum and Rubin, 1984; Abadie and Imbens, 2002). Specifically, I implemented the bias-corrected nearest neighbor matching estimator developed by Abadie and Imbens (2002) to estimate the average treatment effect of vertical integration. The results of this analysis are presented in Table 6. Consistent with the multi-staged analyses based on instrumental variables, the results of Table 6 indicate that vertical integration increases both marketing investments and commercial performance, and that the effect on commercial performance is mediated by these downstream investments.

Despite the economic importance of my empirical context, a potential limitation of this study is the fact that it focuses on vertical integration choices within the fairly unique setting of the motion picture industry. Unlike many other settings, the rate of new product development in movies is quite rapid – with film production taking an average of 2-3 months and with several new films being released to the

theatrical market every week. While this rapid cycle sets the motion picture industry apart from many other product development contexts, it is precisely this factor that makes the film industry an appealing setting for empirical analysis. As noted by prior scholars (Christensen, 1997; Eliashberg, Elberse, and Leenders, 2006), settings with rapid development or industry cycles allow scholars to examine performance outcomes using a large sample of products or firm outcomes during a given period. This would be a much more difficult endeavor if the analysis had relied on 'slower' contexts as a source of data. Furthermore, since this study focuses on the hazard associated with uncertain access to specialized complementary assets, another concern may be raised regarding the presence of this hazard in alternative development contexts. Uncertain access to complementary assets is certainly a concern in the packaged foods industry, where securing supermarket distribution and shelf space is of paramount importance. However, many new products in this industry fail to secure supermarket distribution, destroying their commercial prospects (Montgomery, 1975). A similar situation is present in the music industry, where technological advances have allowed artists to produce and record their own albums. However, record promotion and distribution continue to represent key specialized complementary resources that elude many independent artists, even despite the emergence of a few online distribution channels.

An interesting extension of the present study may be to include strategic alliances in the comparative analysis (e.g., Gulati, Lawrence, and Puranam, 2005). While this study found that vertical integration results in superior commercial performance relative to market exchange, it remains to be seen how strategic alliances compare to these alternative modes of organization, particularly in product development contexts. Through a strategic alliance with an owner of specialized complementary assets, an upstream innovator may be more willing to pursue projects that entail higher production costs, akin to the case of vertical integration. Prior work on alliances and relational contracts has noted that the

long-term value of a relationship might reduce the shirking and agency costs that are typically associated with market transactions (Baker, Gibbons, and Murphy, 2002). As a result, strategic alliances may result in greater downstream investments in complementary resources (relative to market exchange), and enhance the commercial performance of new products. However, it remains an open empirical question how alliances perform relative to market exchange and vertical integration in promoting commercial success, and whether alliances lie closer to one of these two extremes.

Conclusion

The literature on vertical integration has been dominated by rationales involving opportunism and incentive conflict. However, in product development settings where ex-post access to specialized complementary assets is highly uncertain, incentive conflict is relegated to a secondary concern. The primary hazard of market exchange in such settings is securing a downstream contract to access these complementary resources in the first place. The present study highlights this hazard, showing that it has significant implications for the scope of downstream asset owners and consequently, the commercial outcomes of products developed. Specifically, uncertain access to specialized complementary assets drives the downstream owners of these assets to vertically integrate into upstream innovation to source more expensive products. Furthermore, vertical integration increases the commercial performance of new products and does so though superior downstream investments in specialized complementary resources. Thus, this study extends the literature on vertical integration deeper into the domain of new product development, a context where firm boundary choices are extensive, but are still not well understood. By examining how vertical integration affects the commercial performance of new products, this study provides another step in that direction.

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Table 1: Summary Statistics and Pairwise Correlations (N = 1520)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Vertical Integration	1.000													
2 Marketing Investment	0.3439**	1.000												
3 Commercial Performance	0.3664**	0.7245**	1.000											
4 Critical Rating	-0.0135	-0.3090**	0.1050**	1.000										
5 Prior Independence Experience	-0.0936**	-0.0589*	-0.0654*	-0.0063	1.000									
6 Producer Past Success	0.2090**	0.3372**	0.2856**	-0.1338**	0.2488**	1.000								
7 Minor Label	-0.2615**	-0.6209**	-0.4885**	0.2122**	0.0696**	-0.2611**	1.000							
8 Season	0.0083	0.0308	0.0882**	0.0125	0.031	0.0235	-0.0185	1.000						
9 Production Cost	0.3680**	0.6555**	0.6503**	-0.1226**	0.0109	0.4218**	-0.5509**	0.0136	1.000					
10 Star Power	0.2081**	0.2847**	0.2527**	-0.0821**	0.0680**	0.2968**	-0.2640**	0.0289	0.4387**	1.000				
11 U.S. Production	0.0376	0.0233	0.0298	0.0547*	-0.0696**	-0.0163	-0.0346	0.0332	-0.1043**	0.0267	1.000			
12 Duration	0.0901**	0.0677**	0.2385**	0.2602**	0.1020**	0.1654**	-0.1118**	0.0085	0.3525**	0.1587**	-0.0853**	1.000		
13 Writer Past Performance	0.1548**	0.2522**	0.2740**	-0.0177	0.0055	0.2463**	-0.1886**	-0.0265	0.4067**	0.2279**	-0.0458	0.1774**	1.000	
14 Artistic Stake	-0.0196	-0.0830**	-0.0553*	0.1129**	0.0141	-0.0561*	0.0292	-0.0139	-0.0578*	-0.016	0.0363	0.1750**	0.0982**	1.000
Mean	0.718	6.711	16.527	46.953	0.516	14.907	0.247	0.637	16.773	16.518	0.567	108.056	11.998	0.134
Std. Dev.	0.450	2.149	1.725	26.428	0.500	5.320	0.432	0.133	1.201	2.334	0.496	19.379	7.535	0.341
Min	0.000	0.000	9.045	0.000	0.000	0.000	0.000	0.000	10.048	0.000	0.000	59.000	0.000	0.000
Max	1.000	8.322	20.137	100.000	1.000	19.127	1.000	1.000	19.037	18.248	1.000	231.000	19.112	1.000

Significance of correlation: * p<0.05 ** p<0.01

Table 2: Vertical integration choices of movie distributors (probit)

	Vertical Integration	
	(1)	(2)
Production Cost		0.428**
		(0.0557)
Star Power		0.0437*
		(0.0212)
Duration	0.0102**	-0.00203
	(0.00254)	(0.00261)
Writer Past Performance	0.0188**	0.00106
	(0.00488)	(0.00543)
Artistic Stake	-0.0660	0.156
	(0.108)	(0.118)
MPAA Rating (Omitted = PG)		
G	-0.147	-0.0756
	(0.264)	(0.334)
R	-0.381**	-0.168+
	(0.0858)	(0.0898)
Genre Controls	Yes	Yes
Distributor Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Constant	-0.285	-6.485**
	(0.372)	(0.884)
Pseudo R^2	0.127	0.194
X^2	216.0	268.2
N	1520	1520

Robust standard errors in parentheses
+ p<0.10 * p<0.05 ** p<0.01

Table 3: Effect of Vertical Integration on Marketing Investments

	OLS	Treatment Effects Model	
	Marketing Investment	Vertical Integration (1st Stage)	Marketing Investment (2nd Stage)
Vertical Integration	0.459**		0.850**
	(0.0969)		(0.199)
Producer Independent Experience		-0.285**	
		(0.0824)	
Producer Past Performance		0.0246**	
		(0.00837)	
Critical Rating	-0.0113**	0.00246	-0.0115**
	(0.00154)	(0.00167)	(0.00153)
Season	0.0724	-0.130	0.0863
	(0.281)	(0.280)	(0.279)
Production Cost	0.748**	0.359**	0.704**
	(0.0628)	(0.0622)	(0.0626)
Star Power	-0.0271	0.0361+	-0.0315
	(0.0208)	(0.0207)	(0.0208)
Duration	-0.000327	-0.00289	0.0000791
	(0.00233)	(0.00268)	(0.00229)
Writer Past Performance	-0.000307	0.0000560	-0.000511
	(0.00525)	(0.00555)	(0.00521)
U.S. Production	0.358**	0.198*	0.340**
	(0.0755)	(0.0809)	(0.0744)
Artistic Stake	-0.169	0.167	-0.180
	(0.118)	(0.117)	(0.117)
Minor Label	-1.537**	-0.310**	-1.495**
	(0.145)	(0.111)	(0.145)
MPAA Rating Controls	Yes	Yes	Yes
Genre Controls	Yes	Yes	Yes
Distributor Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Constant	-5.510**	-5.345**	-5.062**
	(0.955)	(1.008)	(0.935)
Adjusted R^2	0.615		
Rho			-0.176*
X^2			1931.6
N	1520	1520	1520

Robust standard errors in parentheses
+ p<0.10 * p<0.05 ** p<0.01

Table 4: Effect of Vertical Integration on Commercial Performance

	OLS		Treatment Effects Model			
	(1)	(2)	(3)		(4)	
	Commercial Performance	Commercial Performance	Vertical Integration (1st Stage)	Commercial Performance (2nd Stage)	Vertical Integration (1st Stage)	Commercial Performance (2nd Stage)
Vertical Integration	0.402**	0.459**		0.604**		0.686**
	(0.0842)	(0.0887)		(0.142)		(0.145)
Producer Independent Experience			-0.288**		-0.315**	
			(0.0826)		(0.0824)	
Producer Past Performance			0.0234**		0.0260**	
			(0.00823)		(0.00826)	
Minor Label	-0.783**		-0.303**	-0.761**		
	(0.113)		(0.113)	(0.111)		
Critical Rating	0.0168**	0.0151**	0.00278+	0.0167**	0.00216	0.0150**
	(0.00132)	(0.00129)	(0.00167)	(0.00130)	(0.00164)	(0.00127)
Season	0.634**	0.622**	-0.119	0.641**	-0.127	0.630**
	(0.212)	(0.219)	(0.278)	(0.210)	(0.279)	(0.217)
Production Cost	0.695**	0.815**	0.364**	0.671**	0.412**	0.785**
	(0.0558)	(0.0526)	(0.0620)	(0.0556)	(0.0595)	(0.0521)
Star Power	-0.0325	-0.0267	0.0370+	-0.0348	0.0407+	-0.0295
	(0.0227)	(0.0234)	(0.0209)	(0.0228)	(0.0215)	(0.0234)
Duration	0.00575**	0.00647**	-0.00310	0.00596**	-0.00282	0.00669**
	(0.00197)	(0.00199)	(0.00270)	(0.00193)	(0.00272)	(0.00195)
Writer Past Performance	0.00277	0.000671	0.0000103	0.00266	-0.00114	0.000617
	(0.00467)	(0.00477)	(0.00558)	(0.00461)	(0.00556)	(0.00472)
U.S. Production	0.277**	0.313**	0.267**	0.267**	0.204*	0.301**
	(0.0637)	(0.0649)	(0.0626)	(0.0626)	(0.0805)	(0.0637)
Artistic Stake	-0.237*	-0.214*	-0.243*	-0.243*	0.174	-0.221*
	(0.0958)	(0.0990)	(0.0945)	(0.0945)	(0.118)	(0.0975)
MPAA Rating Controls	Yes	Yes	Yes	Yes	Yes	Yes
Genre Controls	Yes	Yes	Yes	Yes	Yes	Yes
Distributor Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.366**	1.028	-5.423**	3.598**	-6.387**	1.365+
	(0.902)	(0.838)	(1.018)	(0.886)	(0.958)	(0.818)
Adjusted R^2	0.563	0.541				
Rho				-0.108+		-0.118+
X^2				1473.4		1299.5
N	1520	1520	1520	1520	1520	1520

Robust standard errors in parentheses
+ p<0.10 * p<0.05 ** p<0.01

Table 5: Examination of the joint effects of vertical integration and downstream complementary investments on commercial outcomes

	OLS	3-Staged Model Estimated Simulatenously		
	Commercial Performance	Vertical Integration (1st Stage)	Marketing Investments (2nd Stage)	Commercial Performance (3rd Stage)
Marketing Investment	0.490**			0.513**
	(0.0237)			(0.0574)
Vertical Integration	0.179**		0.869**	0.117
	(0.0681)		(0.239)	(0.188)
Minor Label		-0.310**	-1.493**	
		(0.111)	(0.146)	
Producer Independent Experience		-0.284**		
		(0.0828)		
Producer Past Performance		0.0247**		
		(0.00843)		
Critical Rating	0.0222**	0.00241	-0.0115**	0.0226**
	(0.00115)	(0.00172)	(0.00154)	(0.00138)
Season	0.598**	-0.132	0.0869	0.595**
	(0.176)	(0.280)	(0.279)	(0.175)
Production Cost	0.333**	0.358**	0.702**	0.316**
	(0.0447)	(0.0627)	(0.0642)	(0.0690)
Star Power	-0.0190	0.0358+	-0.0317	-0.0181
	(0.0182)	(0.0209)	(0.0208)	(0.0180)
Duration	0.00594**	-0.00284	0.0000989	0.00587**
	(0.00164)	(0.00269)	(0.00229)	(0.00163)
Writer Past Performance	0.00284	0.0000769	-0.000521	0.00295
	(0.00369)	(0.00556)	(0.00521)	(0.00365)
U.S. Production	0.102+	0.198*	0.339**	0.0951+
	(0.0527)	(0.0809)	(0.0747)	(0.0557)
Artistic Stake	-0.153+	0.167	-0.181	-0.149+
	(0.0805)	(0.117)	(0.117)	(0.0811)
MPAA Rating Controls	Yes	Yes	Yes	Yes
Genre Controls	Yes	Yes	Yes	Yes
Distributor Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Constant	5.975**	-5.334**	-5.041**	6.135**
	(0.667)	(1.013)	(0.942)	(0.877)
Adjusted R^2	0.705			
X^2			325.5	
Log pseudolikelihood			-5320.8	
N	1520		1520	

Robust standard errors in parentheses
+ p<0.10 * p<0.05 ** p<0.01

Table 6: Nearest Neighbor Matching to Estimate the Treatment Effect of Vertical Integration on Marketing Investments and Commercial Performance†

Outcome	Matching on Marketing Investments	Number of Matches	Average Treatment Effect of Vertical Integration (ATE)
Marketing Investments	—[a]	2	0.227* (0.0978)
		3	0.214* (0.0944)
		4	0.247** (0.0897)
Commercial Performance	No[b]	2	0.316** (0.0926)
		3	0.349** (0.0890)
		4	0.345** (0.0881)
Commercial Performance	Yes[c]	2	0.123 (0.0903)
		3	0.132 (0.0855)
		4	0.137 (0.0849)

Standard errors in parentheses
+ p<0.10 * p<0.05 ** p<0.01

† Analysis is implemented using the bias-corrected matching estimator specified by Abadie and Imbens (2002)

a. Observations matched on the explanatory variables in the OLS model of Table 3 with exact matching on Production Cost (after splitting values into deciles) and Minor Label

b. Observations are matched on the explanatory variables in Model (2) of Table 4 with exact matching on Production Cost (after splitting values into deciles)

c. Observations are matched on the explanatory variables in the OLS model of Table 5 with exact matching on Production Cost (after splitting values into deciles)