The Impact of Firm Speed Capabilities on the Decision to Go It Alone or Partner

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Abstract

This study empirically examines the role of intrinsic speed capabilities, which refer to the ability to execute investment projects faster than competitors, in shaping corporations' choice of alliances versus autonomous project development. Our basic premise is that firms lacking intrinsic speed capabilities (i.e., slow firms) are more likely to turn to alliances to supplement their capability deficiency. However, we expect that the ability of slow firms to partner with fast firms hinges on the former's possession of complementary supporting assets. Our empirical analyses furnish evidence supporting these ideas using data from the global liquefied natural gas (LNG) industry.

INTRODUCTION

A core topic in strategy research on firms' corporate development activities is explaining why firms choose to engage in an investment project themselves through internal, or autonomous, development versus through a partnership with another firm. Prior literature has focused on resource considerations for the firm and the project, with some studies suggesting that firms are more likely to partner when they do not have sufficient resources to carry out a project (Shan, 1990). By contrast, other studies suggest firms are more likely to partner when they have strong resource endowments, enabling them to attract potential partners (Mitchell & Singh, 1992). These studies therefore highlight demand versus supply considerations, and studies have begun to integrate these ideas using a needs versus attractiveness view, where firms use alliances to supplement a resource deficiency, but they must have other valuable resources to attract a partner (Eisenhardt & Schoonhoven, 1996; Ahuja, 2000; Rothaermel & Boeker, 2008; Garrette, Castañer, & Dussauge, 2009). A recent study further synthesizes the literature by suggesting that resource endowments of a firm need to be studied in combination with product (or project) resource requirements. More specifically, firms turn to alliances when there is a mismatch between the resource requirements of the project and the resource endowments of the firm (Garrette *et al.*, 2009).

While we have significant conceptual understanding of corporations' choice of alliances versus autonomous development, we know less about how firm speed determines this decision. By contrast, executives routinely invoke speed as a rationale for partnerships over other means of corporate development and investment. For instance, at a recent conference, the VP of external innovation at Johnson and Johnson indicated that firm speed matters in their decisions of whether to partner or go alone, explaining "we are a slow firm. We partner to go faster." In addition, many projects are very time consuming and take many years, and numerous industries are characterized by capital investment with long time-to-builds, such as semiconductor production facilities, oil and gas facilities, and chemical facilities (Koeva, 2000). Thus, the ability of firms to execute a project quickly potentially figures into a firm's calculus as to whether to take on a project alone or take on a corporate partner.

Several research streams could speak to the role of firm speed in the partner versus go it alone decision. First, there is an extensive literature of empirical studies on horizontal alliance formation (e.g., Hamel, Doz, & Prahalad, 1989; Nohria & Garcia-Pont, 1991; Eisenhardt & Schoonhoven, 1996; Stuart, 1998; Ahuja, 2000; Garrette *et al.*, 2009). In a careful review, Garrette *et al.* (2009) point out that only a few studies have focused on the decision between alliances versus the autonomous alternative (Shan, 1990; Mitchell & Singh, 1992; Eisenhardt & Schoonhoven, 1996; Garrette *et al.*, 2009), and none of these papers focused on firm speed. Another relevant prior literature is the extensive research stream on capability seeking in alliances (e.g., Barney, 1999; Ahuja, 2000; Hitt, Dacin, Levitas, Arregle, & Borza, 2000; Hitt, Ahlstrom, Dacin, Levitas, & Svobodina, 2004), which explores how firms partner to access the capabilities of other firms. However, this literature has not focused on firm speed capabilities and specifically on their implications for the go it alone vs partner decision. The broad literature on the performance implications of alliances is relevant as well. In a recent paper, Castañer, Mulotte, Garrette, and Dussauge (2014) interestingly find that partnering tends to lengthen time-to-market. This paper suggests there are substantial speed costs to alliances on average, but it did not focus specifically on firm speed capabilities as an antecedent to the partner versus go it alone decision in the first place. While firm speed conceptually should play an important role in firms' decisions of whether to partner or go it alone, this area of inquiry remains understudied in the literature.

This paper focuses on the implications of firm speed capabilities (or, for brevity, firm speed) in the choice of developing a project autonomously versus partnering. By firm speed, we mean the intrinsic speed capabilities of the firm, an idea in past competitive strategy research that captures the ability of firms to execute investment projects faster than competitors at the same cost (Hawk, Pacheco-De-Almeida, & Yeung, 2013; Pacheco-de-Almeida, Hawk, & Yeung, 2015). Our goal in this paper is to develop and empirically examine a nuanced theory about how and when firm speed affects companies' decisions of whether to partner or go it alone. Our basic proposition is that firms anticipate differential speed benefits from alliances versus the autonomous alternative based upon the intrinsic speed capabilities of the focal firm. Specifically, firms lacking these intrinsic speed capabilities (i.e., slow firms) are more likely to turn to alliances to supplement their capability deficiency. Alliances may be a means for slower firms to try to overcome their own inability to move quickly in project development by accessing or acquiring the capabilities of partner firms. Consistent with this capability seeking argument, we expect that slow (fast) firms are more (less) likely to partner than go alone. However, while slow firms may want to partner with fast partner firms to access their capabilities, an important consideration is how slow firms can successfully bargain within the market for alliances to access the speed capabilities of other firms. We thus expect that the ability of slow firms to partner with fast partner firms hinges on their possession of valuable complementary assets in order to be able to bargain for a partnership with a fast partner firm. Empirical analyses of projects in the global liquefied natural gas (LNG) industry provide evidence consistent with our theory.

Our paper offers several contributions to the literature. In broad terms, we identify firm speed as a capability that matters for firms' decisions to go it alone or partner for complex projects. Speed has been investigated in recent competitive strategy research (e.g., Hawk *et al.* (2013); Pacheco-de-Almeida *et al.* (2015), but has not been given adequate attention in empirical corporate strategy research on the ways that firms enter markets and organize projects. Our arguments and evidence demonstrate that speed has important implications for such boundary of the firm choices emphasized in corporate strategy research. We show that firms value speed as a capability to access through partnerships when undertaking complex projects, and we also show how they transact upon capabilities via alliances in order to access the speed capabilities of faster firms in the industry. We therefore provide additional evidence for the needs versus attractiveness view of alliances (Eisenhardt & Schoonhoven, 1996; Ahuja, 2000; Rothaermel & Boeker, 2008; Garrette *et al.*, 2009), and demonstrate how complementary assets valuable to projects allows firms to bargain on the market for alliances and access faster partners. Practical advice and articles on alliances have over several decades routinely mentioned the value of partnerships in fostering speed (Hamel *et al.*, 1989; Ohmae, 1989; Bleeke & Ernst, 1991), but we know of no systematic evidence of how a need for a capability in speed influences governance decisions, and so we offer an empirical contribution by showing how the need for speed influences firms' make versus ally decisions. We also complement existing research on speed that shows how this capability determines the timing of entry into markets (Hawk *et al.*, 2013) by demonstrating that speed also has important implications for whether firms engage in external corporate development activities such as alliances rather than organic growth and internal corporate development.

BACKGROUND THEORY

In order to develop our theoretical framework and build up a set of testable research hypotheses, we first cover background theory across several research streams concerning speed in investment project execution, firm speed capabilities, and the potential speed implications of alliances. This background theory is useful in providing linkages between organizational speed and firms' decisions to engage in autonomous development of projects versus partnerships, as we are joining together streams of research on speed and partnerships that have developed separately from one another in competitive strategy and corporate strategy research, respectively. We then develop our specific predictions regarding the role of firm speed in the decision to develop projects autonomously or via a partnership.

Speed in Investment Project Development

Speed in investment project development is an important part of the how firms develop new resources and grow. In particular, when firm growth is accompanied by large and lengthy capital investment, fast execution of the resource accumulation process may be particularly desirable. Speed capabilities in project development have many benefits. Faster firms can complete market entry sooner, thereby realizing future revenue streams as soon as possible. More generally, speed in various organizational activities has this benefit, whether construction of new facilities or the development and commercialization of new technologies. The ability to execute investment projects quickly may also enable firms to be earlier to the market and preempt competition. The benefits of speed have been a recurring theme interwoven in many general strategy topics such as dynamic capabilities (Teece, Pisano, & Shuen, 1997; Helfat *et al.*, 2007; Teece, 2007), first mover advantages (Lieberman & Montgomery, 1988, 1998), and time based competition (Stalk, 1988; Stalk & Hout, 1990). The potential value of speed has also been frequently discussed for alliances, yet ideas surrounding the benefits of speed have been emphasized in practitioner-oriented articles rather than in the research base of the field (Hamel *et al.*, 1989; Ohmae, 1989; Bleeke & Ernst, 1991).

While speed in investment project development is likely to be desirable, it is also governed in part by time compression diseconomies, the theoretical phenomenon where project acceleration typically results in higher project development costs (Dierickx & Cool, 1989). There are several reasons for why costs go up as project development is accelerated, such as diminishing returns to allocating more resources to accelerate a project, information loss from parallel processing of activities that would otherwise be handled sequentially, and additional costs from attempting several concurrent approaches to find the optimal approach to accelerate the project (for a review, see Graves (1989)).

Given heterogeneity in various firm capabilities, it is likely that firms will differ in their abilities to compress time and execute investment projects quickly. Some firms may possess intrinsic speed capabilities, an idea in recent papers that captures the ability of some firms to execute investment projects faster than competitors at the same cost (Hawk *et al.*, 2013; Pacheco-de-Almeida *et al.*, 2015). Intrinsically fast firms may thus be able to realize future revenue streams sooner, enhancing financial performance, and may have a higher probability of preempting slower competitors by having an earlier pick on favorable sites, inputs, and relationships with consumers and suppliers. Other firms, however, may lack intrinsic speed capabilities. For these slow firms, there are several disadvantages they experience. For instance, revenues from the project will be realized further off into the future, resulting in a lower expected value for the project due to heavier discounting of cash flows. In addition, slower firms also risk being preempted by faster competitors, resulting in potentially higher costs from late entry due to having a later pick on desirable sites, or later access to key suppliers or customers (Lieberman & Montgomery, 1988, 1998). A recent study found a substantial amount of time inefficiency across firms (Hawk & Pacheco-de-Almeida, 2018), suggesting that many firms face these potentially higher costs from being a slower firm.

The Theoretical Speed Implications of Alliances

As discussed in the introduction, alliances have long been mentioned over several decades as a potential way to organize economic activity that may help a firm move faster. While our focus is on the implications of firm speed capabilities for the decision to partner or go it alone, the theoretical ideas surrounding the speed implications of alliances can bear upon these market entry and project organization choices in the first place.

Executives might expect speed benefits from alliances, compared to autonomous project development when making these governance choices for two main reasons. Most fundamentally, partnerships enable the firm to access the capabilities of partner firms (Argyres, 1996; Barney, 1999; Ahuja, 2000; Hitt *et al.*, 2000; Hitt *et al.*, 2004; Fabrizio, 2012). Partner firms may possess a skill set that may be needed and relevant to the rapid execution of an investment project. Rather than developing this skill set internally, the focal firm may be able to source these skills from a partner firm that are transferable to the focal project. A talented partner firm, thus, may be able to contribute to project development via its endowment of firm capabilities that help accelerate the rapid completion of the investment project under consideration. Beyond firm capabilities, partnerships may also enable the firm to access other needed resources needed for the project that they lack (Kogut, 1988; Zajac & Olsen, 1993; Mitchell, Dussauge, & Garrette, 2002; Garrette *et al.*, 2009; Castañer *et al.*, 2014). Various partner firm resources can be accessed and deployed to the focal project, which may facilitate faster execution of the focal project. Second, an additional potential speed benefit of partnerships may be potential learning benefits for the focal firm (Grant & Baden-Fuller, 2004). If the partner firm possesses a capability set that facilitates fast execution of the project, the focal firm may be able to learn and absorb these capabilities, potentially enabling fast execution of investment projects by the focal firm, which may in turn reduce time compression diseconomies or project development time for the current project as well as future projects.

However, alliances also present several downsides such that firms are apt to use collaborative agreements selectively based on the benefits they anticipate from them. For instance, relative to internal organization, partnerships can present coordination challenges (e.g., Thompson, 1967; Gulati & Singh, 1998; White & Lui, 2005), which may lead to costly mistakes and rework. The sharing of information across firms may be done less efficiently than withing the boundaries of an organization (Allen, Lee, & Tushman, 1980; Kogut, 1989; Williamson, 1991; Griffin & Hauser, 1992; Langlois, 1992; Monteverde, 1995; Teece, 1996; Hatch & Mowery, 1998; Chesbrough & Teece, 1999; Leiblein, Reuer, & Dalsace, 2002; Garrette *et al.*, 2009; Qian, Agarwal, & Hoetker, 2012; Castañer *et al.*, 2014). For instance, joint development of an investment project may require temporal specificity in the form of precise scheduling, timing, and coordination across partners (Masten, Meehan, & Snyder, 1991; Pirrong, 1993; David, Rawley, & Polsky, 2013). This need for tight coordination could result in delays in project development if one party delays activities or information sharing, whether intentionally for bargaining reasons or unintentionally due to errors in scheduling or executing tasks. Partnering firms may also not share a common language (Conner, 1991; Foss, 1996) or lack unstructured technical dialogue or other important interpersonal communication (Monteverde, 1995), and these communication differences and challenges may aggravate and impair information sharing and project development. Collaboration may also lead to delays due to transaction costs associated with negotiating, monitoring, and enforcing agreements between the firms (Williamson, 1991; Parkhe, 1993). *Ex post* adaptation requirements (Forbes & Lederman, 2009) may also rise with the technological or environmental uncertainties firms encounter in alliances, and the ensuing conflicts and renegotiations of contracts can impede the efficient execution of an investment project. In sum, coordination and cooperation considerations can make alliances costly to implement compared to the internal development of complex investment project.

Empirical results regarding the actual speed implications of the make versus ally decision are limited, but one relevant study provides initial insights: Castañer *et al.* (2014) empirically investigated the performance implications of the make versus ally decision and found that alliances on average lengthen, rather than shorten, time-to-market. Note that this result is a mean result for their sample, but we also note that this does not suggest that all alliances are speed impairing. Our basic theoretical premise, as discussed in our theory development below, is that there exist differential anticipated speed benefits of alliances across firms due to the capability endowment of the focal firm. Specifically, our goal in this paper is to develop nuanced theory about one kind of firm heterogeneity, the intrinsic speed capabilities of the focal firm, that shapes the choices firms make when organizing complex projects autonomously or in collaboration with another firm. We elaborate below.

RESEARCH HYPOTHESES

Firm Speed and the Decision to Go It Alone versus Partner

To set up our theoretical development, we conceptualize the decision of whether to do an alliance versus go it alone as a choice of whether to enter the market for alliances or not. Whenever a firm considers the option of an alliance, a firm must decide whether to enter the marketplace for a partnership based on the potential advantages the firm foresees, and this assessment influences the bargaining behavior and terms that the focal firm might accept with a potential partner and hence the decision of whether to proceed with partnership or forego the market for alliances and go it alone. Given that our theoretical focus is the anticipated speed implications of the alliance versus autonomous development alternative, we accordingly frame the decision to enter the market for alliances as determined by a potential speed benefit analysis conducted by the focal firm. If the potential speed benefits are great, the focal firm will be more accommodating in the terms it demands for a potential alliance and will increase the probability that the firm chooses to do an alliance. If the potential speed benefits are minimal, the firm will be much less accommodating in the terms it demands for a potential partnership and this will decrease the likelihood that the firm will choose to do a partnership.

We therefore first consider the role of the focal firm’s speed capabilities in the decision to partner or go it alone. The basic theoretical premise of our investigation is that this decision of whether to enter the market for alliances and partner, or stay out of the market for alliances and go it alone, is likely to depend on the speed capabilities of the focal firm. Most fundamentally, the speed capabilities of the focal firm are likely to shape the assessment by the focal firm of the potential speed benefits of an alliance. Intrinsically faster firms have an advantage relative to slower competitors in that they possess an internal set of firm capabilities to move quickly, allowing them to have a higher probability of realizing revenue streams sooner and preempting competitors. For these fast firms, they are less likely to need to seek the help of other firms to execute the focal investment project quickly. When assessing the decision of whether to enter the market for alliances or not, the intrinsically fast firm is likely to conclude that the potential speed benefits of an alliance are minimal. More specifically, since the fast firm can already move quickly without a partnership, autonomous project development is likely to be more attractive in order to avoid the coordination burdens, potential conflicts, and other downsides of taking on a partner (e.g., Poppo & Zenger, 2002; Anderson & Dekker, 2005; Hagedoorn & Hesen, 2007; Hoetker & Mellewigt, 2009). As a result, an intrinsically fast firm would demand much more aggressive terms in the market for alliances, reducing the probability of a realized partnership, resulting in the firm opting to stay out of the market for alliances and choosing to go it alone.

By contrast, for slow firms, the potential speed benefits of alliances are likely to be much greater. Since intrinsically slow firms are unable to move quickly on their own, slow firms are more likely to try to seek help externally to tap into the capabilities of other firms to accelerate their focal investment project. When assessing whether to enter the market for alliances or not, the intrinsically slow firm is likely to see greater potential benefits to partnering with another firm as a capability seeking mechanism (Barney, 1999; Ahuja, 2000), accessing the capability set of other partner firms to overcome their own capability shortcoming and potentially accelerating market entry. For instance, a partner firm may be able to deploy its capabilities to move quickly to the focal project, accelerating project completion. If the partner firm has a better endowment of speed capabilities than the focal firm, the partner firm may also teach the slow focal firm to execute project development faster at the same cost, leading to potential learning benefits for the slow focal firm. In these cases, the slow firm can benefit either by accessing the speed capabilities of the partner or by acquiring such capabilities via learning through the partnership (Grant & Baden-Fuller, 2004). Given these large potential speed benefits of an alliance, the intrinsically slow firm is likely to be more accommodating in the terms it demands from a prospective partner in the market for alliances, increasing the likelihood of a realized partnership, resulting in the firm deciding to enter the market for alliances and partner rather than go it alone. We thus obtain the following prediction:

Hypothesis 1: Intrinsically slow (fast) firms are more (less) likely to choose an alliance over autonomous project development.

Bargaining for Speed in the Market for Alliances

In the forgoing arguments, we suggest that slow firms are likely to prefer partnerships over autonomous development due to the potential speed benefits from accessing the speed capabilities of partner firms. A remaining question, however, is: why would any fast partners be willing to partner with a slow firm?

Much of the alliance literature indeed focuses on what resources and capabilities a firm seeks in alliances (e.g., access to markets, technologies, customer relationships, etc.) without also giving equal attention to its ability to trade for these benefits in such economic exchanges. In markets for alliances, many sought-after firms have many options for potential partnerships, and the greater availability of options is likely to give these firms greater bargaining power (Nash, 1953; Ozmel, Yavuz, Reuer, & Zenger, 2017). The alliance literature has emphasized these issues through a so-called needs versus attractiveness view that should be integrated into in the foregoing arguments (Eisenhardt & Schoonhoven, 1996; Ahuja, 2000; Rothaermel & Boeker, 2008; Garrette *et al.*, 2009). That is, firms may want to partner to overcome a need, but they must also somehow bring something valuable to a prospective partner in order to successfully bargain for and attract a desired partner in the market for alliances to secure a deal for the desired resources and capabilities. Otherwise, contributions to the partnership would become one sided, making the partnership unattractive to prospective exchange partners. The needs versus attractiveness view therefore accommodates a focal firm's willingness and ability to form a partnership and in so doing brings together demand and supply considerations in alliance markets underpinning the formation of collaborative agreements.

The theoretical conundrum articulated above can be framed in terms of the differential speed benefit framework used thus far in our theory development. Specifically, a potential partner firm engages in the same differential speed benefit analysis underlying the development of hypothesis 1. That is, the option to enter into an alliance is a function of the perceived benefits of the alliance relative to going it alone. Given that a fast prospective partner can autonomously carry out a project quickly without a partnership, the perceived potential speed benefits of an alliance are likely to be minimal, predisposing the partner firm to stay out of the market for alliances and go it alone (as argued in hypothesis 1). This logic suggests that, in order for a slow focal firm to ally with a fast partner firm, the slow focal slow firm must elevate the potential benefits of an alliance realized by the fast partner firm in order for a partnership to materialize.

Following this logic, we expect that the ability of slow firms to obtain a fast partner hinges on the slow firm possessing a set of valuable complementary supporting assets it brings to a potential collaboration. Possession of valuable complementary supporting assets has frequently been shown to play an important role in many strategic decisions and firm performance (Teece, 1986; Mitchell, 1989, 1991; Tripsas, 1997). Furthermore, numerous alliance studies have shown that complementary assets play an important role in alliance formation (Arora & Gambardella, 1990; Tallman & Shenkar, 1994; Chung, Singh, & Lee, 2000; Rothaermel, 2001; Rothaermel & Boeker, 2008). In our specific context, we focus on a set of valuable supporting assets that are especially relevant for the development of the focal project. If these complementary assets are deployed to the focal project, the performance of the focal project is likely to be enhanced, benefitting both the partner firm and the focal firm in the alliance. These complementary assets therefore would allow slow firms to bargain for partnerships with fast firms, making the focal firm more attractive and increasing the probability of a collaborative agreement to be reached.

Accordingly, we expect that a slow firm is unlikely to partner successfully with fast partners if the slow firm does not bring valuable supporting assets to the partnership. In these situations, prospective fast partners are unlikely to be attracted to a potential alliance with the slow focal firm, despite the latter's need for a partnership for a project. Since the slow focal firm does not bring strengths that elevate the potential benefits for a partner firm, the potential alliance is unlikely to be viewed as mutually beneficial.

Since a fast prospective partner has many potential outside options for other partnerships, the fast partner firm is likely to demand exacting terms for a potential collaboration or rule out the partnership entirely. In these situations, the slow focal firm lacking valuable supporting assets will more likely be forced to settle for slow partner firms or go it alone rather than secure fast partner firms.

By contrast, if a slow firm does in fact possess valuable supporting assets, the slow firm can successfully bargain for and attract fast partner firms to overcome its own inability to move quickly. Prospective fast partner firms will likely perceive greater potential benefits from the potential alliance and conclude that the likelihood of mutual benefit in the partnership is greater: the valuable supporting assets possessed by the slow focal firm have the potential to enhance project development performance and yield benefits to both partner firms. Complementary assets thus enable the slow firm to make a better case of its value-added contribution to a potential partnership and thus elevate the potential benefits to the partner firm and in turn lower the terms that a fast prospective partner might demand in the market for alliances. As a result, the slow focal firm with complementary assets has a better chance at successfully bargaining for and obtaining a partnership with a fast partner firm in the market for alliances. We thus expect that the ability of slow firms to bargain for and partner with fast partner firms in the market for alliances hinges on the possession of valuable complementary assets.

In sum, we obtain the following prediction:

Hypothesis 2: Valuable complementary assets increase the likelihood of slow firms partnering with fast partner firms.

METHODS

We investigate the choice between autonomous versus joint project development in the context of Liquefied Natural Gas investment projects from 1997 to 2015. Natural gas is predominately comprised of methane, and it represents an energy source often used for electricity generation, the heating of homes and buildings, and many other applications. Natural gas is found in a gaseous state, and it is often transported via pipelines when potential markets are nearby. When pipelines are not economical due to large distances or bodies of water, oil and gas firms often convert natural gas into liquefied natural gas (or LNG) by cooling methane to -161.5 degrees Celsius, a process which also shrinks natural gas to 1/600th of its original size (Chandra, 2006). This liquefied form of natural gas can then be shipped economically to import markets via specialized LNG tankers and then re-gasified to be used by customers (Tusiani & Shearer, 2007).

Firms participating in the LNG market invest in LNG facilities as part of an LNG "chain" reaching from export markets to import markets (Chandra, 2006; Tusiani & Shearer, 2007). In export markets, firms build liquefaction facilities, which are massive, highly capital-intensive plants that essentially purify and refrigerate natural gas into its liquefied form. To transport the LNG, firms own or hire LNG tankers to transport LNG and keep LNG cool to maintain its liquid form. In import markets, firms build gasification facilities, which are very expensive gas processing plants which store LNG, reheat LNG into its gaseous form, and then transfer natural gas into the pipeline network to be used by customers. Each investment represents a substantial commitment by firms. For instance, liquefaction facilities often cost over $1 billion, LNG tankers often cost more than $150 million, and gasification facilities often cost more than $500 million. Each investment also represents a substantial time lag in project development. For instance, liquefaction facilities often take 6 years to build, LNG tankers often take 2 years, and gasification facilities often take 2-3 years (Tusiani & Shearer, 2007). As a result, LNG investment projects represent an ideal setting to study firm speed and firm choices between autonomous versus joint project development given the substantial capital outlays required and time lags involved.[1]

[1] LNG project development is a complex process that takes time and may involve multiple parties collaborating with different roles. Tusiani and Shearer (2016) describe the project formation process as "a web of intertwined and interdependent venture and fiscal agreements, resource and cost assessments, and construction contracts (that) must be established. Shipping as well as buyer commitments must be secured. All of these must be brought together on a closely coordinated schedule. Project formation…is a complex, costly, and often lengthy process" (pg. 403). Chandra (2006) also emphasizes: "Taking a gas project from concept to operation is a complicated and lengthy process involving numerous parties with convergent and divergent motivations relative to the *project sponsor*….A project sponsor that can manage the process effectively will be rewarded with a project that is under budget and delivers the promised product on time" (pp. 122-123). These quotes illustrate that coordination is an essential part of project development, and activities assigned to different parties vary considerably across projects. As a result,

Data and Sample

Our primary data source is LNG construction data from the Oil and Gas Journal. The Oil and Gas Journal tracks oil and gas construction project activity worldwide, and they have been collecting LNG construction activity as well. We supplement our data with the data collected on construction activity from Hawk *et al.* (2013), yielding a set of 370 projects from 1997 to 2015. After linking our data to data associated with needed covariates, our final regressions are based on 117 announced LNG construction projects by 31 lead firms from 1997 to 2015, of which 36 are joint ventures and 81 are developed by one firm alone. Our data are at the project level, and each project appears only once in our data from the perspective of the lead firm listed first on the project.

Variables

For our dependent variables, we first create a dummy variable JV which captures whether the firm decides to partner with another firm in the LNG project through a joint venture or to go it alone. Accordingly, JV equals 1 if the firm initiates an LNG project via a joint venture. If the firm elects to go it alone and pursue autonomous development, the dependent variable is set to 0. Second, we create a categorical variable $Partner$ that takes three values capturing whether the focal firm partners with fast partners ($Partner = Fast\ Partner$), slow partners ($Partner = Slow\ Partner$), or opts for autonomous project development as the baseline category. We categorize partner firms as fast or slow based on their realized values of the central explanatory variable $Slowness_{j,t}$, where a positive value indicates a slow partner firm and a negative value indicates a fast partner firm. In cases where there is more than one partner firm, we use the average of the $Slowness_{j,t}$ values for the partner firms to make the determination. We also conducted sensitivity analyses using the max and min values for the partner firms and found results consistent with our main findings.

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parties to a LNG joint venture may have pooled, sequential, or reciprocal interdependencies (Thompson, 1967; Gulati & Singh, 1998) in project development depending on the specific project and parties involved.

For our central explanatory variable capturing the slowness (or lack of speed capabilities) of the firm, we first estimate the intrinsic speed capabilities of the firm following the same method used in Hawk *et al.* (2013) and Pacheco-de-Almeida *et al.* (2015). This approach follows a similar intuition as past strategy studies focused on total factor productivity or efficiency, wherein a first stage regression is estimated to obtain a residual estimate of conceptual interest to be used subsequently in a second stage regression (e.g., Chung, Mitchell, & Yeung, 2003; Knott & Posen, 2005; Cassiman & Veugelers, 2006; Wu & Knott, 2006; Knott, Posen, & Wu, 2009; Balasubramanian, 2011; Rawley & Simcoe, 2013; Wu, 2013). The basic idea is to regress time-to-build on a set of explanatory variables related to systematic determinants of time-to-build, such as the project type, region, and project capacity. This regression predicts the average expected time-to-build for a project, controlling for systematic variation across projects. We then use the residual as a measure of idiosyncratic firm speed. A negative residual corresponds to a firm executing a project faster than the predicted average. Similarly, a positive residual corresponds to a firm executing a project slower than the predicted average. We then standardize the residual and take the average for a firm across projects for a particular year, in order to aggregate up to the firm level to obtain a firm level measure of firm speed. Our final measure $Slowness$ captures a lack of intrinsic speed capabilities of the firm, with positive values indicating an intrinsically slow firm. The lower the value of this variable, the greater the intrinsic speed capabilities of a firm.

If we were to estimate this measure using LNG construction projects, we would face endogeneity concerns, inasmuch as our measure may be correlated with factors in the error term that are related to the choice between autonomous versus joint development (e.g., selectively speeding up or slowing down intentionally for either autonomous or joint development projects). To mitigate these endogeneity concerns, we first take the same approach as in Hawk *et al.* (2013) and use oil and gas projects unrelated to LNG (i.e., gas processing, petrochemicals, pipelines, refineries, sulfur facilities) to instrument for intrinsic firm slowness in LNG. The logic of instrumenting using unrelated projects is as follows: characteristics of oil and gas projects of a firm worldwide are conceptually unlikely to be correlated with a particular go it alone versus partner decision for a particular LNG project, consistent with the exogeneity of an instrument. However, the resulting estimate of intrinsic firm slowness based on unrelated projects should be correlated with the intrinsic firm slowness of the firm within LNG given the common project management processes and cultures used by oil and gas firms in project development (Hawk *et al.*, 2013). Using this empirical design, our measure of firm slowness should therefore present less of an endogeneity problem. In a section below devoted to our identification strategy, we discuss other empirical analyses carried out to investigate the implications of firm speed capabilities for the ways that firms organize projects in an autonomous or collaborative manner.

In particular, to estimate firm speed capabilities, we have assembled construction project data from 1997 to 2015 for non LNG oil and gas projects (gas processing, petrochemicals, pipelines, refineries, sulfur facilities) for 4656 projects. Our data for oil and gas projects (unrelated to LNG) come from the Oil and Gas Journal. From this source, we have information on time-to-build, capacity, project type and location. Following the approach in Hawk *et al.* (2013) and Pacheco-de-Almeida *et al.* (2015), we estimate the following equation (with subscripts f, i, l, t denoting facility, industry, location and time, respectively):

$$\ln T_{f,i,l,t} = \beta_1 \ln Capacity_{f,i,l,t} + \beta_2 \ln DemandGrowth_{l,t} + \overrightarrow{\beta_3} IndustryDummies + \overrightarrow{\beta_4} RegionDummies + \overrightarrow{\beta_5} YearDummies + \theta_{f,i,l,t} \quad (1)$$

$T_{f,i,l,t}$ is time-to-build of the facility (in months)[2], $Capacity_{f,i,l,t}$ is capacity of the facility (in volume and mass units), $DemandGrowth_{l,t}$ is local demand growth (proxied by yearly real GDP growth rate from the World Bank), and $IndustryDummies$, $RegionDummies$, and $YearDummies$ are sets of dummies

[2] We follow the same methodology in past literature (Hawk *et al.*, 2013; Pacheco-de-Almeida *et al.*, 2015) to construct time to build (by following projects across issues of the Oil and Gas Journal and adding 90 days to both ends of the time interval defined by the first and last issues that the project appears) and discounting (using $\left(1 - e^{-rT_{f,i,l,t}}\right)/r$) by an approximation of the average weighted average cost of capital in the oil and gas industry (calculated for firms in SIC codes 28 and 29, based on Compustat items as follows: $r = \left(\frac{Earnings\ per\ share}{Year\ End\ Stock\ Price}\right)\left(\frac{Market\ Capitalization}{Market\ Capitalization + Long\ Term\ Debt + Current\ Liabilities}\right) + \left(\frac{Interest\ Expense}{Long\ Term\ Debt + Current\ Liabilities}\right)\left(\frac{Long\ Term\ Debt + Current\ Liabilities}{Market\ Capitalization + Long\ Term\ Debt + Current\ Liabilities}\right)$).

for industry, geographic region and year, respectively. $\theta_{f,i,l,t}$ is the residual which serves as the basis for our speed measure. After estimating this equation, we take $\theta_{f,i,l,t}$, standardize it, take the average for each firm year, and collapse the measure to the firm year level. The resulting variable is our measure of the slowness of the firm, denoted $Slowness_{j,t}$ for firm j in year t. Thus, our measure of intrinsic firm slowness is time variant.

For our predictions regarding valuable complementary assets, we follow precedent in the literature (Hawk *et al.*, 2013) and use a proxy, *LNG Tankers*, constructed as a count of the number of LNG Tankers that a firm possesses. Data for this variable were obtained from Tusiani and Shearer (2007) and the 2016 World LNG Report published by the International Gas Union. Firms with more LNG Tankers may have a head start on establishing a viable LNG chain, and may possess a set of valuable relationships in the industry or engineers and managers with LNG specific expertise, which may in turn make them more attractive to potential partner firms for an LNG project. Firms possessing such complementary assets may also have a greater reputation in the LNG market, which may in turn facilitate LNG contract negotiation and execution to facilitate the generation and maintenance of future revenue streams from the focal project.

We also incorporated several controls to account for factors suggested by the literature on the decision between autonomous versus joint project development. Prior experience with partner-based or autonomous-based project development may affect firm learning and firms' decisions to partner or go it alone as well as their abilities to address coordination challenges and other exchange hazards (e.g., Anand & Khanna, 2000; Colombo, 2003; Hagedoorn, Lorenz-Orlean, & van Kranenburg, 2009). We construct $Partner\ Experience$ and $Go\ It\ Alone\ Experience$ as counts of the number of past projects where the firm developed the project with a partner or alone, respectively, as of the prior year. To create measures that are as comprehensive as possible, we use all Oil and Gas Journal projects (LNG and non-LNG) in our data. We also control for firm size and age in case larger or older firms systematically approach the partner vs go alone decision differently than younger or smaller firms based on their abilities and incentives to partner. We include $Firm\ Size$, constructed as the natural log of total sales of the firm from Compustat, and $Firm\ Age$, constructed as the number of years since the firms' founding (founding dates were obtained from Compustat and internet searches). Competitive pressures or increased demand could also induce firms to partner or go it alone (Eisenhardt & Schoonhoven, 1996). To account for competitive pressures, we construct *Rival Entry*, a count of the number of announced LNG projects from all other firms besides the focal firm as of the time of the project's announcement. To account for differing demand conditions, we include *Natural Gas Price*, the Henry Hub Natural Gas Spot Price (in dollars per million Btu) from the EIA. In case firms from different parent industries approach the go it alone vs partner decision differently, we include dummies for 2 digit SIC membership of the parent company, for codes 13 (Oil and Gas Extraction), 29 (Petroleum and Coal Products), 49 (Electric and Gas Services) and other. We also include dummies for the geographic basin of the project (Atlantic, Pacific, Mideast) as well as LNG project type (liquefaction, gasification). We also control for other temporal effects that may shift the incentives to partner or go alone with the inclusion of a year time trend.

Baseline Statistical Method

The relationship between firm speed and the choice of whether to partner or go it alone can be expressed as the following logit model:

$$Pr(JV = 1) = F\left(\beta_0 + \beta_1 Slowness_{j,t} + \boldsymbol{\beta_2 X_j}\right) \tag{2}$$

where $F(\quad)$ is the cumulative distribution function of the logistic distribution, $Slowness_{j,t}$ is our measure of the intrinsic slowness of the firm, and $\boldsymbol{X_j}$ contains our remaining explanatory variables. We estimate equation 2 with maximum likelihood estimation while adjusting standard errors to be robust to clustering by firm. Hypothesis 1 suggests that slow firms are more likely to partner than go alone, leading to the theoretical expectation that $\beta_1 > 0$.

Our theoretical development suggests that slow firms would like to partner with fast partner firms to overcome their own inability to move quickly, yet the question is why any fast partner firm would partner with a slow focal firm. The next element of our theoretical framework is the expectation that the ability of a slow firm to get a fast partner hinges on the slow firm possessing valuable complementary assets (measured by *LNG Tankers*) to bargain for partnerships with fast partners. It follows that slow firms without complementary assets should be unable to partner with fast firms. Without these valuable supporting assets to attract a fast partner firm, slow firms must settle for slow partners or go it alone.

To test these ideas, we adjust our model specification to be a multinomial logit model. The dependent variable $Partner$ is a categorical variable taking three values, capturing whether the focal firm partners with a fast partner ($Partner = Fast\ Partner$), slow partner ($Partner = Slow\ Partner$), or goes it alone, which serves as the baseline category. As before, we estimate the model with maximum likelihood estimation while adjusting standard errors to be robust to clustering by firm. Given that employing a multinomial logit model requires the independence of irrelevant alternatives (IIA) assumption to hold, we ran Hausman tests of the IIA hypothesis and found no evidence to reject it. In robustness checks, we also employ a variety of alternative model specifications (e.g., separate logit and random effects probit models) and continue to find similar results. To test the idea that slow firms bargain for fast partner firms in this manner (H2), we introduce the following contingency for the impact of a firm's speed capabilities:

$$\beta_1 = \alpha_0 + \alpha_1 Complementary\ Assets \qquad (3)$$

Substituting this contingency in the above multinomial logit model, we obtain the following expression we can use to test our theory:

$$\alpha_0 Slowness_{j,t} + \alpha_1 Complementaryassets \cdot Slowness_{j,t} \quad (4)$$

Following our theoretical arguments, we can test Hypotheses 2 as follows. First, consider the results for firms who partner with slow partner firms (where the dependent variable $Partner = Slow\ Partner$). For firms who partner with slow partners, we can expect α_0 > 0 or α_0 = 0 (capturing the scenario where slow firms without complementary assets must settle for slow partners and are thus more likely partner with them or go it alone) and α_1 = 0 (slow firms with valuable complementary assets are not more likely to partner with slow firms since they have the ability to obtain fast partners). Next, consider the results for firms who partner with fast partner firms (where the dependent variable $Partner = Fast\ Partner$). For firms who partner with fast partners, we can expect α_0= 0 (slow firms with no complementary assets cannot get fast partners), and $\alpha_1 > 0$ (slow firms with increasing amounts of valuable complementary assets are more likely to obtain partnerships with fast partners).

Identification Strategy

In order to test our theory, our empirical objective is to estimate the impact of intrinsic speed capabilities on firms' decision of whether to partner or go it alone, and we also wish to empirically explore slow firms' preferences for fast partners and the role of complementary assets in enabling slow firms to bargain for and obtain fast partners. We thus needed to select an analytic approach that allows us to obtain an estimate of the causal effect between intrinsic firm slowness and partnership decisions in LNG projects. We also sought to address potential endogeneity concerns such as omitted variable bias, simultaneity and/or reverse causality as well as concerns that our measure of firm slowness may not be randomly assigned across firms.

We thus use several analytic approaches to estimate the impact of intrinsic firm slowness on partnership decisions. We articulate our overall identification strategy in a Directed Acyclic Graph (DAG) in Figure 1 as a way to structure the analyses towards identification of a particular effect in a causal system (Morgan & Winship, 2014). As depicted in the DAG, our empirical objective is to identify a causal effect between intrinsic firm slowness (labelled as variable D) and the decision to partner or go it alone (labelled as variable Y).

Our first identification strategy is to use regression, or identification by adjustment (depicted on the right side of the DAG in Figure 1). In this approach, we attempt to obtain a consistent estimate of firm slowness on firms' partnership decisions by controlling for all other influences on our outcome variable of interest. We thus include a vector of control variables labelled as X in the DAG. We build in several features of our empirical design and take several steps to address potential endogeneity concerns. First, as noted above, we instrument for intrinsic firm slowness using unrelated projects, which helps to address simultaneity and/or reverse causality. It is important to note that our estimate of firm slowness is based on unrelated projects from LNG, which reduces the potential concern for reverse causality or simultaneity. This is because it is unlikely a particular partnership decision in a given LNG project would affect intrinsic firm slowness for a firm across a variety of unrelated projects worldwide in oil and gas. Moreover, the temporal structure of our measure of firm slowness further reduces this concern: since our slowness measure captures firm idiosyncratic project completion speed relative to the systematic average of projects completed in a given year, the firm slowness instrument has a lagged structure relative to the current partnership decision for the LNG project in the current year, further reducing reverse causality and/or simultaneity concerns. This empirical design also helps reduce potential correlation with the error term from omitted variable bias: if firm differences in expectation of the LNG market, for instance, are in the error term and are correlated with both our measure of firm slowness and the decision to go it alone or partner, we would have an endogeneity problem. Since our measure of firm slowness is based on unrelated projects, we avoid this potential correlation with the error term. Second, we include a vector of controls suggested from the literature that may affect the go it alone versus partner decision, reducing potential omitted variable bias. Third, we conduct additional analysis using random effects probits to further account for potential omitted variable bias from time invariant omitted firm heterogeneity. Fourth, we then conduct a series of robustness checks using additional controls and alternative variable definitions to further address the risk of omitted variable bias.

Of course, an additional concern regarding identification of the impact of intrinsic firm slowness on partnership decisions is that intrinsic firm slowness is not randomly assigned across firms. As a consequence, our next identification strategy is to use treatment effects analysis, or identification by balancing (depicted on the left side of the DAG in Figure 1). In this approach, we define the treatment as a binary indicator set to 1 if the firm is intrinsically slow and 0 otherwise. We then approximate the experimental ideal by creating a balanced treatment group and control group using inverse probability weighting based on propensity scores estimated from a set of covariates (labelled S in the DAG) that predict the propensity to be intrinsically slow or not. If successfully balanced, the treatment group and control group should be as similar as possible except for their treatment status, allowing us to compare like with like. A second stage weighted regression is then estimated to obtain the marginal effect of slowness on the probability of whether to partner or go it alone. This estimate of the average treatment effect, if consistent with our main results, would provide further reassurance that we are obtaining a consistent estimate of the impact of intrinsic firm slowness on the ways that firm organize projects on an autonomous or collaborative basis.

Our next identification strategy is to use doubly robust estimation, which combines regression adjustment with identification by balancing. This approach (depicted on the bottom of the DAG in Figure 1) continues to use identification by balancing on a set of variables predicting the propensity to be intrinsically fast, but it also includes a set of covariates as controls in the second stage regression. An attractive feature of this approach is its doubly-robust property, where a consistent estimate is achieved as long as one part of the model (selection or outcome) is correctly specified (Morgan & Winship, 2014).

In sum, we use a variety of identification strategies (regression adjustment, identification by balancing, and doubly robust estimation) to study the impact of intrinsic firm slowness on the go it alone versus partner decision. As depicted in the DAG in Figure 1, each method attempts to break potential unobservable interdependencies (labelled as U in the DAG) that could undermine identification of the impact of firm slowness on firm partnership decisions. By triangulating across multiple methods and examining the theoretical relationship of interest using a variety of identification lenses, we seek to obtain a set of empirical evidence that convincingly tests our theory.

RESULTS

We present descriptive statistics and a correlation matrix in Table 1. To examine whether collinearity is a concern, we checked variance inflation factors (VIFs). All VIF values were under 10, suggesting collinearity is at acceptable levels. Looking at Table 1, we see correlations consistent with theoretical expectations: Slowness is positively correlated with the decision to partner versus go it alone. The remaining correlations also yield interesting insights: larger, older and more experienced firms tend to partner more than go alone, and firms with greater complementary assets appear to be more likely to proceed autonomously than partner. Greater market prices and entry by rivals tends to also induce partnering rather than going alone. We next turn to estimation results from multivariate models to better address omitted variable bias concerns and obtain our main results.

[Insert Tables 1 and 2 about here]

We present logit and multinomial logit results in Table 2. Column I in Table 2 presents results for the logit model that examines the relationship between firm slowness and the decision to partner or go it alone. Consistent with Hypothesis 1, we find a positive and significant coefficient for slowness. Firm slowness makes it more likely a firm will elect to partner rather than go it alone. The marginal effect suggests that a one standard deviation increase in slowness is associated with a 0.113 increase in the predicted probability to partner rather than go alone, a 36.7% increase in the baseline predicted probability of 0.308. These results are supportive of our expectation that slow firms are generally electing to partner rather than take on an LNG investment project alone.

Columns II and III present baseline results for our multinomial logit model with no interaction terms. We then test H2 in Columns IV and V by introducing an interaction between slowness and complementary assets (as measured by LNG tankers) to examine whether the ability of slow firms to obtain fast partners hinges on the possession of supporting complementary assets. We first consider the results for firms who partner with slow partner firms in Column IV. As expected, we find a positive and significant coefficient for slowness alone and an insignificant coefficient on the interaction between slowness and complementary assets (measured by LNG tankers). Slow firms with no complementary assets (captured by the coefficient on slowness alone) are electing to partner with slow partner firms. Additional complementary assets for slow firms (captured by the slowness * tankers interaction) do not increase the probability of slow firms partnering with slow partner firms (since they can attract fast partners). Next, we consider the results for firms who collaborate with fast partner firms in Column V. As before, the coefficient on slowness alone captures the case for slow firms with no complementary assets. As expected, we find an insignificant result for this coefficient, supporting our theoretical expectation that slow firms with no complementary assets are unable to partner with fast partner firms. However, we find a positive and significant coefficient on the interaction between slowness and complementary assets (measured by LNG tankers). This result suggests that each incremental additional LNG tanker significantly increases the probability that a slow firm collaborates with a fast partner firm.

To help in interpreting the interaction between LNG tankers and slowness on the ability of firms to partner with fast versus slow partner firms within our multinomial logit model, we follow best practice in interpreting interaction effects in nonlinear models (Hoetker, 2007) and examine our results graphically. Accordingly, we plot in Figure 2 the marginal effects of slowness across values of LNG tankers (ranging from 0 tankers to 10 tankers) by partner type (Fast Partners versus Slow Partners). We also tabulate the marginal effects in Table 3. Figure 2 and Table 3 reinforce our theoretical expectation. On the left side of the graph firms have no LNG tankers (corresponding to 0 on the x axis). For firms that partner with slow firms, firms with no complementary assets have a positive marginal effect of .081 (p=.085). Slow firms with no complementary assets are settling for partnering with slow partner firms. As we increase the complementary assets possessed by the focal firm, the marginal effect for partnering with slow firms approaches 0 and is no longer significant. These slow firms with complementary assets are no longer settling for partnering with slow partner firms. For firms that partner with fast firms, firms with no complementary assets have a marginal effect that is close to 0 (.007) and is insignificant (p=.841). These firms are unable to successfully partner with fast partners. However, as we increase the complementary assets possessed by the firm, the marginal effect consistently becomes positive (ranging from .164 to .480) and strongly significant (all with p = .000). These results thus support our expectation that the ability of slow firms to collaborate with fast partner firms hinges on the possession of valuable complementary assets to attract a fast partner firm: with complementary assets, slow firms can successfully bargain for partnerships with fast partner firms.

[Insert Figure 2 and Table 3 about here]

Additional Analysis: Treatment Effect Analysis

Our goal is to identify a causal effect of firm slowness on the decision to go it alone or partner. While our theoretical arguments and the results above are suggestive of a causal relationship, one threat to causality is that firm slowness is not randomly distributed across firms. As discussed in the identification strategy section, we conduct additional analyses to model selection into firm slowness using treatment effect analysis techniques. In this approach, we define "treatment" as being slow or not, defined as 1 if a firm has a positive slowness value and 0 otherwise. Treatment effect analysis then uses matching or weighting to create a treatment group and a control group that are as similar as possible to each other given the set of observable covariates and differ only in whether they receive treatment or not. A second stage weighted regression is then estimated to obtain the marginal effect of slowness on the probability of whether to partner or go it alone. This estimate of the average treatment effect, if consistent with our main results, would add clarity to whether our findings represent a consistent estimate of the impact of firm slowness on the decision to partner or go it alone.

We use two treatment effect analysis techniques: propensity score inverse probability weighting (using the teffects ipw package in stata), and doubly robust estimation (using the teffects iwpra package in stata). In the first approach, a propensity score logit model is estimated to obtain estimates of the propensity of a firm to receive treatment. Propensity scores are then used for weighting to obtain balance between a treatment group and control group. We use our same set of covariates as in our initial analysis and obtain good balance between our treatment and control groups after weighting (a table displaying covariate balance between the treatment and control group is available upon request). To further verify that covariate balance is achieved, we conducted a test for covariate balance between treated and control groups after weighting using the tebalance, overid command in stata, and we verified that we are unable to reject the null that the covariates are balanced (p=.98). A second stage linear probability regression is then estimated using the balanced treated and untreated groups. Table 4 Column I presents these results, where the coefficients from the linear probability model can be interpreted as percentage points. The estimate of both the average treatment effect (ATE) and the average treatment effect of the treated (ATET) are both supportive of our theory: a slow firm has a higher probability of partnering rather than going it alone by 35.4 percentage points (using the ATE) or 31.7 percentage points (using the ATET). In the second approach of doubly robust estimation, the same set of covariates are used also as controls in the second stage outcome regression. This inclusion gives the estimator a doubly robust property, where a consistent estimate is achieved if either the selection model or the outcome model is correct (even if one of them is mis-specified). Table 4 Column II displays the results of the doubly robust estimation, and the findings are supportive of our theory: a slow firm has a higher probability of partnering rather than going it alone by 33.9 percentage points (using the ATE) or 31.5 percentage points (using the ATET). These findings of the doubly robust estimation are consistent with our main results, providing additional reassurance that our main findings represent a consistent estimate of the impact of firm speed on partnership decisions.

[Insert Table 4 about here]

Additional Robustness Checks

We conducted multiple additional robustness checks. First, we tried several alternative econometric specifications. We reran our results using separate logit models rather than the multinomial logit model, and we also ran random effect probit specifications to further address concerns about potential time invariant firm heterogeneity. Using either approach, the results and interpretations were similar to our main results. We also tried using different adjustments to our standard errors such as using White robust standard errors without clustering or unadjusted standard errors, and we obtained qualitatively similar results. The one finding that occasionally turned insignificant is the result from the multinomial logit model that slow firms without complementary partnering are significantly more likely to partner with slow firms. In our main findings, the corresponding marginal effect for slow firms with no complementary assets was only significant at the 10% level as shown in Figure 2 and Table 3. This finding may be less robust than the remainder of our findings, suggesting that slow firms with little to offer potential partners may even have trouble attracting a slow partner firm and need to go it alone.

We also conducted several robustness checks using alternative constructions of our variables or additional controls. Regarding our speed capability measure, we tried using an alternative construction using the average speed values of firms across our sample period, and we received results similar to our main results. Regarding our other explanatory variables, we examined alternative measures for firm size (using total assets), alliance experience and go it alone experience (using projects up through the current year besides the focal project, as well as experience measures based only on LNG projects), and rival entry (using lagged values), and this yielded results similar to the main findings. In case firm innovativeness affects the decision to partner or go alone in the construction projects we investigated, we also included R&D Intensity (R&D expense / total sales) as an additional control and continued to find similar results. In case project size affects the decision to partner or go alone, we also included LNG project capacity as a control. While data availability reduced our sample size, we continued to find results consistent with our main findings. As an additional check, we conducted regression diagnostics and identified influential outliers using Pearson residual, deviance residual, and Pregibon leverage values, and we continued to find results similar to our main results after excluding these observations.

DISCUSSION

Contributions and Implications

This study examines the impact of firms' intrinsic speed capabilities on their decisions to develop large investment projects with alliances versus autonomously. As theoretically expected, we find that slow firms are generally more likely to partner than go it alone. A remaining question is why a fast partner firm would be willing to partner with a slow firm. We then find that the ability of slow firms to collaborate with fast partner firms hinges on the former's possession of valuable complementary assets.

This study makes several contributions to the literature. First, we contribute to the literature that focuses on firm decisions between autonomous- versus partnership-based project development. Past research has shown that firms often partner to overcome deficiencies in resources and capabilities of various kinds (Shan, 1990; Mitchell & Singh, 1992; Eisenhardt & Schoonhoven, 1996; Ahuja, 2000; Garrette *et al.*, 2009). We build upon and extend this important stream of research by showing that firm speed capabilities matter in the decision to partner versus go it alone in project development. It would be valuable in future research to explore how intrinsic speed capabilities could substitute or complement other capabilities firms possess or access via partnerships and that have been featured in this literature. In addition, in our study, we focused on the focal firm choosing to develop a project autonomously or via a partnership. However, during alliance formation, there are other parties involved, and firms are often involved in portfolios of collaborations that are interdependent. This suggests there are opportunities to investigate the implications of firm speed capabilities for other alliance decisions, including partner selection (e.g., Hitt *et al.*, 2004), portfolio building (e.g., Hoffmann, 2007; Lavie, 2007), and so forth.

Second, we contribute to the broader alliance literature by examining the motivation of entering alliances to move faster. Previous alliance research often invokes going faster as a motivation for alliances (Hamel *et al.*, 1989; Ohmae, 1989; Bleeke & Ernst, 1991). However, this link between firm speed capabilities and whether to initiate an alliance or not has remained unexamined. We introduce the notion of intrinsic speed capabilities to the alliance literature, and we are the first to investigate and empirically show the role of intrinsic speed capabilities in the decision to develop an investment project autonomously versus via a partnership. It would be valuable to extend this work in a number of ways. A further research extension would be to examine the dynamics of capability access versus the acquisition and learning of speed capabilities within partnerships. Grant and Baden-Fuller (2004) indicate a distinction between accessing a partner firms' knowledge or capabilities versus learning from the partner in order to acquire the knowledge or capabilities. It would be interesting to know if firms only access the speed capabilities of partner firms for the purposes of a focal project, or if they also enhance and learn their own speed capabilities from the partnerships. The distinction between access and learning could be very valuable regarding our understanding of the development of intrinsic speed capabilities within firms.

We also contribute more specifically to the perspective in the alliance literature of the needs versus attractiveness dynamic in alliances – that firms partner to satisfy their own needs, but they must also possess distinctive resources and capabilities to attract a suitable alliance partner (Eisenhardt *et al.*, 1996; Ahuja, 2000; Rothaermel *et al.*, 2008; Garrette *et al.*, 2009). Our results are in accord with this bargaining dynamic, where the ability of slow firms to obtain fast partners hinges on the possession of valuable complementary supporting assets. Future research on how firms specifically transact for speed capabilities alongside other resources and capabilities within alliance markets would be valuable in advancing competence-based perspectives on interfirm collaboration and the bargaining that takes place in such factor markets based upon collaborators' outside options.

An additional opportunity for future research stems from the fact that our study is silent regarding the performance implications of autonomously and jointly developed projects, both at the firm level and at the project level. Our focus has been on the antecedents of the decision of whether to partner or go it alone. While we theoretically consider the differential speed benefits of alliances to firms, we do not examine the performance realized in alliances versus going it alone, whether the speed of project completion, efficiency, or returns. It would therefore be valuable to examine the ultimate performance consequences of slow firms partnering with other firms, of fast firms going it alone, etc.. Additionally, it would also be interesting to look at more proximate outcomes such as trust, stability, and other aspects of the relationships that collaborative agreements entail. Our focus has been at structural choices of whether to partner or not, and there may be valuable insights that can be obtained by looking at the processes of collaboration, how relationships evolve, and the relational and formal governance mechanisms that support complex projects beset with time pressures (e.g., Poppo & Zenger, 2002). Following partnerships longitudinally over time might give a richer understanding of the evolution of these relationships and coordination outcomes. A longitudinal study of these projects could also give insights regarding the speed of execution of projects over time, whether there are delays, and if speed capabilities help by affording alliances temporal slack to facilitate adaptation as unforeseen contingencies surface. It may also be that speed capabilities are more helpful for particular projects with certain features or for particular kinds of firms or partnerships.

Our study also contributes more broadly to the corporate strategy literature and the competitive strategy literature by integrating ideas from corporate strategy about boundary of the firm decisions with ideas from competitive strategy about firm speed capabilities (Hawk *et al.*, 2013; Pacheco-de-Almeida *et al.*, 2015). Our theory and evidence demonstrates one way in which firm speed matters in corporate strategy -- the selection of particular expansion modes. We argue and show that the ability to move quickly is an important consideration in how firms organize complex projects. Given our focus on firms' partner versus go-it-alone choices, an interesting extension for future research would be to examine the role of firm speed capabilities in acquisitions as well as in how firms choose between different expansion modes like acquisitions versus alliances versus organic growth (Capron & Mitchell, 2009). Given our focus on firms' partner versus go-it-alone choices in complex construction projects, it would be valuable and interesting to consider the role of speed capabilities in other contexts, including exploring these dynamics in markets for technology (Gans & Stern, 2003). In particular, it would be interesting to look at how speed affects these technology commercialization decisions where startups decide to partner with incumbents possessing downstream capabilities versus commercializing technologies themselves, just as incumbents face choices concerning open versus proprietary innovation strategies that might also reflect speed considerations.

Limitations and Future Research Directions

In addition to the research opportunities mentioned above, our study has other limitations that extensions to this research might address. First, we focused on one industrial context, liquefied natural gas and the oil and gas industry, which raises a question about the generalizability of our findings to other industries. LNG and oil and gas are industries with long resource accumulation lags, and we would expect our findings to generalize well to other industrial contexts where time to build is an important consideration. It would be interesting to extend our analysis to other settings where resource accumulation lags may be shorter. Future research could look at similar dynamics in industries that change quickly due to short resource accumulation lags. It may also be interesting to extend our results to high technology industries with a fast rate of technological obsolescence. It could be that, if fixed investment is likely to become obsolete quickly, firm speed may be an even more important consideration when firms choose to develop projects autonomously versus with a partner. Another interesting facet regarding the generalizability of our results to other contexts would be to examine how country heterogeneity and cross border collaboration might affect the boundary of the firm choices we studied as well as the role of speed. It could also be interesting to look at international projects that present different coordination challenges and time considerations due to countries' differing institutional environments.

An additional consideration regarding generalizability is that we restrict our focus to one particular type of alliance, joint ventures in oil and gas. Future research could look at different types of alliances such as equity partnerships or non-equity alliances that can present different capacity for coordination, administrative control, and incentives. It would be interesting to consider if our results extend to other forms of collaboration and possibly do a more nuanced examination of governance structures that firms put in place to mitigate some of the inefficiencies of partnerships. It could be that firm speed (or lack of firm speed) may influence how firms structure and design their partnerships to facilitate coordination and cooperation with partner firms. Research along these lines could be promising to join together competitive strategy and corporate strategy research in new ways, examine the role of speed capabilities along with other resources that firms leverage and access through partnerships, and provide new guidelines to executives making choices about how best to organize complex investment projects.

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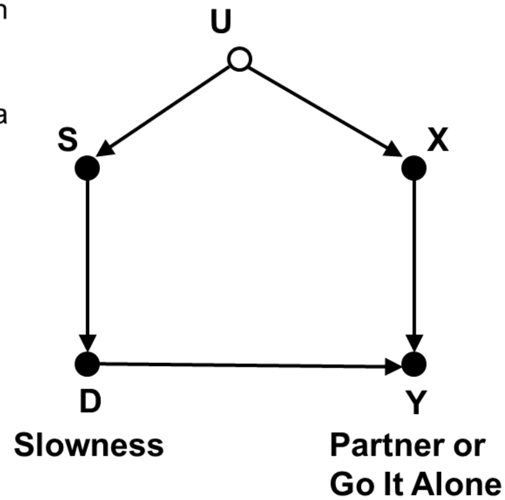
Figure 1: Directed Acyclic Graph (DAG) depicting identification strategy

Approach 2: Treatment Effect Analysis (Identification by Balancing)
- Approximate the Experimental Ideal with a Balanced Treatment and Control Group using Matching or Weighting
- Treatment is 1 if Slowness is > 0
- Inverse Probability Weighted Propensity Score Estimation using teffects ipw package in stata



Approach 1: Regression (Identification by Adjustment)
- Unrelated projects used to measure firm slowness
- Simultaneity and Reverse Causality concerns reduced
- Omitted Variable Bias Concerns addressed with controls, robustness checks, RE Probits

Approach 3: Doubly Robust Estimation
-- Combine both using teffects ipwra package in stata

Figure 2: Marginal effect of slowness on predicted probability of obtaining slow or fast partners at various levels of complementary assets (proxied by number of LNG tankers)

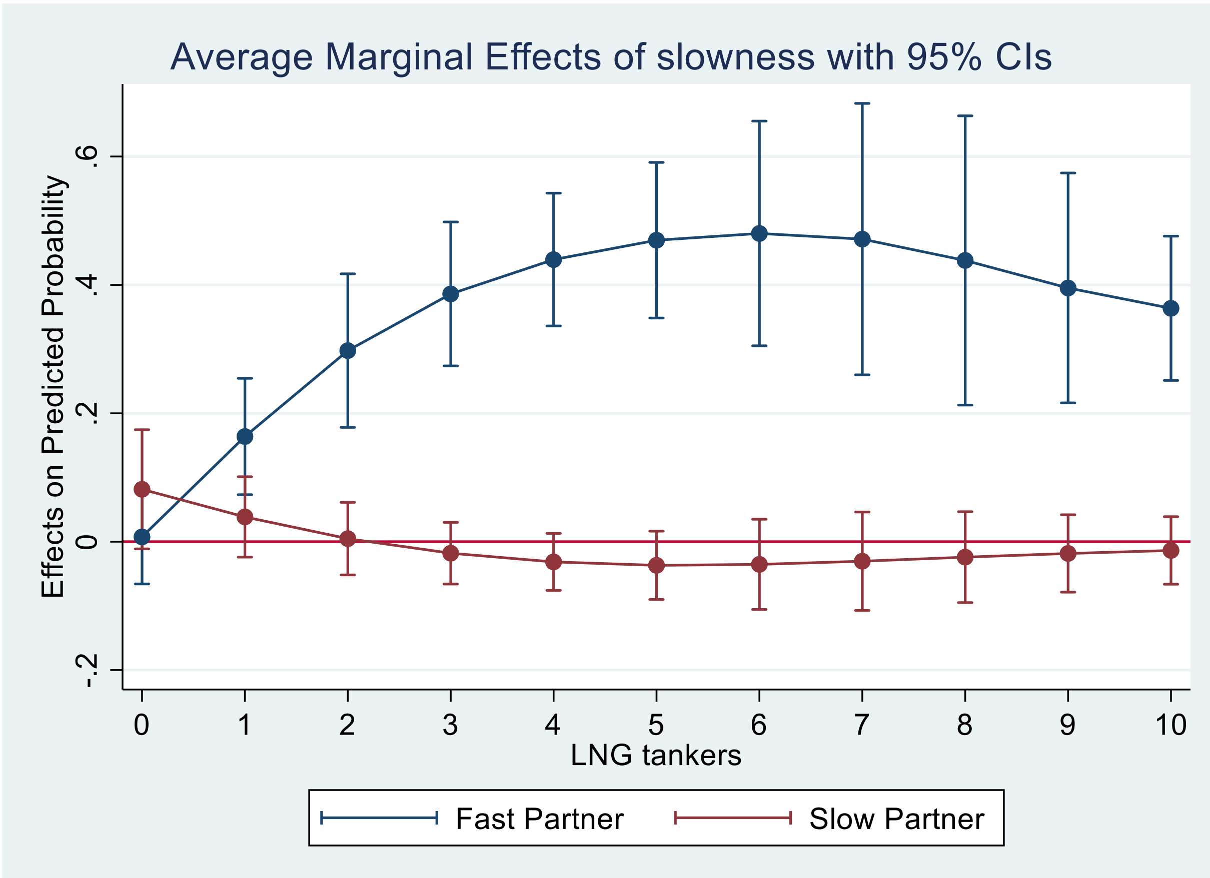


Table 1. Descriptive statistics and correlation table

Variable	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9
1. Alliance	.31	.46	0	1	1								
2. Slowness	.14	.60	-2.00	1.68	0.27	1							
3. Tankers	2.03	3.12	0	10	-0.09	-0.10	1						
4. Partner Experience	20.97	16.84	0	62	0.08	0.02	0.37	1					
5. Go Alone Experience	56.81	42.50	1	177	0.05	-0.09	0.48	0.73	1				
6. Firm Size	10.67	1.69	4.96	12.51	0.06	-0.09	0.33	0.60	0.75	1			
7. Firm Age	78.25	42.89	5	140	0.02	0.02	0.09	0.46	0.45	0.62	1		
8. Rival Entry	30.46	13.97	0	50	0.06	0.09	-0.14	0.28	0.21	0.11	0.12	1	
9. Natural Gas Price	5.73	1.80	2.09	8.86	0.08	0.04	-0.09	0.28	0.17	0.09	-0.13	0.34	1

Table 2. Logit and Multinomial Logit Estimation Results

	I	II	III	IV	V
	Alliance Instead of Go It Alone	Partner With Slow Partners	Partner With Fast Partners	Partner With Slow Partners	Partner With Fast Partners
Slowness	1.052**	.844**	1.380**	.903**	.287
	(.406)	(.334)	(.697)	(.411)	(.389)
Tankers	-.170	-.121	-.087	-.127	-.532**
	(.123)	(.277)	(.247)	(.276)	(.232)
Slowness X Tankers				-.047	1.623***
				(.172)	(.454)
Partner Experience	.013	.038	.065	.038	.153*
	(.030)	(.049)	(.058)	(.053)	(.084)
Go It Alone Experience	.010	-.004	-.007	-.002	-.024
	(.011)	(.024)	(.031)	(.026)	(.047)
Firm Size	-.234	-.462	-.970	-.556	-1.534**
	(.353)	(.760)	(.670)	(.768)	(.685)
Firm Age	-.002	.003	.026*	.004	.028
	(.007)	(.014)	(.015)	(.015)	(.019)
Rival Entry	.009	.017	.003	.008	.061*
	(.021)	(.030)	(.032)	(.030)	(.032)
Natural Gas Price	.187	.275	.149	.278	.060
	(.167)	(.264)	(.406)	(.250)	(.590)
LNG Basin Dummies	Y	Y	Y	Y	Y
Project Type Dummy	Y	Y	Y	Y	Y
Industry Dummies	Y	Y	Y	Y	Y
Year Trend	Y	Y	Y	Y	Y
N	117	106		106	
Log-L	-59.192	-57.388		-52.585	
Pseudo R^2	.180	.237		.301	

*** significant at 1%; ** significant at 5%; * significant at 10%

Note. Results reported are from estimation of logit and multinomial logit models. For the multinomial logit, going alone is the benchmark dependent variable category. Standard errors robust to clustering by firm are reported in the parentheses. LNG geographic basin dummies, a LNG project type dummy, parent industry dummies, a year trend, and a constant are included in the regressions, but results are not reported in the table. The sample size difference between the logit and multinomial logit results is due to a lack of speed data (from our estimation of equation 1) for several partner firms.

Table 3. Marginal effect of slowness predicting partner type, at various levels of complementary assets (proxied by LNG tankers)

	I	II	III	IV
Predicting Partner With	Complementary Assets (Tankers)	Slowness Marginal Effect dy/dx	Delta-Method Std. Err.	P - Value
Slow Partner	0	.082	.047	.085
Slow Partner	1	.039	.032	.227
Slow Partner	2	.005	.029	.869
Slow Partner	3	-.018	.024	.464
Slow Partner	4	-.031	.023	.164
Slow Partner	5	-.037	.027	.175
Slow Partner	6	-.035	.036	.324
Slow Partner	7	-.030	.039	.436
Slow Partner	8	-.024	.036	.505
Slow Partner	9	-.018	.031	.551
Slow Partner	10	-.014	.027	.610
Fast Partner	0	.007	.037	.841
Fast Partner	1	.164	.046	.000
Fast Partner	2	.298	.061	.000
Fast Partner	3	.386	.057	.000
Fast Partner	4	.439	.053	.000
Fast Partner	5	.470	.062	.000
Fast Partner	6	.480	.089	.000
Fast Partner	7	.471	.108	.000
Fast Partner	8	.438	.115	.000
Fast Partner	9	.395	.091	.000
Fast Partner	10	.364	.057	.000

Table 4. Treatment Effects Analysis

	I	II
	Inverse Probability Weighted Propensity Score Estimation	Doubly Robust Estimation
Slowness ATE (Average Treatment Effect)	.354*** (.071)	.339*** (.071)
Slowness ATET (Average Treatment Effect on the Treated)	.317*** (.072)	.315*** (.073)

*** significant at 1%; ** significant at 5%; * significant at 10%

Note. Results are from a second stage linear probability model explaining the probability of partnering versus going it alone. Estimations are done using the teffects ipw and teffects ipwra packages in stata. Coefficients in the linear probability model can be interpreted as percentage points. For instance, a coefficient of .354 implies that firms receiving the treatment of being slow have an increased probability of partnering over going it alone by 35.4 percentage points.