Disentangling Reputational Effects in Alliances
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Disentangling Reputational Effects in Alliances

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An important consequence of an alliance is that partnering firms combine their reputations by associating them to jointly implemented projects. However, an often-overlooked aspect is that those reputations may themselves change due to both the announcement of firms' decision to form the alliance and the performance of joint projects. We develop a formal model that provides an integrated perspective of these reputational effects, while allowing us to isolate and characterize each of them. We find that the way in which firms' competence levels affect their decision to form an alliance determines how firms' reputations evolve following the announcement of the alliance and the performance of joint projects. This indicates that the analysis of the reputational effects of an alliance requires understanding the firms' alliance formation decision in the first place. We show, for instance, that a firm's reputation may decrease following the decision to form an alliance, and that the impact of project performance on the reputations of alliance partners can be very asymmetric. Among other things, our analysis implies that a firm's desirability as an alliance partner does not necessarily increase with its reputation and level of competence.

Key words: Reputation, resource-based approaches, alliances, game theory

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1. Introduction

A firm's reputation can be broadly defined as an intangible resource that, contingent on the firm's past actions and outcomes, embodies public perceptions about the firm's ability to deliver valuable outcomes (Fombrun 1996, Lange et al. 2011). An extensive literature construes a firm's reputation as a signal of competence in different domains—such as the quality of its products or services, its financial health, or the effectiveness of its leadership—and argues that a (high) reputation can be a source of sustainable competitive advantage and above-normal returns (e.g., Weigelt and Camerer 1988, Fombrun and Shanley 1990, Deephouse 2000, Hörner 2002, Bergh et al. 2010, Zavyalova et al. 2016). The impact of reputation on firm performance can be attested by several empirical studies. For example, Roberts and Dowling (2002) showed that firms with good reputations are better able to sustain superior profits; Greenwood et al. (2005) found evidence that a high firm reputation positively affects the operating performance of professional service accounting firms; and Raithel and Schwaiger (2015) found a relationship between superior firm reputation from the perspective of the general public and increases in shareholder value.

Previous research has demonstrated the relevance of firm reputation as a determinant of firms' alliance formation decisions. This literature largely interprets reputation as a signal of a firm's competence and resourcefulness to potential alliance partners, emphasizing how a higher reputation increases a firm's *opportunities* (and its propensity) to form alliances, as it enhances the firm's desirability as a potential partner (Dollinger et al. 1997, Stuart et al. 1999, Stern et al. 2014). Notwithstanding, there is also the recognition that a higher reputation may sometimes decrease a firm's propensity to engage in alliances, because it reduces the firm's *need* to access other firms' valuable reputations, competencies, and resources (Gu and Lu 2014). Overall, these studies provide important insights about how firms' *existing* reputations, which result from their past actions and outcomes, affect firms' opportunities and incentives to form alliances.

However, both the decision to form an alliance and the performance of the projects that are jointly implemented with alliance partners may constitute important signals of a firm's level of

competence, thereby affecting its reputation.[1] By focusing on how firms' *existing* (or *initial*) reputations affect their opportunities and incentives to form alliances, previous studies have largely overlooked these *dynamic* signaling effects of alliances on firms' reputations. In this paper, we contribute to this research stream by providing an integrated perspective of the reputational implications of alliances. We develop a game-theoretic model to analyze how reputational considerations affect firms' incentives to form alliances, taking into account not only the implications of firms' existing (or initial) reputations, but also the dynamic signaling effects of the observation of their decision to form an alliance and of the performance of the projects in which they participate. The model allows us to shed more light on the intricacies of the important relationship between firm reputation and alliance formation decisions.

The dynamic signaling effects of alliances on firms' reputations are both interesting and non-trivial. First, the effect of the announcement of an alliance on firms' reputations should depend on how firms' competence levels affect their incentives to form an alliance. For example, if two firms form an alliance only when both of their competence levels are high, then the alliance formation decision is likely to signal high competence levels of both firms, and thereby to increase their reputations. Thus, to understand how the announcement of an alliance affects firms' reputations, one needs to consider how firms make the alliance formation decision. Second, to the extent that the performance of a jointly implemented project within an alliance depends on the contributions of multiple firms, it may convey more or less information about a given firm's level of competence. As a result, it may happen that a firm gets the bulk of the credit (blame) for the good (bad) performance of a joint project within an alliance.

In our model, two firms decide whether to form an alliance. If firms do not form an alliance, each implements its own projects independently. If firms do form an alliance, they implement (at least) some of their projects jointly. In abstract, this definition of alliance is broad enough to encompass, for example, joint ventures, franchising agreements, and situations where a firm outsources the production of an important component to another firm. For concreteness, we consider that a project consists of producing and selling a product to consumers. Each firm has an underlying quality (or level of competence) that

[1] In this paper, we refer to "project" broadly as any product, service, activity, initiative, or business conducted or implemented by one or more firms.

affects the performance of the projects (i.e., products) in which it participates. We assume that firms' qualities are known to them, but a "hidden characteristic" from consumers. The expectations that consumers form about firms' qualities correspond to firms' reputations.[2] Firms' reputations are important determinants of firms' profits because consumers base their valuation of a product on those reputations. In turn, firms' qualities are important for firms' profits because they affect project (or product) performance and, thereby, future reputations.[3]

Through our analysis, we isolate and characterize three cumulative reputational effects—the *complementarity effect*, the *performance effect*, and the *announcement effect*—that influence firms' gains from an alliance, and thereby their alliance formation decision. We discuss these effects next.

In essence, an alliance involves one or more projects that are jointly implemented by firms and in which, among other things, firms share and combine their reputations. The complementarity effect corresponds to this *direct* impact of the alliance on the reputations of jointly implemented projects. As expected, we find that the complementarity effect has a positive impact on profits if the alliance contributes to associate high firm reputations with high-value projects. This happens, for instance, when a given firm's product benefits from the high reputation of an alliance partner in manufacturing a critical component or designing a key feature. For example, consider the alliance between Huawei and Leica to jointly improve the photography experience provided by the Huawei P9 and P9 Plus flagship smartphones, launched in 2016. In the context of that alliance, the complementarity effect relates to the positive spillover that most certainly accrued from Leica's legendary reputation as a camera manufacturer to the P9 and P9 Plus smartphones.

However, this association of firms' reputations to joint projects is not the only reputational effect resulting from an alliance. As hinted before, firms' reputations may also themselves evolve, since

[2] Thus, this is an adverse selection model of reputation, where there is incomplete information about firms' characteristics, and reputation corresponds to others' beliefs about those characteristics (e.g., Kreps and Wilson 1982, Milgrom and Roberts 1982). An alternative approach to the modeling of reputations within microeconomics is that of moral hazard models, where firms' actions are not observable, and the analysis focuses on the conditions under which firms have the incentive to exert costly effort to develop or protect a valuable reputation (e.g., Klein and Leffler 1981, Shapiro 1983, Tirole 1996).

[3] A firm may have different reputations, corresponding to the perceptions of different stakeholder groups, such as consumers, investors, or public entities (e.g., Fombrun and Shanley 1990, Carter and Deephouse 1999, Haleblian et al. 2017). The formalization of reputation as a signal of quality to consumers provides a very natural and intuitive avenue to discuss different reputational effects. Furthermore, it reflects the idea that, in general, potential partners are better informed about each other's characteristics than other stakeholders, such as consumers.

consumers may update their expectations about firms' qualities after observing the alliance formation decision and the performance of the projects in which firms participate.

The performance effect is the *signaling* impact of the performance of the projects in which firms participate on their reputations. Our analysis of the performance effect establishes a clear distinction between independent and joint project implementation. When a project is independently implemented by a firm, we show that a good (bad) performance of the project necessarily signals a high (low) firm quality, and thus has a positive (negative) impact on the firm's reputation. This is intuitive, since under independent implementation the firm is solely responsible for project performance. In contrast, when a project is jointly implemented by firms under an alliance, no firm is solely responsible for the project's performance, and there may be an asymmetric attribution of responsibility for the project's success or failure across firms. We show that the impact of a joint project's performance on firms' reputations depends, not only on their participation levels in the project, but also on consumers' perceived correlation between firms' qualities. This perceived correlation depends on how firms' qualities affect their decision to form an alliance. A positive perceived correlation between firms' qualities reinforces the impact of joint project performance on a firm's reputation, that is, it increases the positive (negative) impact of joint project success (failure) on the firm's reputation. Conversely, a negative perceived correlation between firms' qualities mitigates this impact. In the limit, if a firm's participation in the joint project is low enough, such a negative perceived correlation may actually lead the firm's reputation to decrease (increase) after a joint project success (failure).

The announcement effect corresponds to the *signaling* impact of the announcement of the decision to form an alliance on firms' reputations. Our analysis of the announcement effect shows that its magnitude and sign crucially depend on how firms' qualities influence their alliance formation decision. For example, if synergies that are not related to reputational considerations—such as those stemming from combinations of different resources and capabilities (e.g., Capron and Mitchell 2012), or from economies of scale and overall efficiency improvements (e.g., Gomes-Casseres 1997)—are strong enough to motivate firms to form an alliance regardless of their qualities, then the announcement of the alliance is uninformative about firms' qualities, leaving firms' reputations unchanged. In contrast, if firms' decision

to form an alliance depends on their qualities, the announcement of the alliance can lead to changes in firms' reputations. Specifically, if the high (low) quality of a firm favors the alliance formation decision, then the announcement of the alliance signals a high (low) firm quality, increasing (decreasing) the firm's reputation. In these cases, we show that the sign of the announcement effect (i.e., whether firms' incentives to form an alliance increase or decrease with their qualities) is contingent on the level of uncertainty that consumers have about firms' qualities and on firms' participation levels in the different joint projects under an alliance.

Fundamentally, our analysis highlights the importance of expanding the notion of reputational synergies in alliances to include, not only the more *static* direct combinations of firms' reputations and projects (the complementarity effect), but also *dynamic* signaling effects resulting from the announcement of alliances and from project performance. We show that the combined profit impact of the announcement and performance effects may determine firms' optimal choice between forming an alliance and independent project implementation, by countering and dominating the profit impact of the complementarity effect. This underscores that a perspective that focuses exclusively on the complementarity effect may lead to mistaken alliance formation decisions. Furthermore, our consideration of the three reputational effects also brings forth interesting implications for partner selection in alliances. We show, for example, that a high-reputation partner is not necessarily preferable to a low-reputation partner and, similarly, that a high-quality partner is not necessarily preferable to a low-quality partner. These and other implications are discussed in detail later.

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 analyzes the choice between an alliance and independent project implementation. Section 4 characterizes the three cumulative reputational effects associated with firms' decision to form an alliance. Section 5 discusses the implications of our results and situates our paper within broader scholarly discussions. Finally, section 6 provides some concluding remarks.

2. Model

To capture and characterize the three aforementioned reputational effects, we develop a model with two firms—*A* and *B*—and three periods—zero, one and two. Firms are endowed with projects, which are

implemented in periods one and two. In period zero, the two firms face the opportunity to form an alliance. If firms decide to form an alliance, they implement some of their projects jointly. Alternatively, if they do not form an alliance, each firm implements its projects independently. Whether to form an alliance is the only decision that firms make. We analyze this decision, and its implications for the evolution of firms' reputations and the reputations of their projects. Figure 1 presents an overview of the model, which is presented in detail below.

- Insert Figure 1 here -

2.1 Firms' Projects

Firms *A* and *B* are endowed, respectively, with projects P_A and P_B that are implemented in period two. Firm *A* is also endowed with another project P_C that is implemented in both period one and period two. With the early implementation of project P_C in period one we capture, in the simplest possible way, the impact of a project's performance on firms' reputations and on the reputation of their future projects—that is, the performance effect.

If firms decide not to form an alliance, firm *A* implements projects P_A and P_C alone and firm *B* implements project P_B alone. Under an alliance, firms implement jointly *at least* project P_C. Thus, the model contemplates a wide range of alliances, encompassing situations where projects P_A or P_B are also implemented jointly, as well as situations where they are implemented independently. However, since our analytical focus is on the reputational implications of a given alliance (rather than on firms' choice of an optimal alliance configuration), we assume that if firms form an alliance their relative participations in (or contributions to) projects P_A, P_B, and P_C are fixed and exogenously given.[4] We denote the participation level of firm i in project P_j by $\alpha_i^j \in [0,1]$, with $\alpha_A^j + \alpha_B^j = 1$, for $i \in \{A, B\}$ and $j \in \{A, B, C\}$. Thus, when firms choose not to form an alliance and to implement their projects independently, $\alpha_A^A = \alpha_B^B = \alpha_A^C = 1$.

For concreteness, we consider throughout that a project consists of producing and selling a product. A project P_j (and its associated product) either performs well (i.e., succeeds) or not (i.e., fails) in each period in which it is implemented. In case of failure, the value that consumers would attribute to

[4] In the e-companion to the paper, we partially relax this assumption by analyzing firms' choice between two alliances that differ in the breadth of their scope, as measured by the number jointly implemented projects that each alliance entails.

project P_j's product is $V_j > 0$; in case of success, that value is $V_j(1 + \mu)$, where $\mu > 0$ represents a valuation premium for a successful product.[5] Project P_j's product is an "experience good", that is, a product whose performance (and value) consumers can only ascertain after their purchasing decision.

2.2 Firms' and Projects' Qualities

Firms may have different levels of competence that affect the performance of the projects that they implement. A firm's level of competence is summarized by a one-dimensional variable, its quality $q_i \in [0,1]$, for $i \in \{A, B\}$.[6] Firms' qualities are drawn at the beginning of period zero from a distribution $G(q)$, with $q = (q_A, q_B)$. We assume that the quality of project P_j is given by $q_{P_j} = \alpha_A^j q_A + \alpha_B^j q_B$, the weighted average of the qualities of the two firms, where the weights are the firms' participation levels in the project. This specification captures, in a simple (and analytically tractable) way, the intuitive idea that the quality of a joint project is increasing in the quality of each participating firm, and that the impact of a firm's quality on the quality of a joint project is stronger the higher the firm's participation level in that joint project.[7] Note that, if a project is implemented independently by firm i, its quality is simply given by firm i's quality q_i. And by forming an alliance, a firm may associate its quality to the other firm's project(s). A project's quality is a fundamental determinant of its performance. The quality of project P_j, q_{P_j}, is the probability that the project (and its associated product) performs well (i.e., succeeds) in a given period in which it is implemented. Thus, based on q_{P_j}, the value that consumers would attribute to project (product) P_j is given by their expected valuation

$$V_j\left(1 + \mu q_{P_j}\right).$$

2.3 Firms' and Projects' Reputations

However, consumers do not know firms' (exact) qualities. Instead, they hold beliefs about firms' qualities, and those beliefs determine firms' reputations.[8] Specifically, we model a firm's reputation as

[5] This formulation amounts to assuming that, for each project P_j, the mass of consumers for the associated product is operationalized by a representative consumer with unitary demand. Assuming an arbitrary number of consumers for each product would not change our results.
[6] In the same parsimonious spirit of Cabral and Pacheco-de-Almeida (2019), we may think of quality q_i as a summary measure of firm i's level of competence.
[7] Nonetheless, one of the limitations of this specification is that it does not capture the possibility of mutual learning between alliance partners. To address this issue, we explored an alternative specification where we sought to incorporate the impact of mutual learning between alliance partners in the quality of joint projects. The findings from that analytical exploration are summarized in the Discussion section.
[8] If consumers could observe firms' (and projects') qualities, firm reputation would be irrelevant. Reputations matter when qualities cannot be directly observed by consumers. For simplicity, we consider that consumers share a common set of beliefs about firms' qualities. This assumption is attuned to the prevalent theorizing practices on firm reputation, which assume collective inferences or assessments by a given stakeholder group (e.g., Carter and Deephouse 1999, Rindova et al. 2005, Mishina et al. 2012).

the expected value of its quality according to consumers' beliefs. For instance, at the beginning of period zero, consumers' beliefs about firms' qualities are given by $G(q)$, the actual distribution from which those qualities are drawn. Thus, firm i's reputation at that time is simply the expected value of q_i according to the distribution $G(q)$, that is, $\int q_i dG(q)$. We assume that consumers initially perceive firms' qualities as independent from one another.[9] A key feature of consumers' beliefs about firms' qualities is that they may be updated as relevant new information about firms' qualities becomes publicly available. Thus, firms' reputations may evolve over time.

In our model, two events may provide consumers with such information: the decision to form an alliance in period zero and the performance of project P_C in period one. We denote by r_i the *initial reputation* of firm i at the beginning of period zero. We denote by r_i^d the *interim reputation* of firm i at the beginning of period one, after consumers have observed firms' decision $d \in \{I, J\}$ in period zero—where $d = I$ if firms do not form an alliance and thus each firm implements its own projects independently, and $d = J$ if firms form an alliance through which they jointly implement some projects. Finally, we denote by $r_i^d(\varphi)$ the *ex-post reputation* of firm i at the beginning of period two, after the decision d in period zero and the performance of project P_C in period one $\varphi \in \{f, s\}$ have been observed by consumers—where $\varphi = s$ if project P_C was a success in period one, and $\varphi = f$ if it was a failure.

Akin to the reputation of a firm, the reputation of a project P_j corresponds to consumers' expected value of that project's quality q_{P_j}. Therefore, it is equal to the weighted average of the reputations of the firms that implement project P_j. Specifically, the reputation of project P_C in period one is $r_{P_C}^d := \alpha_A^C r_A^d + \alpha_B^C r_B^d$, given $d \in \{I, J\}$. And the reputation of project P_j (with $j \in \{A, B, C\}$) in period two is $r_{P_j}^d(\varphi) := \alpha_A^j r_A^d(\varphi) + \alpha_B^j r_B^d(\varphi)$, given $d \in \{I, J\}$ and $\varphi \in \{f, s\}$. Thus, firms' reputations and their evolution are important because they determine the reputations of the projects in which firms participate.[10]

[9] Technically, this means that firms' qualities are initially perceived by consumers as statistically independent (i.e., not correlated) according to $G(q)$. As discussed below, this assumption allows consumers' perceived correlation between firms' qualities to emerge endogenously as a result of the announcement of firms' decision to form an alliance. Thus, it allows us to better isolate the impact of an alliance on firms' reputations.

[10] For consumer beliefs about firms' and projects' qualities to be updatable at different stages in the model, consumers must be able to infer firms' participation levels in jointly implemented projects. To capture this idea parsimoniously, we assume that consumers have an accurate idea of firms' participation levels in jointly implemented projects. Clearly, this assumption is less applicable to some empirical settings, such as upstream vertical collaborations and situations where franchised and firm-owned establishments co-exist. However, assuming inaccurate inferences by consumers about firms' participation levels in joint projects would complicate the analysis substantially, with limited foreseeable insights. To wit, it would force us to consider a probability distribution over firms' participation levels in joint projects that would make Bayesian updating applicable, not only to consumers' expectations of firms' qualities (i.e., firms' reputations), but also to consumers' expectations of firms' participations in joint projects.

In contrast to consumers, a firm knows both its quality and the quality of the other firm. The implicit assumption here is that firms are able to conduct some form of due diligence to evaluate each other's quality and can do so accurately. This makes it such that firms' decision to form an alliance may depend on their qualities. Crucially, when this is the case, firms' decision provides information about their qualities to consumers, thereby affecting firms' reputations—that is, the announcement effect is present.

In our analysis, a relevant aspect of assumed beliefs is that consumers do not know *a priori* that firms face the opportunity to form an alliance, nor do they expect it. An implication of this is that, if firms decide not to form an alliance, consumers interpret that as a continuation of the *status quo*, and do not update their beliefs about firms' qualities. Therefore, firms' (and projects') initial and interim reputations may only differ if an (unexpected) alliance is formed.[11] The fact that consumers do not update their beliefs in the absence of an alliance captures the idea that, when an alliance is not expected by consumers, they are unlikely to change their perception about firms' qualities if no alliance is announced. Conceivably, this idea fits most real-life situations well since firms tend to be secretive about their alliance possibilities and to make an announcement only when they decide to form an alliance.[12]

2.4 Firms' Profits

We assume that the revenue generated by a given project corresponds to the value that consumers attribute to that project (and its associated product).[13] Since consumers do not observe firms' and projects' qualities, their expected valuation of a project depends on their expectations about firms' and projects' qualities, which are firms' and projects' reputations, respectively. Thus, consumers' expected valuation of project P_j's product in a certain period is actually given by

$$V_j\left(1 + \mu\tilde{r}_{P_j}\right),$$

[11] See the e-companion to the paper—section EC.1.2—for a microfoundation of this assumption in our model. For a similar assumption, where no updating of beliefs occurs if the *status quo* is maintained, see for example Cabral's (2000) analysis of reputation stretching.

[12] If consumers expect that firms face the opportunity to form an alliance with some probability, then they may update their beliefs about firms' qualities even if no alliance is formed. However, if that probability is sufficiently small, our results about the evolution of reputations when an alliance is formed remain valid. This follows from a continuity argument similar to that in Cabral (2000).

[13] This is consistent with a situation where firms have all the bargaining power relative to consumers and, therefore, consumers pay their willingness-to-pay for the product. As in the models of reputation by Tadelis (1999) and Cabral (2000), this assumption is required to isolate our reputational effects of interest (i.e., those stemming from alliance formation decisions and from project performance), since it allows us to ignore signaling effects through prices.

where $\tilde{r}_{P_j}$ is the reputation of project P_j in that period, as defined above. Note that μ then also captures the importance of project reputation for consumer value (and for project revenues).

In practice, alliances may generate synergies that are not related to reputational considerations, and those synergies may affect alliance formation decisions. With a slight abuse of language, we call those synergies *reputation-independent synergies*, and model them as cost reductions. Specifically, we let $K > 0$ denote the total cost incurred by the two firms if all projects are implemented independently. Through an alliance, firms may then achieve a cost-reducing synergy $S \geq 0$, with $S < K$. Naturally, S should be affected by the level of compatibility between alliance partners—in domains such as processes and routines, decision-making styles, or shared values and culture—, which is an important aspect for joint value creation and overall alliance success (Dyer and Singh 1998, Kale and Singh 2009).[14]

We assume that frictionless side payments between firms are possible under an alliance. This implies that, when firms' joint profits are higher under an alliance, both firms can be made better off.[15] Thus, when deciding in period zero whether to form an alliance or to implement their projects independently, firms choose the alternative that maximizes their expected joint profits.

Firms' joint profits consist of the revenues that they obtain from the various projects net of the total cost of implementing those projects. Given decision $d \in \{I, J\}$ and firm qualities $q = (q_A, q_B)$, we can express firms' expected joint profits in period zero $\Pi^d(q)$ in the following compact way

$$\Pi^d(q) = V_A + V_B + 2V_C - K + \mathbf{1}_{d=J}(d)S$$
$$+\mu\left\{r^d_{P_C}V_C + \sum_{j\in\{A,B,C\}} r^d_{P_j}(f)V_j + q^d_{P_C} \times \sum_{j\in\{A,B,C\}}\left[r^d_{P_j}(s) - r^d_{P_j}(f)\right]V_j\right\},$$

where $q^I_{P_C} = q_A$ and $q^J_{P_C} = \alpha^C_A q_A + \alpha^C_B q_B$ correspond, respectively, to the quality of project P_C under independent and joint implementation. The first line above corresponds to the profit component that does

[14] We explicitly incorporate reputation-independent synergies in our model to acknowledge the fact that alliances can be motivated by considerations other than reputational effects. Moreover, as we will show, reputation-independent synergies influence the reputational effects of alliances. It is important to note, however, that an analysis of the reputational effects of alliances can be done without considering reputation-independent synergies. We elaborate on these issues in the Discussion section.

[15] With frictionless side payments, a firm whose profit from its own projects may be lower under an alliance can always be compensated by the other firm when firms' joint profits under that alliance are higher. In other words, an increase in firms' joint profits stemming from an alliance allows each firm to have a positive relational rent (Dyer and Singh 1998). With this assumption, we do not mean to downplay the importance of problems in transferring and dividing surplus within alliances, and associated issues of trust, commitment, and moral hazard between partners (e.g., Khanna et al. 1998, Kale et al. 2000, Shah and Swaminathan 2008, Adegbesan and Higgins 2011). Rather, our approach is motivated by our interest in isolating and analyzing how the interplay of reputational and non-reputational effects influences the potential for synergies in alliances, which exist when the total value of firms under an alliance is greater than the sum of their standalone values (e.g., Damodaran 2005, Cabral and Pacheco-de-Almeida 2019).

not depend on reputational effects: reputation-independent project revenues and costs, and potential reputation-independent synergies—where $\mathbf{1}_{d=J}(d)$ is an indicator function, with $\mathbf{1}_{d=J}(J) = 1$ and $\mathbf{1}_{d=J}(I) = 0$. The second line above is the profit component that depends on reputations. There, the first term inside the squiggly brackets corresponds to the reputation-dependent revenue stemming from project P_C in period one, which depends on the interim reputation of project P_C ($r^d_{P_C}$) in period one. The second and third terms correspond to the expected reputation-dependent revenues associated with projects P_A, P_B, and P_C in period two, which depend on ex-post reputations in period two. Ex-post reputations in period two are the reputations associated with a success of project P_C in period one ($r^d_{P_j}(s)$) with probability $q^d_{P_C}$, and the reputations associated with a failure of project P_C in period one ($r^d_{P_j}(f)$) with probability $1 - q^d_{P_C}$.

2.5 Equilibrium Concept

Since the model includes updatable consumer beliefs at two stages, we use *Bayesian* equilibrium as the solution concept. This means that, in equilibrium, for any realization of the firms' qualities q, the firms' decision in period zero must be optimal (i.e., firms form an alliance *if and only if* $\Pi^J(q) > \Pi^I(q)$) given the evolution of consumers' beliefs, which determine firms' and projects' reputations. Moreover, consumers' beliefs (and, consequently, firms' and projects' reputations) must be consistent with the firms' equilibrium decision. This means that both the firms' decision and consumers' beliefs are jointly determined in equilibrium, and that firms' and projects' reputations evolve *endogenously* in our model.

3. Firms' Alliance Decision

We begin our analysis with firms' choice between forming an alliance and independent project implementation. The reputational effects that may influence this decision—the complementarity effect, the performance effect, and the announcement effect—are discussed in detail in the next section.

In our model, two main factors determine firms' alliance formation decision: reputational considerations and reputation-independent synergies. In the analysis that follows, it is useful to distinguish between two types of situations, depending on the relative importance of the two factors.

When the reputation-independent synergies from an alliance are sufficiently strong relative to the importance of reputation for consumer value (i.e., when S is sufficiently large relative to μ), it is optimal

for firms to form an alliance regardless of reputational considerations.[16] In this case we say that reputation-independent synergies are *dominant*. Dominant reputation-independent synergies capture situations where firms' decision to form an alliance is determined, not by reputational considerations, but by motivations such as combining other complementary resources and capabilities or achieving economies of scale and other efficiency improvements (e.g., Dyer and Singh 1998, Dyer et al. 2004, Villalonga and McGahan 2005, Wang and Zajac 2007, Capron and Mitchell 2012). With dominant reputation-independent synergies, firms always form an alliance in equilibrium. Although in this type of situations reputational considerations do not affect firms' decision, firms' and projects' reputations (and their evolution) are still important, as they affect firms' joint profits.

In many other situations, however, reputational considerations play a key role in determining firms' decision to form an alliance. In our model, those situations correspond to when the reputation-independent synergies from an alliance are not sufficiently strong relative to the importance of reputation for consumer value (i.e., when S is not very large relative to μ).[17] In this case we say that reputation-independent synergies are *not dominant*. The fact that, in these situations, firms' decision to form an alliance is affected by reputational considerations implies that such decision may also depend on firms' qualities. This is because firms' qualities affect the performance of the projects in which they participate and, thereby, the evolution of firms' (and projects') reputations.

When reputation-independent synergies are not dominant, the characterization of firms' decision to form an alliance in equilibrium is generally more complicated because the evolution of reputations is itself endogenous—that is, it depends on how firms' qualities affect their decision to form an alliance. We provide a detailed discussion of these aspects in the next section, where we analyze the different reputational effects. Despite these intricacies, we find that there are only three possible types of equilibrium configurations when reputation-independent synergies are not dominant and, because of that, firms' decision to form an alliance is determined by reputational considerations.

[16] The formal condition for this to happen is $S > \mu[r_A V_C + r_B V_B + r_A^I(s)(V_A + V_C)]$ (see the e-companion to the paper for more details).
[17] The formal condition for this to happen is $S \leq \mu[r_A V_C + r_B V_B + r_A^I(s)(V_A + V_C)]$) (see the e-companion to the paper for more details).

LEMMA 1. *If reputation-independent synergies are not dominant, then there are three possible types of equilibrium configurations:*

(i) Firms form an alliance regardless of their qualities;

(ii) Firms implement their projects independently regardless of their qualities;

(iii) Firms form an alliance if and only if $\Pi^J(q) > \Pi^I(q) \Leftrightarrow \gamma_A q_A + \gamma_B q_B > z$*, where* γ_A*,* γ_B*, and* z *are scalars, and either (iii.a)* $\gamma_A \geq 0$ *and* $\gamma_B > 0$*; or (iii.b)* $\gamma_A < 0$ *and* $\gamma_B \geq 0$*.*

Proof of Lemma 1. All proofs are presented in the e-companion to the paper.

The proof of Lemma 1 (in the e-companion to the paper) shows that each of these equilibrium configurations is verified for some assumed model parameters. Equilibrium configurations (i) and (ii) highlight the importance of reputational effects in different ways. Equilibrium configuration (i) shows that, even when reputation-independent synergies are weak or non-existent, reputational synergies may still create the incentive for firms to form an alliance regardless of their qualities. Equilibrium configuration (ii) shows that negative reputational synergies may create the incentive for firms *not* to form an alliance regardless of their qualities, even in the presence of reputation-independent synergies.

Equilibrium configurations (iii.a) and (iii.b) are possibly the most representative of firms' alliance formation decisions in practice, since they are the configurations for which firms' decision depends on their qualities (or levels of competence). In both configurations, firms form an alliance if and only if the inequality $\Pi^J(q) > \Pi^I(q) \Leftrightarrow \gamma_A q_A + \gamma_B q_B > z$ is verified. Each γ_i, which is endogenously determined in equilibrium, measures the marginal impact of the quality of firm i (q_i) on firms' joint profits under an alliance relative to independent project implementation. Since firms' alliance formation decision is conditional on their qualities—that is, for some realizations of firms' qualities an alliance is formed, while for other realizations it is not—, equilibrium configurations (iii.a) and (iii.b) are called *semi-separating equilibria* in game-theoretic terms.[18] Note that the condition $\Pi^J(q) > \Pi^I(q)$, which identifies the firms that form an alliance in equilibrium, ensures that those firms do not have an incentive to pretend they are of another type (i.e., with different quality levels) by not forming an alliance. Similarly, the condition $\Pi^J(q) \leq \Pi^I(q)$, which identifies the firms that do not form an alliance in equilibrium, ensures that those firms do not have an incentive to pretend they are of another type by forming an alliance.

[18] In contrast, since in equilibrium configurations (i) and (ii) firms' alliance formation decision is independent of their qualities, those equilibrium configurations are called *pooling equilibria*. The same is true for when reputation-independent synergies are dominant, and thus firms form an alliance regardless of their qualities.

Panels A and B of Figure 2 illustrate, respectively, equilibrium configurations (iii.a) and (iii.b), with $\gamma_i \neq 0$ for $i \in \{A, B\}$.

- Insert Figure 2 here -

In both equilibrium configurations, firms' incentive to form an alliance is (weakly) increasing in firm *B*'s quality q_B since $\gamma_B \geq 0$. This happens because of our simplifying assumption that firm *B* has no project of its own in period one. Thus, its quality q_B can only have a positive effect on firms' joint profits if an alliance is formed, by affecting the likelihood of success of project P_C in period one. The case of firm *A* is different: since γ_A can be positive (as in equilibrium configuration (iii.a), Panel A) or negative (as in equilibrium configuration (iii.b), Panel B), firms' incentive to form an alliance may increase or decrease with firm *A*'s quality q_A. This happens because firm *A* participates in project P_C *both* under an alliance and under independent project implementation. Thus, its quality q_A has a positive effect on firms' joint profits regardless of their decision, by affecting the likelihood of success of project P_C in period one in both cases. The question is then whether that effect is greater under an alliance (as in configuration (iii.a)) or under independent project implementation (as in configuration (iii.b)). As discussed in detail later, this depends on firm *A*'s participation levels in the different projects under the alliance and on the uncertainty that consumers have about firms' qualities.

Interestingly, the case of equilibrium configuration (iii.b) (represented in Panel B of Figure 2) brings forth the implication that a firm may prefer a low-quality partner to a high-quality partner. Under the assumption that firms' objective is to maximize their joint profits, the best partner for a given firm is the one that leads to the highest incremental joint profits of an alliance relative to independent project implementation. Consider the case of firm *B*, which faces the opportunity to form an alliance with firm *A*. Since $\gamma_A < 0$, increases in firm *A*'s quality q_A increase more joint profits under independent project implementation than under an alliance, thereby reducing the incremental joint profits of an alliance. Thus, the higher the quality of firm *A*, the less attractive it becomes as a partner for firm *B*.

4. Reputational Effects

The decision to form an alliance has a multifaceted impact on firms' reputations and on the reputations of the projects that firms implement. In this section, we show that the reputational implications of an alliance

can be described by three cumulative reputational effects: the complementarity effect, the performance effect, and the announcement effect. We also discuss how these effects influence the value created by an alliance and firms' choice between an alliance and independent project implementation.

4.1 Complementarity Effect

The decision to form an alliance fundamentally affects the way in which firms' reputations are associated to projects. Under independent project implementation, each firm *fully* associates its reputation to its own projects. Firm *A*'s projects (P_A and P_C) are implemented with firm *A*'s reputation, while firm *B*'s project (P_B) is implemented with firm *B*'s reputation. In contrast, under an alliance, the reputation of a jointly implemented project is a combination of the partnering firms' reputations. Clearly, an alliance contributes to increase the reputation of a given firm's project if, through joint project implementation, it allows another firm to associate its higher reputation to that project. The complementarity effect is this *direct* impact that an alliance has on the reputations of jointly implemented projects.

What is the impact of the complementarity effect on firms' joint profits, and thereby on firms' incentives to form an alliance? To answer this question, we need to isolate the complementarity effect from the possible reputational implications of the announcement of an alliance and of project performance (i.e., the announcement and performance effects). We do so by setting firms' interim and ex-post reputations equal to their initial reputations in firms' joint profits expression (i.e., $r_i = r_i^d = r_i^d(\varphi)$, for $i \in \{A, B\}$, $d \in \{I, J\}$, and $\varphi \in \{f, s\}$). As a result, firms' joint profits under independent project implementation become

$$\overline{\Pi}^I = V_A + V_B + 2V_C - K + \mu\{r_A V_A + r_B V_B + 2r_A V_C\},$$

and firms' joint profits under an alliance become

$$\overline{\Pi}^J = V_A + V_B + 2V_C - K + S + \mu\{\textstyle\sum_{j\in\{A,B\}}\left(\alpha_A^j r_A + \alpha_B^j r_B\right)V_j + 2\left(\alpha_A^C r_A + \alpha_B^C r_B\right)V_C\}.$$

Taking these expressions, the complementarity effect contributes to increase firms' joint profits under an alliance if and only if firms' total revenue under that alliance ($\overline{\Pi}^J - S + K$) is greater than firms' total revenue under independent project implementation ($\overline{\Pi}^I + K$). This happens when the alliance contributes to combine high firm reputations with high-value projects.

PROPOSITION 1. *The complementarity effect has a positive impact on firms' joint profits under an alliance if and only if the alliance contributes to combine the high reputation of a given firm with the high-value project(s) of the other firm (i.e., if and only if* $\overline{\Pi}^J - S > \overline{\Pi}^I \Leftrightarrow (r_B - r_A)\left(\alpha_B^A V_A + 2\alpha_B^C V_C - \alpha_A^B V_B\right) > 0$*).*

Proposition 1 echoes well-established ideas about the value of partner complementarity in the alliance literature (e.g., Gulati and Gargiulo 1999, Chung et al. 2000, Kale and Singh 2009). The intuition behind inequality $(r_B - r_A)\left(\alpha_B^A V_A + 2\alpha_B^C V_C - \alpha_A^B V_B\right) > 0$ is simple. Suppose that firm *B* has a higher reputation than firm *A* ($r_B - r_A > 0$). Then, through the complementarity effect, an alliance has an overall (direct) positive impact on firms' joint profits if the positive profit impact of associating firm *B*'s higher reputation to firm *A*'s projects ($\alpha_B^A V_A$ and $2\alpha_B^C V_C$) more than compensates for the loss from associating firm *A*'s lower reputation to firm *B*'s project ($\alpha_A^B V_B$). This is more likely to happen the larger the basic values of firm *A*'s projects (V_A and V_C) and the smaller the basic value of firm *B*'s project (V_B). Thus, the complementarity effect has a positive impact on firms' gains from an alliance when the alliance contributes to combine the high reputation of one firm with the high-value projects of the other firm, whereas it has a negative impact otherwise.

Evidently, a positive impact of the complementarity effect on firms' joint profits favors the formation of an alliance. In our model, this is reflected in the expansion of the set of firm quality levels for which firms form an alliance in equilibrium. For example, in the equilibria presented in Lemma 1 (iii), a positive profit impact of the complementarity effect contributes to decrease the threshold level of quality q_B (for a given quality q_A) above which firms choose an alliance. And if the profit impact of the complementarity effect is sufficiently large, it may give firms the incentive to choose an alliance regardless of their qualities, as in the equilibria presented in Lemma 1 (i).

The analysis of the complementarity effect brings forth the counterintuitive implication that, from the pure standpoint of complementarities between firms' reputations and projects, a high-reputation partner is not necessarily preferable to a low-reputation partner. As mentioned previously, in our model the best partner is the one that maximizes the *incremental joint profits* of an alliance relative to independent project implementation. If we focus on the complementarity effect, the incremental joint profits of an alliance are given by

$$\overline{\Pi}^J - \overline{\Pi}^I = S + \mu(r_B - r_A)\left(\alpha_B^A V_A + 2\alpha_B^C V_C - \alpha_A^B V_B\right).$$

Suppose that $r_B - r_A > 0$, as before. Suppose also that $\alpha_B^A V_A + 2\alpha_B^C V_C - \alpha_A^B V_B > 0$, so that the impact of the complementarity effect on firms' joint profits is positive. It is straightforward to see that an increase in the reputation of firm *A* will reduce the incremental joint profits from the alliance. Intuitively, while a higher reputation of firm *A* increases firms' joint profits under the alliance, it also increases firm *A*'s profits under independent project implementation, contributing to increase firms' joint profits faster under independent project implementation than under the alliance. If, for example, firms used a fixed split to share the incremental joint profits from the alliance, the higher firm *A*'s reputation, the lower firm *B*'s profit under the alliance. Thus, all else being equal, firm *B* would be better off if it formed an alliance with a low-reputation partner than with a high-reputation partner.

This result that a high-reputation partner is not necessarily preferable to a low-reputation partner goes against conventional wisdom on the impact of firm reputation on alliance formation, according to which a high-reputation partner is always preferable (Dollinger et al. 1997, Stuart et al. 1999, Gu and Lu 2014).[19] Nonetheless, it follows naturally from a dyadic (or multi-sided) perspective that considers the impact of alliances on the projects and profits of *all* firms, rather than focusing on the projects and profit of a given firm (for a related discussion, see Wang and Zajac, 2007). More broadly, it reflects the general point in the corporate strategy literature that, in order to fully evaluate the value-creating potential of alliances, one should consider both the impact of other firms' resources or capabilities on the focal firm (e.g., Hennart 1988, Balakrishnan and Koza 1993) and the impact of the focal firm's resources or capabilities on other firms (e.g., Dyer and Singh 1998, Kale and Singh 2009, Capron and Mitchell 2012).

4.2 Performance Effect

The complementarity effect is essentially a static effect. We now turn to the analysis of dynamic reputational effects associated with the formation of an alliance. Since consumers do not observe firms' qualities, they update their beliefs about those qualities based on relevant information that becomes

[19] Interestingly, the analysis of the complementarity effect allows us to identify *opportunity* and *need* mechanisms that are analogous to those discussed in the literature on reputation and alliances (Dollinger et al. 1997, Stuart et al. 1999, Stern et al. 2014, Gu and Lu 2014). A higher reputation increases a firm's opportunity to create value by combining its reputation with other firms' projects. However, a higher reputation also decreases the firm's need to combine other firms' high reputations with its own projects. Clearly, the opportunity of a given firm corresponds to the need of another firm, and *vice versa*. The ultimate effect of a higher reputation on a firm's propensity to form alliances will depend on the relative strength of the two opposing mechanisms (Gu and Lu, 2014).

available. The observed performance of the projects in which firms participate constitutes an important source of such information, as firm quality is a determinant of project performance. The performance effect is the signaling impact of the performance of the projects in which firms participate on their reputations. It is captured in our model by the impact of the performance of project P_C in period one on the reputations of firms *A* and *B*, and we study it by comparing firms' interim and ex-post reputations (i.e., by comparing r_i^d and $r_i^d(\varphi)$).

An important difference between an alliance and independent project implementation concerns the scope of the performance effect. Under independent project implementation, the performance of a given project affects *only* the reputation of the firm that implements it. In contrast, under an alliance, the performance of any joint project affects the reputations of *both* firms. Because of this difference in scope, the way in which consumers update their beliefs after observing the performance of a project that is jointly implemented through an alliance is more intricate, since consumers may attribute the responsibility for a success or failure of that joint project mainly to one of the two firms. We now illustrate how this asymmetric attribution of responsibility is generated and discuss its implications for firms' reputations.[20]

Let us start by taking the case in which firms do not form an alliance, and thus firm *A* implements project P_C independently ($d = I$). In this case, it can be shown that the ex-post reputations of firm *A* after a success ($\varphi = s$) or failure ($\varphi = f$) of project P_C in period one are, respectively

$$r_A^I(s) = r_A + \frac{\sigma_A}{r_A} \quad \text{and} \quad r_A^I(f) = r_A - \frac{\sigma_A}{1-r_A},$$

where σ_A (≥ 0) is the variance of q_A according to consumers' initial beliefs about firms' qualities. Since firm *B* does not participate in the implementation of project P_C, its ex-post reputations are identical to its initial reputations in this case (i.e., $r_B^I(s) = r_B^I(f) = r_B$).[21] For firm *A*, a good performance of project P_C has a positive impact on its reputation, whereas a bad performance has a negative impact. Moreover, that impact will be greater in absolute value—and thus more informative about firm *A*'s quality to consumers—the higher consumers' initial uncertainty about firm *A*'s quality (σ_A).

[20] The following expressions for firms' ex-post reputations are formally stated and proven in the e-companion to the paper (Lemma EC.1).
[21] Recall that, if consumers observe that project P_C is implemented independently by firm *A* at the end of period zero, they interpret that as a continuation of the *status quo*, and thus do not update their initial beliefs about firms' qualities at that stage. This means that consumers' interim beliefs about firms' qualities will be identical to their initial beliefs, and thus firms' interim reputations will be identical to their initial reputations.

If firms form an alliance, they implement project P_C jointly ($d = J$). In this case, the ex-post reputations of firm i ($i \in \{A, B\}$) after a success or failure of project P_C in period one are, respectively

$$r_i^J(s) = r_i^J + \frac{\alpha_i^C \sigma_i^J + (1-\alpha_i^C)\sigma_{A,B}^J}{\alpha_A^C r_A^J + \alpha_B^C r_B^J} \quad \text{and} \quad r_i^J(f) = r_i^J - \frac{\alpha_i^C \sigma_i^J + (1-\alpha_i^C)\sigma_{A,B}^J}{1-\alpha_A^C r_A^J - \alpha_B^C r_B^J},$$

where σ_i^J (≥ 0) is the variance of q_i and $\sigma_{A,B}^J$ is the covariance of q_A and q_B, both according to consumers' interim beliefs after observing the formation of the alliance in period zero. There are two important differences here relative to independent project implementation. First, firms' participation levels in project P_C now affect the magnitude of the performance effect. Second, consumers' perceived correlation between firms' qualities, represented by the (positive or negative) covariance $\sigma_{A,B}^J$, also matters. Note that $\sigma_{A,B}^J$ is endogenously generated as a result of consumers' interim belief updating at the end of period zero.[22] If firm i's participation (α_i^C) is lower, after observing project P_C's performance consumers will update their beliefs about firm i's quality by placing a lower weight on their standalone perception of firm i's quality (σ_i^J), and a greater weight on their perception of how firm i's quality relates to the other firm's quality ($\sigma_{A,B}^J$). This reflects the greater relative importance of the other firm's quality for project P_C's performance. Proposition 2 follows from the above expressions.

PROPOSITION 2.

(i) A good (bad) performance of a project that is implemented independently by a firm has a positive (negative) impact on the reputation of that firm.
(ii) In contrast, both a good and a bad performance of project that is jointly implemented by the two firms under an alliance may have a positive or a negative impact on the reputation of one of the firms.

Result (i) is clear given our foregoing arguments about independent project implementation. Result (ii) illustrates that, under an alliance, consumers may indeed attribute the responsibility for a success or failure of a jointly implemented project mainly to one of the two firms. Result (ii) does so by emphasizing possible limit cases where, due to this asymmetric attribution of responsibility, a firm's reputation may actually decrease (increase) following a success (failure) of a joint project. For these limit

[22] As mentioned before, firms' qualities are initially perceived by consumers as independent. Thus, any perceived correlation between firms' qualities is generated *endogenously* by firms' equilibrium decision of whether to form an alliance, through consumers' interim updating of their beliefs. The emergence of a negative perceived correlation between firms' qualities happens in situations like the one represented in Panel A of Figure 2 where, as the quality of firm *B* (q_B) increases, a lower quality of firm *A* (q_A) is required for firms to choose an alliance in equilibrium (and *vice versa*). As a result, if firms choose an alliance and q_B is high, q_A is more likely to be low. Similarly, if firms choose an alliance and q_B is low, q_A is more likely to be high. This translates into a perceived negative correlation between q_A and q_B.

cases to occur, firms' participation levels in the joint project need to be sufficiently uneven. The intuition is the following. Suppose that firm *A*'s participation in the (jointly implemented) project P_C (α_A^C) is low. In the case of a success of project P_C, consumers revise their beliefs about firm *B*'s quality upward (i.e., firm *B*'s reputation increases), because firm *B*'s participation in that project (α_B^C) is high. However, following the observation (or the announcement) of an alliance, consumers may also perceive firms' qualities as being negatively correlated (i.e., $\sigma_{A,B}^J < 0$). If this negative correlation is sufficiently high (in absolute value), following a success of project P_C consumers revise their beliefs about firm *A*'s quality downward (i.e., firm *A*'s reputation decreases).

Despite these subtleties, we identify situations where, even under an alliance, the performance effect is unambiguously positive. Proposition 3 highlights the corresponding *sufficient* conditions.

PROPOSITION 3.

(i) In alliances where reputation-independent synergies are dominant, the performance of a jointly implemented project has a positive impact on the reputation of the two firms.
(ii) In alliances where reputation-independent synergies are not dominant (and firms' alliance formation decision depends on their qualities), the performance of a jointly implemented project has a positive impact on the reputation of a given firm if:
(ii.a) The firm's participation in the joint project is sufficiently high; or
(ii.b) Consumers' uncertainty about the other firm's quality is sufficiently low.

Result (i) of Proposition 3 establishes an important difference between alliances where reputation-independent synergies are dominant and alliances where they are not. As argued above, a negative impact of joint project performance on a firm's reputation is only possible if, following the observation (or the announcement) of an alliance, consumers perceive firms' qualities as being negatively correlated. Since consumers initially perceive firms' qualities as being independent, the perception of a negative correlation following the decision to form an alliance can only emerge if that decision depends on firms' qualities. This is clearly not the case for alliances where reputation-independent synergies are dominant, since firms form an alliance regardless of their qualities. Naturally, this is also not the case when reputation-independent synergies are not dominant, but reputational synergies nonetheless create incentives for firms to form an alliance regardless of their qualities (Lemma 1 (i)).

Results (ii.a) and (ii.b) of Proposition 3 focus on alliances where firms' alliance formation decision depends on their qualities. Result (ii.a) expresses the intuitive idea that, if a firm has a high enough participation level in a joint project, a success (failure) of that project will necessarily be interpreted as a signal of high (low) quality of that firm by consumers. As such, it further emphasizes the importance of firms' participation levels in joint projects for the performance effect within alliances. In reality, the participation of a firm in a joint project is likely to depend on the firm's project-specific "resource richness", that is, the extent to which the firm controls resources that are key for the implementation of the project, such as distribution networks, technology, and know-how. Thus, our analysis brings forth the implication that the resource richness of an alliance partner may not always benefit a focal firm: whereas forming an alliance with a resource-constrained partner ensures that the success of a jointly implemented project has a positive impact on a firm's reputation, in an alliance with a resource-rich partner this may not be the case. This result is in line with a number of studies in the corporate strategy literature that illustrate how an alliance with a resource-rich partner may sometimes undermine a firm's performance, either because a resource-rich partner may use its power to induce inordinate contributions from the firm and to appropriate a larger share of the value created by the alliance (Bae and Gargiulo 2004, Lavie 2007), or because such an alliance may stifle the development of the firm's own resources and capabilities, thereby bearing negative implications for its future growth (Singh and Mitchell 2005, Vandaie and Zaheer 2014).

Result (ii.b) highlights that the impact of the performance of a jointly implemented project on the reputation of a focal firm is contingent on the uncertainty that consumers have about the quality of the other firm. Fundamentally, this result follows from the fact that if consumers have little uncertainty about the quality of one of the two firms, their perceived correlation between the two firms' qualities will necessarily be very low in absolute value.[23] As seen above in the expressions of firm i's ex-post reputations, when that correlation (as captured by the covariance $\sigma_{A,B}^{J}$) is small in absolute value, a good (bad) project performance necessarily increases (decreases) firm i's reputation. From the standpoint of a

[23] In abstract mathematical terms, this result is known as the Cauchy-Schwarz inequality, which can be applied to any two random variables. In our model, the two random variables of interest are q_A and q_B. See the e-companion to the paper for details.

focal firm, this result suggests an important difference between partnering with mature (or well-established) firms and non-mature (or less established) firms—that is, between partnering with firms for which external stakeholders have low uncertainty and partnering with firms for which that uncertainty is high, such as fledgling start-ups. Our results indicate that, while in an alliance with a mature partner the success of a jointly implemented project will typically have a positive impact on the reputation of the firm, this is not warranted in an alliance with a non-mature partner.

4.3 Announcement Effect

The announcement effect is the signaling impact of the announcement of the decision to form an alliance on firms' reputations. It is captured in our model by the impact of the announcement of an alliance in period zero on the reputations of firms *A* and *B*, and we study it by comparing firms' initial and interim reputations (i.e., by comparing r_i and r_i^d).

We find that the announcement effect crucially depends on how firms' qualities affect the alliance formation decision. For example, if in equilibrium firms form an alliance only if their qualities are sufficiently high—as in Lemma 1 (iii.a) (and Figure 2, Panel A)—, then following the announcement of the alliance consumers will (correctly) update their beliefs about firms' qualities upward, and firms' reputations will increase. In contrast, when firms form an alliance independently of their qualities—as when reputation-independent synergies are dominant and in Lemma 1 (i)—, the alliance formation decision reveals no information about firms' qualities to consumers, and thus the announcement of the alliance has no effect on firms' reputations. Following this rationale, Proposition 4 characterizes the announcement effect for different cases.

PROPOSITION 4.

(i) If reputation-independent synergies are dominant, the announcement of an alliance has no effect on firms' reputations.

(ii) If reputation-independent synergies are not dominant (and firms' alliance formation decision depends on their qualities), the announcement of an alliance may have a positive or a negative effect on a firm's reputation.

Result (i) follows from the fact that, when reputation-independent synergies are dominant, firms form an alliance regardless of their qualities. In such cases, since firms' reputations are unaffected by the

announcement of the alliance, the announcement effect can be ignored in the evaluation of firms' potential gains from the alliance. For the same reason, this also happens when reputation-independent synergies are not dominant, but reputational synergies (such as those generated by the complementarity and performance effects) still create incentives for firms to form an alliance regardless of their qualities (Lemma 1 (i)).

The case of result (ii)—alliances where firms' decision depends on their qualities—is substantially different. Not only is the announcement of an alliance informative about firms' qualities to consumers, but also the resulting effect on firms' reputations may be non-trivial. Namely, a given firm's reputation may increase or decrease following the announcement of an alliance. To illustrate this point, let us consider firm *A*. Its quality q_A has a positive effect on firms' joint profits both under an alliance and under independent project implementation, in both cases by affecting the likelihood of success of project P_C in period one. If firms' joint profits increase faster with q_A under an alliance than under independent project implementation, firms' incentives to form an alliance increase with q_A (i.e., γ_A is positive). This is correctly inferred by consumers when they observe an alliance, and thus the announcement of an alliance has a positive impact on firm *A*'s reputation. If instead firms' joint profits increase more slowly with q_A under an alliance than under independent project implementation, firms' incentives to form an alliance decrease with q_A (i.e., γ_A is negative), and the announcement of an alliance has a negative impact on firm *A*'s reputation. These two instances are represented in Panels A and B of Figure 2, respectively.[24]

Despite this *a priori* ambiguous impact of the announcement of an alliance on a firm's reputation, we identify *sufficient* conditions for a firm's reputation to increase or decrease. These conditions are summarized in Proposition 5, focusing again on firm *A*.

PROPOSITION 5. *If reputation-independent synergies are not dominant (and firms' alliance formation decision depends on their qualities):*

(i) The announcement of an alliance has a positive impact on firm A's reputation if the uncertainty that consumers have about the quality of firm A is sufficiently low and the uncertainty that consumers have about the quality of firm B is high.

[24] The illustration with firm *B* is more straightforward than that with firm *A*. Because of a simplifying modeling choice, firm *B* is not endowed with a project of its own in period one. This implies that its quality q_B can only have a positive effect on firms' joint profits under an alliance, by affecting the likelihood of success of project P_C in period one. Hence, firms' incentive to form an alliance is necessarily (weakly) increasing in q_B (i.e., $\gamma_B \geq 0$). This is correctly inferred by consumers when they observe an alliance, and therefore the announcement of an alliance has a (weakly) positive signaling impact on firm *B*'s reputation.

(ii) The announcement of an alliance has a negative impact on firm A's reputation if the uncertainty that consumers have about the quality of firm A is sufficiently high and its participation in the focal project P_C under an alliance is sufficiently low.

The intuition for result (i) of Proposition 5 is the following. If consumers have low uncertainty about the quality of firm *A* (i.e., a relatively precise idea of quality q_A) and project P_C is implemented independently by firm *A*, the performance of project P_C is likely to have a small impact on the reputation of firm *A*. However, if firm *A* forms an alliance, the performance of the (jointly implemented) project P_C will also affect the reputation of firm *B*. If consumers have significant uncertainty about the quality of firm *B*, the potential impact of the performance of project P_C on firm *B*'s reputation is large. Therefore, a higher quality of firm *A* will have a greater impact on firms' joint profits if firms form an alliance than if they pursue independent project implementation (i.e., $\gamma_A > 0$). As argued above, this is correctly inferred by consumers when they observe an alliance, and thus the reputation of firm *A* increases. Returning to our previous analogy with mature (or well-established) firms and non-mature (or less established) firms, this result suggests that a mature and a non-mature firm may have purely reputational motivations to form an alliance. Moreover, since the underlying mechanism for the result is the improvement of the reputation of the mature firm, such an alliance may be desirable even if the reputation or the competence level of the non-mature firm are not very high.

Result (ii) of Proposition 5 identifies conditions under which the announcement effect is negative. Despite contrasting with result (i), its intuition is analogous. If consumers have significant uncertainty about the quality of firm *A* and firm *A*'s participation level in project P_C under an alliance is low, a higher quality of firm *A* will have a greater impact on firms' joint profits if firm *A* implements project P_C independently than if firms form an alliance and implement project P_C jointly (i.e., $\gamma_A < 0$). Again, as argued above, this is correctly inferred by consumers when they observe an alliance, and thus firm *A*'s reputation decreases. To the extent that a high participation of a firm in a joint project reflects that firm's project-specific "resource richness", this result has an interesting implication. While it may be tempting (and often necessary) for a resource-constrained firm to form an alliance with a resource-rich partner—to gain access to important resources and competences like distribution channels, technology, or know-how

(e.g., Stuart, 2000)—, such an alliance may constitute a double-edged sword for the resource-constrained firm, as the announcement of the alliance may have a negative impact on its reputation.

4.4 Combined Impact of the Three Reputational Effects

The cumulative impact of the three identified reputational effects determines whether reputational synergies contribute to increase or decrease the value created by an alliance relative to independent project implementation. A salient implication of our analysis is that the notion of reputational synergies should include, not only the more *static* direct combinations of firms' reputations and projects (the complementarity effect), but also the *dynamic* signaling effects of the announcement of an alliance and of project performance. Indeed, as indicated by Proposition 6 below, a perspective that focuses exclusively on the complementarity effect may lead to mistaken decisions.

> PROPOSITION 6. *The combined impact of the announcement and performance effects on firms' joint profits under an alliance (versus independent project implementation) may counter and dominate the impact of the complementarity effect, thereby determining firms' optimal choice between forming an alliance and not doing so.*

The proof of Proposition 6 (in the e-companion to the paper) presents a detailed example. In that example, we show that focusing on the (negative) complementarity effect and overlooking the announcement and performance effects would lead high-quality firms to make the suboptimal decision of not forming an alliance.

As hinted in our prior discussions, ascertaining the impact of the announcement and performance effects may be *a priori* challenging, since they are sophisticated and endogenously determined in equilibrium. Despite this, our analysis provides valuable insights on how critical contingencies affect, not only the direction of the announcement and performance effects, but also their relative importance in determining firms' alliance formation decisions. Specifically, their relative importance largely depends on the precision of (consumers') perceptions of firms' qualities or competence levels. If there is little uncertainty about the qualities of both firms—possibly because both firms are mature (or well-established)—the complementarity effect typically dominates, as the reputational impacts of the announcement of an alliance and of project performance are likely to be negligible. In contrast, if there is substantial uncertainty about the quality of at least one of the two firms, the announcement and

performance effects will tend to be particularly important. The relative importance of the different reputational effects also depends on the extent to which firms' initial reputations differ. If firms' initial reputations are similar, the complementarity effect fades, and the other effects are more likely to take center stage.

5. Discussion

We now consider relevant connections between the presented analysis and different research streams. Notably, our results have important implications for the scholarly literature that focuses on partner selection in alliances (e.g., Geringer 1988, Shah and Swaminathan 2008). Our discussion of possible equilibrium configurations implies that a firm may prefer a low-quality partner to a high-quality partner. Similarly—and perhaps more importantly in the context of this paper—, the analysis of the complementarity effect reveals that a high-reputation partner is not necessarily preferable to a low-reputation partner. These results may counter intuition and conventional wisdom (Dollinger et al. 1997, Stuart et al. 1999, Gu and Lu 2014), but they naturally follow from the application of a dyadic (or multi-sided) perspective that considers the impact of an alliance on the reputations and projects of *all* firms involved. Furthermore, our consideration of the announcement effect complements established sociological status-based arguments on partner selection, whereby a focal firm should prefer to partner with highly regarded firms, since the endorsement provided by those firms signals (and reinforces) the focal firm's own status, recognition, or legitimacy (e.g., Oliver 1990, Stuart 2000, Dacin et al. 2007).[25] In the context of our model, applying this endorsement mechanism would suggest that forming an alliance with a high-reputation partner should always have a positive impact on a firm's reputation. However, the analysis of the announcement effect implies that forming an alliance with a high-reputation partner may have a negative impact on a firm's reputation (i.e., signal a low firm quality), because the incentive to form an alliance may decrease with a firm's quality.

[25] Reputation and status can be interpreted as distinct but related signals of quality (or competence). Whereas reputation is more akin to an *absolute* expectation of an entity's quality given its prior actions, status is closer to an expectation of an entity's placement in a socially constructed *ordering* or *ranking* of quality (e.g., Merton 1957, Stern et al. 2014). Broadly, sociological status-based arguments on partner selection purport that associations with highly regarded partners are typically beneficial for an entity because they function as endorsements of that entity's quality (e.g., Merton 1968 [1973], Podolny 1994). This happens since highly regarded partners are likely to be both selective about the entities that they associate themselves with, and reliable evaluators of the qualities of those entities.

Moreover, another way of understanding our analysis is to consider it from the perspective of the resource-based view (RBV) of the firm (e.g., Penrose 1959, Wernerfelt 1984, Barney 1986, 1991, Dierickx and Cool 1989, Peteraf 1993). We see our analysis as bringing forth three main implications from the standpoint of the RBV. First, since a reputation is a valuable resource that is largely *non-separable* from its holder (i.e., a firm), there are limitations to its *tradability* or *transferability* across firms. This hampers the existence of "strategic factor markets" for firm reputation (Barney 1986, Dierickx and Cool 1989), and implies that joint project implementation through alliances is a primary means for firms to share their reputations. Second, the dynamic signaling effects uncovered in our model (i.e., the announcement and performance effects) highlight that, in the case of reputation, resource deployment and accumulation processes are closely *intertwined*. A firm associates its reputation to a given project by participating in it. In turn, the value of the firm's reputation may evolve based, not only on project outcomes, but also on the observation of the firm's decision to participate in the project.[26] Finally, the fact that the deployment of a firm's reputation to a project may, in and of itself, reduce the value of that reputation and thereby impair its deployment to other projects indicates that reputation deployment decisions should be carefully considered by managers, notwithstanding the largely *fungible* and *scale free* nature of firm reputation as a resource (e.g., Levinthal and Wu 2010, Wu 2013).

Beyond the realm of strategy, this paper is also related to an established body of literature in economics that studies the dynamics of reputation formation and evolution (e.g., Klein and Leffler 1981, Kreps and Wilson 1982). This literature largely focuses on projects developed by a single entity. There are, however, some exceptions, such as the articles by Jeon (1996) and Bar-Isaac (2007) on reputation formation in teams of individuals, and the article by Almeida Costa and Vasconcelos (2010) on the reputational implications of partnerships to develop a new project.[27] Our analysis complements those

[26] Resource accumulation and deployment processes are also intertwined in the case of innovations and capabilities that are developed through learning-by-doing processes. However, in the case of firm reputation, the mechanisms that drive the relationship between deployment and accumulation processes are different: they result from updated inferences that are made about the firm following the announcement of the firm's projects and the performance of those projects.

[27] Given that we formalize reputations as signals of firms' qualities to consumers, another (more indirectly) related literature to our paper is the literature on brand alliances within marketing (e.g., Park et al. 1996, Simonin and Ruth 1998, Rao et al. 1999). Brand alliances can be broadly defined as situations where two or more brand names are presented jointly to consumers. This literature shows empirical evidence that combining two or more brands may enhance consumers' quality perceptions of a given product (Park et al. 1996, Rao et al. 1999)—in a similar way to the complementarity effect—, and that consumers' attitudes toward a brand alliance have spillovers on their subsequent attitudes toward the partnering brands (Park et al. 1996, Simonin and Ruth 1998)—akin to the announcement and performance effects. Hence, our game-theoretic analysis contributes to this literature as well.

articles in several ways. First, the focus of our model is on projects that firms may implement either independently or jointly, which allows us to contrast the reputational implications of alliances and independent project implementation. Second, the fact that we analyze a broad range of alliances—by not imposing any restrictions on the number of jointly implemented projects and on firms' participation levels therein—allows us to provide a comprehensive view of their reputational implications. Third, we explicitly consider that firms may have non-reputational motivations to form alliances and examine the reputational implications of an alliance both when such motivations determine the firms' decision and when they do not. Finally, we isolate and provide an integrated analysis of three cumulative reputational effects that are associated with firms' alliance formation decisions.

We close this section by discussing some of the model assumptions. The model incorporates reputation-independent synergies in addition to reputational effects. However, an analysis of the reputational effects of alliances can be done without considering reputation-independent synergies. In fact, alliances where reputation-independent synergies are not present are a particular case of alliances where reputation-independent synergies are not dominant, which are analyzed in the model. Nonetheless, it is important to consider reputation-independent synergies because, as extensively studied in the strategy literature, alliances are often motivated by considerations other than reputational effects (e.g., Dyer and Singh 1998, Dyer et al. 2004, Villalonga and McGahan 2005, Wang and Zajac 2007, Capron and Mitchell 2012). Thus, the incorporation of reputation-independent synergies in the model allows us to highlight how those synergies interact with (and influence) reputational effects to determine firms' incentives to form alliances. Moreover, it allows us to better situate the analysis and results in the context of the existing strategy research. Finally, as illustrated in the Conclusion section below, the consideration of reputation-independent synergies aids the derivation of empirical implications from the results and the identification of reputational effects in real-life alliance formation decisions.

We have also assumed that the quality of a jointly implemented project is given by the weighted average of the qualities of the two participating firms, where the weights are the firms' participation levels in the project. This is a simple (and analytically tractable) way of capturing the intuitive idea that an increase in a firm's quality has a positive impact on the quality of a joint project in which the firm

participates, and that this impact is stronger the higher the firm's participation level in that joint project. However, one limitation of this specification is that it does not capture the possibility of mutual learning between alliance partners in the context of a joint project. Such mutual learning could increase the quality of a joint project beyond the weighted average of the participating firms' qualities.[28] A parsimonious way of incorporating mutual learning between alliance partners in our model would be to assume that the quality of a jointly implemented project P_j is given by $q_{P_j} = \lambda + (1-\lambda)(\alpha_A^j q_A + \alpha_B^j q_B)$, where the parameter $\lambda \in [0,1)$ would capture the extent of mutual learning in the context of the joint project. Higher (Lower) levels of λ would correspond to situations where mutual learning becomes more (less) relevant for the quality of a joint project relative to the basic combination of firms' qualities. We explored this alternative specification and obtained that the set of possible equilibrium configurations and the associated reputational effects remain qualitatively the same as in the base specification. Nonetheless, it also became evident that the possibility of mutual learning increases firms' incentives to form an alliance. This happens not only because mutual learning has a positive impact on the qualities of jointly implemented projects, but also because this impact is anticipated by consumers, leading to increases in the reputations of those joint projects.[29]

Although the definition of alliances in our model is quite general, we did not consider the reputational implications of the choice between different types of alliances. In the e-companion to the paper, we explore this aspect with a model extension that analyzes firms' choice of alliance scope.[30] In that extension, we consider that firms have two contrasting alliance options: a *narrow alliance*, where they collaborate in the implementation of a single project, and a *wide alliance*, where they collaborate in

[28] Conceivably, mutual learning could even allow the quality of a joint project to exceed the highest of the two firms' individual qualities. We thank an anonymous Reviewer for pointing out these issues.

[29] In contrast to this analytical exploration based on our model, the existing research on learning within alliances largely focuses on the latent tension between partnering firms' shared incentives to exchange knowledge to achieve an alliance's objectives, and on each firm's own private incentives to learn as much (and as fast) as possible from other alliance partners both to increase its bargaining power *vis-à-vis* those partners and to obtain advantages outside the context of the alliance (e.g., Hamel et al. 1989, Hamel 1991, Khanna et al. 1998). We leave the examination of the potentially insightful (and complex) interplay of learning, reputational effects, and bargaining positions in alliances for future research.

[30] The existing literature on alliance scope largely emphasizes how the scope of collaboration in an alliance may affect the tension between firms' incentives to exchange knowledge to achieve the alliance's objectives and their incentives to learn to attain their own private goals (e.g., Khanna 1998, Khanna et al. 1998, Baum et al. 2000, Oxley and Sampson 2004, Lunnan and Haugland 2008). Rather than addressing this tension between common and private benefits, in the extension of our model we follow the same approach as in the main analysis, focusing on the impact of the scope of the alliance on firms' joint profits.

the implementation of all their projects.[31] Intuitively, the analysis of the complementarity effect in this case implies that greater complementarities between firms' reputations and projects (i.e., a higher reputation of one firm and more valuable projects of the other firm) promote a greater scope of collaboration between firms. In line with our main analysis, we also show that the impact of the announcement and performance effects on the choice between a narrow and a wide alliance may counter and dominate the complementarity effect and, therefore, should not be ignored.

Despite being framed in terms of alliances, the model extension on alliance scope may also capture some of the differences between the reputational implications of mergers and acquisitions (M&As) and alliances. Since M&As typically entail a greater degree of integration of the firms' organizations than alliances, they conceivably involve a greater scope of collaboration between those organizations. Therefore, in the model extension, a wide alliance may approximate a merger or an acquisition, and the foregoing comparison between a wide and a narrow alliance may then also capture important features of how reputational implications affect firms' choice between M&As and alliances.[32] Hence, the model extension may complement the existing literature on firms' choice between these two governance modes, by emphasizing the role of reputational implications therein.[33]

Lastly, in our model we focus on reputation as consumers' perceptions of firm quality. The formalization of reputation as a signal of quality to potential consumers provides a very natural and intuitive avenue to discuss the different reputational effects and the influence of firms' underlying qualities (or levels of competence) in their decision to form an alliance. This modeling choice may also be justified by the fact that prospective alliance partners typically conduct some form of due diligence to evaluate each other's characteristics with a significant level of accuracy, and therefore are likely to be

[31] As an example of a narrow alliance, consider again the partnership between Huawei and Leica to collaborate in the development of phone photography technology. A wide alliance can be illustrated by the 1999 cross-shareholding agreement between Renault and Nissan, which yielded synergies in multiple areas, such as the joint development of engines, platforms, batteries, and other key components.

[32] Of course, even in the case of M&As, the firms' organizations may not implement all their projects jointly. For example, following the acquisition of Whole Foods by Amazon in 2017, the two organizations retained a significant level of autonomy. Thus, the assumption that under a merger or an acquisition all the projects are implemented jointly by the firms' organizations does not necessarily hold. Independently of the specific operationalization of the scope of collaboration under a merger or an acquisition and under an alliance, the main point here is that the scope of collaboration is conceivably greater under the former type of governance mode.

[33] The existing literature has stressed several distinct factors that may influence firms' choice between M&As and alliances, such as information asymmetries between firms, the non-separability of the desired complementary resources and capabilities from firms, appropriability risks, management and integration costs, and legal or institutional barriers (e.g., Hennart 1988, Balakrishnan and Koza 1993, Dyer et al. 2004, Villalonga and McGahan 2005, Wang and Zajac 2007, McCann et al. 2016).

better informed about each other than external stakeholders (such as consumers). In contrast to our approach, the existing empirical literature on how firms' reputations affect their alliance activity largely focuses on reputation as a signal of firm quality (or level of competence) to potential partners (Dollinger et al. 1997, Stuart et al. 1999, Gu and Lu 2014, Stern et al. 2014). Despite this difference, it is important to note that similar effects would be present if firms' reputations were formalized as signals of firms' qualities to other potential partners beyond a focal alliance. Broadly, whereas in our model reputational considerations are important because they affect firms' future revenues from projects (and associated products), in that case reputational considerations would matter because they would affect firms' prospects of forming future alliances with other potential partners.

6. Conclusion

In this paper, we develop an adverse selection game-theoretic model to analyze how reputational considerations affect firms' incentives to form alliances. Our model allows us to isolate and characterize three cumulative reputational effects—the complementarity effect, the performance effect, and the announcement effect—and to discuss how their interplay may influence firms' gains from forming an alliance. In doing so, we provide a conceptual framework that contributes to a better understanding of the reputational implications of alliances and that could be useful to managerial practice.

Our results also bring forth implications that are amenable to empirical testing. First, it is likely that reputational synergies between firms will be a weaker predictor of alliance formation decisions when other types of synergies are stronger. For example, we expect the announcement effect to be insignificant in alliances where the potential for synergies that are not related to reputational considerations is very high. In contrast, when the potential for such synergies is lower, the analysis of the complementarity effect supports the prediction that alliances between mature firms with disparate reputation levels will be more prevalent (as they should be more synergistic) than alliances between mature firms with similar reputation levels. Moreover, all else being equal, we expect the announcement of an alliance and the performance of joint projects to have a more significant impact on the reputations of non-mature firms than on the reputations of mature ones. Our results also suggest that the direction and magnitude of these

dynamic signaling effects should be contingent, not only on the maturities of the partnering firms, but also on their relative degrees of resource richness.[34]

In closing, we mention two salient theoretical research opportunities that could complement our work. It may be interesting to study the reputational implications of alliances while explicitly incorporating alliance partners' value appropriation concerns, as these may have a significant influence on the formation and functioning of alliances (e.g., Khanna et al. 1998, Kale et al. 2000, Shah and Swaminathan 2008, Adegbesan and Higgins 2011). In our model, we largely abstract from these issues by assuming that firms can transfer surplus between themselves without frictions, and thus that their objective is to maximize joint profits. In addition, given our specific theoretical focus, our model does not address partner search and matching processes, since it assumes that the pair of firms that face the opportunity to form an alliance is exogenously defined. Studying the impact of reputational considerations on those processes should enable a tighter connection between this line of work and research that focuses on the endogenous emergence of firm networks (e.g., Gulati and Gargiulo 1999).

References

Adegbesan, J. A., M. J. Higgins. 2011. The intra-alliance division of value created through collaboration. *Strategic Management Journal* **32**(2) 187–211.

Almeida Costa, L., L. Vasconcelos. 2010. Share the fame or share the blame? The reputational implications of partnerships. *Journal of Economics & Management Strategy* **19**(2) 259–301.

Bae, J., M. Gargiulo. 2004. Partner substitutability, alliance network structure, and firm profitability in the telecommunications industry. *Academy of Management Journal* **47**(6) 843–859.

Balakrishnan, S., M.P. Koza. 1993. Information asymmetry, adverse selection and joint ventures. *Journal of Economic Behavior & Organization* **20**(1) 99–117.

Bar-Isaac, H. 2007. Something to prove: Reputation in teams. *RAND Journal of Economics* **38**(2) 495–511.

Barney, J.B. 1986. Strategic factor markets: Expectations, luck, and business strategy. *Management Science* **32**(10) 1231–1241.

[34] Our analysis of the announcement effect also suggests that, in situations where firms' reputations result from the perceptions of financial markets (instead of consumers), reputational considerations should be an important explanatory factor of how the announcement of an alliance between publicly listed firms affects those firms' stock-market valuations. Insofar as the desirability of an alliance is contingent on the partnering firms' competence levels, changes in those firms' stock-market valuations upon the announcement of the alliance ought to reflect, among other things, updated inferences of financial markets about those firms' competence levels (i.e., changes to those firms' reputations from the perspective of financial markets). In such cases, studying empirically the impact of reputational considerations on firms' stock-market valuations seems to be another worthwhile research endeavor, from the standpoint of both academic interest and managerial practice.

Barney, J.B. 1991. Firm resources and sustained competitive advantage. *Journal of Management* 17(1) 99–120.

Baum, J.A., T. Calabrese, B.S. Silverman. 2000. Don't go it alone: Alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal* **21**(3) 267–294.

Bergh, D.D., D.J. Ketchen Jr, B.K. Boyd, J. Bergh. 2010. New frontiers of the reputation-performance relationship: insights from multiple theories. *Journal of Management* **36**(3) 620–632.

Cabral, L.M. 2000. Stretching firm and brand reputation. *RAND Journal of Economics* **31**(4) 658–673.

Cabral, L.M., G. Pacheco-de-Almeida. 2019. Alliance formation and firm value. *Management Science* **65**(2) 879–895.

Capron, L., W. Mitchell. 2012. *Build, borrow, or buy: Solving the growth dilemma*. Harvard Business Press: Cambridge, MA.

Carter, S.M., D.L. Deephouse. 1999. 'Tough talk' and 'soothing speech': Managing reputations for being tough and for being good. *Corporate Reputation Review* **2**(4) 308–332.

Chung, S., H. Singh, K. Lee. 2000. Complementarity, status similarity and social capital as drivers of alliance formation. *Strategic Management Journal* **21**(1) 1–22.

Dacin, M.T., C. Oliver, J.P. Roy. 2007. The legitimacy of strategic alliances: An institutional perspective. *Strategic Management Journal* **28**(2) 169–187.

Damodaran, A. 2005. The value of synergy. Technical report, Stern School of Business, New York University: New York, NY.

Deephouse, D.L. 2000. Media reputation as a strategic resource: An integration of mass communication and resource-based theories. *Journal of Management* **26**(6) 1091–1112.

Dierickx, I., K. Cool. 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Science* **35**(12) 1504–1511.

Dollinger, M.J., P.A. Golden, T. Saxton. 1997. The effect of reputation on the decision to joint venture. *Strategic Management Journal* **18**(2) 127–140.

Dyer, J.H., P. Kale, H. Singh. 2004. When to ally and when to acquire. *Harvard Business Review* **82**(4) 109–115.

Dyer, J.H., H. Singh. 1998. The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review* **23**(4) 660–679.

Fombrun, C.J. 1996. *Reputation: Realizing Value from the Corporate Image*. Harvard Business School Press: Cambridge, MA.

Fombrun, C.J., M. Shanley. 1990. What's in a name? Reputation building and corporate strategy. *Academy of Management Journal* **33**(2) 233–258.

Geringer, J.M. 1988. *Joint venture partner selection: Strategies for developed countries*. Quorum Books: Westport, CT.

Gomes-Casseres, B. 1997. Alliance strategies of small firms. *Small Business Economics* **9**(1) 33–44.

Greenwood, R., S. X. Li, R. Prakash, D. L. Deephouse. 2005. Reputation, diversification, and organizational explanations of performance in professional service firms. *Organization Science* **16**(6) 661–673.

Gu, Q., X. Lu. 2014. Unraveling the mechanisms of reputation and alliance formation: A study of venture capital syndication in China. *Strategic Management Journal* **35**(5) 739–750.

Gulati, R., M. Gargiulo. 1999. Where do interorganizational networks come from? *American Journal of Sociology* **104**(5) 1439–1493.

Haleblian, J.J., M.D. Pfarrer, J.T. Kiley. 2017. High-reputation firms and their differential acquisition behaviors. *Strategic Management Journal* **38**(11) 2237–2254.

Hamel, G., Y. L. Doz, C. K. Prahalad. 1989. Collaborate with your competitors and win. *Harvard Business Review* **67**(1) 133–139.

Hamel, G. 1991. Competition for competence and interpartner learning within international strategic alliances. *Strategic Management Journal* **12**(S1) 83–103.

Hennart, J.F. 1988. A transaction costs theory of equity joint ventures. *Strategic Management Journal* **9**(4) 361–374.

Hörner, J. 2002. Reputation and Competition. *American Economic Review* **92**(3) 644–663.

Jeon, S. 1996. Moral hazard and reputational concerns in teams: Implications for organizational choice. *International Journal of Industrial Organization* **14**(3) 297–315.

Kale, P., H. Singh. 2009. Managing strategic alliances: What do we know now, and where do we go from here? *Academy of Management Perspectives* **23**(3) 45–62.

Kale, P., H. Singh, H. Perlmutter. 2000. Learning and protection of proprietary assets in strategic alliances: Building relational capital. *Strategic Management Journal* **21**(3) 217–237.

Khanna, T. 1998. The scope of alliances. *Organization Science* **9**(3) 340–355.

Khanna, T., R. Gulati, N. Nohria. 1998. The dynamics of learning alliances: Competition, cooperation, and relative scope. *Strategic Management Journal* **19**(3) 193–210.

Klein, B., K.B. Leffler. 1981. The role of market forces in assuring contractual performance. *Journal of Political Economy* **89**(4) 615–641.

Kreps, D.M., R. Wilson. 1982. Reputation and imperfect information. *Journal of Economic Theory* **27**(2) 253–279.

Lange, D., P.M. Lee, Y. Dai. 2011. Organizational reputation: A review. *Journal of Management* **37**(1) 153–184.

Lavie, D. 2007. Alliance portfolios and firm performance: A study of value creation and appropriation in the US software industry. *Strategic Management Journal* **28**(12) 1187–1212.

Levinthal, D.A., B. Wu. 2010. Opportunity costs and non-scale free capabilities: Profit maximization, corporate scope, and profit margins. *Strategic Management Journal* 31(7) 780–801.

Lunnan, R., S.A. Haugland. 2008. Predicting and measuring alliance performance: A multidimensional analysis. *Strategic Management Journal* **29**(5) 545–556.

McCann, B.T., J.J. Reuer, N. Lahiri. 2016. Agglomeration and the choice between acquisitions and alliances: An information economics perspective. *Strategic Management Journal* **37**(6) 1085–1106.

Merton, R.K. 1957. The role-set: Problems in sociological theory. *British Journal of Sociology* **8**(2) 106–120.

Merton, R.K. 1968 [1973]. The Matthew effect in science. In *The Sociology of Science*, Storer NW (ed.). University of Chicago Press: Chicago, IL: 439–459.

Milgrom, P., J. Roberts. 1982. Predation, reputation, and entry deterrence. *Journal of Economic Theory* **27**(2) 280–312.

Mishina, Y., E. S. Block, M. J. Mannor. 2012. The path dependence of organizational reputation: How social judgment influences assessments of capability and character. *Strategic Management Journal* **33**(5) 459–477.

Oliver, C. 1990. Determinants of interorganizational relationships: Integration and future directions. *Academy of Management Review* **15**(2) 241–265.

Oxley, J.E., R.C. Sampson. 2004. The scope and governance of international R&D alliances. *Strategic Management Journal* **25**(8-9) 723–749.

Park, C.W., S.Y. Jun, A.D. Shocker. 1996. Composite branding alliances: An investigation of extension and feedback effects. *Journal of Marketing Research* **33**(4) 453–466.

Penrose, E.T. 1959. *The Theory of the Growth of the Firm*. John Wiley & Sons: New York, NY.

Peteraf, M.A. 1993. The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal* **14**(3) 179–191.

Podolny, J.M. 1994. Market uncertainty and the social character of economic exchange. *Administrative Science Quarterly* **39**(3) 458–483.

Raithel, S., M. Schwaiger. 2015. The effects of corporate reputation perceptions of the general public on shareholder value. *Strategic Management Journal* **36**(6) 945–956.

Rao, A.R., L. Qu, R.W. Ruekert. 1999. Signaling unobservable product quality through a brand ally. *Journal of Marketing Research* **36**(2) 258–268.

Rindova, V.P., I.O. Williamson, A.P. Petkova, J.M. Sever. 2005. Being good or being known: An empirical examination of the dimensions, antecedents, and consequences of organizational reputation. *Academy of Management Journal* **48**(6) 1033–1049.

Roberts, P.W., G.R. Dowling. 2002. Corporate reputation and sustained superior financial performance. *Strategic Management Journal* **23**(12) 1077–1094.

Shah, R.H., V. Swaminathan. 2008. Factors influencing partner selection in strategic alliances: The moderating role of alliance context. *Strategic Management Journal* **29**(5) 471–494.

Shapiro, C. 1983. Premiums for high quality products as returns to reputations. *The Quarterly Journal of Economics* **98**(4) 659–679.

Simonin, B.L., J.A. Ruth. 1998. Is a company known by the company it keeps? Assessing the spillover effects of brand alliances on consumer brand attitudes. *Journal of Marketing Research* **35**(1) 30–42.

Singh, K., W. Mitchell. 2005. Growth dynamics: The bidirectional relationship between interfirm collaboration and business sales in entrant and incumbent alliances. *Strategic Management Journal* **26**(6) 497–521.

Stern, I., J.M. Dukerich, E. Zajac. 2014. Unmixed signals: How reputation and status affect alliance formation. *Strategic Management Journal* **35**(4) 512–531.

Stuart, T.E. 2000. Interorganizational alliances and the performance of firms: A study of growth and innovation rates in a high-technology industry. *Strategic Management Journal* **21**(8) 791–811.

Stuart, T.E., H. Hoang, R.C. Hybels. 1999. Interorganizational endorsements and the performance of entrepreneurial ventures. *Administrative Science Quarterly* **44**(2) 315–349.

Tadelis, S. 1999. What's in a Name? Reputation as a Tradeable Asset. *American Economic Review* **89**(3) 548–563.

Tirole, J. 1996. A theory of collective reputations (with applications to the persistence of corruption and to firm quality). *The Review of Economic Studies* **63**(1) 1–22.

Vandaie, R., A. Zaheer. 2014. Surviving bear hugs: Firm capability, large partner alliances, and growth. *Strategic Management Journal* **35**(4) 566–577.

Villalonga, B., A.M. McGahan. 2005. The choice among acquisitions, alliances, and divestitures. *Strategic Management Journal* **26**(13) 1183–1208.

Wang, L., E.J. Zajac. 2007. Alliance or acquisition? A dyadic perspective on interfirm resource combinations. *Strategic Management Journal* **28**(13) 1291–1317.

Weigelt, K., C. Camerer. 1988. Reputation and corporate strategy: A review of recent theory and applications. *Strategic Management Journal* **9**(5) 443–454.

Wernerfelt, B. 1984. A resource-based view of the firm. *Strategic Management Journal* **5**(2) 171–180.

Wu, B. 2013. Opportunity costs, industry dynamics, and corporate diversification: Evidence from the cardiovascular medical device industry, 1976–2004. *Strategic Management Journal* **34**(11) 1265–1287.

Zavyalova, A., M.D. Pfarrer, R.K. Reger, T.D. Hubbard. 2016. Reputation as a benefit and a burden? How stakeholders' organizational identification affects the role of reputation following a negative event. *Academy of Management Journal* **59**(1) 253–276.

Appendix: Figures

Initial Conditions	Period Zero	Period One	Period Two
- Firm A and firm B have projects P_j with $j \in \{A, B, C\}$. Projects P_A and P_B, which belong respectively to firm A and firm B, start in period two. Project P_C, which belongs to firm A, starts in period one (and continues in period two). - Firm $i = A, B$ has a quality $q_i \in [0,1]$ and an initial reputation $r_i \in [0,1]$. Firms know each other's qualities. In contrast, consumers do not know firms' (exact) qualities. They hold beliefs about those qualities, which determine firms' reputations.	- Firms decide (decision d) to implement their projects either independently or jointly, through an alliance ($d \in \{I, J\}$). - After firms' decision $d \in \{I, J\}$ is observed by consumers, firm i's reputation is updated to $r_i^d \in [0,1]$ (interim reputation).	- Project P_C is implemented and its performance outcome (φ) is revealed: either a failure or a success ($\varphi \in \{f, s\}$). - Depending on the performance of project P_C and on firms' decision d, firm i's reputation is updated to $r_i^d(\varphi) \in [0,1]$ (ex-post reputation).	- Projects P_A, P_B, and P_C are implemented.

Figure 1 Timing of the Model and Main Parameters

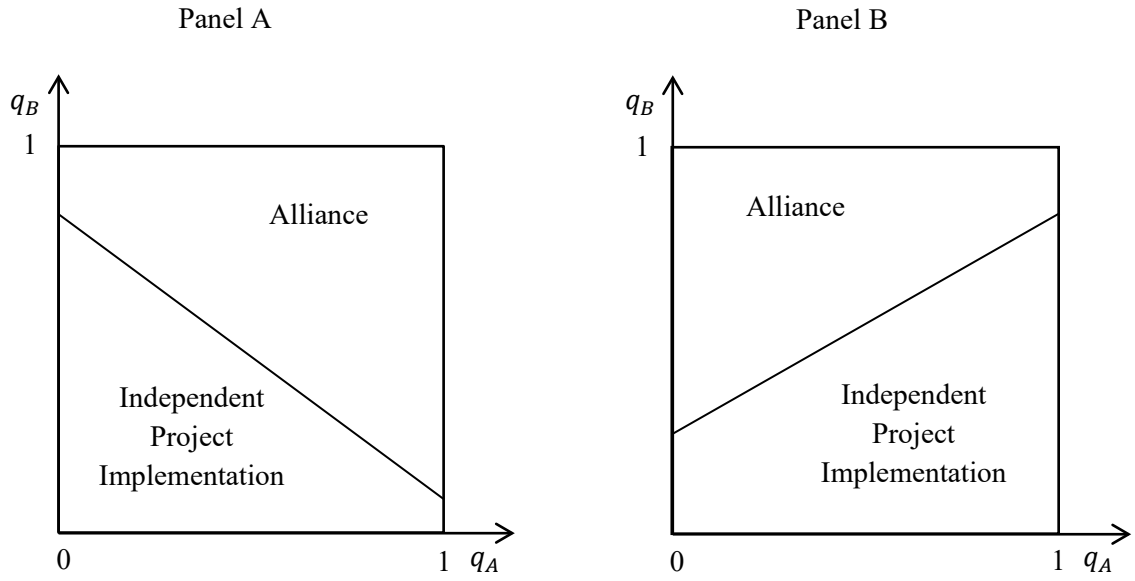

Figure 2 Equilibrium Configurations where Independent Project Implementation and an Alliance Occur for Different Firm Qualities

Disentangling Reputational Effects in Alliances

E-Companion: Proofs and Supplementary Material

EC.1 Prior Notes

EC.1.1 Notation and Equilibria

Throughout the analytical proofs, we denote a strategy of the two firms by the function $x(q)$: $[0,1] \times [0,1] \rightarrow \{0,1\}$. For each profile of firms' qualities $q = (q_A, q_B)$, $x(q)$ specifies the firms' decision of whether to form an alliance, where $x(q) = 0$ if firms choose not to form an alliance and thus to implement their projects independently (i.e., $d = I$), and $x(q) = 1$ if firms choose to form an alliance and thus to implement some of their projects jointly (i.e., $d = J$).

Moreover, our analysis focuses on *sabotage-free* equilibria, that is, equilibria where firms' joint profits are never higher if project P_C fails than if it succeeds and, therefore, firms never have the incentive to make project P_C fail on purpose.

EC.1.2 Belief Updating by Consumers

We assume that consumers may update their beliefs at the interim stage, but *only* when they observe an alliance. This assumption is consistent with situations where an alliance is not anticipated by consumers. So, if consumers observe that the *status quo* is maintained, they will not make any inferences about firms' qualities. One way of formalizing this idea is by assuming that there is a continuum of firms in the economy and only a countable (i.e., with probability measure zero) subset of them face the opportunity to form an alliance. In this case, if consumers do not observe which firms face an opportunity to form an alliance, they will not update their beliefs about the quality of any two firms that do not form an alliance.

However, as is the case in our model, if consumers observe that two firms formed an alliance, they may update their beliefs about the firms' qualities. When updating their beliefs, consumers take into account their initial beliefs about the firms' qualities, as well as the firms' strategy $x(q)$ in equilibrium. Note that we mentioned that consumers *may* update their beliefs if they observe an alliance. To be more precise, consumers always go through the process of revising their beliefs when they observe an alliance. Nonetheless, it is possible that, at the end of the revision process, their interim beliefs are identical to their initial beliefs. Next, we detail precisely how consumers' revise their beliefs.

The notion of Bayesian equilibrium implicitly assumes that consumers know the firms' strategy $x(q)$ in equilibrium. That is, consumers' expectations about how firms behave when they face the opportunity to form an alliance are correct. A Bayesian equilibrium also requires that consumers use Bayes' rule to update their beliefs. Thus, when consumers observe an alliance at the end of period zero, their interim beliefs are obtained by applying Bayes' rule to their initial beliefs $G(q)$ (with corresponding density $g(q)$) in the following way: $g_1^J(q) = x(q)g(q)/\int x(\hat{q})dG(\hat{q})$. A technical assumption that we make is that the distribution $G(q)$ is atomless and the corresponding density $g(q) > 0$, for all firm qualities $q = (q_A, q_B) \in [0,1] \times [0,1]$. Note that consumers may have different initial beliefs about qualities q_A and q_B. Furthermore, following the standard practice in models using the Bayesian equilibrium as a solution concept, we assume that consumers' initial beliefs (or priors) are correct—that is, $G(q)$ is also the distribution from which firms' qualities are drawn.

Consumers update their beliefs also at the ex-post stage after observing the performance of project P_C at the end of period one. After observing the performance of project P_C, consumers' ex-post beliefs are obtained by applying Bayes' rule to their interim beliefs $G_1^d(q)$ (and $g_1^d(q)$) in the following way: $g_2^d(q|\varphi) = \Pr[\varphi|q,d]g_1^d(q)/\int \Pr[\varphi|\hat{q},d]\, dG_1^d(\hat{q})$, where $\Pr[\varphi = s|q,d]$ and $\Pr[\varphi = f|q,d]$ represent, respectively, the probability that project P_C succeeds and the probability that project P_C fails, both conditional on firms' qualities $q = (q_A, q_B)$ and decision $d \in \{I,J\}$. Note that $\Pr[\varphi = s|q,d = J] = q_{P_C}^J = \alpha_A^C q_A + \alpha_B^C q_B$, $\Pr[\varphi = s|q,d = I] = q_{P_C}^I = q_A$, and $\Pr[\varphi = f|q,d] = 1 - \Pr[\varphi = s|q,d]$.

EC.1.3 Dominant Reputation-Independent Synergies

We derive here a necessary and sufficient condition that ensures that reputation-independent synergies *dominate* reputational considerations in firms' decision and, as a result, firms always choose an alliance (i.e., $x(q) = 1$ for all

$q \in [0,1] \times [0,1]$) regardless of reputational considerations. To derive that condition, we need to compare firms' expected joint profits for extreme cases under independent project implementation and under an alliance.

Let us start with firms' expected joint profits under independent project implementation, which are given by $\Pi^I(q_A) = V_A + V_B + 2V_C - K + \mu\{r_A V_C + [q_A r_A^I(s) + (1 - q_A) r_A^I(f)](V_A + V_C) + r_B V_B\}$. These profits are the highest possible when the quality of firm A q_A is one (since by Lemma EC.1 presented below, $r_A^I(s) > r_A^I(f)$), and are then given by $\Pi^I(q_A = 1) = V_A + V_B + 2V_C - K + \mu\{r_A V_C + r_A^I(s)(V_A + V_C) + r_B V_B\}$.

Let us now consider firms' expected joint profits under an alliance, which are given by $\Pi^J(q_A, q_B) = V_A + V_B + 2V_C - K + S + \mu\left\{r_{P_C}^J V_C + \sum_{j\in\{A,B,C\}} r_{P_j}^J(f) V_j + q_{P_C}^J \times \sum_{j\in\{A,B,C\}} [r_{P_j}^J(s) - r_{P_j}^J(f)] V_j\right\}$. These profits are the lowest possible if we assume that firms' reputations drop to zero when consumers observe an alliance—that is, if we assume that, in the event of an alliance, firms' interim and ex-post reputations become zero. In that case, firms' expected joint profits are given by $\underline{\Pi^J} = V_A + V_B + 2V_C - K + S$.

Hence, firms always form an alliance in equilibrium (i.e., $x(q) = 1$ for all $q \in [0,1] \times [0,1]$) regardless of reputational considerations if the following condition is satisfied $\underline{\Pi^J} > \Pi^I(q_A = 1) \Leftrightarrow S > \mu[r_A V_C + r_B V_B + r_A^I(s)(V_A + V_C)]$. If this condition is satisfied, then reputation-independent synergies S are dominant and reputational considerations have no impact on firms' decision. If this condition is not satisfied, reputational considerations will affect firms' decision.

Finally, from result (i) of Lemma EC.1 (presented below) we have $r_A^I(s) = r_A + \frac{\sigma_A}{r_A}$, so we can transform the above condition into $S > \mu\left[r_A V_C + r_B V_B + (r_A + \frac{\sigma_A}{r_A})(V_A + V_C)\right] = \mu\left[2r_A V_C + r_A V_A + r_B V_B + \frac{\sigma_A}{r_A}(V_A + V_C)\right]$, so that it only depends on exogenous model parameters.

EC.1.4 Lemma EC.1

In this e-companion, we prove a technical lemma—Lemma EC.1—that is not fully reported in the body of the paper but that is used to obtain our results. Lemma EC.1 uses consumers' ex-post beliefs ($G_2^d(q|\varphi)$ and $g_2^d(q|\varphi)$) to compare firms' interim and ex-post reputations. It shows that the impact of the performance of an independently implemented project (in our model, project P_C) on the reputation of a given firm (in our model, firm A) is always positive. It also shows that the impact of a jointly implemented project on the reputation of a given firm depends on consumers' perceived variance of the firm's quality (σ_i^J for all $i \in \{A, B\}$), as well as on consumers' perceived correlation (more specifically, covariance) between that firm's quality and the quality of the other firm ($\sigma_{A,B}^J$).

LEMMA EC.1.

(i) Under independent implementation of a project (project P_C), the ex-post reputations of firm A in case of a success ($\varphi = s$) and of a failure ($\varphi = f$) are:

$$r_A^I(s) = r_A + \frac{\sigma_A}{r_A} \text{ and } r_A^I(f) = r_A - \frac{\sigma_A}{1 - r_A},$$
$$\text{such that } r_A^I(s) - r_A^I(f) = \frac{\sigma_A}{(r_A)(1 - r_A)},$$

where σ_A is the variance of q_A, according to initial beliefs $G(q)$ (which are equal to interim beliefs $G_1^I(q)$).The ex-post reputation of firm B is the same as the initial (and interim) reputation ($r_B = r_B^I = r_B^I(s) = r_B^I(f)$).

(ii) Under joint implementation of a project (project P_C), the ex-post reputations of firm $i \in \{A, B\}$ in case of a success ($\varphi = s$) and of a failure ($\varphi = f$) are:

$$r_i^J(s) = r_i^J + \frac{\alpha_i^C \sigma_i^J + (1 - \alpha_i^C)\sigma_{A,B}^J}{\alpha_A^C r_A^J + \alpha_B^C r_B^J} \text{ and } r_i^J(f) = r_i^J - \frac{\alpha_i^C \sigma_i^J + (1 - \alpha_i^C)\sigma_{A,B}^J}{1 - \alpha_A^C r_A^J - \alpha_B^C r_B^J},$$
$$\text{such that } r_i^J(s) - r_i^J(f) = \frac{\alpha_i^C \sigma_i^J + (1 - \alpha_i^C)\sigma_{A,B}^J}{(\alpha_A^C r_A^J + \alpha_B^C r_B^J)(1 - \alpha_A^C r_A^J - \alpha_B^C r_B^J)},$$

where σ_i^J and $\sigma_{A,B}^J$ are, respectively, the variance of q_i and the covariance of q_A and q_B, according to interim beliefs $G_1^J(q)$.

Proof of Lemma EC.1. We start with result (ii). By definition, $r_i^J(\varphi) = \int q_i dG_2^J(q|\varphi)$ for all $i \in \{A, B\}$ and $\varphi \in \{f, s\}$. Applying Bayes' rule to interim beliefs, we obtain that $g_2^J(q|\varphi) = \Pr[\varphi|q] g_1^J(q) / \int \Pr[\varphi|\hat{q}]\, dG_1^J(\hat{q})$, where $\Pr[s|q] = \alpha_A^C q_A + \alpha_B^C q_B$ and $\Pr[f|q] = 1 - \alpha_A^C q_A - \alpha_B^C q_B$. Using this expression for $g_2^J(q|\varphi)$ and applying standard integration properties, we obtain $r_i^J(\varphi) = \int q_i \Pr[\varphi|q]\, dG_1^J(q) / \int \Pr[\varphi|\hat{q}]\, dG_1^J(\hat{q})$ for all $i \in \{A, B\}$. The first two equations in result (ii) are obtained by using this equation when $\varphi = s$ and $\varphi = f$ and doing the following

for the two cases: (i) replacing $\Pr[s|q]$ with $\alpha_A^C q_A + \alpha_B^C q_B$ and $\Pr[f|q]$ with $1 - \alpha_A^C q_A - \alpha_B^C q_B$; (ii) using the fact that $var(x) = E(x^2) - [E(x)]^2$ and $cov(x,y) = E(xy) - E(x)E(y)$ for any given random variables x and y; (iii) rearranging the terms; (iv) noticing that by the definition of interim reputation $\int \alpha_i^C q_i dG_1^J(q) = \alpha_i^C \int q_i dG_1^J(q) = \alpha_i^C r_i^J$. The last equation in result (ii) follows directly from the first two equations in the same result.

We now prove result (i). $r_A^I(s)$ and $r_A^I(f)$ follow directly from result (ii) by noting that $r_A^I(\varphi) = r_A^J(\varphi)$ for all $\varphi \in \{f,s\}$ when $\alpha_A^C = 1$ and $G_1^I(q) = G(q)$. Similarly, $r_B^I(s)$ and $r_B^I(f)$ follow directly from result (ii) by noting that $r_B^I(\varphi) = r_B^J(\varphi)$ for all $\varphi \in \{f,s\}$ when $\alpha_B^C = 0$ and $G_1^I(q) = G(q)$, and that, under initial beliefs $G(q)$, qualities q_A and q_B are independent (meaning that their covariance is zero). ■

EC.2 Proofs of the Propositions and Lemmas in the Body of the Paper

Proof of Lemma 1. Let us start with the proof of result (i), the case of an equilibrium configuration in which $x(q) = 1$ for all $q \in [0,1] \times [0,1]$. In any equilibrium configuration in which firms form an alliance for at least some combination of their qualities, consumers' interim beliefs in the event of an alliance are obtained by applying Bayes' rule to their initial beliefs $G(q)$. Thus, $g_1^J(q) = x(q)g(q)/\int x(\hat{q})dG(\hat{q})$. It follows that in an equilibrium where $x(q) = 1$ for all $q \in [0,1] \times [0,1]$ we have $G_1^J = G$. Thus, in this type of equilibrium $G_1^J = G_1^I = G$. Given G and the other basic parameters of the model, such an equilibrium configuration exists if and only if $\Pi^J(q) > \Pi^I(q)$ for all $q \in [0,1] \times [0,1]$.

We conclude the proof of result (i) by providing an example where indeed $\Pi^J(q) > \Pi^I(q)$ for all $q \in [0,1] \times [0,1]$. Suppose that initial beliefs about firm i's quality are described by the density function $f_i(q_i) = [q_i^{\omega_i - 1}(1-q_i)^{\beta_i - 1}]/\int \hat{q}_i^{\omega_i - 1}(1-\hat{q}_i)^{\beta_i - 1} d\hat{q}_i$ for all $i \in \{A,B\}$. Thus, $f_i(q_i)$ is a Beta distribution. Hence, $g(q) = f_A(q_A) \times f_B(q_B)$. Let $\omega_A = 46.625$, $\beta_A = 139.88$, $\omega_B = 13.313$, and $\beta_B = 4.4375$. Let also $V_A = V_C = 2$, $V_B = 1$, $\alpha_i^j = 0.5$ for all $i \in \{A,B\}$ and $j \in \{A,B,C\}$, $K = 1$, and $S = 0$. Given the above initial beliefs, $r_A = 0.25$ and $r_B = 0.75$. Since $G_1^I = G_1^J = G$, interim reputations satisfy $r_i^I = r_i^J = r_i$ for all $i \in \{A,B\}$. Applying Bayes' rule to interim beliefs we obtain ex-post beliefs. Hence, $g_2^d(q|\varphi) = \Pr[\varphi|q,d] g_1^d(q)/\int \Pr[\varphi|\hat{q},d]\, dG_1^d(\hat{q})$ and since in this type of equilibrium $G_1^I = G_1^J = G$, we can easily obtain ex-post beliefs G_2^I and G_2^J. Using those ex-post beliefs, we can then obtain the ex-post reputations $r_A^I(f) = 0.24867$, $r_A^I(s) = 0.254$, $r_B^I(f) = r_B^I(s) = r_B = 0.75$, $r_A^J(f) = 0.249$, $r_A^J(s) = 0.251$, $r_B^J(f) = 0.74$, and $r_B^J(s) = 0.76$. Using these reputations, we can obtain $\Pi^J(q)$ and $\Pi^I(q)$. In this case, we have $\partial(\Pi^J(q) - \Pi^I(q))/\partial q_A = 0.0117 > 0$ and $\partial(\Pi^J(q) - \Pi^I(q))/\partial q_B = 0.330 > 0$. Thus, we will have $\Pi^J(q) > \Pi^I(q)$ for all $q \in [0,1] \times [0,1]$ if $\Pi^J(0,0) > \Pi^I(0,0)$, which is the case since $\Pi^J(0,0) = 6 + \mu 3.4725$ and $\Pi^I(0,0) = 6 + \mu 2.2447$ (recall that by assumption $\mu > 0$).

Let us now turn to the proof of result (ii) of Lemma 1. We show that for some parameter values an equilibrium configuration in which $x(q) = 0$ for all $q \in [0,1] \times [0,1]$ exists. In this type of equilibrium configuration, an alliance occurs with probability zero, that is, it is off the equilibrium path. The notion of Bayesian equilibrium imposes no restrictions on beliefs off the equilibrium path, which means that one can choose any possible interim and ex-post beliefs G_1^J and G_2^J off the equilibrium path. In particular, since $g(q) > 0$ for all $q \in [0,1] \times [0,1]$, we can choose G_1^J and G_2^J such that r_i^J and $r_i^J(\varphi)$ (for all $i \in \{A,B\}$ and $\varphi \in \{f,s\}$) are as small as desired. So, we can choose them so that $r_i^J = r_i^J(\varphi) = 0$ (for all $i \in \{A,B\}$ and $\varphi \in \{f,s\}$), in which case $\Pi^J = V_A + V_B + 2V_C - K + S$. We need to compare these joint profits with firms' joint profits under independent project implementation. If firms implement their projects independently, their joint profits are given by $\Pi^I(q) = V_A + V_B + 2V_C - K + \mu\{r_A V_C + [q_A r_A^I(s) + (1-q_A) r_A^I(f)](V_C + V_A) + r_B V_B\}$. These joint profits depend only on firm A's quality q_A and are increasing in it (note that from result (i) of Lemma EC.1 it follows that $r_A^I(s) > r_A^I(f)$). Thus, an equilibrium in which firms always choose to implement their projects independently regardless of their qualities exists if and only if $\Pi^J \le \Pi^I(q_A = 0, q_B)$, which is equivalent to $S \le \mu\{r_A V_C + r_A^I(f)(V_C + V_A) + r_B V_B\}$. This condition is satisfied for example when $S \le \mu\{r_A V_C + r_B V_B\}$.

Finally, we prove result (iii) of Lemma 1. Consider an arbitrary equilibrium configuration in which, for some set $H \subset [0,1] \times [0,1]$, we have $x(q) = 1$ if $q \in H$ and $x(q) = 0$ if $q \notin H$. By the definition of Bayesian equilibrium, firms optimize given interim and ex-post beliefs (and their corresponding reputations), forming an alliance if and only if their qualities q are such that $\Pi^J(q) > \Pi^I(q)$, where $\Pi^J(q)$ and $\Pi^I(q)$ are given by $\Pi^d(q) = V_A + V_B + 2V_C - K + \mathbf{1}_{d=J}(d)S + \mu\left\{r_{P_C}^d V_C + \sum_{j \in \{A,B,C\}} r_{P_j}^d(f) V_j + q_{P_C}^d \times \sum_{j \in \{A,B,C\}} [r_{P_j}^d(s) - r_{P_j}^d(f)] V_j\right\}$. The

interim and ex-post reputations in the $\Pi^J(q)$ and $\Pi^I(q)$ expressions are those associated with this equilibrium configuration. Condition $\Pi^J(q) > \Pi^I(q)$ is equivalent to $\gamma_A q_A + \gamma_B q_B > z$, where $\gamma_A = -[r_A^I(s) - r_A^I(f)](V_A + V_C) + \alpha_A^C \sum_{j\in\{A,B,C\}}[r_{P_j}^J(s) - r_{P_j}^J(f)]V_j$, $\gamma_B = \alpha_B^C \sum_{j\in\{A,B,C\}}[r_{P_j}^J(s) - r_{P_j}^J(f)]V_j$, and $z = r_A V_C + r_B V_B + r_A^I(f)[V_A + V_C] - r_{P_C}^J V_C - \sum_{j\in\{A,B,C\}} r_{P_j}^J(f)V_j - S/\mu$. Result (ii) follows from these four facts about γ_A and γ_B: (i) $\gamma_B \geq 0$, as we consider only *sabotage-free* equilibria (indeed, if $\gamma_B < 0$, firms' joint profits would be higher when project P_C failed than when it succeeded and, therefore, firms would have the incentive to make it fail); (ii) γ_A may be positive or negative (we provide below two examples of equilibrium configurations, one for each case); (iii) $\gamma_A \neq 0$ or $\gamma_B \neq 0$, otherwise firms' optimal decision is independent of their qualities, and the equilibrium configuration under consideration is not verified; (iv) $\gamma_A < 0$ if $\gamma_B = 0$, since $r_A^I(s) > r_A^I(f)$.

For completeness, we now provide examples of each of these equilibrium configurations. In what follows, we denote consumers' initial beliefs about firm i's quality by the cumulative distribution function $F_i(q_i)$ (with corresponding density $f_i(q_i)$) for all $i \in \{A, B\}$. Hence, $g(q) = f_A(q_A) \times f_B(q_B)$. We start by providing an example of the sub-type of equilibrium configuration of result (iii.a). Let $f_A(q_A) = q_A^{50}(1-q_A)^{25} / \int_0^1 \hat{q}_A^{50}(1-\hat{q}_A)^{25} d\hat{q}_A$ and $f_B(q_B) = 1$. Thus, F_A is a Beta distribution and F_B is a uniform distribution. This implies that $r_A = 0.6623$ and $r_B = 0.5$. Let also $\alpha_i^j = 0.5$ for all $i \in \{A, B\}$ and $j \in \{A, B, C\}$. Finally, let $V_A = V_B = 1$, $V_C = 2$, $K = 1$, and $S = 0$. Given these parameters, firms forming an alliance if and only if $\gamma_A q_A + \gamma_B q_B > z \Leftrightarrow q_B > 0.6674 - 0.6444 q_A$ characterizes the equilibrium configuration. In this equilibrium configuration, firms' interim and ex-post reputations are: $r_A^J = 0.6648$, $r_B^J = 0.6195$, $r_A^J(f) = 0.6621$, $r_A^J(s) = 0.6663$, $r_B^J(f) = 0.5528$, $r_B^J(s) = 0.6567$, $r_A^I(f) = 0.6538$, and $r_A^I(s) = 0.6667$. We now provide an example of the sub-type of equilibrium configuration of result (iii.b). Let $f_A(q_A) = 1$ and $f_B(q_B) = 1$. Hence, F_A and F_B are uniform distributions. This implies that $r_A = r_B = 0.5$. Let also $\alpha_A^j = 0.3$ and $\alpha_B^j = 0.7$ for all $j \in \{A, B, C\}$. Finally, let $V_A = V_B = V_C = 1$, $K = 1$, and $S = 0$. Given these parameters, firms forming an alliance if and only if $\gamma_A q_A + \gamma_B q_B > z \Leftrightarrow q_B > -0.302 + 1.07 q_A$ characterizes the equilibrium configuration. In this equilibrium configuration, firms' interim and ex-post reputations are: $r_A^J = 0.4008$, $r_B^J = 0.5928$, $r_A^J(f) = 0.3151$, $r_A^J(s) = 0.4752$, $r_B^J(f) = 0.4676$, $r_B^J(s) = 0.7016$, $r_A^I(f) = 1/3$, and $r_A^I(s) = 2/3$. ■

Proof of Proposition 1. As mentioned in the text, the impact of the complementarity effect on firms' joint profits is computed by setting the firms' interim and ex-post reputations equal to their initial reputations (i.e., $r_i = r_i^d = r_i^d(\varphi)$, for $i \in \{A, B\}$, $d \in \{I, J\}$, and $\varphi \in \{f, s\}$). This implies that $\Pi^J(q) = \overline{\Pi}^J = V_A + V_B + 2V_C - K + S + \mu\{2(\alpha_A^C r_A + \alpha_B^C r_B)V_C + \sum_{j\in\{A,B\}}(\alpha_A^j r_A + \alpha_B^j r_B)V_j\}$ and $\Pi^I(q) = \overline{\Pi}^I = V_A + V_B + 2V_C - K + \mu(2r_A V_C + r_A V_A + r_B V_B)$. Therefore, $\overline{\Pi}^J - S > \overline{\Pi}^I \Leftrightarrow (r_B - r_A)(\alpha_B^A V_A - \alpha_A^B V_B + 2\alpha_B^C V_C) > 0$. ■

Proof of Proposition 2. Result (i) of Proposition 2 follows directly from the application of Lemma EC.1.

We now turn to the proof of result (ii). We show here that the impact of the performance of the jointly implemented project P_C on the reputation of a firm may be negative. Below, in the proof of Proposition 3, we provide conditions under which this impact is positive. For a situation in which the impact is negative, consider the following example: Let $f_A(q_A) = q_A^{10}(1-q_A)^{10} / \int \hat{q}_A^{10}(1-\hat{q}_A)^{10} d\hat{q}_A$ and $f_B(q_B) = (q_B - 0.5)^{20} / \int (\hat{q}_B - 0.5)^{20} d\hat{q}_B$ be the initial beliefs about the quality of firm *A* and firm *B*, respectively. Hence, $g(q) = f_A(q_A) \times f_B(q_B)$. Let also $\alpha_A^A = \alpha_A^C = 0.15$, $\alpha_A^B = 0.99$, $V_A = 5$, $V_B = 5.4315$, $V_C = 24.11$, $K = 1$, and $S = 0$. Given these parameters, in equilibrium firms form an alliance if and only if their qualities are such that $q_B > 0.0680 - 0.0882 q_A$. In this equilibrium configuration, $r_A^J(f) = 0.5280 > 0.5040 = r_A^J(s)$. ■

Proof of Proposition 3. Let us start with the proof of result (i), for the case of alliances where reputation-independent synergies are dominant, and therefore firms form an alliance regardless of their qualities. In this type of equilibrium configuration, as $x(q) = 1$ for all $q \in [0,1] \times [0,1]$ we have $G_1^J = G$, that is, consumers' interim beliefs are identical to their initial beliefs (see the proof of result (i) of Lemma 1 for details). Since consumers initially perceive the qualities of firms *A* and *B* as independent, they also perceive them as independent at the interim stage (after observing an alliance). This means that the covariance of q_A and q_B according to interim beliefs G_1^J is zero (i.e., $\sigma_{A,B}^J = 0$). It follows directly from result (ii) of Lemma EC.1 that $r_i^J(s) > r_i^J > r_i^J(f)$.

We now turn to results (ii.a) and (ii.b), for the case of alliances where reputation-independent synergies are not dominant and firms' alliance formation decision depends on their qualities. We prove these results by identifying *sufficient* conditions for the impact of the performance of the jointly implemented project P_C on the reputation of a firm to be positive. Turning to result (ii.a), we now show that if α_i^C is sufficiently high, then $r_i^J(s) > r_i^J > r_i^J(f)$ for all $i \in \{A, B\}$. By the Cauchy-Schwarz inequality, we know that $|\sigma_{A,B}^J| \leq \sqrt{\sigma_A^J \sigma_B^J}$, which implies that $\alpha_i^C \sigma_i^J + (1-\alpha_i^C)\sigma_{A,B}^J \geq \alpha_i^C \sigma_i^J - (1-\alpha_i^C)\sqrt{\sigma_A^J \sigma_B^J}$. Thus, for $\alpha_i^C \sigma_i^J - (1-\alpha_i^C)\sqrt{\sigma_A^J \sigma_B^J} > 0 \Leftrightarrow \alpha_i^C > (\sqrt{\sigma_A^J \sigma_B^J}) \Big/ (\sigma_i^J + \sqrt{\sigma_A^J \sigma_B^J})$, it is necessarily the case that $\alpha_i^C \sigma_i^J + (1-\alpha_i^C)\sigma_{A,B}^J > 0$. Hence, the result follows directly from the application of Lemma EC.1.

Finally, we prove result (ii.b) by showing that, when consumers have sufficiently low uncertainty about the quality of either firm *A* or firm *B*, the impact of the performance of project P_C on the reputation of the other firm is positive. For concreteness, suppose that the uncertainty that consumers have about the quality of firm *A* is sufficiently low (the case of firm *B* is analogous); there is significant uncertainty only about firm *B*'s quality. That is, σ_A^J is sufficiently close to zero while σ_B^J is bounded away from zero. By the Cauchy-Schwarz inequality, we know that $|\sigma_{A,B}^J| \leq \sqrt{\sigma_A^J \sigma_B^J}$, which implies that $\sigma_{A,B}^J$ is also sufficiently close to zero. It follows from result (ii) in Lemma EC.1 that $r_B^J(s) > r_B^J > r_B^J(f)$. ■

Proof of Proposition 4. Let us start with the proof of result (i), for the case where reputation-independent synergies are dominant, and therefore firms form an alliance regardless of their qualities. In this type of equilibrium configuration, as $x(q) = 1$ for all $q \in [0,1] \times [0,1]$ we have $G_1^J = G$, that is, consumers' interim beliefs are identical to their initial beliefs (see the proof of result (i) of Lemma 1 for details). Hence, $r_i^J = r_i$ for $i \in \{A, B\}$.

We now turn to result (ii), for the case where reputation-independent synergies are not dominant and firms' alliance formation decision depends on their qualities. The proof consists of comparing, in equilibrium configurations where firms' decision to form an alliance depends on their qualities (i.e., in which $x(q) = 1$ if and only if $\gamma_A q_A + \gamma_B q_B > z$), firms' initial and interim reputations when they form an alliance. Let $E[\,.\,]$ denote the expectation operator according to interim beliefs G_1^J. By definition, $r_i^J = E[\tilde{q}_i]$ for all $i \in \{A, B\}$. By the law of iterated expectations, $r_i^J = E_{q_j}\{E[\tilde{q}_i|q_j]\}$ for all $i, j \in \{A, B\}$ and $i \neq j$. Thus, a sufficient condition for $r_i^J \geq r_i$ is that $E[\tilde{q}_i|q_j] \geq r_i$ for all q_j such that $g_1^J(q) > 0$ for some q_i. Likewise, a sufficient condition for $r_i^J \leq r_i$ is that $E[\tilde{q}_i|q_j] \leq r_i$ for all q_j such that $g_1^J(q) > 0$ for some q_i. Let $g_1^J(q_i|q_j) = g_1^J(q) / \int g_1^J(\hat{q}_i, q_j) d\hat{q}_i$ and let $G_1^J(q_i|q_j)$ denote its cumulative function. $G_1^J(q_i|q_j)$ is the interim conditional distribution of $\tilde{q}_i$ given q_j. In what follows, let $F_i(q_i)$ denote consumers' beliefs about firm i's quality for all $i \in \{A, B\}$ (with corresponding density $f_i(q_i)$). Note that $g(q) = f_A(q_A) \times f_B(q_B)$. From the expression for $g_1^J(q_i|q_j)$, from $g_1^J(q) = x(q)g(q) / \int x(\hat{q}) dG(\hat{q})$, and from the fact that $g(q) = f_A(q_A) \times f_B(q_B)$, it follows that $g_1^J(q_i|q_j) = x(q) f_i(q_i) / \int x(\hat{q}_i, q_j) f_i(\hat{q}_i) d\hat{q}_i$.

Taking firm *B*, we can show that $r_B^J \geq r_B$ in any equilibrium configuration where firms' decision to form an alliance depends on their qualities. Let us fix q_A such that $x(q) > 0$ for some q_B. If follows from result (iii) of Lemma 1 that $x(q)$ is weakly increasing in q_B.[1] The fact that $x(q)$ is weakly increasing in q_B implies that $G_1^J(q_B|q_A)$ first-order stochastically dominates F_B—see $g_1^J(q_i|q_j) = x(q) f_i(q_i) / \int x(\hat{q}) f_i(\hat{q}_i) d\hat{q}_i$—, which in turn means that $E[\tilde{q}_B|q_A] \geq r_B$. This implies $r_B^J \geq r_B$.

Turning to firm *A* and following an analogous reasoning to the one used above to show that $r_B^J \geq r_B$, we can show that in the first sub-type of equilibrium configuration presented in result (iii) of Lemma 1, $r_A^J \geq r_A$. Note that, in such an equilibrium configuration, $\gamma_A \geq 0$, which implies that, given q_B, $x(q)$ is weakly increasing in q_A. Note

[1] Note that in the characterization of the possible equilibrium configurations in result (iii) of Lemma 1, we have $\gamma_B \geq 0$. This implies that, given q_A such that $x(q) > 0$ for some q_B, either $x(q) = 1$ for all $q_B \in [0,1]$, or $x(q) = 0$ if $q_B \leq \hat{q}_B$ for some $\hat{q}_B \in (0,1)$ and $x(q) = 1$ otherwise.

also that an example of this sub-type of equilibrium configuration—corresponding to result (iii.a) of Lemma 1—is presented in the proof of Lemma 1.

Finally, also for firm *A*, we can show that, in the second sub-type of equilibrium configuration presented in result (iii) of Lemma 1, $r_A^J \leq r_A$. To obtain this result, consider this equilibrium configuration and fix q_B such that $x(q) > 0$ for some q_A. In this equilibrium configuration, $\gamma_A < 0$, which implies that $x(q)$ is non-increasing in q_A.[2] The fact that $x(q)$ is non-increasing in q_A implies that F_A first-order stochastically dominates $G_1^J(q_A|q_B)$—see $g_1^J(q_i|q_j)$—, which in turn means that $E[\tilde{q}_A|q_B] \leq r_A$. This implies that $r_A^J \leq r_A$. Note also that an example of this sub-type of equilibrium configuration—corresponding to result (iii.b) of Lemma 1—is presented in the proof of Lemma 1. ■

Proof of Proposition 5. Let us start with the proof of result (i). Consider equilibrium configurations where firms' decision to form an alliance depends on their qualities (i.e., in which $x(q) = 1$ if and only if $\gamma_A q_A + \gamma_B q_B > z$). As shown in the proof of result (iii) of Lemma 1, $\gamma_A = -[r_A^I(s) - r_A^I(f)](V_A + V_C) + \alpha_A^C \sum_{j\in\{A,B,C\}}[r_{P_j}^J(s) - r_{P_j}^J(f)]V_j$. The proof of Proposition 4 establishes that in any such equilibrium where $\gamma_A \geq 0$—which corresponds to the sub-type of equilibrium configuration mentioned in result (iii.a) of Lemma 1—, $r_A^J \geq r_A$. Thus, the proof of result (i) of Proposition 5 consists of showing that, when σ_A is sufficiently low (i.e., the uncertainty that consumers have about firm *A*'s quality is sufficiently low), an equilibrium configuration in which $\int x(q)g(q)dq > \varepsilon$ for a fixed $\varepsilon > 0$ (i.e., the ex-ante probability that firms form an alliance is bounded away from zero) cannot be an equilibrium configuration in which $\gamma_A < 0$—which would correspond to the sub-type of equilibrium configuration mentioned in result (iii.b) of Lemma 1. We prove this result by contradiction. Suppose that $\gamma_A < 0$. Because of $\gamma_A < 0$ and $\gamma_B \geq 0$, G_1^J is such that $\sigma_{A,B}^J \geq 0$. Moreover, since $\int x(q)g(q)dq > \varepsilon$ for a fixed $\varepsilon > 0$, G_1^J is non-degenerate and σ_i^J is bounded away from zero for all $i \in \{A, B\}$. It follows that $r_i^J(s) - r_i^J(f)$ is greater than zero (from Lemma EC.1) and bounded away from zero for all $i \in \{A, B\}$. Thus, $\alpha_A^C \sum_{j\in\{A,B,C\}}[r_{P_j}^J(s) - r_{P_j}^J(f)]V_j$ is greater than zero and bounded away from zero. Next, note that for a fixed $r_A \in (0,1)$, $[r_A^I(s) - r_A^I(f)](V_A + V_C) \longrightarrow 0$ as $\sigma_A \longrightarrow 0$. This is because, as shown in Lemma EC.1, $r_A^I(s) - r_A^I(f) = \sigma_A/[r_A(1 - r_A)]$. Since $\alpha_A^C \sum_{j\in\{A,B,C\}}[r_{P_j}^J(s) - r_{P_j}^J(f)]V_j$ is greater than zero and bounded away from zero, and $[r_A^I(s) - r_A^I(f)](V_A + V_C) \longrightarrow 0$ as $\sigma_A \longrightarrow 0$, it is clear from the expression for γ_A that, if σ_A is sufficiently small, $\gamma_A > 0$. This is not compatible with the considered equilibrium configuration.

Result (ii) of Proposition 5 comes from the following four observations. First, $\alpha_A^C \sum_{j\in\{A,B,C\}}[r_{P_j}^J(s) - r_{P_j}^J(f)]V_j \longrightarrow 0$ as $\alpha_A^C \longrightarrow 0$. Note that $r_{P_j}^J(s) - r_{P_j}^J(f) \leq 1$ for all $j \in \{A, B, C\}$, implying that $\sum_{j\in\{A,B,C\}}[r_{P_j}^J(s) - r_{P_j}^J(f)]V_j$ is bounded. Second, as shown in Lemma EC.1, $r_A^I(s) - r_A^I(f) = \sigma_A/[r_A(1 - r_A)]$. Third, given the foregoing two observations, when α_A^C is sufficiently small there exists σ_A^* such that for $\sigma_A > \sigma_A^*$, $\gamma_A < 0$.[3] Fourth, as shown in the proof of Proposition 4, in equilibrium configurations where firms' decision to form an alliance depends on their qualities (i.e., in which $x(q) = 1$ if and only if $\gamma_A q_A + \gamma_B q_B > z$) and $\gamma_A < 0$, $r_A^J \leq r_A$. The fact that $\sigma_A^* \longrightarrow 0$ as $\alpha_A^C \longrightarrow 0$ follows directly from the first, second, and third observations. ■

Proof of Proposition 6. This result is proven by presenting a numerical example which illustrates that, in alliances where reputation-independent synergies are not dominant, ignoring the announcement and performance effects may lead to mistaken alliance formation decisions by firms.

Suppose that consumers' initial beliefs about firms' qualities are described by the following density function $g(q) = f_A(q_A) \times f_B(q_B)$, where $f_A(q_A) = q_A^{50}(1 - q_A)^{25} / \int_0^1 \hat{q}_A^{50}(1 - \hat{q}_A)^{25} d\hat{q}_A$ and $f_B(q_B) = 1$.[4] This implies that firms' initial reputations are $r_A = 0.6623$ and $r_B = 0.5$. Let also $\alpha_i^j = 0.5$, for $i \in \{A, B\}$ and $j \in \{A, B, C\}$, such that, in the case of an alliance, firms participate equally across all projects. Let also $V_A = V_B = 1$ and $V_C = 2$.

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[2] Note that, given q_B such that $x(q) > 0$ for some q_A, either $x(q) = 1$ for all $q_A \in [0,1]$, or $x(q) = 1$ if $q_A < \hat{q}_A$ for some $\hat{q}_A \in (0,1)$ and $x(q) = 0$ otherwise.

[3] Consider, for example, $\sigma_A^* = \alpha_A^C(0.25)\left(\sum_{j\in\{A,B,C\}} V_j\right)/(V_A + V_C)$.

[4] The fact that qualities q_A and q_B enter separately $g(q)$ through the marginal density functions $f_A(q_A)$ and $f_B(q_B)$ means that qualities q_A and q_B are initially perceived by consumers as independent. Furthermore, given the specific marginal density functions considered, the associated cumulative distribution functions $F_A(q_A)$ and $F_B(q_B)$ are, respectively, a Beta distribution and a uniform distribution.

Naturally, for reputational effects to be present, we assume some $\mu > 0$. Finally, for simplicity, we assume also that reputation-independent (cost-reducing) synergies from an alliance are non-existent (i.e., $S = 0$). Given these assumptions, firms form an alliance in equilibrium if and only if $\Pi^J(q) > \Pi^I(q) \Leftrightarrow 0.0694q_A + 0.1081q_B > 0.0719$. Thus, this is an equilibrium configuration where firms form an alliance if and only if their qualities are sufficiently high—as in result (iii.a) of Lemma 1. Moreover, in equilibrium firms' interim and ex-post reputations are endogenously determined and correspond to: $r_A^J = 0.6648$, $r_B^J = 0.6195$, $r_A^J(f) = 0.6621$, $r_A^J(s) = 0.6663$, $r_B^J(f) = 0.5528$, $r_B^J(s) = 0.6567$, $r_A^I = r_A = 0.6623$, $r_B^I = r_B = 0.5$, $r_A^I(f) = 0.6538$, $r_A^I(s) = 0.6667$, and $r_B^I(f) = r_B^I(s) = r_B = 0.5$.

Taking the above equilibrium values, we now decompose the impact of the different reputational effects on joint profits, and thus on firms' equilibrium decision. The procedure used in this decomposition is fully described in Figure EC.1.

1. Firms form an alliance in equilibrium if and only if:
$$\Pi^J(q) > \Pi^I(q) \Leftrightarrow \Pi^J(q) - \Pi^I(q) > 0$$

2. For decision $d \in \{I, J\}$, consider the following:
   - $\overline{\Pi}^d$: Firms' joint profits if firms' reputations remained equal to their initial reputations
   - $\overline{\overline{\Pi}}^d$: Firms' joint profits if firms' reputations remained equal to their interim reputations

3. Adding and subtracting $\overline{\Pi}^J$, $\overline{\Pi}^I$, $\overline{\overline{\Pi}}^J$, $\overline{\overline{\Pi}}^I$, and $S(\geq 0)$ from the above expression, we get:
$$\underbrace{\left(\Pi^J(q) - \overline{\overline{\Pi}}^J\right)}_{} - \underbrace{\left(\Pi^I(q) - \overline{\overline{\Pi}}^I\right)}_{} + \underbrace{\left(\overline{\overline{\Pi}}^J - \overline{\Pi}^J\right)}_{} - \underbrace{\left(\overline{\overline{\Pi}}^I - \overline{\Pi}^I\right)}_{} + \underbrace{\left(\overline{\Pi}^J - S - \overline{\Pi}^I\right)}_{} + S > 0$$
$$\Leftrightarrow \Delta\Pi^J_{Perf.}(q) - \Delta\Pi^I_{Perf.}(q) + \Delta\Pi^J_{Anno.} - \Delta\Pi^I_{Anno.} + \Delta\Pi_{Comp.} + S > 0$$

   where:
   - S: Reputation-independent synergies from an alliance
   - $\Delta\Pi_{Comp.}$: Profit impact of the complementarity effect (i.e., assuming firms' reputations remained equal to their initial reputations)
   - $\Delta\Pi^d_{Anno.}$, for $d \in \{I, J\}$: Profit impact of the announcement effect relative to the case in which firms' reputations remained equal to their initial reputations
   - $\Delta\Pi^d_{Perf.}(q)$, for $d \in \{I, J\}$: Profit impact of the performance effect relative to the case in which firms' reputations remained equal to their interim reputations

4. Aggregating $\Delta\Pi^J_{Perf.}(q) - \Delta\Pi^I_{Perf.}(q)$ and $\Delta\Pi^J_{Anno.} - \Delta\Pi^I_{Anno.}$ above, we have:
$$\underbrace{\left[\Delta\Pi^J_{Perf.}(q) - \Delta\Pi^I_{Perf.}(q)\right]}_{} + \underbrace{\left[\Delta\Pi^J_{Anno.} - \Delta\Pi^I_{Anno.}\right]}_{} + \underbrace{\Delta\Pi_{Comp.}}_{} + \underbrace{S}_{} > 0$$

Impact of the performance effect on firms' incentive to form an alliance	Impact of the announcement effect on firms' incentive to form an alliance	Impact of the complementarity effect on firms' incentive to form an alliance	Impact of reputation-independent synergies on firms' incentive to form an alliance

Figure EC.1 Decomposition of the Impact of the Three Reputational Effects on Firms' Equilibrium Decision

We start by taking the perspective of firms that would only consider the complementarity effect and potential reputation-independent synergies, thus ignoring the performance and announcement effects. This corresponds to assuming that firms' reputations remained equal to their initial reputations regardless of firms' decision and project outcomes. Thus, when deciding whether to form an alliance, firms would only consider $\overline{\Pi}^J$ and $\overline{\Pi}^I$, which correspond to joint profits if firms' reputations remained the same as their initial reputations. In particular, firms would decide to form an alliance if and only if $\overline{\Pi}^J > \overline{\Pi}^I \Leftrightarrow \overline{\Pi}^J - \overline{\Pi}^I > 0 \Leftrightarrow \Delta\Pi_{Comp.} + S > 0$, where $\Delta\Pi_{Comp.} = \overline{\Pi}^J - S - \overline{\Pi}^I$ corresponds to the profit impact of the complementary effect. In our numerical example, since we assume no reputation-independent synergies from an alliance (i.e., $S = 0$), we have $\Delta\Pi_{Comp.} + S = -0.3246 + 0 < 0$, meaning that in this case firms would choose independent project implementation regardless of their qualities. As discussed before, if and only if firms' combined qualities are sufficiently high, an alliance is the optimal choice. Thus, considering only the complementarity effect (and potential reputation-independent synergies) may lead to a mistaken decision, in the form of independent project implementation in situations where an alliance is the optimal choice.

We now consider the impact of the announcement effect on firms' decision. For a given decision $d \in \{I, J\}$, the profit impact of the announcement effect can be computed as $\Delta\Pi^d_{Anno.} = \overline{\overline{\Pi}}^d - \overline{\Pi}^d$, where $\overline{\overline{\Pi}}^d$ corresponds to joint profits if firms' reputations remained equal to their interim reputations. In our numerical example, $\Delta\Pi^J_{Anno.} = 0.366$ and $\Delta\Pi^I_{Anno.} = 0$, meaning that the profit impact of the announcement effect is positive if firms form an alliance, and zero under independent project implementation.[5] Thus, the impact of the announcement effect on firms' incentive to form an alliance (given by $\Delta\Pi^J_{Anno.} - \Delta\Pi^I_{Anno.} = 0.366$) is positive. If firms considered the complementarity and announcement effects and potential reputation-independent synergies, but ignored the performance effect, they would decide to form an alliance if and only if $\overline{\overline{\Pi}}^J > \overline{\overline{\Pi}}^I \Leftrightarrow \overline{\Pi}^J + \Delta\Pi^J_{Anno.} > \overline{\Pi}^I + \Delta\Pi^I_{Anno.} \Leftrightarrow \Delta\Pi_{Comp.} + S + \left[\Delta\Pi^J_{Anno.} - \Delta\Pi^I_{Anno.}\right] > 0$. In our numerical example, we have $\Delta\Pi_{Comp.} + S + \left[\Delta\Pi^J_{Anno.} - \Delta\Pi^I_{Anno.}\right] = -0.3246 + 0 + [0.366 - 0] = 0.0414 > 0$, meaning that the joint impact of the complementarity and announcement effects on firms' incentive to form an alliance is positive. As a result, in this case firms would choose to form an alliance regardless of their qualities. Since, as discussed before, the optimal decision is an alliance if and only if firms' combined qualities are sufficiently high, ignoring the performance effect may lead to a mistaken decision, in the form of an alliance in situations where independent project implementation is the optimal choice.

Finally, we turn to the performance effect. For a given decision $d \in \{I, J\}$, the profit impact of the performance effect can be computed as $\Delta\Pi^d_{Perf.}(q) = \Pi^d(q) - \overline{\overline{\Pi}}^d$.[6] In our numerical example, $\Delta\Pi^J_{Perf.}(q) = 0.1081(q_A + q_B) - 0.1388$ and $\Delta\Pi^I_{Perf.}(q) = 0.0387q_A - 0.0255$, meaning that, if firms' qualities are sufficiently high, the profit impact of the performance effect is positive regardless of their decision. The impact of the performance effect on firms' incentive to form an alliance is given by $\Delta\Pi^J_{Perf.}(q) - \Delta\Pi^I_{Perf.}(q) = 0.0694q_A + 0.1081q_B - 0.1133$, which is increasing in both quality q_A and quality q_B.[7] If firms considered all three reputational effects and potential reputation-independent synergies, they would choose an alliance if and only if $\Pi^J(q) > \Pi^I(q) \Leftrightarrow \overline{\Pi}^J + \Delta\Pi^J_{Anno.} + \Delta\Pi^J_{Perf.}(q) > \overline{\Pi}^I + \Delta\Pi^I_{Anno.} + \Delta\Pi^I_{Perf.}(q) \Leftrightarrow \Delta\Pi_{Comp.} + S + \left[\Delta\Pi^J_{Anno.} - \Delta\Pi^I_{Anno.}\right] + \left[\Delta\Pi^J_{Perf.}(q) - \Delta\Pi^I_{Perf.}(q)\right] > 0$. In our numerical example, we have $\Delta\Pi_{Comp.} + S + \left[\Delta\Pi^J_{Anno.} - \Delta\Pi^I_{Anno.}\right] + \left[\Delta\Pi^J_{Perf.}(q) - \Delta\Pi^I_{Perf.}(q)\right] = -0.3246 + 0 + [0.366 - 0] + [0.0694q_A + 0.1081q_B - 0.1133] = 0.0694q_A + 0.1081q_B - 0.0719$, which corresponds to the equilibrium configuration that was described at the beginning.

This numerical example underscores the idea that, when reputational considerations are important determinants of firms' decision to form an alliance, firm managers should consider the different reputational effects in that decision, as not doing so may lead to suboptimal choices. In this example, while for high qualities of the two firms the gains from an alliance stemming from the performance and announcement effects dominate the losses stemming from the complementary effect; for low qualities of the two firms the losses from an alliance stemming from the performance and complementarity effects dominate the gains stemming from the announcement effect. Thus, high-quality firms would wrongly implement their projects independently if their managers only considered the complementarity effect. ■

[5] Note that $\overline{\overline{\Pi}}^I = \overline{\Pi}^I$, since the interim reputations are the same as the initial reputations under independent project implementation.

[6] Note that, unlike $\Delta\Pi_{Comp.}$ and $\Delta\Pi^d_{Anno.}$, $\Delta\Pi^d_{Perf.}(q)$ depends *directly* on firms' qualities q, as firms' qualities determine the likelihood of success (i.e., the performance) of project P_C.

[7] This justifies why, in the equilibrium configuration of this numerical example, the likelihood of an alliance is increasing in firms' qualities.

EC.3 Model Extension: Alliance Scope

Despite their practical relevance, alliance scope decisions have been somewhat understudied in the literature. Existing research largely focuses on learning alliances (i.e., alliances where partners' main objective is to learn from each other), in which there is a latent tension between firms' incentives to exchange knowledge to achieve the alliance's objectives (i.e., common benefits) and their incentives to learn as much (and as fast) as possible to derive advantages outside the context of the alliance (i.e., private benefits) (Hamel et al. 1989, Hamel 1991). The relative magnitude of these common and private benefits is determined by the interplay between the scope of an alliance and the extent of the outside activities of alliance partners. As such, the relative scope of an alliance is pointed out as a determinant of alliance partners' commitment to it (e.g., Khanna, 1998, Khanna et al. 1998, Baum et al. 2000, Oxley and Sampson 2004, Lunnan and Haugland 2008).

In our model, the assumption that firms' objective is to maximize their joint profits—and hence that surplus can be transferred between firms without frictions—blurs the above distinction between common and private benefits. This is attested by the fact that our model allows for profits stemming from any projects (within or outside an alliance) to be shared between alliance partners. Thus, instead of addressing potential tensions between common and private benefits in alliances, the analysis presented here is on how reputational considerations affect firms' joint profits and, from that standpoint, firms' optimal choice of alliance scope.

An analytically tractable way of examining firms' choice of alliance scope is to compare two contrasting alliance options: a narrow alliance ($d = N$), where firms jointly implement only project P_C and implement their other projects (projects P_A and P_B) independently, and a wide alliance ($d = W$), where firms jointly implement all their projects (projects P_A, P_B, and P_C). While the assumption that firms jointly implement all their projects in a wide alliance may seem extreme, it establishes a clear contrast to a narrow alliance, and thus a convenient benchmark.

To analyze how reputational considerations affect firms' choice of alliance scope, we make some additional assumptions. To isolate alliance scope (captured by the number of jointly implemented projects) from other dimensions of firms' collaboration, we consider that firms *A* and *B* have the same participation levels in project P_C under a narrow alliance and under a wide alliance. This implies that the quality of project P_C is the same in both cases ($q_{P_C}^N = q_{P_C}^W = \alpha_A^C q_A + \alpha_B^C q_B$).[8] Thus, the difference between the two types of alliances is that in a narrow alliance we have $\alpha_A^A = \alpha_B^B = 1$ and $\alpha_A^B = \alpha_B^A = 0$, whereas in a wide alliance we have $\alpha_i^j \in (0,1)$ for $i, j \in \{A, B\}$. Moreover, we assume that reputation-independent synergies are the same in the case of a wide alliance and in the case of a narrow alliance and, as before, given by S.[9] Finally, to focus solely on the choice between a wide alliance and a narrow alliance, we consider that reputation-independent synergies are sufficiently strong, so that it is always optimal for firms to choose one of the two types of alliances over independent project implementation. The formal condition for this to happen is $S > \mu[r_A V_C + r_B V_B + r_A^I(s)(V_A + V_C)]$. Note that this condition is the same as the one presented in section 3 of the paper, to ensure that reputation-independent synergies were dominant.

Since reputation-independent synergies are assumed to be the same under a wide alliance and under a narrow alliance, the choice between the two is determined by reputational considerations. It turns out that these reputational considerations are captured by the cumulative impact of the three reputational effects that we previously identified in our main analysis: the complementarity effect, the performance effect, and the announcement effect.

As before, we isolate the impact of the complementarity effect on firms' joint profits by setting firms' interim and ex-post reputations equal to their initial reputations (i.e., $r_i = r_i^d = r_i^d(\varphi)$, for $i \in \{A, B\}$, $d \in \{N, W\}$, and $\varphi \in \{f, s\}$). This implies that firms' joint profits become invariant to their qualities (i.e., $\Pi^d(q) = \overline{\Pi}^d$, for $d \in \{N, W\}$).

> PROPOSITION EC.1. *A wide alliance has a greater impact than a narrow alliance on firms' joint profits through the complementarity effect if and only if the wider alliance scope contributes to combine the high reputation of a given firm with the high-value project(s) of the other firm (i.e., if and only if* $\overline{\Pi}^W - S > \overline{\Pi}^N - S \Leftrightarrow (r_B - r_A)(\alpha_B^A V_A - \alpha_A^B V_B) > 0$*).*

Proof of Proposition EC.1. We first introduce some additional notation that is necessary to write firms' expected joint profits. If firms decide to form a wide alliance, let $r_{P_C}^W$ and $r_{P_j}^W(\varphi)$ denote, respectively, the reputation of project P_C in period one and the reputation of project P_j (for $j \in \{A, B, C\}$ and $\varphi \in \{f, s\}$) in period two. Likewise, if firms

[8] It is important to note that, while this assumption considerably simplifies the analysis, it does not affect the main results.

[9] Presumably, reputation-independent synergies should differ depending on firms' alliance scope. Nonetheless, it is difficult to establish *a priori* which type of alliance will have the strongest reputation-independent synergies. For example, while a wide alliance may provide more opportunities for resource sharing and rationalization of activities, it may also be associated with more complex and costly coordination processes.

decide to form a narrow alliance, let $r_{P_C}^N$ and $r_{P_j}^N(\varphi)$ denote, respectively, the reputation of project P_C in period one and the reputation of project P_j (for $j \in \{A, B, C\}$ and $\varphi \in \{f, s\}$) in period two. Firms' expected joint profits depend on $d \in \{N, W\}$, and are denoted by $\Pi^d(q) = V_A + V_B + 2V_C - K + S + \mu\left\{r_{P_C}^d V_C + \sum_{j\in\{A,B,C\}} r_{P_j}^d(f)V_j + q_{P_C}^d \times \sum_{j\in\{A,B,C\}}[r_{P_j}^d(s) - r_{P_j}^d(f)]V_j\right\}$, where $r_{P_C}^d = \alpha_A^C r_A^d + \alpha_B^C r_B^d$ and $r_{P_C}^d(\varphi) = \alpha_A^C r_A^d(\varphi) + \alpha_B^C r_B^d(\varphi)$ (for $d \in \{N, W\}$ and $\varphi \in \{f, s\}$). Furthermore, we assume that $q_{P_C}^N = q_{P_C}^W = \alpha_A^C q_A + \alpha_B^C q_B$. Since under a wide alliance projects P_A and P_B are assumed to be implemented jointly, whereas under a narrow alliance they are assumed to be implemented independently, respectively, by firm *A* and by firm *B*, we have $r_{P_j}^W(\varphi) = \alpha_A^j r_A^W(\varphi) + \alpha_B^j r_B^W(\varphi)$ and $r_{P_j}^N(\varphi) = r_j^N(\varphi)$, for $j \in \{A, B\}$.

The proof of Proposition EC.1 is analogous to that of Proposition 1. If we set $r_i = r_i^d = r_i^d(\varphi)$ for all $i \in \{A, B\}$, $d \in \{N, W\}$, and $\varphi \in \{f, s\}$, then $\Pi^W(q) = \overline{\Pi}^W = V_A + V_B + 2V_C - K + S + \mu\{2(\alpha_A^C r_A + \alpha_B^C r_B)V_C + (\alpha_A^A r_A + \alpha_B^A r_B)V_A + (\alpha_A^B r_A + \alpha_B^B r_B)V_B\}$ and $\Pi^N(q) = \overline{\Pi}^N = V_A + V_B + 2V_C - K + S + \mu\{2(\alpha_A^C r_A + \alpha_B^C r_B)V_C + r_A V_A + r_B V_B\}$. Therefore, $\overline{\Pi}^W - S > \overline{\Pi}^N - S \Leftrightarrow (r_B - r_A)(\alpha_B^A V_A - \alpha_A^B V_B) > 0$. ■

The condition in Proposition EC.1 highlights that, from the standpoint of the profit impact of the complementarity effect, a wide alliance is preferred to a narrow alliance if one firm has a high reputation and the other firm has high-value projects. For example, if $r_B > r_A$, the condition is satisfied as long as V_A is sufficiently large relative to V_B. More generally, a greater potential to combine the high reputation of one firm with the high-value projects of the other firm, in and of itself, promotes a greater alliance scope.

Beyond the complementarity effect, the optimal choice of alliance scope is also influenced by the announcement and performance effects. As before, the analysis of these two effects is based on firms' interim and ex-post reputations, which depend on the verified equilibrium configuration. Thus, the analysis of the announcement and performance effects requires the characterization of firms' equilibrium strategies. This is done in Lemma EC.2.

LEMMA EC.2. *Two possible types of equilibrium configurations exist where either a wide alliance or a narrow alliance can be optimal:*

(i) Firms form the wide alliance if and only if the quality of the joint project P_C is above a given threshold (i.e., $\Pi^W(q) > \Pi^N(q) \Leftrightarrow \alpha_A^C q_A + \alpha_B^C q_B > y$, where y is a scalar), and form the narrow alliance otherwise.

(ii) Firms form the narrow alliance if and only if the quality of the joint project P_C is above a given threshold (i.e., $\Pi^N(q) > \Pi^W(q) \Leftrightarrow \alpha_A^C q_A + \alpha_B^C q_B > y$, where y is a scalar), and form the wide alliance otherwise.

Proof of Lemma EC.2. Recall that we are considering situations where independent project implementation is always dominated and, therefore, in equilibrium firms either form a narrow alliance or a wide alliance—that is, $x(q) \in \{0,1\}$ for all $q \in [0,1] \times [0,1]$, where in this case $x(q) = 0$ if firms choose to form a narrow alliance (i.e., $d = N$), and $x(q) = 1$ if firms choose to form a wide alliance (i.e., $d = W$). In these equilibrium configurations, firms form a wide alliance if and only if $\Pi^W(q) > \Pi^N(q)$, and form a narrow alliance otherwise. Using the expressions for firms' expected joint profits and the fact that $q_{P_C}^N = q_{P_C}^W = \alpha_A^C q_A + \alpha_B^C q_B$, we have $\Pi^W(q) > \Pi^N(q) \Leftrightarrow (\alpha_A^C q_A + \alpha_B^C q_B) \times \left\{\sum_{j\in\{A,B,C\}}\left[r_{P_j}^W(s) - r_{P_j}^W(f)\right]V_j - \sum_{j\in\{A,B,C\}}\left[r_{P_j}^N(s) - r_{P_j}^N(f)\right]V_j\right\} > (r_{P_C}^N - r_{P_C}^W)V_C + \sum_{j\in\{A,B,C\}}\left(r_{P_j}^N(f) - r_{P_j}^W(f)\right)V_j$. The term inside the squiggly brackets represents the difference between the derivative of firms' expected joint profits with respect to the quality of project P_C under a wide alliance and the equivalent derivative under a narrow alliance (i.e., $\left(\partial\Pi^W(q)/\partial q_{P_C}^W\right) - \left(\partial\Pi^N(q)/\partial q_{P_C}^N\right)$). If the term inside the squiggly brackets is positive, we obtain the equilibrium configuration described in result (i) of Lemma EC.2. If the term inside the squiggly brackets term is negative, we obtain the equilibrium configuration described in result (ii) of Lemma EC.2. If the term inside the squiggly brackets is zero, firms either form a narrow alliance or a wide alliance regardless of their qualities. If the term inside the squiggly brackets is not zero, the relevant condition for each of the two equilibrium configurations in results (i) and (ii) of Lemma EC.2 can be written as $\alpha_A^C q_A + \alpha_B^C q_B > y$, where y aggregates all the other terms of the relevant inequality. ■

The two equilibrium configurations identified in Lemma EC.2 are represented, respectively, in Panel A and Panel B of Figure EC.2. In both cases, downward sloping lines in the space of firm qualities (q_A, q_B) separate the region where firms form a wide alliance from the region where firms form a narrow alliance.

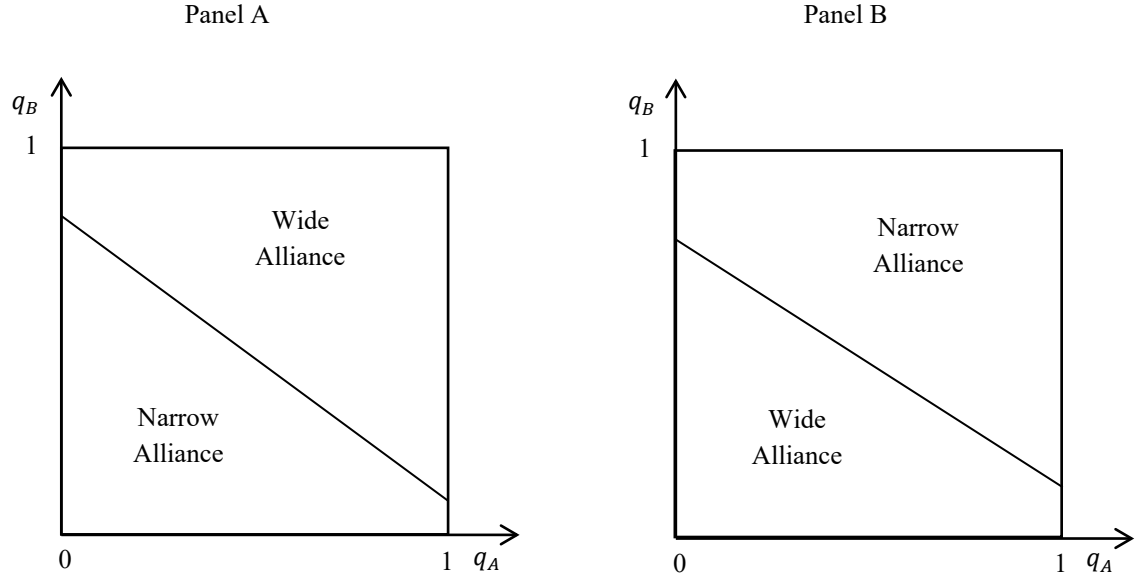

Figure EC.2 Equilibrium Configurations where a Wide and a Narrow Alliance Occur for Different Firm Qualities

In the equilibrium configuration depicted in Panel A, firms form a wide alliance when their qualities are high and form a narrow alliance when their qualities are low. This means that the impact of firms' qualities on joint profits through a success of (joint) project P_C in period one—that is, the impact of the performance effect on firms' joint profits—is higher when the scope of their collaboration goes beyond project P_C. The opposite happens in Panel B. Moreover, since in Panel A firms are more likely to form a wide alliance if their qualities are high, the announcement of a wide (narrow) alliance signals a high (low) quality of both firms to consumers. In Panel B, the opposite happens.

As in our main analysis, the announcement and performance effects may be consequential for firms' choice of alliance scope, since in equilibrium these two effects may counter and dominate the complementarity effect. Proposition EC.2 states this result formally.

> PROPOSITION EC.2. *The combined impact of the announcement and performance effects on firms' joint profits under a wide alliance (versus a narrow alliance) may counter and dominate the impact of the complementarity effect, thereby determining firms' optimal choice of alliance scope.*

Proof of Proposition EC.2. This result is proven by presenting a numerical example which, in the same spirit of the prior numerical example that was used to prove Proposition 6, illustrates how ignoring the announcement and performance effects may lead to mistaken decisions between a narrow alliance and a wide alliance. Suppose that consumers' initial beliefs about firms' qualities are described by the density function $g(q) = f_A(q_A) \times f_B(q_B)$, where $f_A(q_A) = (1-q_A)^{10}/\int_0^1 (1-\hat{q}_A)^{10} d\hat{q}_A$ and $f_B(q_B) = q_B^8(1-q_B)^4/\int_0^1 \hat{q}_B^8(1-\hat{q}_B)^4 d\hat{q}_B$. This implies that firms' initial reputations are $r_A = \int_0^1 \hat{q}_A f_A(\hat{q}_A) d\hat{q}_A \approx 0.083333$ and $r_B = \int_0^1 \hat{q}_B f_B(\hat{q}_B) d\hat{q}_B = 9/14 = 0.64286$. Let also $\alpha_A^A = \alpha_A^C = 0.5$, $\alpha_A^B = 0.95$, $V_A = 10$, $V_B = 35$, and $V_C = 35$. Note that the values of S, K, and μ are irrelevant as long as S is sufficiently large relative to μ, so that a narrow alliance and a wide alliance are always better than independent project implementation. Given these assumptions, firms form a wide alliance in equilibrium if and only if $\Pi^W(q) > \Pi^N(q) \Leftrightarrow 0.5q_A + 0.5q_B > 0.299$, and form a narrow alliance otherwise.

We now compare the optimal decision above with the decision that would be made by firms that would only consider the complementarity effect and potential reputation-independent synergies, thus ignoring the performance and announcement effects. This corresponds to assuming that firms' reputations remained equal to their initial

reputations regardless of firms' decision and project outcomes. Thus, when deciding whether to form a narrow alliance or a wide alliance, firms would only consider $\overline{\Pi}^W$ and $\overline{\Pi}^N$, which correspond to joint profits if firms' reputations remained the same as their initial reputations. In particular, firms would decide to form a wide alliance if and only if $\overline{\Pi}^W > \overline{\Pi}^N$. In our numerical example, we have $\overline{\Pi}^W - \overline{\Pi}^N = \mu 32.944 - \mu 48.75 = -\mu 15.806 < 0$, meaning that in this case firms would choose to form a narrow alliance regardless of their qualities. As discussed before, if firms' qualities are sufficiently high, a wide alliance is the optimal choice. Thus, considering only the complementarity effect (and potential reputation-independent synergies) may lead to a mistaken decision, in the form of a narrow alliance in situations where a wide alliance is the optimal choice.

This numerical example corresponds to a situation where the combined impact of the announcement and performance effects on the optimal choice between a narrow alliance and a wide alliance may counter and dominate the impact of the complementarity effect. Akin to the previous numerical example in the proof of Proposition 6, this example emphasizes that firm managers should consider the different reputational effects, as not doing so may lead to suboptimal alliance scope choices. ■

Overall, the analysis presented in this model extension highlights the potential importance of the three reputational effects for firms' choice of alliance scope.

References

Baum, J. A., T. Calabrese, B. S. Silverman. 2000. Don't go it alone: Alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal* **21**(3) 267–294.

Hamel, G. 1991. Competition for competence and interpartner learning within international strategic alliances. *Strategic Management Journal* **12**(S1) 83–103.

Hamel, G., Y. L. Doz, C. K. Prahalad. 1989. Collaborate with your competitors and win. *Harvard Business Review* **67**(1) 133–139.

Khanna, T. 1998. The scope of alliances. *Organization Science* **9**(3) 340–355.

Khanna, T., R. Gulati, N. Nohria. 1998. The dynamics of learning alliances: Competition, cooperation, and relative scope. *Strategic Management Journal* **19**(3) 193–210.

Lunnan, R., S. A. Haugland. 2008. Predicting and measuring alliance performance: A multidimensional analysis. *Strategic Management Journal* **29**(5) 545–556.

Oxley, J. E., R. C. Sampson. 2004. The scope and governance of international R&D alliances. *Strategic Management Journal* **25**(8-9) 723–749.