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Partner Uncertainty and the Dynamic Boundary of the Firm

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Partner Uncertainty and the Dynamic Boundary of the Firm*

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Abstract

We develop a new theory of the dynamic boundary of the firm where asset owners may want to change partners ex-post. The model identifies a fundamental trade-off between (i) a “displacement externality” under non-integration, where a partner leaves a relationship even though his benefit is worth less than the loss to the displaced partner, and (ii) a “retention externality” under integration, where a partner unnecessarily retains the other. With more asset specificity, displacement externalities matter more and retention externalities less, so that integration becomes more attractive. Our model also shows that wealthy partners would want to commit to ex-post wealth constraints.

Keywords: Asset ownership, control rights, firm boundaries, asset specificity, specific investments, wealth constraints.

JEL classification: D23, D82, D86.

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1 Introduction

A central question in the theory of the firm is who should own the productive assets. It is commonly presumed that all asset owners know who their optimal trading partners are. In this paper we introduce uncertainty about the optimal partner match. This uncertainty generates a dynamic trade-off between the commitment to a trading relationship (integration) versus the flexibility of seeking new relationships (non-integration). We ask how partner uncertainty affects the allocation of property rights over productive assets, and how it influences the subsequent evolution and performance of the firm.

We identify a novel trade-off between integration and non-integration that is based on the dynamics of partner changes. Non-integration gives parties the freedom to easily leave their partners, whereas integration gives parties the security that their partners cannot easily leave them. Each regime has its strengths and weaknesses. Under non-integration parties have the flexibility of leaving, but may also find themselves in a situation where the harm to the party left behind exceeds the benefit to the leaving party. We call this a *displacement externality*. Under integration no such inefficient leaving occurs, but partners may find themselves in the opposite situation: Partners may inefficiently stay together even though the individual value of leaving would exceed the joint value of staying together. We call this a *retention externality*.

We use a model set-up similar to Grossman and Hart (1986) where there are two owner-managers. They have inalienable human capital, as well as alienable co-specialized assets, which we can think of physical capital or intellectual property. We allow for team production, so that the partners’ profit sharing agreement affects their effort incentives. The optimal allocation of property rights either consists of integration with joint asset control, or non-integration where each partner retains control over his own asset. We first consider a simple model without specific investments. This shuts down the standard trade-off for the optimal asset ownership known from the property rights theory, and allows us to focus on the new determinants that emerge solely from partner uncertainty.
The optimal ex-ante allocation of asset ownership depends on the degree of partner uncertainty, and the associated inefficiencies. Our base model shows that joint asset ownership is optimal when displacement externalities loom large, whereas individual asset ownership is preferred when retention externalities matter more. The relative importance of displacement and retention externalities depends on how good the original match between partners is. The greater the asset specificity, the greater the displacement externality, and also the smaller the retention externality. Higher asset specificity therefore favors joint asset ownership.

When allowing for relation-specific investments we find that joint asset ownership always provides stronger incentives for specific investments. The key intuition is that joint asset ownership is efficient when the internal match is good, but can cause retention externalities when the internal match is poor. By contrast, individual asset ownership is efficient when the internal match is poor, but can cause displacement externalities when the internal match is good. Consequently, joint (individual) asset ownership increases (decreases) the difference between the good and the bad match, which is good (bad) for incentives.

We also find that wealthy owners actually want to constrain the amount of wealth that is available for ex-post transfers. This is because having wealth is a double-edged sword: On the one hand, it enables transfer payments that mitigate ex-post inefficiencies. On the other hand, it weakens ex-ante incentives for specific investments, precisely because it allows partners to mitigate ex-post inefficiencies when the partner match is poor. In fact, the model shows that the optimal wealth is always sufficiently low to create a binding constraint.

The model generates testable predictions concerning the dynamics of firm boundaries and partner selection. Most important is the prediction that integration is associated with greater partner stability. This prediction stands out against the property rights literature (Grossman and Hart, 1985) which typically assumes optimal partner matches, and therefore does not even consider dynamic stability. The model also generates predictions about the initial allocation of property rights over assets. The higher the quasi-rents for the initial partner match, the more
desirable it is to integrate. This formalizes an argument commonly associated with transaction cost theories (Williamson, 1985), namely that integration is more attractive when the value of an asset within the partnership is high compared to its current outside value. However, the model also predicts that the higher the expected quasi-rents in a potential match with an alternative partner, the less attractive it is to integrate upfront. This last prediction takes a new dynamic perspective, comparing current quasi-rents against potential future quasi-rents from alternative trading relationships.

2 Related Literature

Our model makes several departures from the seminal property rights models of Grossman, Hart and Moore (GHM henceforth). First, our base model deliberately excludes specific investments, which is the central mechanism for determining asset ownership in the GHM model. Second, our model allows for ex-post inefficiencies, which do not occur in GHM. Third, in the GHM model switching to an outside partner is a threat that is never exercised in equilibrium, whereas in our model partner changes actually occur in equilibrium. For example, buyouts can actually occur in our model. Fourth, our model allows partners to contractually specify prices ex-ante. Fifth, in our model the optimal type of integration is joint asset ownership, whereas in the GHM model integration always consists of one agent owning both assets.

5Note, however, that our model includes private effort. We incorporate a moral-hazard-in-teams problem (Holmström, 1982) into our production function. This yields a concave utility frontier as long as the agents’ wealth constraints are binding, which generates the ex-post inefficiencies.
6The non-contractibility of prices is crucial for the property rights theory. We assume that prices are contractible at all times. However, our model does have some contractual incompleteness concerning interim information that allows partners to update their profitability forecasts. If these updates are verifiable, then the optimal allocation of assets becomes state-contingent. Even then the underlying trade-off between displacement and retention externalities remains valid.
7Cai (2003) examines a model with both specific and general investments, and shows that joint asset ownership becomes optimal when the two types of investments are substitutes. Halonen (2002) provides conditions under which joint asset ownership is optimal in a repeated game framework; see also Blonski and Spagnolo (2003). Our model provides a novel reason for the optimality of joint asset ownership, namely to prevent the dissolution of efficient partnerships.
Our theory provides a fresh perspective on one of the central tenets of transaction cost economics. Williamson (1975, 1985) argues that higher asset specificity should lead to integration, providing some verbal reasoning about opportunism and ex-post price haggling. More formal theories tend to dismiss these explanations, because rational agents should be able to resolve ex-post inefficiencies, and anticipate ex-ante any distributional consequences.\(^8\) Yet, there is strong empirical support that asset specificity is associated with integration.\(^9\) In our model binding wealth constraints create ex-post inefficiencies that are robust to renegotiation. Asset specificity matters not because of price haggling, but because of partner uncertainty, and its associated displacement and retention externalities. We also augment the standard transaction cost logic by identifying a dynamic trade-off, namely that asset specificity in the current relationship has to be compared against expected asset specificity in a potential future relationship.

A prior literature considers the possibility of ex-post inefficiencies.\(^10\) Of historic interest is that, in addition to their seminal 1986 paper, Grossman and Hart published a less well known book chapter in 1987 with a model where there are ex-post inefficiencies and no specific investments (Grossman and Hart, 1987). More recently, Hart (2009) and Hart and Holmström (2010) examine asset ownership in models with "reference points" where in certain states agents can commit to inefficiently withhold cooperation without renegotiation. Aghion et al. (2012) provide a model where renegotiation is hampered by ex-post asymmetric information. They show how the ex-ante asset allocation plays a role over and above any contractual arrangements.

In our model ex-post inefficiencies derive from a binding wealth constraint. We are not the first to consider wealth constraints. Aghion and Bolton (1992), for example, use them in a financial contracting model. In their model there are fixed non-transferable private benefits that

\(^8\)Indeed, GHM’s property rights theory challenges Williamson’s reasoning, arguing that what matters are marginal incentives to increase asset specificity through specific investments (see also Whinston, 2003). More recently, several paper develop formal models with costly ex-post adjustments, in the spirit of the transaction cost literature. See in particular Bajari and Tadelis (2001), Tadelis (2002), Matouschek (2004), and Casas-Arce and Kittsteiner (2011).

\(^9\)See Lafontaine and Slade (2007) for a comprehensive survey of the empirical literature.

\(^10\)Gibbons (2005) identifies these as adaptation-based theories of the firm. Segal and Whinston (2012) classify them as theories with imperfect bargaining.
can lead to ex-post inefficient decisions, depending on the allocation of control rights. The main difference to our model is that they focus on financial structures in a single asset model with liquidation, whereas we consider integration decisions in a model with two assets and partner uncertainty.

Joint asset ownership in our model can also be interpreted as a set of mutually exclusive contracts. As such our paper is related to the large literature on exclusive contracting and vertical foreclosure. Aghion and Bolton (1987) examine how a seller can lock buyers into long-term contracts to reduce the threat of entry from a competing seller. Bolton and Whinston (1993) use a property-rights approach to study how concerns about supply assurances can motivate vertical integration. Segal and Whinston (2000) show that exclusive contracts have no effect on specific investments. De Fontenay, Gans, and Groves (2010) further generalize these results. These models typically find that exclusive contracts matter if there is no renegotiation, but that they no longer matter once renegotiation is allowed. In our model there is renegotiation; yet exclusive contracts still matter because renegotiation cannot always achieve the efficient outcome.

Our paper is also related to the emerging literature on the economics of entrepreneurship. One part of this literature examines the formation of partnerships and teams. Prat (2002) considers the benefits of forming heterogeneous teams. Franco, Mitchell, and Vereshchagina (2011) identify conditions under which moral hazard leads to assortive matching among team members. Hellmann and Perotti (2011) examine how idea generators are matched with idea developers, both within firms and markets. These theories are mostly concerned with the process by which initial partners form a team. Hellmann and Thiele (2015) further ask at what stage founders actually want to commit to a team. Their theoretical set-up is related to the current model, but their focus is on relating the timing of contracting to uncertainty about founder characteristics.

The remainder of this paper is structured as follows. The next section introduces our main model. Section 4 examines how partners make choices about staying versus leaving a rela-

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11See also Jing and Winter (2014) for a broader overview of the literature on exclusionary contracts.
tionship, and identifies the optimal asset ownership in the absence of specific investments. In Section 5 we then analyze the role of asset ownership for the partners’ incentives to make relation-specific investments. In Section 6 we identify the optimal allocation of control rights over critical assets, accounting for specific investments and ex-post transfer payments. In Section 7 we discuss how allowing for asymmetric partners would affect our main insights. Section 8 summarizes our main results, and explores avenues for future theoretical and empirical work. All proofs are in the Online Appendix, which is available on the authors’ websites.

3 The Base Model

Consider an initial match of two risk-neutral partners, for ease of exposition called Alice (A) and Bob (B). For example, Bob can be the owner an upstream firm selling an input to Alice as the owner of a downstream firm, which Alice needs to manufacture an end product. The value of their initial outside options is normalized to zero. Each partner initially owns a co-specialized asset, and has wealth $w \equiv w_A = w_B \geq 0$.

There are five dates; see Figure 1 for a graphical overview. At date 0, both partners decide on an ownership structure for both assets. While we consider all ownership structures, the key decision will be whether partners keep individual asset ownership, or they agree on joint asset
ownership. At date 1, both partners can make relation-specific investments to improve the value of joint production. At date 2, Alice and Bob learn about the prospect of their partnership, and may find alternative partners. They then decide whether to stay together, or to leave and form a new partnership. Alice and Bob may also renegotiate any division of surplus. At date 3, partners exert private effort to produce output. Finally, at date 4, all returns are realized.

In case of a successful joint production, Alice and Bob generate the profit $y$ at date 4. We assume that $y$ is verifiable, and that it has a distribution $\Omega_{in}(y)$ over some interval $y \in [\underline{y}, \overline{y}]$ with $0 \leq \underline{y} < \overline{y} \leq \infty$. We denote the expected value by $\pi = \int_{\underline{y}}^{\overline{y}} y \, d\Omega_{in}(y)$, and refer to it as the inside prospect of the match between Alice and Bob. We assume that the inside prospect $\pi$ is observable by both partners, but non-verifiable by outside parties.

At date 1 Alice and Bob can invest in their relationship to improve the distribution of potential profits $y$. Specifically we assume that the expected profit $\pi$ can take on two values: $\pi \in \{\pi_L, \pi_H\}$, with $\pi_H > \pi_L > 0$. The inside prospect $\pi$ will be high with probability $p = p(r_A, r_B)$ ($\pi = \pi_H$), and low with probability $1 - p$ ($\pi = \pi_L$), where $p$ is concave increasing in the partners’ relation-specific investments $r_A$ and $r_B$. Specific investments are non-contractible, and impose convex private costs $\psi(r_i)$, $i = A, B$, with $\psi(0) = \psi'(0) = 0$. To ensure interior solutions we assume that $p(0, 0) = 0$ and $\partial p(\cdot)/\partial r_i|_{r_i=0} = \infty$, $i = A, B$. We also assume that the cross-partial is not too negative: $\partial^2 p(\cdot)/\partial r_A \partial r_B > -\kappa$, where $\kappa > 0$. This ensures that the reaction functions of both partners are well-behaved.\footnote{A sufficient and intuitive assumption is that the specific investments $r_A$ and $r_B$ are (weak) strategic complements, so that $\partial^2 p(\cdot)/\partial r_A \partial r_B \geq 0$.}

Alice and Bob learn the actual inside prospect $\pi \in \{\pi_L, \pi_H\}$ at date 2. Depending on the observed inside prospect $\pi \in \{\pi_L, \pi_H\}$ at date 2, Alice and Bob can decide to break their original partnership and match with alternative partners. Specifically we assume that Alice finds an alternative partner, called Charles ($C$), with probability $q > 0$. We assume symmetry so that Bob discovers an alternative partner, called Dora ($D$), with the same
probability $q$.\footnote{Recall that Alice and Bob have complementary assets which both are needed for production. This excludes the possibility of Alice partnering with Dora, or Bob partnering with Charles.} For simplicity we assume that both alternative partners, Charles and Dora, have zero wealth, and normalize their outside options to zero. The profit $y$ of a successful alternative partnership has the distribution $\Omega_{\text{out}}(y)$. We denote the expected value by $\sigma = \int y d\Omega_{\text{out}}(y)$, which we refer to as the outside prospect.

At date 3 the partners engage in joint production; this can be either Alice and Bob ($A, B$), or Alice and Charles ($A, C$) and/or Bob and Dora ($B, D$). Joint production requires \(i\) the use of both of the partners’ complementary assets, and \(ii\) their private efforts, which we denote $e_i$, $i = A, B, C, D$. A partner’s disutility of effort is $c(e_i)$, with $c'(e_i) > 0$, $c''(e_i) > 0$, and $c(0) = c'(0) = 0$. Production either generates a joint profit at date 4 (success), or no profit at all (failure). The success probability is given by $\mu(e_i e_j)$, $i, j \in \{\{A, B\}, \{A, C\}, \{B, D\}\}$, which is increasing and concave in its argument $e_i e_j$, with $\mu(0) = 0$. Thus, the partners’ efforts are complementary, and success requires that both partners apply strictly positive efforts (i.e., $e_i, e_j > 0$).

The realized profit $y$ at date 4 can be divided between the two partners according to any sharing rule where Alice obtains $\alpha y$ and Bob receives $\beta y$, with $\alpha + \beta = 1$. Depending on the ownership structure this sharing rule can be implemented in different ways. Under joint asset ownership, we think of $\alpha$ and $\beta$ as a division of ownership shares from the jointly owned venture. Under individual asset ownership there are no ownership shares, so the division of surplus comes from some transfer price.$^{15}$

Ownership defines control rights over the productive assets. We assume that Alice and Bob initially have full rights of control over their respective assets. Alice and Bob can then choose to retain their control rights at date 0 (individual asset ownership); they can then simply wait

\footnote{In principle it is possible to make $\alpha$ and $\beta$ contingent on $y$. In the case of joint asset ownership, it is easy to verify that for any division of surplus with variable $\alpha$ and $\beta$, there exists an equivalent division of surplus with a constant $\alpha$ and $\beta$. W.l.o.g we can therefore focus on constant $\alpha$'s and $\beta$'s. In the case of individual asset ownership, $\alpha$ and $\beta$ depend on how transfer prices are specified, i.e., how they depend on the realization of $y$. To keep our notation as simple as possible we focus on the case of constant $\alpha$'s and $\beta$'s. This is w.l.o.g since all that matters is the expected profit share at date 2.}
until date 2 to see whether in fact they want to partner up. If they do, they negotiate a transfer price which determines their profit shares \((\alpha, \beta)\) at that time. Alternatively, the partners can agree at date 0 to share control rights over both assets (joint asset ownership). This requires that Alice and Bob negotiate the ownership shares \(\alpha\) and \(\beta\) at date 0 (we discuss in the Online Appendix why we can limit ourselves to individual and joint asset ownership). Ownership matters because it affects the ability of a partner to leave: Under individual asset ownership, a partner with a superior outside option can always leave without the consent of the other. Under joint asset ownership, the two partners share control rights over both assets, so that leaving requires consent of the other partner.

The two initial partners Alice and Bob determine asset ownership at date 0. Bargaining can also occur at date 2, where it may involve two or more parties. Because of a potentially binding wealth constraint (in case each partner’s initial wealth \(w\) is sufficiently low), we need a bargaining solution for games with non-transferable utilities. We adopt the bargaining protocol of Hart and Mas-Colell (1996), where in each round one member at the bargaining table is selected at random to make a proposal, and where there is a small probability that a partner whose proposal was rejected, is permanently eliminated from the bargaining.\(^\text{16}\) We assume that the only members at the bargaining table are those who have the control rights to affect the decision. This means that under individual asset ownership, bargaining takes place between the two partners who want to engage in joint production. Under joint asset ownership, however, leaving requires the consent of the other partner. A new partner (Charles or Dora) therefore has to engage in trilateral bargaining with both of the original partners (Alice and Bob). In the Online Appendix we show that alternative bargaining protocols may generate different levels

\(^{16}\)This is a multi-player generalization of the breakdown game by Binmore, Rubinstein, and Wolinsky (1986). This bargaining protocol generates the Maschler-Owen consistent NTU value, which is a generalization of the Shapley value for games with non-transferable utility (Maschler and Owen, 1992). For bilateral bargaining games, the Maschler-Owen consistent NTU value reduces to the Nash bargaining solution. For a more extensive discussion of this, see Hart (2004).
of utility, but they do not affect the basic logic of how partners make optimal asset ownership decisions.

4 The Role of Asset Ownership

We first analyze how asset ownership affects the renegotiation outcome between Alice and Bob at date 2, and therefore their decision to stay together or to match with alternative partners. We then identify the optimal asset ownership that Alice and Bob agree on at date 0. To show that our key insights do not rely on specific investments, we deliberately shut down this part of the model until Section 5, and assume for now that the probability of a high inside prospect, $p$, is fixed.

4.1 Joint Production

In our model there is team production.\footnote{Because of the binary nature of outcomes (success or failure), there is no possibility for budget breaking as in Holmström (1982).} Alice and Bob choose their respective efforts $e_A$ and $e_B$ to maximize their expected utilities:\footnote{The analysis is analogous for joint production with a new partner (Charles or Dora) except that the inside prospect $\pi \in \{\pi_L, \pi_H\}$ is to be replaced by the outside prospect $\sigma$.}

$$
U_A(\alpha; \pi) = \alpha \mu(e_A e_B) \pi - c(e_A) \quad U_B(\beta; \pi) = \beta \mu(e_A e_B) \pi - c(e_B)
$$

Figure 2 illustrates the utility-possibility frontier for different profit shares $\alpha$ and $\beta = 1 - \alpha$. The frontier is backward bending because every partner relies on the productive effort of his co-partner. If one partner exerts no effort (which occurs when $\alpha \in \{0, 1\}$), joint production never succeeds ($\mu(0) = 0$), and Alice and Bob both get a zero utility. We can also see from Figure 2 that the total surplus is maximized when each (symmetric) partner gets exactly half of the expected profit $\pi$ ($\alpha = \beta = 1/2$); we formally prove this in the Online Appendix. However,
each partner prefers to get more than half of the expected profit, i.e., the individually optimal profit shares for Alice and Bob satisfy $\alpha^{\text{max}} = \beta^{\text{max}} > 1/2$.

### 4.2 Symmetric Outside Options

We can now analyze how the allocation of control rights over the two assets, affects Alice’s and Bob’s decision at date 2 to stay together or to dissolve their partnership. For this we first consider the outcome in case they have identical outside options.

If neither Alice nor Bob found an alternative partner, which occurs with probability $(1-q)^2$, joint production is the only option. Because of symmetry, both partners share the profits equally, so that $\alpha^* = \beta^* = 1/2$. For this case we denote the expected utility of each partner by $U(\pi) \equiv U_A(\pi) = U_B(\pi)$.

Now suppose that Alice and Bob each found an alternative partner, which occurs with probability $q^2$. If Alice and Bob decide to stay together, they agree on $\alpha^* = \beta^* = 1/2$. The expected utility for each partners is then $U(\pi)$. Alternatively, Alice and Bob can decide to match with Charles and Dora respectively. They then bargain over the division of the expected profit $\sigma$ from their new partnerships. Recall that the alternative partners, Charles and Dora, both have zero
outside options. The same applies to Alice and Bob during the bargaining.\footnote{Technically, under the Hart and Mas-Colell bargaining protocol, there is an \( \varepsilon \) probability that the bargaining fails. Thus, with probability \( \varepsilon \), Alice has the fall-back option of going back to Bob, and vice versa. The Hart and Mas-Colell bargaining protocol then assumes that \( \varepsilon \to 0 \), implying that Alice’s and Bob’s outside options converge to zero.} The Nash bargaining solution then implies that the profit shares for Alice and Bob in their new partnerships are given by \( \alpha = \beta = 1/2 \).\footnote{Throughout the paper we use an asterisk (\( ^* \)) to indicate equilibrium profit shares under joint production (Alice-Bob match); a hat (\( \hat{\cdot} \)) indicates the equilibrium profit shares in alternative matches (either Alice-Charles match, or Bob-Dora match).} For this case we denote expected utility of each partner by \( U(\sigma) \).

It is straightforward to show that \( U(\sigma) = U(\pi) \) when \( \sigma = \pi \in \{\pi_L, \pi_H\} \). Thus, Alice and Bob stay together (joint production) with \( \alpha^* = \beta^* = 1/2 \) as long as \( \pi \geq \sigma \). Otherwise they dissolve their partnership, and match with their alternative partners Charles and Dora.

And because leaving is mutually beneficial for \( \sigma > \pi \), it is irrelevant whether they agreed on individual or joint asset ownership at date 0.

4.3 Asymmetric Outside Options

The most interesting scenario arises when only one partner found an alternative partner at date 2. This occurs with probability \( q(1-q) \). We discuss the implications of individual and joint asset ownership separately.

4.3.1 Individual Asset Ownership

Suppose Alice and Bob agreed on individual asset ownership at date 0, and w.l.o.g. assume that only Alice found an alternative partner at date 2, Charles. To identify potential inefficiencies that may then arise, we first consider the case where Alice and Bob have no initial wealth \( (w = 0) \). We then relax this assumption and show how Alice and Bob can use their wealth to (partially) offset these inefficiencies.

Individual asset ownership allows Alice to unilaterally take her asset and form a new partnership with Charles without Bob’s consent. The outside option of Alice when bargaining with
her alternative partner Charles is to go back to Bob, and thus given by $U(\pi)$.

Let $\hat{\alpha}_I$ denote the equilibrium profit share for Alice when partnering with Charles, where the subscript $'I'$ indicates individual asset ownership. Alice’s expected utility is then $U_A(\hat{\alpha}_I; \sigma)$.

When Alice leaves Bob and matches with Charles, Bob’s expected utility becomes $U_B = 0$. This is clearly smaller than his expected utility $U_B(\pi)$ under joint production with Alice. Thus, Alice imposes a displacement externality on Bob when displacing him with the alternative partner Charles. Leaving Bob is jointly inefficient when $U_A(\hat{\alpha}_I; \sigma) < 2U(\pi)$.

Alice could also stay with Bob but use her better outside option to renegotiate a higher profit share. The outside option of Alice when renegotiating with Bob is given by $U_A(\alpha_I^*; \sigma)$. Let $\alpha_I^*$ denote the equilibrium profit share for Alice when staying with Bob.

The renegotiation then leads to the expected utility $U_A(\alpha_I^*; \pi)$ for Alice, and $U_B(\beta_I^*; \pi)$ for Bob, with $\beta_I^* = 1 - \alpha_I^*$. Relative to the equal division of profits with $\alpha = \beta = 1/2$, this outcome is more favorable to Alice, and less favorable to Bob. Most importantly, it is jointly inefficient since joint surplus is maximized at $\alpha = \beta = 1/2$.

Whether the partner with the outside option stays or leaves the initial partnership depends on the inside project $\pi \in \{\pi_L, \pi_H\}$ that the two partners observe at date 2. In the Online Appendix we derive a threshold of the inside prospect, $\hat{\pi}_I(\sigma) = \sigma$, so that asymmetric outside options under individual asset ownership with zero wealth lead to displacement when $\pi < \hat{\pi}_I(\sigma)$, and unequal profit shares when $\pi \geq \hat{\pi}_I(\sigma)$.

If Alice and Bob have some wealth $w > 0$, they could make transfer payments to (partially) offset these inefficiencies. With unlimited wealth the ex-post inefficiencies can be completely eliminated (Alice then stays with $\alpha = \beta = 1/2$). In the Online Appendix we characterize

\footnote{According to the Hart and Mas-Colell bargaining protocol, this outside option would only be realized if the bargaining between Alice and Charles breaks down, so that Alice loses Charles as a potential trading partner. In this case, both Alice and Bob would have zero outside options, so that they split the equity in half.}

\footnote{More formally, $\hat{\alpha}_I$ maximizes the Nash product $[U_A(\hat{\alpha}_I; \sigma) - U(\pi)]^{1/2}[U_C(1 - \hat{\alpha}_I; \sigma)]^{1/2}$. It is easy to see that for any $U(\pi) > 0$ we have $\hat{\alpha}_I \in (1/2, 1)$.}

\footnote{Using Nash bargaining, $\alpha_I^*$ maximizes $[U_A(\alpha_I^*; \pi) - U(\sigma)]^{1/2}[U_B(1 - \alpha_I^*; \pi)]^{1/2}$. Moreover, note that $U(\sigma) > 0$ implies $\alpha_I^* \in (1/2, 1)$.}

13
the minimum amount of wealth, denoted \( w_I \), that is required to fully eliminate the inefficiencies. We also characterize \( w_I \geq 0 \) as the lower bound, below which wealth cannot change the renegotiation outcome (Alice still prefers to partner with Charles).

**Lemma 1** Consider individual asset ownership and suppose that the two original partners have asymmetric outside options. Then, there exists a threshold \( \tilde{\pi}_I(\sigma, w) \) such that the partner with the better outside option leaves if \( \pi < \tilde{\pi}_I(\sigma, w) \). Otherwise, if \( \pi \geq \tilde{\pi}_I(\sigma, w) \), he stays but renegotiates his share on the expected joint profit \( \pi \). The threshold \( \tilde{\pi}_I(\sigma, w) \) is decreasing in wealth \( w \) for \( w_I \leq w \leq w_I \).

Joint production between Alice and Bob is the outcome under individual asset ownership with asymmetric outside options whenever the inside prospect \( \pi \) is sufficiently high (\( \pi \geq \tilde{\pi}_I(\sigma, w) \)). The partner with the better outside option then renegotiates the division of surplus, which is optimal from a selfish perspective but compromises the efficiency of joint production (as long as the partners do not have sufficient wealth for transfers to settle on an equal split of profits). Displacement, on the other hand, occurs whenever the prospect of the original partnership is sufficiently low (\( \pi < \tilde{\pi}_I(\sigma, w) \)). This imposes a displacement externality on the partner without outside option.

The effect of more initial wealth \( w \) is to allow the partner without outside option to offer a larger transfer payment. This makes staying (with renegotiation) more attractive for the partner with the outside option. As a consequence the region where the original partners stay together is larger, i.e., the critical value \( \tilde{\pi}_I \) becomes smaller.

### 4.3.2 Joint Asset Ownership

Now consider joint asset ownership, and w.l.o.g. assume again that only Alice found an alternative partner, Charles, at date 2.

Suppose Alice wants to leave Bob. Without wealth, Alice can only buy out her asset by offering Bob a share on the future return \( \sigma \) from her new partnership with Charles. Productive
effort is then only applied by Alice and Charles, so that Bob is a shareholder who does not add any value. We define \( \hat{\alpha}_J \) and \( \hat{\beta}_J \) as the equilibrium shares on the return \( \sigma \) for Alice and Bob, respectively. The equilibrium share for Charles is denoted by \( \hat{\gamma}_J \). For this scenario we denote the expected utility for Alice as \( U_A(\hat{\alpha}_J; \sigma) \), and for Bob as \( U_B(\hat{\beta}_J; \sigma) \). This buyout arrangement impairs effort incentives, and thus lowers the expected payoff from Alice’s partnership with Charles.

However, the profit share \( \hat{\beta}_J \) offered to Bob may not suffice to buy his consent, so that Alice is forced to stay despite leaving being jointly efficient, which is the case when \( U(\sigma) > 2U(\pi) \). Bob then imposes a retention externality on Alice.

Which of the two inefficiencies – inefficient buyout or retention – arises in equilibrium, depends again on the inside project \( \pi \in \{\pi_L, \pi_H\} \) that Alice and Bob observe at date 2. In the Online Appendix we characterize the threshold \( \hat{\pi}_J(\sigma) \), so that asymmetric outside options under joint asset ownership with zero wealth lead to retention when \( \pi \geq \hat{\pi}_J(\sigma) \), and inefficient buyout when \( \pi < \hat{\pi}_J(\sigma) \).

When Alice and Bob have some wealth \( w > 0 \), they can make side-payments to mitigate these inefficiencies. In the Online Appendix we characterize the minimum amount of wealth, denoted \( \overline{w}_J \), that is necessary to eliminate all ex-post inefficiencies under joint asset ownership (Alice can buy out her asset without offering Bob a profit share). Likewise we characterize the lower bound of wealth, \( \underline{w}_J \geq 0 \), below which wealth cannot affect the renegotiation outcome (the transfer is not enough for Bob to let Alice go).

**Lemma 2** Consider joint asset ownership and suppose that the two original partners have asymmetric outside options. Then, there exists a threshold \( \hat{\pi}_J(\sigma, w) \), such that the partner with the better outside option leaves with consent if \( \pi < \hat{\pi}_J(\sigma, w) \). Otherwise, if \( \pi \geq \hat{\pi}_J(\sigma, w) \), he stays with \( \alpha^* = \beta^* = 1/2 \). The threshold \( \hat{\pi}_J(\sigma, w) \) is increasing in wealth \( w \) for \( \underline{w}_J \leq w < \overline{w}_J \).

\[\text{---}24\text{---}\]We provide a complete characterization of \( \hat{\alpha}_J, \hat{\beta}_J, \) and \( \hat{\gamma}_J \) in the Online Appendix, using the Maschler-Owen consistent NTU value.
Joint production between Alice and Bob is the equilibrium outcome as long as the inside prospect $\pi$ is sufficiently high ($\pi \geq \hat{\pi}_J(\sigma, w)$). They then split everything in half ($\alpha^* = \beta^* = 1/2$), so that total surplus is maximized. In contrast, Alice and Bob agree to break up whenever the alternative partnership is attractive enough ($\pi < \hat{\pi}_J(\sigma, w)$). Unless the partner with the better outside option, say Alice, has sufficient wealth ($w \geq w_J$), she needs to offer Bob a stake in the new partnership with Charles in exchange for regaining control rights over her asset. The effect of more wealth $w$ is to enable Alice to make larger payments to Bob, thereby allowing her to retain more of the equity of the new partnership with Charles. This makes the buyout option more attractive, and leaving occurs for a larger range of parameters, i.e., the critical value $\hat{\pi}_J$ is increasing in $w$.

4.4 Optimal Asset Ownership

With symmetric outside options it is irrelevant whether Alice and Bob agreed on individual or joint asset ownership; the outcome is always jointly efficient. Only for asymmetric outside options and binding wealth constraints the allocation of control rights matters.
**Proposition 1** Suppose $w < \min\{w_I, w_J\}$. Then, there exists a threshold $\hat{\pi}_V(\sigma)$, such that the contract choice for the two partners at date 0 is as follows:

(i) For $\pi_L, \pi_H < \hat{\pi}_V(\sigma)$, they choose individual asset ownership.

(ii) For $\pi_L, \pi_H \geq \hat{\pi}_V(\sigma)$, they choose joint asset ownership.

(iii) For $\pi_L < \hat{\pi}_V(\sigma) < \pi_H$, there exists a threshold $\hat{p} \in (0, 1)$, such that both partners choose joint asset ownership at date 0 whenever $p \geq \hat{p}$; otherwise they choose individual asset ownership.

The threshold $\hat{\pi}_V(\sigma)$ satisfies $\hat{\pi}_J(\sigma, w) < \hat{\pi}_V(\sigma) < \hat{\pi}_I(\sigma, w)$, and is increasing in $\sigma$.

For now let us focus on the scenarios (i) and (ii) to explain the rationale behind Proposition 1. For this we refer to Figure 3, which presumes that Alice and Bob have asymmetric outside options at date 2. Dissolving their partnership is then jointly efficient if the inside prospect is sufficiently low ($\pi < \hat{\pi}_V(\sigma)$); otherwise joint production with an equal split of profits maximizes joint surplus.

Consider regions (I) and (II). In these two regions the inside prospect $\pi$ is sufficiently high, so that Alice’s and Bob’s joint utility is maximized when they remain together. Under individual asset ownership there is a displacement externality: In region (II) the outside prospect $\sigma$ is sufficiently attractive, so that the partner with outside option simply leaves without renegotiation. In region (I), the partner with outside option merely uses his opportunity to switch as a bargaining chip. Both of these outcomes are ex-post inefficient from a joint perspective. These inefficiencies can be avoided with joint asset ownership, where Alice and Bob always remain together without renegotiation.

In regions (III) and (IV), the inside prospect is weak relative to the outside prospect, so that dissolving the partnership in case of asymmetric outside options would maximize Alice’s and Bob’s joint surplus. In region (IV) the partner with outside option has to buy himself
free under joint asset ownership, which compromises effort incentives in his new partnership.
However, in region (III) the outside prospect is not high enough to warrant a buyout. As a
consequence the partner without outside option inefficiently retains the other. Obviously, these
retention inefficiencies can be avoided with individual asset ownership.

Now consider the most interesting scenario (iii) from Proposition 1. Alice and Bob then
choose joint asset ownership if the inside prospect $\pi$ is likely to be high ($p \geq \hat{p}$), because
preserving the partnership is likely to be valuable. Otherwise they choose individual asset
ownership in order to retain the flexibility to dissolve a likely inefficient partnership ($p < \hat{p}$).
Thus, the threshold $\hat{p}$ balances (i) the risk of preserving inefficient partnerships (joint ownership
with $\pi = \pi_L$), and (ii) the risk of compromising otherwise efficient partnerships (individual
ownership with $\pi = \pi_H$). Overall we note that for this scenario the ex-ante optimal allocation of
control rights can lead to ex-post inefficiencies, namely a displacement inefficiency (individual
ownership), associated with regions (I) and (II) in Figure 3, and a retention externality (joint
ownership), associated with regions (III) and (IV).

If the internal learning process was based on verifiable signals so that an ex-ante contract can
distinguish between $\pi = \pi_L$ and $\pi = \pi_H$, then Alice and Bob could write a contingent contract
which stipulates individual asset ownership at date 2 whenever $\pi = \pi_L < \hat{\pi}_V(\sigma)$, and joint asset
ownership whenever $\pi = \pi_H \geq \hat{\pi}_V(\sigma)$. For the remainder of this paper we assume that $\pi$
is non-verifiable, which seems very plausible within the present context, given that learning about
the inside prospect is specific to the collaboration of the two partners. Moreover, we focus on
the most interesting scenario where $\pi_L < \hat{\pi}_V(\sigma) < \pi_H$. This implies that the ex-ante decision
over asset ownership involves a trade-off between the flexibility of individual asset ownership
versus the commitment value of joint asset ownership.
5 Relation-specific Investments

We now augment our model and allow Alice and Bob to make relation-specific investments at date 1.

Note that both partners are symmetric at date 1, so that in equilibrium they choose the same level of specific investment. We define $r^*_I(w)$ as the equilibrium relation-specific investment of a partner under individual asset ownership, and $r^*_J(w)$ as the equilibrium investment under joint asset ownership. We provide a complete characterization of the partners’ expected utilities and the equilibrium investment levels, $r^*_I(w)$ and $r^*_J(w)$, in the Online Appendix (see Proof of Proposition 2).

For now let us assume that Alice and Bob use their entire wealth to mitigate ex-post inefficiencies. For this the next proposition compares the specific investments under individual asset ownership ($r^*_I(w)$) and joint asset ownership ($r^*_J(w)$) for different wealth levels.

**Proposition 2** For $w < \max\{w_I, w_J\}$, joint asset ownership provides greater incentives for relation-specific investments, i.e., $r^*_J(w) > r^*_I(w)$. Moreover,

(i) $r^*_J(w)$ is decreasing in the partners’ wealth $w$ for $w_J \leq w < \bar{w}_J$, and

(ii) $r^*_I(w)$ is increasing in the partners’ wealth $w$ for $w_I \leq w < \bar{w}_I$.

For $w \geq \max\{w_I, w_J\}$, relation-specific investments are identical and constant under individual and joint asset ownership, i.e., $r^*_I(w) = r^*_J(w)$.

Figure 4 illustrates the insights from Proposition 2 (allowing for all renegotiation scenarios: $w_i = 0$ and $w_i > 0$, $i = I, J$). To explain the key intuition, let us first focus on the case with zero wealth ($w = 0$), so that Alice and Bob cannot make any ex-post transfers. With joint asset ownership, the partner combination is always efficient when the inside prospect is high, but leads to inefficient retention when the inside prospect is low. The latter inefficiency of joint
asset ownership widens the difference in utilities between a low and a high inside prospect. With individual asset ownership, the partner combination is always efficient when the inside prospect is low, but causes displacement problems when the inside prospect is high. The latter inefficiency of individual asset ownership narrows the difference in utilities between a low and a high inside prospect. We therefore find that joint asset ownership provides stronger incentives for specific investments ($r_J^*(0) > r_I^*(0)$), precisely because the inefficiency then arises when the partners have failed to develop a strong internal relationship.

The next question is what happens to specific investments when Alice and Bob have some initial wealth $w > 0$? Under individual asset ownership, wealth allows them to smooth out ex-post inefficiencies in the good state $\pi = \pi_H$. This improves the marginal benefit of specific investments, so that $r_I^*(w)$ is increasing in $w$. Under joint asset ownership, wealth helps Alice and Bob to correct ex-post inefficiencies in the bad state $\pi = \pi_L$. This makes the difference between the bad and the good state relatively smaller, and therefore compromises Alice’s and Bob’s incentives to make relation-specific investments. Thus, $r_J^*(w)$ decreases in $w$, while $r_I^*(w)$ increases.

Alice and Bob can eliminate all ex-post inefficiencies for sufficiently high wealth levels ($w \geq \max\{\overline{w}_I, \overline{w}_J\}$). That is, with enough wealth they can always dissolve their partnership.
in the bad state ($\pi_L$), so that $V(\pi_L) = U(\sigma)$; and they can always agree on staying together with an equal split of profits in the good state ($\pi_H$), so that $V(\pi_H) = 2U(\pi)$. The allocation of control rights is then irrelevant, and the marginal incentives for specific investments are the same ($r^*_I(w) = r^*_J(w)$).

6 Specific Investments and Optimal Asset Ownership

We can now complete our model and identify the optimal ownership structure for Alice and Bob, accounting for their specific investments and potential ex-post transfers.

We first characterize Alice’s and Bob’s expected utilities for different levels of wealth, assuming again that they use their entire wealth to mitigate ex-post inefficiencies.\(^{25}\)

Lemma 3 Under individual asset ownership, the expected utility of a partner at date 0, denoted by $EU_I(w)$, has three distinct segments:

(i) For $w < w_I$, $EU_I(w)$ is constant in $w$.

(ii) For $w_I \leq w < \bar{w}_I$, $EU_I(w)$ is strictly increasing in $w$.

(iii) For $w \geq \bar{w}_I$, $EU_I(w)$ is constant in $w$.

The previous sections identified two distinct facets of wealth. On the one hand, having wealth allows Alice and Bob to mitigate potential inefficiencies arising from asymmetric outside options; and doing so is always optimal ex-post. On the other hand, having wealth affects their incentives for relation-specific investments. Under individual asset ownership the ex-post efficiency effect of wealth and the incentive effect of wealth both go in the same direction: More wealth improves the renegotiation outcome at date 2; it also improves ex-post incentives

\(^{25}\)The expected utility is obviously increasing in wealth itself, so we focus on the expected utility from the productive activities, net of initial wealth. This expected utility still depends on wealth, since wealth affects both incentives and ex-post payoffs (case of asymmetric outside options).
for specific investments at date 1 because the inefficiencies are associated with a high inside prospect. The expected utility $EU_1(w)$ is therefore increasing in wealth $w$ in the range $w \in [w_I, \bar{w}_I)$, and constant everywhere else.

We now turn to joint asset ownership. For the next lemma we define $w^*_J$ as the wealth level which maximizes the expected utility of a partner under joint ownership at date 0.

**Lemma 4** Under joint asset ownership, the expected utility of a partner at date 0, denoted by $EU_J(w)$, has the following properties:

(i) For $w < w_J$, $EU_J(w)$ is constant in $w$.

(ii) For $w_J \leq w < \bar{w}_J$, there exists a threshold $\tilde{\pi}_H$ such that $w^*_J = w_J$ for all $\pi_H \geq \tilde{\pi}_H$, and $w^*_J \in (w_J, \bar{w}_J)$ for all $\pi_H < \tilde{\pi}_H$.

If $w^*_J = w_J$, then $EU_J(w)$ is strictly decreasing in $w$ for $w \in [w_J, \bar{w}_J)$.

If $w^*_J > w_J$, then $EU_J(w)$ is strictly increasing in $w$ for $w \in [w_J, w^*_J)$, and strictly decreasing in $w$ for $w \in (w^*_J, \bar{w}_J)$.

(iii) For $w \geq \bar{w}_J$, $EU_J(w)$ is constant in $w$.

Lemma 4 shows that a partner’s expected utility under joint asset ownership is not necessarily monotone in wealth. This is because wealth has two opposite effects: It allows Alice and Bob in case of asymmetric outside options to improve their ex-post payoffs in the bad state $\pi = \pi_L$. However, this concurrently compromises Alice’s and Bob’s incentives to invest in their relationship (see Proposition 2). Which effect dominates then depends on the importance of relation-specific investments, as reflected by the parameter $\pi_H$. For sufficiently high values of $\pi_H$ ($\pi_H \geq \tilde{\pi}_H$), the incentive effect always dominates. In this case the expected utility $EU_J(w)$ is decreasing in $w$, and has its maximum at zero wealth.\footnote{If $w_J > 0$, there is a range $[0, w_J]$ where $EU_J(w)$ is maximized.} For lower values of $\pi_H$
Figure 5: Wealth and Expected Utilities under Individual and Joint Asset Ownership

\( \pi_H < \hat{\pi}_H \), the incentive effect does not always dominate. In the Online Appendix we show that the expected utility \( EU_J(w) \) then first increases in wealth, and then decreases.

We can now derive a condition so that Alice and Bob prefer joint to individual asset ownership at date 0. For parsimony we define \( \bar{w} \equiv \max\{\bar{w}_I, \bar{w}_J\} \).

**Proposition 3** There always exists a critical wealth level \( w_0 \), with \( w_0 \in [0, w^*_J] \), such that the partners strictly prefer joint asset ownership for all \( w \in (w_0, \bar{w}) \).

Figure 5 compares the expected utility levels under individual versus joint asset ownership. If Alice and Bob have sufficient wealth \( (w \geq \bar{w}) \), they can eliminate all ex-post inefficiencies in case of asymmetric outside options. The specific ownership structure is then irrelevant (i.e., \( EU_I(w) = EU_J(w) \) for \( w \geq \bar{w} \)). For \( w < \bar{w} \), however, there always exists a region where joint asset ownership is preferred to individual asset ownership. This region extends all the way down to \( w_0 \). In some cases we have \( w_0 = 0 \), so that joint asset ownership is optimal for all levels of wealth; see the left graph of Figure 5 where \( \pi_H \leq \hat{\pi}_H \). In other cases we have \( w_0 > 0 \), so that joint asset ownership is only optimal for intermediate levels of wealth; see the right graph of Figure 5 where \( \pi_H > \hat{\pi}_H \). All this implies that the two partners, Alice and Bob, only choose individual asset ownership at date 0 when \( (i) \) relation-specific investments are not
very important for their partnership ($\pi_H \leq \hat{\pi}_H$), and (ii) they have little or no initial wealth ($w \leq w_0$). Otherwise they always have a (weak) preference for joint asset ownership.

We can see from Figure 5 that the partners’ expected utilities depend on how much wealth they have available for ex-post transfers. An interesting question is what wealthy partners would do if they can commit to limiting the amounts that can be used for ex-post transfer payments? We get the following corollary, which immediately follows from the above, and can be seen directly off Figure 5.

**Corollary 1** If wealthy partners can commit to limiting the wealth available for ex-post transfer payments, then they always choose joint asset ownership and commit to being wealth constrained at $w = w^*_J$.

The maximum of the expected utilities, $EU^{\text{max}} = \max\{EU_I(w), EU_J(w)\}$, is always reached at $EU_J(w^*_J)$. This implies that the combination of joint asset ownership and a wealth constraint at $w^*_J$ achieves the best trade-off between ex-ante incentives for specific investments and ex-post efficiency. Interestingly, in the case of $\pi_H \geq \hat{\pi}_H$, we even have $w^*_J = 0$. The optimal arrangement for wealthy partners is then joint asset ownership with the commitment to a zero wealth constraint ex-post.

### 7 Asymmetric Partners

In our base model we focused on two symmetric partners. Naturally one may ask whether our key trade-off between displacement and retention externalities remains intact when allowing for asymmetric partners. We focus on two sources of asymmetry: asymmetric wealth and asymmetric outside options.

Suppose the two partners have different initial wealth levels. For example, one of the partners may be a wealth-constrained entrepreneur, the other an established corporation with large cash reserves. For simplicity suppose that Alice is fully wealth constrained but Bob faces no
such constraints. Consider individual asset ownership with a high inside prospect ($\pi_H$). If only Alice finds an outside partner, she may want to leave. This causes a displacement externality. Now if Bob has wealth, he can make a transfer payment that convinces Alice to stay, making both parties better off. Unfortunately this solution only works in one of the two asymmetric scenarios. If only Bob finds an outside partner, he may want to leave. Alice does not have the wealth to retain Bob, and thus the displacement externality arises again in equilibrium. A similar argument applies to joint asset ownership with a low inside prospect ($\pi_L$). If only Bob finds an outside partner, he normally is affected by the retention externality. If Bob has wealth, he can make a transfer payment to buy out Alice. However, if only Alice finds an outside partner, she cannot buy herself free, and the retention externality arises again in equilibrium. Overall we see that with asymmetrically wealthy partners the same inefficiencies occur, only less frequently. All that is needed for our key model insights is that at least one of the partners has insufficient wealth to completely eliminate potential displacement and retention externalities.

It remains to discuss how asymmetric expectations about their outside options affect the partners’ assets ownership decisions. For this we use a simplified version of our model without specific investments, where Alice and Bob each get a utility $\pi/2$ when staying together, and $\sigma/2$ when matching with alternative partners. We also assume that Alice will find an alternative partner, Charles, with probability $q_A$, while Bob will find Dora with probability $q_B (\neq q_A)$.

In the Online Appendix we show that Alice prefers joint asset ownership if

$$q_A < \hat{q}_A = \left[ \left( \frac{1 - q_B}{q_B} \right) \left( \frac{\sigma - \pi}{\pi} \right) + 1 \right]^{-1}. $$

Likewise, Bob favors joint ownership if $q_B < \hat{q}_B$, where $\hat{q}_B$ is symmetric to $\hat{q}_A$. The threshold $\hat{q}_A (\hat{q}_B)$ is increasing and convex in $q_B (q_A)$ when $\pi < \sigma/2$. When $\pi > \sigma/2$, it is increasing and concave in $q_B (q_A)$.
Figure 6: Preferences with Ex-ante Asymmetric Outside Options

Figure 6 illustrates Alice’s and Bob’s preferences for joint asset ownership, for different values of $q_A$ (y-axis) and $q_B$ (x-axis). Consider first the left graph where $\pi < \sigma/2$, i.e., where leaving is efficient from a joint perspective. In region $(III)$, Alice is sufficiently unlikely to find an alternative partner, and therefore prefers the protection of joint asset ownership ($q_A < \hat{q}_A$). Likewise, Bob only prefers joint asset ownership in region $(I)$ ($q_B < \hat{q}_B$). We can see that for $\pi < \sigma/2$ the two partners never agree on sharing control rights. Thus, individual asset ownership is the equilibrium outcome for all $q_A, q_B \in (0, 1)$.

The right graph illustrates Alice’s and Bob’s preferences when $\pi > \sigma/2$, i.e., when staying together maximizes their joint surplus. Again, each partner prefers joint asset ownership only when he is sufficiently unlikely to find an alternative match. For Alice this happens in regions $(II)$ and $(III)$, for Bob in regions $(I)$ and $(II)$. In region $(II)$ Alice and Bob both prefer to share control over their assets. Joint asset ownership therefore requires that the two partners are not too dissimilar in terms of their outside prospects.
8 Conclusion

This paper develops a dynamic theory of optimal firm boundaries based on partner uncertainty. The model identifies a fundamental trade-off between two ex-post inefficiencies. Under non-integration (i.e., individual asset ownership) there can be a displacement externality, where a partner may leave even though the benefit is worth less than the loss to the displaced partner. Under integration (i.e., joint asset ownership) there can be a retention externality, where one partner may hold on to the other, even though the benefit to the departing partner would exceed the loss to the remaining partner. Moreover, we show that wealth has two distinct effects. Ex-post, wealth mitigates the displacement and retention externalities. Ex-ante, however, wealth reduces incentives for specific investments. We also find that wealthy owners always want to commit ex-ante to limiting ex-post transfer payments.

Our model generates some new empirical predictions about the dynamics of firm boundaries. Most of the prior theoretical work focuses on comparative statics, and consequently most of the empirical work emphasizes cross-sectional determinants of the integration decision. Our theory suggests an empirical research agenda about the time-series properties of integration. For a given level of asset specificity, our model predicts that partner switching is more common under individual than under joint asset ownership. It seems highly intuitive that switching to outside buyers or suppliers is rarer in a vertically integrated setting. The interesting point is that this simple prediction cannot be obtained from theories with ex-post efficiency: in these models partners always switch exactly at the efficient time, irrespective of asset ownership. Our model also predicts that non-integration is more common in environments with high partner uncertainty. Prior empirical work typically focused on general measures of uncertainty, often with mixed results (see Lafontaine and Slade, 2007). We contend that these measures fail to
distinguish between uncertainty about production and demand, versus uncertainty about partner choices.27

Our analysis suggests avenues for further theoretical work. We focused on team incentives and wealth constraints as source of ex-post inefficiencies; but there may be other sources of inefficiencies, such as asymmetric information (Aghion et al., 2012). Future research may therefore examine how alternative ex-post inefficiencies affect the dynamic properties of firm boundaries. In our model the arrival of superior partners is exogenous. Another interesting extension would be to consider the strategies that firms choose to identify alternative partners. Finally, we chose the simplest possible dynamic specification where partners have at most one opportunity to switch. A worthwhile future research agenda is to extend the model to an infinite horizon. This would allow for a more comprehensive analysis of how asset ownership affects the timing and frequency of partner changes. Overall we believe that looking at the dynamics of asset ownership over time constitutes a new and promising direction for future research.

27Recent work by Fresard, Hoberg and Phillips (2013) provides evidence that indirectly supports our perspective. Using a text-based analysis to measure vertical relationships, they find a positive relationship between firm age and vertical integration.
References


