Alignment of Interests and the Governance of Joint Ventures[1]

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ABSTRACT

The paper analyzes optimal governance structures for the provision of a common input. Monitoring by the future users of the input may improve its quality. Monitoring has a public good component in that it benefits all users, as well as a conflict of interest component in that a monitor may use her proprietary information to bias input choice to her benefit and to the detriment of the other users. The paper compares three familiar governance structures, outside (investor) ownership, vertical integration (undivided control by a user), and joint venture, with the optimal mechanism.

Vertical integration gives the integrated user an incentive to monitor but generates biased decision making. In contrast, a joint venture, by requiring Pareto-improving decisions, yields unbiased decision making, but may provide too little incentives to monitor and generate foot-dragging and deadlocks, especially when the users' objectives are quite divergent.

Often, the size of the conflict of interest among users can be reduced, at a cost, through contractual provisions. Our comparative statics exercises unveil a stark contrast between vertically integrated governance and the joint venture in this respect. Under vertical integration, negative externalities imposed by biased decision making reduce efficiency and do not affect incentives to monitor. In a joint venture, they do not affect decision making but increase the incentive to monitor. Parties to a joint venture are already protected by their control rights and further protection turns out to be counterproductive. We therefore argue that joint venture contracts should be less detailed and offer fewer exit opportunities than contracts protecting non controlling stakeholders.

JEL Classification : D23, G32, L3

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1 Introduction

This paper is concerned with the provision of a common input through a specific-purpose institution : joint venture, alliance, consortium or association (*joint venture* for short). To avoid duplicative activities, to enjoy synergies, to promote a standard, or to solve an appropriability problem, firms often join forces and create producer- or customer-owned enterprises. The latter perform basic research (Bellcore, Electric Power Research Institute, Microelectronics and Computer Technology Corporation), develop new products (General Motors-Toyota's joint venture, Partnership for a New Generation of Vehicles, telecommunications or biotechnology alliances), share expensive equipment or services (hospitals' joint ventures involving expensive health care services, oil companies sharing airport facilities to supply airlines with kerosene, Associated Press), assemble parts produced by the members and market the final product (Airbus), implement network externalities (standardization committees, Visa and MasterCard credit card associations, FTD), or provide joint marketing facilities, advertising, lobbying, and public relations (long-distance moving joint ventures such as Allied Van Lines, physician speciality networks, farm cooperatives such as Land O' Lakes or Ocean Spray).

Often, though, common inputs used by multiple firms are not produced cooperatively. Rather, they are supplied by a single, vertically integrated user of the input selling or licensing the input to other potential users (the case of *vertical integration* or *proprietary shared technology*) or by an entirely separate entity (the case of *vertical separation*). One may therefore wonder why the apparently natural ownership structure, namely the cooperative one, is not pervasive. Or, as Hansmann (1996) puts it, why isn't everyone an owner ?[1]

[1] Antitrust authorities, too, must trade off the efficiency and competitive effects of alternative ownership structures – see Chang-Evans-Schmalensee (1998) for an economic perspective on the courts' treatment of joint ventures. When considering breaking-up companies such as AT&T or Microsoft, keeping infrastructure users (e.g., railroad operators, generation and power distribution companies) from directly managing the infrastructure, competition policy officials and lawmakers need to complement their analysis of competitive effects with an understanding of the functioning of alternative ownership and governance structures. As early as 1898, in *Addyston Pipe* (US vs Addyston Pipe & Steel Co, 83F.271, 6th Circuit), Judge Taft argued for example that restricting competition by the members with the joint venture may be necessary for forming a successful joint venture. Baker (1993) and other economists have sometimes argued that the efficiency cost of compelled

Hansmann's fascinating book and much anecdotal and empirical evidence[2] stress the role of homogeneity of membership in the success of cooperative ventures. Factors of divergence of objectives are many : differences in the users' competitive environments (contested vs safe industry segments, entrants vs incumbents), in installed technologies (research on operational improvements in the technologies used by the established firms vs research on new technologies used by entrants), in competencies, in time horizons (old vs young entrepreneurs, liquidity strapped vs rich firms), in adequation between allocated capacity and needs,[3] in personal opportunities of profiting from the venture's costly side activities,[4] or simply in the choice of technology or the location of investments (differences in standards, differences in stakeholders' locations with respect to decisions of power grid reinforcement). Hansmann argues that homogeneity is actually one of the key motivations for the existence of "capital cooperatives", i.e., business corporations. Investors by and large have a common goal (the return on their investments), and divergences in their objectives, as in the case of debtholders and shareholders, are mainly by design. Hansmann further observes that members of joint ventures or associations try hard to create unity of goals.[5]

A major task of this paper is to relate the divergence of interests to the efficacy of joint ventures and to institutional choice. On the one hand, under heterogeneous goals, most decision processes will give rise to inefficiencies if the ensuing decisions are not renegotiated. For

association may outweigh the potential pro-competitive benefits of opening joint ventures to competitors.

[2] E.g., Baker (1993), Banerjee et al (1997), Brodley (1982), Chang et al. (1998), Emmons-Mueller (1997), Gomes-Casseres (1994), Hart-Moore (1996), Kremer (1998), and Wilson (1973).

[3] For example, it has been argued that AT&T blocked plans to expand the capacity of transcontinental cables between Northern and Southern America as AT&T had a substantial share of the existing joint venture capacity and was not eager to see its rivals expand.

[4] E.g., large vs small farmers in Banerjee et al. (1997).

[5] For example, cooperatives issue little or no capital stock even among their members in order not to create classes of shareholders with interests quite distinct from the nonshareholding members'. There is also a scarcity of cooperatives handling more than one product (and the few multi-product cooperatives are usually organized in profit centers) ; similarly joint ventures in the computer or automobile industries usually have a limited scope. Law firms use sharing rules that promote congruence among partners to the detriment of individual incentives.

Other examples of policies that try to achieve convergence of goals include mutual stakeholdings (equity swaps, mutual board service) and the development of close relationships at multiple organizational levels in an attempt to build trust.

example, the preferred outcome of a dictator or of the median voter need not coincide with the outcome that maximizes total surplus, unless preferences of all members are congruent.[6] The Coase theorem on the other hand implies that if the joint venture's members are symmetrically informed and if they can negotiate the outcome, then heterogeneity has no effect on the efficiency of final outcomes.

This suggests considering situations in which the Coase theorem is unlikely to hold and institutions matter. However, such departures from the Coase theorem do not necessarily explain Hansmann's and others' observations about the covariation of the joint venture choice and homogeneity : While joint ventures intuitively should perform better under homogeneity, so do alternative institutions. Indeed, one might well have formulated the opposite conjecture : In a situation with divergent objectives, the joint venture, by making everyone an owner, should provide all members with some degree of protection against biased technological choices and therefore might be preferred to alternative institutions despite its inefficiency. A theory of joint ventures must address this "heterogeneity puzzle".

We are particularly interested in situations in which producers ought to listen to and be monitored by their users. Different governance structures give rise to different monitoring intensities and to different qualities of decision making.[7] In our two-user model, users' monitoring choices and their use of the resulting information are both strategic. Monitoring allows a user to propose to alter the course of action (if control is shared) or to directly implement this change (if he has control), in a way that may make the input more valuable to both users but also may bias input design to his advantage and to the detriment of the other user. This ambiguity as to the implications of user intervention is central to our analysis.

We study whether familiar governance structures are optimal and how heterogeneity impacts the choice of governance structure. We also derive policies that make the standard institutions

[6] The median voter chooses the outcome in Hart-Moore's (1998) and Kremer's (1998) analyses of associations. Banerjee et al (1997) provide evidence that large growers have disproportionate power in the case of sugar cooperative factories in the Indian state of Maharashtra and, in their model, assume that decisions maximize a weighted social welfare function in which the large growers have disproportionate weights.

[7] See Aghion-Tirole (1997).

more effective. The paper is organized as follows. Section 2 introduces three familiar institutions (vertical separation, vertical integration, joint venture) and provides further motivation for the analysis. Section 3 describes the model. Section 4 compares the three institutions and provides conditions under which one of them is optimal. Section 5 shows that policies that benefit a vertically integrated environment in general hurt joint ventures. Following the lines of Maskin-Moore (1999) and Segal-Whinston (1998a), section 6 analyzes optimal mechanism design with renegotiation (an exercise of interest only if the conditions obtained in section 4 are not satisfied) and generalizes the analysis of sections 4 and 5. Section 7 discusses extensions while section 8 concludes with a summary of the main insights and policy recommendations and lists a few desirable extensions.

Our analysis can be related to several recent papers which analyze specific aspects of the possible divergence of interest among users, or between users and suppliers. Glaeser-Shleifer (1998), Kremer (1998) and Hart-Moore (1998) emphasize different channels through which the divergence of interest among members of a cooperative impacts the efficacy of decision-making. Kremer's paper stages two dimensions of employee moral hazard : investment in firm specific human capital and current effort. Workers are ex ante identical but have different productivities ex post. It assumes that the relationship between a worker's (verifiable) performance and wage cannot be contracted upon ex ante and so there is a risk of expropriation of the workers' investments. The paper compares two institutions : worker cooperative (the workers ex post vote on a linear incentive scheme) and capitalist firm (shareholders ex post choose this scheme). The benefit of a worker cooperative is that the workers have no incentive to expropriate themselves and so invest more in firm- specific human capital. But if the median voter has less than average ability, incentives for contemporaneous effort are dulled. In a similar spirit, Glaeser and Shleifer develop a hold up model in which a firm's customers or employees are somewhat protected by the non-profit status. Indeed the cost-reducing effort of the non-profit firm is lower than that of the for-profit firm. To the extent that cost reductions affect non-contractible quality, then the non-profit status may bring about an improvement.

Hart and Moore (1998) compare input supply by an independent producer and by a not-for-profit cooperative. The independent producer charges a monopoly price to users and so induces underconsumption of the input ; in contrast, a not-for-profit cooperative leads to overconsumption of the input by members of the cooperative relative to outsiders because the members cannot pay themselves dividends in cash and therefore opt for "dividends in kind". Hart and Moore also analyze the impact of median voter choices on the quality of the input.

2 Examples of governance structures

2.1 Typology

An agent or management team A develops an input or a technology that later will be used by two users U_1 and U_2. The focus of this paper is on whom the agent should report to and obey. Control rights on A's activity may be allocated to one of the two users, to nonstakeholding investors who have no direct benefit as users ("investors" for short in what follows), or be shared among two of or the three potential right holders. Figure 1 describes the main resulting governance structures ; bold lines indicate a right holder.

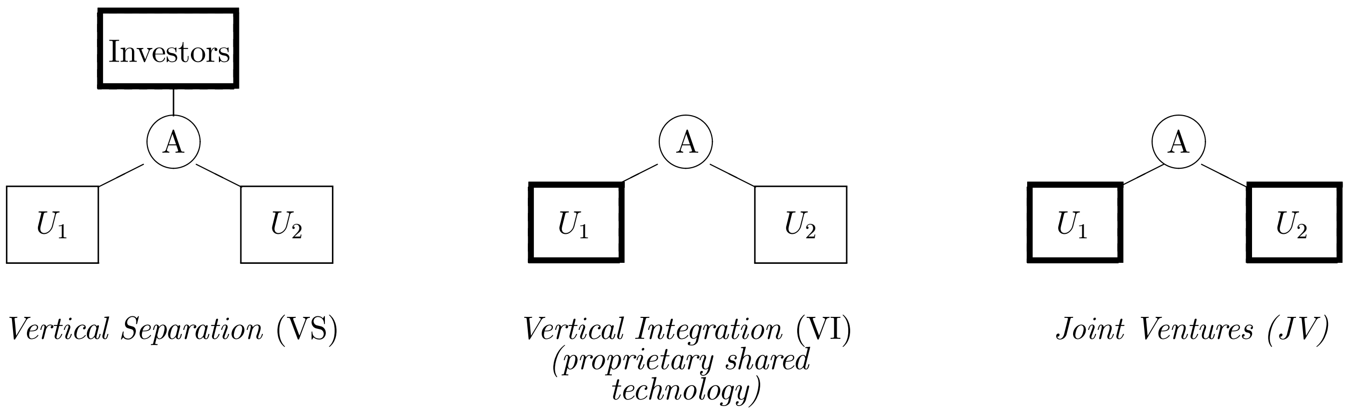

Figure 1 : Main ownership structures

Under *vertical separation*, all control rights over A's activity are given to investors. Users have no control rights over the design of the input and its price. In contrast, under *vertical integration*, all control rights are allocated to a single user, whereas under (horizontal) *joint ventures*, these control rights are shared by both users.[8]

To keep the terminology straight, it is worth stressing that our typology is based on the allocation of *control rights*. In particular, "vertical separation" does not preclude cooperation between the independent owner and the users. This cooperation may take the form of joint financing, long-term contracts, and/or pre-decision-making communication. For example, Microsoft licenses its operating system to computer manufacturers (the OEMs), and does not make computers itself. Thus, if we restrict attention to OEM users of Windows, the vertical separation paradigm applies in that a non user has control over the input design ; this does not prevent Microsoft from communicating substantially with OEMs regarding their needs. Similarly, a nonstakeholding input supplier can ask noncontrolling potential users to participate in the financing ; for example, Mips, a Silicon Valley startup, organized in the 1980s a coalition including NEC, DEC, Bull, software companies, and later on Microsoft and Compaq, to manufacture RISC (reduced information-set computing) chips. Unlike the other competing groups (organized around Sun, IBM, and HP), the Mips RISC group did not involve a joint management governing body. Mips, the lead company, remained in control. Thus, even though Mips might resemble a joint venture, the allocation of control rights links it more closely to the vertical separation paradigm.

2.2 Illustrations

As the following illustrations show, a variety of governance structures are indeed observed, sometimes even within the same industry.

a) *Credit cards and ATMs*

[8] Alternative ownership structures include vertical joint ventures, where the investors and one or the two users share the control rights over A's activity. Another alternative is of course to duplicate input production and limit access to the input owner.

Master Card and Visa, which accounted for 85 percent of all charges on payment cards in 1997, are non-profit joint ventures of financial institutions.[9] The initial industry structure, though, belonged to the vertical integration paradigm. For example, in the 1950s, Bank of America developed a proprietary card, which it licensed to other banks in the 1960s. Bank of America retained the control rights until it turned its card system into an independent joint venture (called NBI and then Visa) with joint management of the card issuing members. Similarly, the Master Card joint venture originated in a prior proprietary system. Note that the industry exhibits some duplication of input production, with the duplication of joint ventures as well as the existence of proprietary credit card systems such as American Express and Discover.

The evolution of the ATM (automatic teller machines) industry bears some resemblance with that of the credit card industry. It is interesting to note that ATM joint ventures have often competed with proprietary shared systems, i.e., systems in which a retail bank licenses its program to other banks, but keeps control of operating rules, fees, and conditions for participation.[10]

b) *News services*

In the US, the news services industry for several decades exhibited an interesting competition between a newspapers joint venture, Associated Press, and two proprietary systems (UP and INS) owned by independent investors. There was thus coexistence of the joint venture and vertical separation ownership structures.[11]

c) *Computer industry*

Alternative governance structures also coexist in the computer industry, as exemplified by the competition between Intel (vertical separation), Mips and the three RISC joint ventures.

[9] See Evans-Schmalensee (1999) for an up-to-date analysis of the credit card industry.

[10] In both Texas and New England, the proprietary network sought favorable acccess to its non-profit joint venture competitor, which reluctanly gave in. See Baker (1993) for more details.

[11] In a well-known antitrust case in 1945 (Associated Press v. United States, 326 U.S.1), Associated Press was forced to abandon its system of partial local exclusivity (which was also used by the two proprietary networks). Non-member newspapers joined massively Associated Press and over the years stopped subscribing to the proprietary networks.

Microsoft's design of Windows roughly fits with the vertical separation paradigm for features of interest to OEMs, and with the vertical integration paradigm for features of interest to some applications software.

d) *Electricity, railroads, telecommunications*

The restructuring of these industries is inspired by two main paradigms : vertical separation of the infrastructure (AT&T breakup, independent transmission grid in the US, UK and several other countries,[12] railroads in Europe) versus vertical integration with access policies (telecommunications in most countries, electricity in Europe, railroads in the US). There have also been examples of joint ventures such as the Pennsylvania-New Jersey-Maryland electricity pool (which was recently replaced by an independent system operator), "global services" telecommunications providers such as Concert (an alliance between AT&T and British Telecom), or transcontinental cable or satellite joint ventures. To be certain, regulation affects the impact of control rights in these industries, but the efficiency effects studied in the paper ought to be relevant nevertheless.

3 The model

• *Users and supplier* : There are two ex ante symmetric, risk neutral users (or groups of users), U_1 and U_2. To produce, they need an essential input. Because of returns to scale, say, this input is produced by a single agent, A. A design or quality decision is made at the interim stage, that impacts the users' final surpluses from producing from the input. The users may have conflicting interests regarding this interim design choice. Besides, the agent cannot be trusted to always choose the design that maximizes the users' aggregate surplus. The users may therefore want to have some control over the decision process.

In this paper, we will not be preoccupied with the agent's incentive to acquire information and will simply assume that she learns for free and announces her preferred choice (which may or may not be optimal for the users).

[12] See e.g. Atwood (1996), Hogan et al. (1996), and Plummer (1990).

• *Timing* : There are three dates, $t = 0, 1, 2$. At date 0 the users choose a governance structure (a contract) so as to maximize their expected surplus.[13] At date 1 the agent learns and recommends her preferred action a^A in the feasible set $\mathcal{A}$. The users may then acquire information about the payoff consequences of alternative technological choices. Then, an action a in the feasible set $\mathcal{A}$ must be chosen. At date 2, the users consume the input. Their surpluses are not verifiable.[14]

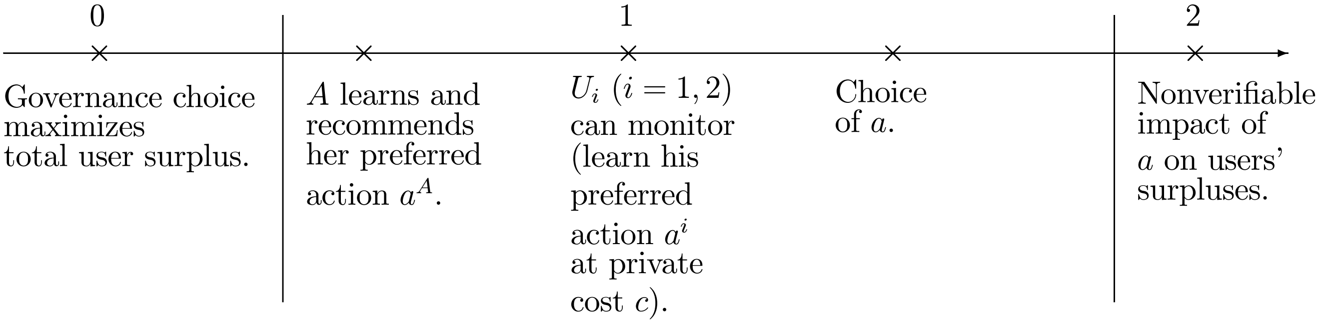

Figure 2 : Timing

• *Altering the agent's proposed course of action* : We normalize each user's expected surplus associated with the agent's preferred action at zero; that is, we are interested in the increments/decrements to the users' surpluses brought about by altering the course of action proposed by the agent.

Before the decision is made, each user can monitor at private cost c; by assumption, non-users are unable to monitor the adequacy of the agent's design with the users' needs. When monitoring, user U_i learns which action a^i in $\mathcal{A}$ is best for him. To simplify the analysis, we assume that there are only two payoff configurations : dissonance between users and congruence (see figure 3).

[13] As is customary in the institutional design literature, the justification for this assumption is that if the resulting contract favors one user, the users can operate a date-0 compensating transfer.

[14] This assumption rules out the benefits from equity participations identified in Dasgupta-Tao (1998, 2000).

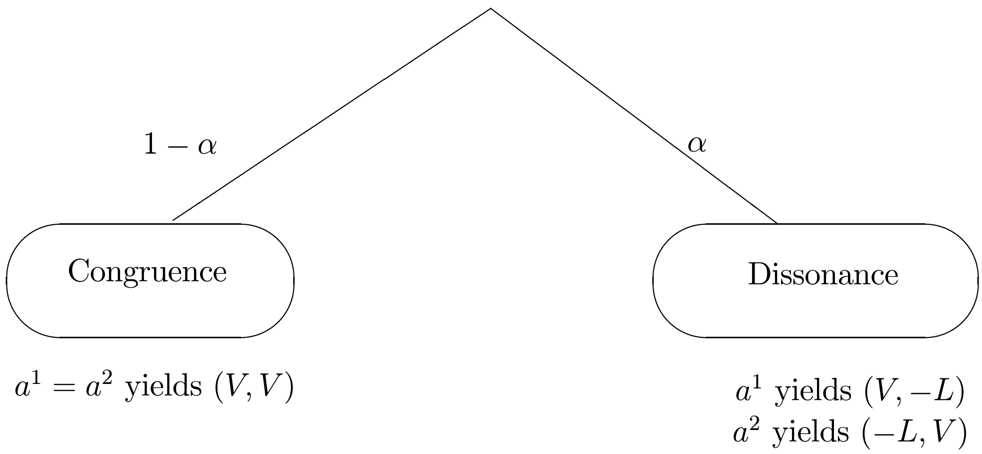

Figure 3 : Information and payoff structures

Congruence : With probability $1-\alpha$, the users' preferred actions coincide : $a^1 = a^2$. Overruling the agent's preferred action a^A then yields an extra surplus $V > 0$ to each user.

Dissonance : With probability α, user U_i's preferred action a^i still yields an extra surplus V to U_i relative to a^A, but imposes a loss $L > V$ on the other user.

All other actions ($a \notin \{a^A, a^1, a^2\}$) give both users a lower surplus than a^A. Note that overruling the agent is always *ex post* efficient in the congruent state and *ex post* inefficient in the dissonant state – since in that case the users would *collectively* be better off not interfering with the agent's proposal. Also, when only one user decides to monitor the agent, the other user may not know whether the informed user's preferred action is good or bad for him.

• *Benchmark : Optimal number of monitors with contractible monitoring*

In this benchmark analysis, we imagine that the users' monitoring behavior can be costlessly specified in the initial contract. Let $m \in \{0, 1, 2\}$ denote the number of monitors. If $m = 0$, the users rubberstamp the agent's design choice. Compared with this benchmark, the users' joint surplus is

$$-c + W_1 \equiv -c + (1-\alpha)(2V) - \alpha(L - V) \quad \text{if } m = 1$$

$$-2c + W_2 \equiv -2c + (1-\alpha)(2V) \quad \text{if } m = 2$$

Clearly, centralized monitoring ($m = 1$) is never desirable when overruling the agent is *interim inefficient* (in the terminology of Holmström-Myerson (1983)) when only one user monitors, that is, when $W_1 < 0$. Furthermore, even if overruling the agent is interim efficient under centralized monitoring ($W_1 > 0$), centralized monitoring is never optimal when users' monitoring activities are *complements*, in that monitoring by one user increases the social value of the other's monitoring :[15]

Définition 1 *The two users' monitoring activities are*

- *complements if*

$$\Delta W \equiv W_2 - W_1 > W_1, \qquad \text{(case } C\text{)}$$

or

$$\alpha(L - V) > (1 - \alpha)V.$$

- *and substitutes in the opposite case,*

$$\Delta W < W_1. \qquad \text{(case } S\text{)}$$

Monitoring by one user increases the social value of the other user's monitoring (case C) when the probability of dissonance (α) or the exposure (L) is large. In that case, duplicated monitoring ($m = 2$) dominates centralized monitoring ($m = 1$) whenever monitoring is desirable at all.[16] Building on this insight, we have :

Proposition 2 *(Verifiable monitoring). Could the users' monitoring activity be specified in a contract, the optimal number of monitors would be :*

- *in case S :*

$$\begin{aligned} m^* &= 0 \quad \text{if } c > W_1 = (1-\alpha)(2V) - \alpha(L - V), \\ m^* &= 1 \quad \text{if } W_1 < c < \Delta W = \alpha(L - V), && \text{(net value } W_1 - c\text{)} \\ m^* &= 2 \quad \text{if } c < \Delta W. && \text{(net value } W_2 - 2c\text{)} \end{aligned}$$

- *in case C :*

$$\begin{aligned} m^* &= 0 \quad \text{if } c > \frac{W_2}{2} = (1-\alpha)V, \\ m^* &= 2 \quad \text{if } c < \frac{W_2}{2}. && \text{(net value } W_2 - 2c\text{)} \end{aligned}$$

[15]The social value of U_i's monitoring equals W_1 if U_j does not monitor and ΔW is U_j monitors.

[16]That is, $W_1 > c$ implies both $\Delta W > c$ and $W_2 > 2c$.

As one would expect, a lack of congruence, as measured either by the probability of dissonance α or by the exposure L, penalizes monitoring. Furthermore, a lack of congruence penalizes monitoring by a single user even more than duplicated monitoring ; therefore, as long as users' monitoring activities are substitutes (case S), the condition for the optimality of duplicated monitoring (then expressed by $c < \Delta W$) becomes easier to satisfy when the probability of dissonance increases.

When α (or L) becomes so large that users' monitoring activities become complement (case C), centralized monitoring is never optimal and a further increase in α then simply makes (duplicated) monitoring less attractive : the condition for the optimality of monitoring (then expressed by $c < W_2/2$) becomes tighter when the probability of dissonance increases.

4 Analyses of familiar governance structures

We now assume more realistically that the users' monitoring behavior is subject to moral hazard. First, and in the tradition of Grossman-Hart (1986) and Hart-Moore (1990), we analyze the performance of familiar institutions and provide a comparison with the upper bound on welfare obtained in Proposition 2 by ignoring moral hazard in monitoring. The governance structures studied in this section are those described in section 2, namely :[17]

Vertical Separation : The supplier is investor owned. The shareholders, who do not know the needs of the users, are unable to monitor the agent's choice and therefore rubberstamp her recommendation. Whether the supplier sells the input to U_1 and U_2 at a price of his choice at date 2, or at a contractually determined price, does not affect the outcome.

Vertical Integration : One of the users, U_1 say, has the control right over the decision. U_1 then delivers the input at some contractually agreed upon price (the analysis would be unchanged

[17] These three institutions are meant to be illustrative of broader classes that encompass many variants. The particular cases we focus on exacerbate the main characteristics of each type of institution : the users' lack of control under structural separation, the asymmetry between integrated and independent users and the bias in decision making under vertical integration, and the need to reach an agreement in the case of a joint venture. Introducing the variants would not affect the qualitative properties of the institutions studied below.

if the price were set at date 2, as long as U_2 does not observe whether U_1 monitors or overrules the agent).

Joint Venture : Any decision requires the consent of each user.[18] That is, the two users bargain at date 1 about the action to be selected. We assume that the Nash bargaining solution prevails : the two users have equal bargaining power.

a) *Vertical separation*

Because the owner is unable to monitor what the users need, vertical separation deprives the organization of its natural monitors of input design (the users). To be certain, a user could monitor the agent and try to be involved in decision making. However, the investor-owned supplier would then raise the final price to that user by the extent, V, of the increase in surplus, and so the monitoring user would lose the monitoring cost. More generally, a user without control right is unwilling to monitor as long as he does not have substantial bargaining power. Thus, vertical separation generates no monitoring.

b) *Vertical integration*

Because incentives to monitor covary with the extent of rights-holding,[19] vertical integration would seem to designate the vertically integrated user as the monitor. The owner monitors if and only if his gain of doing so exceeds his cost, or

$$V \geq c. \tag{1}$$

Does the noncontrolling user have an incentive to monitor ? He could do so at two distinct stages : before the choice of action and after. For the same reason as under vertical separation, the noncontrolling user has no incentive to monitor before the choice of action. He has no incentive to monitor ex post either if, as we have assumed, he is bound by a requirement contract at a predetermined price.[20]

[18] Our joint venture thus corresponds to the case of "joint ownership" in Hart-Moore (1990).

[19] As in Aghion-Tirole (1997).

[20] Suppose in contrast that the price is set ex post by the controlling user. The non-owner does not know whether the modifications brought about by the user reflect the congruent or dissonant state. Suppose that, at cost c, the non-owner can secretely monitor his surplus from the input before purchasing. The owner, anticipating

Thus, if (1) is satisfied, vertical integration implements centralized monitoring, otherwise, it does not generate any monitoring (neither does the joint venture in this case, as we will see).[21]

c) *Joint venture*

By establishing symmetry between the users, the joint venture institution may promote duplicated monitoring. Does there indeed exist an equilibrium of the monitoring game in which both users monitor ? When both monitor, the agent's proposal is overruled only when users have congruent preferences, so that each user gets

$$\frac{W_2}{2} - c = (1-\alpha)V - c.$$

To assess users' incentives to duplicate monitoring, we must consider the outcome of their bargaining when only one user, U_1 say, is informed. When U_1 proposes to overrule the agent, the bargaining game involves *symmetric* information about payoffs : U_2 knows that U_1 has value V for the modification, and himself values it at $(1-\alpha)\,V - \alpha L$. Whether U_1 knows that the state is congruent or dissonant is irrelevant, because U_1 cares only about his own payoff. Under Nash bargaining the gains from trade, $\max\{W_1, 0\}$, are split in halves.[22]

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that the non-owner does not monitor, sets a price based on the average value, $(1-\alpha)V - \alpha L$, of the modification for the non-owner. By monitoring and purchasing only in the case of congruence, the non-owner gains $-c + (1-\alpha)\,[V - ((1-\alpha)V - \alpha L)]$. So, if $(1-\alpha)\alpha(L+V) < c$, the non-owner indeed has no incentive to monitor. Note also that the non-owner would have even less incentive to secretly monitor if the final price were the object of bargaining (and therefore would be lower) rather than set by the owner.

[21] In this model, the "vertical joint venture", in which control would be shared among user U_1, say, and investors, generates less monitoring than vertical integration : Suppose that in such a venture U_1 monitors and bargains with investors to alter the agent's course of action and over a final price. Under Nash bargaining, half of U_1's surplus from monitoring is then captured by investors, leading to reduced incentives to monitor relative to vertical integration. This observation is but the transposition to our model of Hart and Moore's 1990 result according to which joint ownership (here between U_1 and investors) underprotects specific investments and is therefore suboptimal. [A similar remark applies to the comparison of universal ownership, i.e., ownership by investors and the two users, and the joint venture.]

[22] Since the users share equally the social surplus through bargaining, their monitoring activities are *strategic complements* (resp. *strategic substitutes*) when they are complements (resp. substitutes). For example, if the modification is interim efficient ($W_1 > 0$), U_i's net gain from monitoring when user U_j monitors with probability x_j is

$$x_j \frac{\Delta W}{2} + (1-x_j)\frac{W_1}{2} - c;$$

If overruling the agent's proposal is interim efficient ($W_1 > 0$), a user is therefore willing to monitor when the other user also monitors if and only if[23]

$$c \leq \frac{\Delta W}{2} = \frac{\alpha}{2}(L - V). \tag{2}$$

When instead the modification is interim inefficient, duplicated monitoring is incentive compatible if and only if[24]

$$c \leq \frac{W_2}{2} = (1 - \alpha) V, \tag{3}$$

that is, whenever duplicated monitoring is optimal ($m^* = 2$).

The following proposition summarizes our findings :

Proposition 3 *(Moral hazard in monitoring)*

i) Vertical separation always induces no monitoring ($m = 0$).

ii) Vertical integration induces centralized monitoring ($m = 1$) *if and only if* $c \leq V$ *; if* $c > V$*, no institution induces centralized monitoring.*

iii) When the modification is interim efficient, the joint venture induces duplicated monitoring ($m = 2$) *if and only if*

$$c \leq \frac{\Delta W}{2} = \frac{\alpha}{2}(L - V);$$

when instead the modification is interim inefficient, the joint venture induces duplicated monitoring whenever it is optimal ($c < W_2/2$)*. The other two institutions never induce duplicated monitoring.*

monitoring efforts are thus strategic complements if $\Delta W > W_1$, and strategic substitutes otherwise (if the modification is interim inefficient, users' monitoring activities are strategic complements).

[23] When condition (2) is not satisfied, there is no monitoring if $c > \frac{1}{2}\max\{W_1, \Delta W\}$; otherwise, that is, if

$$\frac{\Delta W}{2} < c < \frac{W_1}{2},$$

there are three equilibria, two in pure strategies ("only U_1 monitors", and "only U_2 monitors") and one symmetric mixed strategy equilibrium, if $(1 - \alpha)V - \frac{\alpha(L-V)}{2} > c$, and no monitoring otherwise. We will focus on pure strategies equilibria in what follows.

[24] When condition (3) is violated, it is a dominant strategy for both users not to monitor.

Appendix A provides a graphical description of the comparison between the benchmark outcome described by Proposition 2 and the best outcome that can be implemented by one of the three institutions, as described by Proposition 3. Proposition 3 confirms that the joint venture is most desirable when duplicated monitoring is efficient $(m^* = 2)$: in that case, it is the unique best institution whenever moral hazard problems do not prevent it from effectively inducing monitoring. However, moral hazard does limit its efficiency when the modification is interim efficient : in that case, the private incentive to duplicate monitoring is half its social value. In addition, even if moral hazard does not limit the efficiency of the joint venture, the social value of the joint venture, $W_2 - 2c = 2\left[(1-\alpha)V - c\right]$, makes it relatively unattractive when the probability of dissonance is high, as noted by Hansmann and others.

In contrast, vertical integration works best when centralized monitoring is either the best solution $(m^* = 1)$ or the "second-best" one ($m^* = 2$ is not implementable, and $m = 1$ dominates $m = 0$), while vertical separation is only desirable when monitoring is not efficient $(m^* = 0)$.[25] Note that while a joint venture never induces excessive monitoring, vertical integration may induce overmonitoring when $\max\left\{W_1, \frac{W_2}{2}\right\} < c < V$.

5 Strategies for joint venture success

When the modification is interim inefficient, the benchmark optimum is always easy to implement.[26] We will thus focus from now on on the case were the modification is interim efficient. Note that an increase in the exposure (L) and probability (α) of dissonance makes it then easier to sustain monitoring; in contrast, the welfare from duplicating monitoring $(W_2 - 2c)$ is always independent from the exposure L and decreases with the probability α of dissonance.

[25] In some cases several institutions can yield the same outcome : a joint venture yields $m = 0$ when monitoring is not efficient $(m^* = 0)$ and can also induce $m = 1$ when $W_1/2 < c < \Delta W/2$; and vertical separation yields $m = 0$ when $c > V$. However, as Proposition 3 makes it clear, the joint venture is the only institution that implements duplicated monitoring, while vertical integration maximizes the scope for centralized monitoring and vertical separation constitutes the surest way to deter monitoring.

[26] In that case, either duplicated or no monitoring is optimal. The former is implementable by a joint venture (the private incentive to monitor coincide with its social value in that case), while the latter can be achieved in several ways (vertical separation, joint venture, and even vertical integration if $c > V$).

Building on this insight, in this section we perform comparative statics and unveil factors that help improve the performance and the desirability of the joint venture. We also point out that many of these factors have opposite impacts on the efficiency of joint ventures and of that of vertical integration.

a) *Don't overprotect*

From Proposition 3, the joint venture implements the unconstrained optimum if

$$\frac{\alpha}{2}(L-V) \geq c.$$

Reducing the loss or exposure L is not desirable under the joint venture arrangement. Indeed, a reduction in the loss raises the users' benefit from free-riding, while it does not affect that from monitoring. *A smaller exposure thus reduces the incentive to monitor without altering the efficiency of the joint venture.* Since *users are already protected by their control rights*, they do not need further protection; the only impact of protection is a possible reduction in incentives. This implies that there is no point spending substantial energy at the joint venture design stage in order to limit each party's exposure, and that such effort may actually even be counterproductive.[27]

This is in sharp contrast with the case of vertical integration. *Under U_1-ownership, reducing user U_2's exposure by contractual means increases efficiency without altering user U_1's incentives to monitor.* Protection of the non-owner is therefore desirable.

The application of this latter result to a different context may help grasp the main idea. Consider the standard corporation with equity holders in control and a range of noncontrolling stakeholders (creditors, employees, communities, etc.). Because control is undivided, optimal

[27] To see this, suppose that, at some ex ante contracting cost, the loss L can be reduced to $\ell \in (V, L)$ (so we keep the assumption that overruling the agent is ex post inefficient in case of dissonance). The ex ante surplus (gross of the ex ante cost of protecting the parties) has not changed and is still equal to $-2c + (1-\alpha)(2V)$ but the new incentive compatibility condition for duplicated monitoring,

$$\frac{\alpha}{2}(\ell - V) \geq c,$$

is more difficult to meet under the increased protection.

contracting calls for limiting the noncontrolling stakeholders' exposure to biased decision making by shareholders. This can be viewed as a costly step toward reducing L. In the case of loan contracts, the protection takes the form of giving creditors a nominally fixed claim, pledging them collateral, and providing them with exit options (through short maturities and convertibility). Similarly, many countries attempt to limit externalities imposed by shareholder decision-making on employees.

Our conclusions can be rephrased still in a different way. Suppose that for some exogenous reason the exposure L increases (for instance, market conditions make it more costly not to have the appropriate technology on time). Then the set of parameters for which the joint venture dominates expands, and so does that for which vertical separation is optimal.

b) *Foster commitment by limiting outside activities and exit options*

In what can be viewed as a special case of the previous precept, a joint venture may benefit from curtailing its members' outside opportunities (despite the obvious cost of doing so) in order to strengthen their commitment to and investment in the venture. To illustrate this point, suppose that an outside opportunity for user U_i provides a substitute for this user in case the input proves quite inadequate to its needs, namely when the design is the other user's preferred design and there is dissonance. The existence of an outside opportunity can thus be viewed as a reduction in his potential exposure, L_i. A reduction in L_i has no impact on the joint venture's efficiency but reduces the user's incentive to invest (monitor) in the joint venture. This conclusion seems consistent with a body of anecdotal evidence showing that attempts by parties to a joint venture to reduce their mutual reliance tend to undermine the effectiveness of the joint venture.[28] An implication of this point is that antitrust authorities should not object to exclusivity relationships in research or network joint ventures unless exclusivity substantially reduces competition in the input market.

[28] To be certain, we identify only one effect here. Indeed, while some joint ventures impose various forms of exclusivity (e.g. Visa, Atlas Van Lines), others (e.g., EPRI, Intelsat, Bellcore) don't, either by fear of antitrust prosecution (e.g., being accused of cartelizing the R&D market) or for efficiency reasons (for instance, to let their members enjoy the benefit of multiple sourcing).

It is interesting to contrast this commitment rationale for strong relationships with the existing theories linking control rights and outside opportunities. A major theme of the literature originating in the work of Grossman-Hart (1986) and Hart-Moore (1990) is that outside opportunities (the opportunity to trade with alternative buyers or sellers in their model) *encourage* specific investments in a relationship by protecting each party's investment against expropriation by the other through haggling. The explanation for the difference with our work is that in Grossman-Hart-Moore a party's level of investment and the value of his outside opportunity reinforce each other, whereas they are substitute in our model. Outside opportunities may also be undesirable in the transfer pricing model in Holmström-Tirole (1991),[29] but for a different reason than that given here; there, the existence of outside opportunities encourage parties to invest in inefficient general-purpose technologies that raise their bargaining power vis-a-vis their trading partner.

The noncontrolling user's outside opportunities are beneficial under vertical integration in our model. They increase efficiency by reducing this user's loss in case of dissonance. Outside opportunities have no effect on incentives to monitor and do not affect the controlling user's payoff either. So, outside opportunities are beneficial under vertical integration and detrimental to a joint venture.

c) *Don't belabor agreements*

In our model, actions are all ex ante identical, and there is no reason to exclude some and single out others in the initial contract. Suppose in contrast that the action set can be, perhaps at a cost, subdivided into groups of actions distinguished by ex ante attributes. Intuitively, under vertical integration, the parties to the initial contract may want to prevent the controlling user from taking specific actions or groups of actions (or, more generally, forcing him to compensate the other user if he selects such actions). And indeed, under undivided control, contracts with noncontrolling parties often include extensive restrictions on the controlling party's decision set. For example, a loan contract between creditors and shareholders usually specify a large

[29] Other papers showing how the Hart-Moore results can be overturned when specific and outside investments are substitutable include Rajan-Zingales (1998) and Segal-Whinston (1998b).

number of "positive and negative covenants", that is of dos and don'ts. In the framework of our model such restrictions on the decision set of the controlling user (U_1) can be viewed as reducing the probability of a large negative externality (L_2) on the noncontrolling user (U_2).

Again, the contrast with joint ventures is striking. Joint-venture partners are already protected by their control rights. A prohibition on some actions in our model can only hurt parties (if there is no interim renegotiation) or at best not affect them (in case of interim renegotiation).

To see this, suppose for example that, when the users' preferences diverge, there are not one but two "biased" actions available to each user who has monitored, the first one (B) yielding $(V, -L)$ as before and the second one (b) yielding $(V - \varepsilon, -\ell)$, where $\varepsilon > 0$, $V < \ell < L$: action b is also ex post inefficient but generates a smaller externality or bias than action B.

If in a joint venture, only one user monitors, he will seek to implement B rather than b (since $V > V - \varepsilon$). If instead both users monitor, they will implement neither b nor B when there is dissonance. Hence, the private incentive to duplicate monitoring is given by

$$-c + \frac{\alpha}{2}(L - V).$$

Now, suppose that, at some ex ante contracting cost, action B can be banned (or made verifiable, so that a fine could sanction its adoption), thereby protecting an uninformed user by reducing his exposure. Our analysis shows that such protection is not desirable. Indeed, while this protection does not affect what happens under duplicated monitoring, if only one user monitors he will now seek to implement b, which the uninformed user will agree. Hence, the private incentive to duplicate monitoring is now given by

$$-c + \frac{\alpha}{2}(\ell - V),$$

and is thus smaller than before since $\ell < L$. Hence, protecting the uninformed user again does not enhance the efficiency of the joint venture under duplicated monitoring, but does reduce the incentive to monitor and thus is not desirable as long a duplicated monitoring is efficient.

This conclusion stands in sharp contrast with that for vertical integration. In the absence of protection, the owner gets $V - c$ (assuming he monitors, that is, $V > c$) while the non-owner gets $(1 - \alpha)V - \alpha L$. Protecting the non-owner (by banning action B) affects only slightly the owner's incentives to monitor if ε is small, since the owner now gets $V - \alpha\varepsilon - c$, but has a significant and positive impact on the non-owner, who now gets $(1-\alpha)V - \alpha\ell$. Hence, if the reduction in the loss or exposure $(L-\ell)$ is much larger than the loss of surplus for the informed user (ε), and if the contracting cost of banning action B is small enough, protecting the non-owner increases the efficiency of vertical integration.

d) *Strive for congruence*

As discussed in the introduction, the lack of congruence is often perceived to be fateful to joint ventures. This is confirmed by our analysis, in the sense that an increase in the probability of dissonance, α, reduces the gains from a joint venture, given (per user) by $(1-\alpha)\,V - c$. It should however be noted that an increase in the probability of dissonance *raises* the incentive to monitor in a joint venture, given by

$$\frac{\alpha}{2}(L-V) - c.$$

The reason is that, when only one user monitors, there is a risk of excessive overruling. Hence, an increase in the probability of congruence reduces this risk and thus decreases the incentive to monitor.

6 Optimal contract

We have compared a joint venture, vertical integration and vertical separation and provided conditions under which one of these three institutions is optimal. We now investigate whether and how institutional design can improve upon these basic institutions when these conditions are violated.

First, let us point out that the set of parameters under which the joint venture is viable can, through a simple institutional change, be expanded from the set

$$\frac{\alpha}{2}\,(L-V) \geq c$$

to

$$\frac{\alpha}{2}\,(L-V) + \frac{\alpha}{4}\,(L+V) \geq c$$

Indeed, it is easy to find institutions that implement duplicated monitoring when $c \leq \frac{\alpha(L-V)}{2} + \frac{\alpha(L+V)}{4}$; e.g., an ex post first-price auction for the right to decide, in which the loser receives a transfer equal to the winner's bid; or more simply, a random allocation of the right to decide. Because in our model the decision right is more valuable to a user when he is informed, this policy adds to incentives to monitor.

Still, when deciding whether to monitor, a user does not internalize the positive externality on the other user, who will benefit if the users come to an agreement. This result is reminiscent of other results in the literature. In Anderlini-Felli (1997), two potential trading partners must sink some fixed investment cost before they are able to start bargaining over the division of a pie. Anderlini and Felli show that the Coasian efficient outcome does not come about if one of the potential partners does not derive enough surplus in bargaining to offset this upfront cost. Our analysis of the joint venture institution is also closely related to a large body of literature on "cooperative" and "selfish" investments in bilateral relationships,[30] although that literature does not consider investments in information acquisition and bargaining breakdowns.

We now ask whether one can improve on the three institutions studied so far (vertical separation, vertical integration, and the – enhanced – joint venture)? Interestingly, the answer is no under the following three assumptions :

(A1) Feasible actions are indescribable at date 0.[31] A user always learns (and can describe) one action as well as his payoff attached to that action : This action is his preferred action if he monitors, and a clone of the agent's preferred action (yielding the same payoffs as the agent's preferred action) if he does not. Actions other than the agent's preferred one (or its clones) and the users' preferred ones all gives both users the same very negative payoff.

Assumption (A1) is technical. It prevents mechanisms from telling whether a user has mo-

[30] See, e.g., Grossman-Hart (1986), Hart-Moore (1990) and Hart (1995) for incomplete contract approaches, and Aghion et al. (1994), Che-Hausch (1999), Hart-Moore (1999), Maskin-Tirole (1999b), Nöldeke-Schmidt (1995) and Segal (1995, 1999) for environments in which the optimal complete contract with renegotiation resembles an incomplete contract.

[31] Alternatively, the set $\mathcal{A}$ could be describable at date 0, but the actions in that set would be ex ante identical in the sense that all permutations of payoffs attached to these actions are equally likely.

nitored just on the basis of the number of actions he has learned : a user who has not monitored can still pretend to have learned something and make a recommendation.

(A2) The users observe who has monitored, and can renegotiate ex post.

Assumption (A2) implies that interim inefficient actions cannot be implemented.[32]

(A3) The transfers between users must be balanced.

Assumption (A3) posits the absence of third parties acting as "budget breakers". The key assumption here is that transfers to a third party are impossible.[33]

Appendix B allows for completely general mechanisms and analyzes the conditions under which the unconstrained optimum can be implemented.

Proposition 4 *Under assumptions (A1) through (A3), the following intensities of monitoring can be implemented*

– $m = 0$,

– $m = 1$ *if and only if* $c \leq V$,

– $m = 2$ *if and only if* $c \leq \frac{\alpha}{2}(L - V) + \frac{\alpha}{4}(L + V)$.

Proposition 4 shows in particular that one cannot improve on vertical integration to implement centralized monitoring. The reason is that vertical integration maximizes the integrated user's incentive to monitor by giving him the decision right, and concurrently minimizes the independent user's incentive to monitor by restricting his access to the decision process. Proposition 4 extends the conclusions of Proposition 3 and the implications drawn in section 5 to fully general mechanisms. Note in particular that protecting users by reducing their loss L is again a bad policy for duplicated monitoring.

[32] The describability assumption rules out "strange" recommendations and ensures that renegotiation always starts from either the agent's or one user's preferred action. Together with A2, it implies that all relevant (expected) payoffs are common knowledge and renegotiation is efficient, given the available information.

[33] Assumptions (A2) and (A3) are discussed for example in Hart-Moore (1999), Maskin-Tirole (1999a,b) and Tirole (1999).

7 Free riding and deadlocks

In the basic version of the model presented above, any modification of design proposed by a user is interim, although not necessarily ex post, efficient. There is therefore never any deadlock in bargaining, although ex post bargaining with an uninformed partner has a similar negative impact on the informed user as a deadlock.

It is straightforward to extend the model to account for the existence of deadlocks on rather than off the equilibrium path. Consider the information structure represented in figure 3 bis :

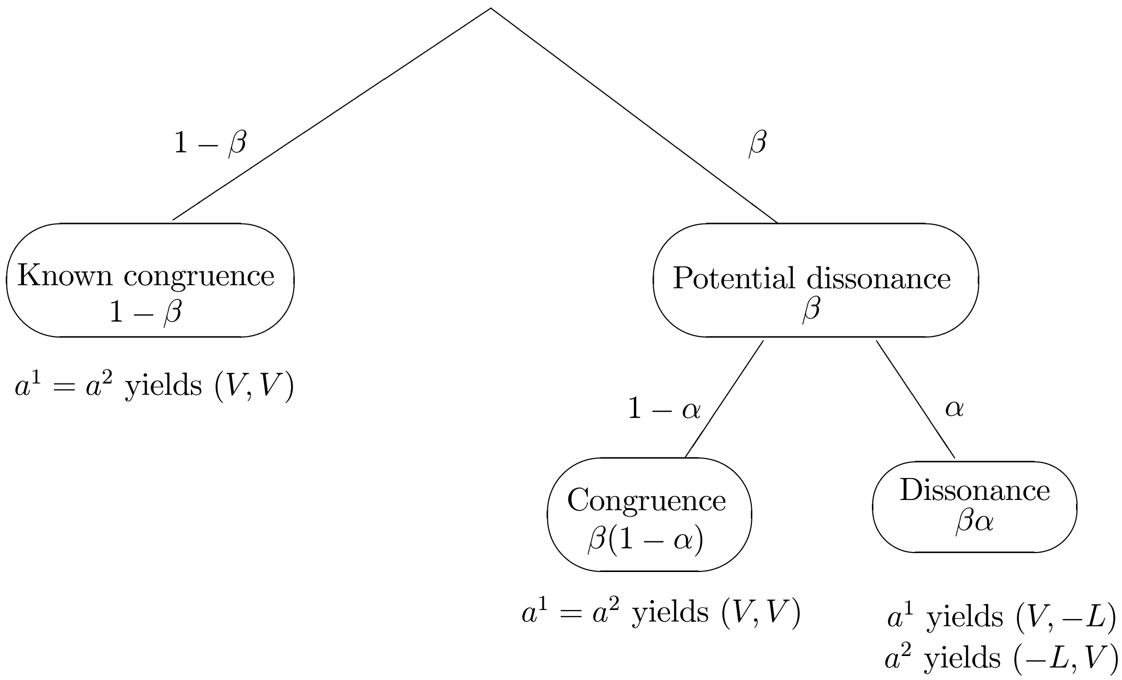

Figure 3bis : Information and payoff structures

After the monitoring stage and before the action a is chosen, a public signal accrues. With probability $1-\beta$, it is common knowledge that the two users have congruent preferences.[34] With probability β, their preferences are *potentially dissonant* : as before, only an informed user knows whether they are congruent or dissonant (the model studied until now had $\beta = 1$).[35]

[34] Alternatively, an informed user could come up with hard (convincing) evidence of congruence.

[35] An alternative interpretation is that there are two states of nature (congruence, dissonance) and two decisions, one over which there is potential dissonance (dissonance with probability α and gains and losses βV and βL) and one over which preferences are congruent, with a gain $(1-\beta)V$ per user.

A key factor in the analysis is whether overruling the agent is efficient when there is potential dissonance. When overruling the agent is interim inefficient, that is, when :

$$W_1 = (1-\alpha)(2V) - \alpha(L-V) < 0,$$

then, in the state of potential dissonance deadlock occurs (as it socially should) when only one user is informed. Yet, monitoring by a single user may be (privately and socially) efficient in a joint venture, as well as under vertical integration, when $\beta < 1$.

The second point of interest is that the possibility of known congruence gives rise to a form of free riding. Indeed, if β is close to 0, monitoring is a pure public good, and it is infeasible (as well as socially suboptimal) to have monitoring by the two users.

We have generalized the analysis to this broader framework and have shown that the key results of sections 4 through 6 carry over.[36]

8 Summary and lines of research

To a large extent, our analysis supports common sense views about cooperative undertakings. Vertical integration (undivided control) generates efficient monitoring of the input supply process as well as biased decision making. In contrast, a joint venture, by requiring Pareto-improving decisions, yields unbiased yet costly decision making. A key challenge for a joint venture is to induce the partners to invest informationally in making the joint venture work. A partner's insufficient interest in the joint venture may result from the concession he forces on the enterprising partner or from his not internalizing the full cost of deadlock.

We showed that policies aimed at improving the efficiency of joint ventures are often the opposite of those benefitting vertically integrated structures. In a joint venture, there is little point writing a detailed contract that protects the partners by reducing potential externalities and specifies covenants restricting the set of possible actions. Partners are already protected by their control rights ; and such contractual features, which are pervasive under undivided

[36] This analysis is available upon request from the authors.

control, only serve to reduce incentives without improving efficiency. Joint ventures may also want to shut down the partners' otherwise desirable outside opportunities in order to foster their commitment to the joint venture. Last, firms may put substantial weight on congruence in their search for potential joint venture partners, although some amount of dissonance can help ensure that they monitor each other.

By focusing on control right aspects of governance structures, our model has ignored other considerations relevant to institutional design. A glaring omission of our analysis is the lack of impact of institutional choice on managerial incentives. In a more general model managerial initiative would depend on who has control. We conjecture that our model is thereby biased in favor of joint ventures and against vertical separation. To understand why, suppose that there are dimensions of input quality that can be verified by the users before consumption (these dimensions relate to "search goods", rather than "experience goods"). Under vertical separation, the price at which the input is sold to users is sensitive to the quality of the input; management can then be offered effective incentives based on supplier profit. The same is true under vertical integration, although to a lesser extent since only half of the sales are external. User-owned joint ventures in contrast are poorly suited for an efficient design of managerial profit-based incentives.[37]

Another oversimplification of our analysis is that users are similar in size and monitoring talents. In asymmetric joint ventures, bigger players are more likely to monitor, i.e., supply the public good, because of their higher stakes. But they may also have trouble getting themselves heard by the smaller players who may have different interests. For example, in associations such as Visa or MasterCard, larger banks may favor innovation at the bank level while smaller ones would prefer association-level innovation. The partners may also have different monitoring skills; some may have R&D capabilities while others excel in marketing or manufacturing; it would be interesting to extend our analysis to multiple dimensions of monitoring.

[37] Being unable to offer bonuses and stock options to their management, non-profit associations often rely on career concern incentives coupled with benchmarking. For a start on this, see Hausman et al. (1999).

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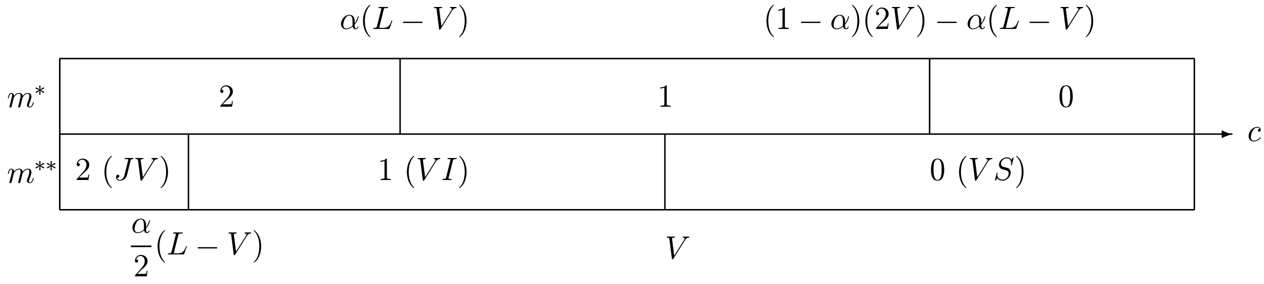
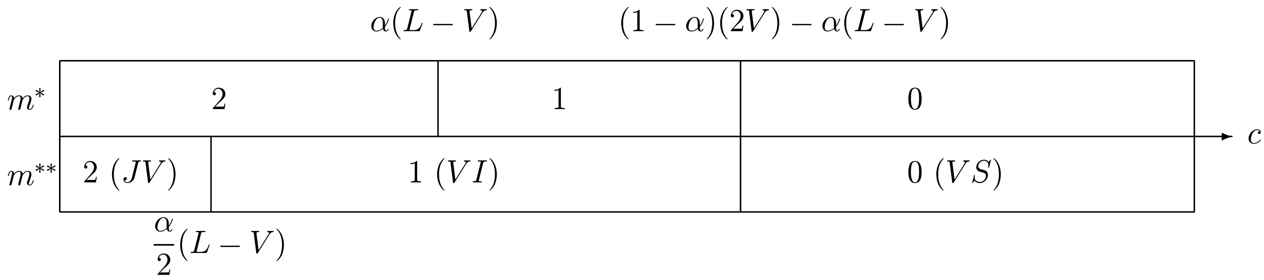
Appendix A : Summary of benchmark optimality and institutions' performance

The following tables compare the optimal number of monitors (denoted by m^{**}) using the best of the three institutions (indicated in parentheses) to the benchmark outcome (m^{*}) :

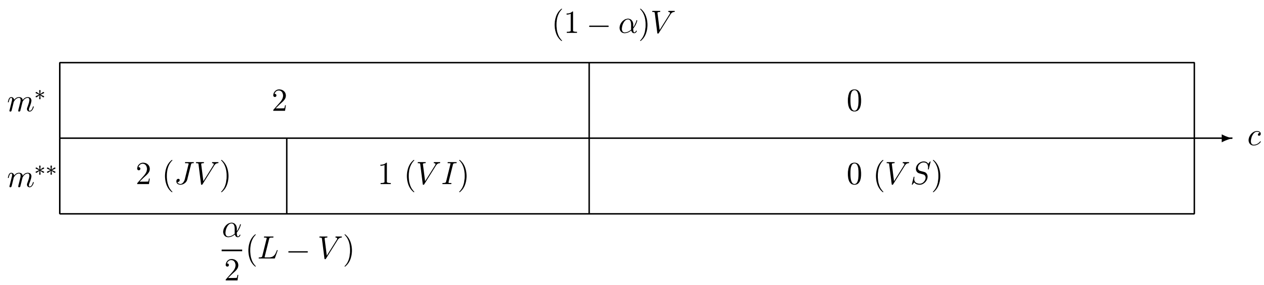
Case 1. Very small dissonance : $(1-\alpha)V > \alpha L$



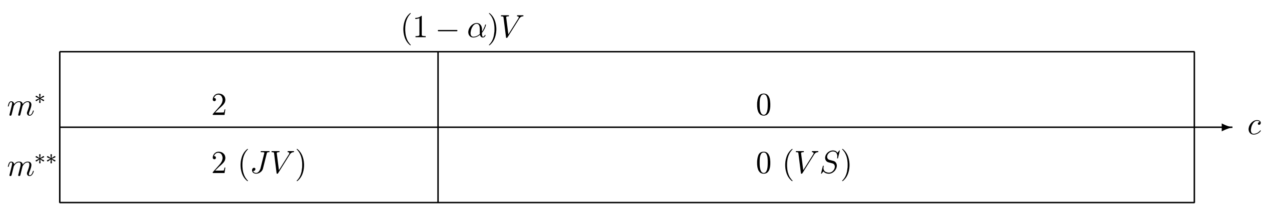
Case 2. Small dissonance : $\alpha L > (1-\alpha)V > \alpha(L-V)$



Case 3. Large dissonance : $\alpha(L-V) > (1-\alpha)V > \frac{\alpha}{2}(L-V)$



Case 4. Very large dissonance : $\frac{\alpha}{2}(L-V) > (1-\alpha)V$



Appendix B : Proof of Proposition 4

Dissonance (state D) has probability α and *congruence* (state C) has probability $1 - \alpha$. The timing of the game is as follows :

- In the first stage, each user decides whether to monitor. Each user then observes : (i) exactly one action (his preferred one if he has monitored, or a clone of the agent's preferred action if he has not) and how to describe it ; and (ii) whether the other has monitored.
- In the second stage, and according to the mechanism designed at the initial stage, each user describes the action he has observed and sends a message, which can mention who has monitored and also include non payoff-relevant information. Based on these messages, the (possibly random) contract specifies balanced transfers and which of the three actions observed by the agent and the users should be implemented.
- Ex post, the users can renegotiate the status quo defined by the contract, through an efficient bargaining game where the gains from bargaining are equally shared.

a) *The ex post bargaining game*

It is useful to first characterize the outcome of the ex post renegotiation stage, starting from a status quo summarized by balanced transfers (t_1, t_2) and an action $\hat{a}$ which, given our describability assumption, can only be the action preferred by the agent, a^A, or the action observed by one user, $\hat{a}^1$ or $\hat{a}^2$. By construction, the expected payoffs attached by each user to each of these three actions are always common knowledge, given the information available to each user.

- When it is common knowledge that users' preferences are congruent (which implies that both users have monitored), U_i eventually gets $t_i + V$ whatever the status quo decision $\hat{a}$, since this status quo generates an identical payoff for both users.
- When instead it is common knowledge that users' preferences are dissonant (again, both users have monitored), a user benefits from having his preferred action be chosen as status

quo. If $\hat{a} = \hat{a}^i = a^i$, after renegotiation U_i and U_j get respectively

$$t_i + V + \frac{1}{2}(L - V) = t_i + \frac{V + L}{2} \equiv t_i + A,$$
$$t_j - L + \frac{1}{2}(L - V) = t_j - A.$$

Whenever $\hat{a} = a^A$, U_i simply gets t_i after renegotiation.

– Assume that U_i is informed but U_j has not monitored. It is then common knowledge that $\hat{a}^i = a^i$, the action observed by U_i, yields V for U_i and an expected surplus of $(1 - \alpha) V - \alpha L = V - 2\alpha A$ for U_j. Hence, the sum of the users' expected surpluses is $W \equiv V + (1 - \alpha) V - \alpha L = 2 (V - \alpha A)$ (> 0 under condition C) and a^i is not renegotiated if chosen as status quo : thus, U_i gets $t_i + V$ while U_j gets $t_j + V - \alpha A$; any other action is replaced with a^i through renegotiation, and each user i gets

$$t_i + \frac{W}{2} = t_i + V - \alpha A.$$

– Lastly, if none of the users has monitored, the users can only obtain the agent's recommendation (or a clone of it) and U_i thus simply gets t_i.

We now successively consider the implementation of the three types of unconstrained optimum. Throughout the analysis, we denote by $\tau_i(\sigma_1, \sigma_2)$ the expected pre-renegotiation transfers and by $\chi_i(\sigma_1, \sigma_2)$ the probability that the pre-renegotiation decision specified by the mechanism consists of the action observed by U_i, as a function of users' interim stage strategies (σ_1, σ_2). Each user U_i's strategy σ_i is a distribution of probability over the set of messages assigned to this user.

b) *Duplicated monitoring :* $m = 2$

If both users monitor, then congruence or dissonance is always common knowledge at the second stage. Denote by

$$t_i^* \equiv (1 - \alpha) t_i^{*C} + \alpha t_i^{*D}$$

the expected pre-renegotiation transfers in the continuation equilibrium, and by x_i^* the probability that the pre-renegotiation status quo action corresponds to U_i's preferred one in state D.

From the above characterization of the renegotiation stage, along the equilibrium path U_i gets an expected utility u_i given by

$$u_i = -c + t_i^* + (1-\alpha) V + \left(x_i^* - x_j^*\right) \alpha A.$$

Consider now a deviation by user U_2, where he does not monitor and furthermore "pretends" U_1 has deviated : That is, denoting by $\hat{\sigma}_i$ the equilibrium continuation strategy played by user U_i when he is the unique monitor, U_2 does not monitor and then plays $(1-\alpha) \hat{\sigma}_2 (C) + \alpha \hat{\sigma}_2 (D)$ (U_2 plays a mixed strategy, not knowing which of C or D prevails), while U_1, having observed that U_2 did not monitor, plays accordingly $\hat{\sigma}_1 (s)$ in each state $s = C, D$. Denote by $\hat{t}_i$ the corresponding expected pre-renegotiation transfers, given by

$$\begin{aligned} \hat{t}_i &= (1-\alpha) \left[(1-\alpha) \tau_i (\hat{\sigma}_1 (C), \hat{\sigma}_2 (C)) + \alpha \tau_i (\hat{\sigma}_1 (C), \hat{\sigma}_2 (D))\right] \\ &\quad + \alpha \left[(1-\alpha) \tau_i (\hat{\sigma}_1 (D), \hat{\sigma}_2 (C)) + \alpha \tau_i (\hat{\sigma}_1 (D), \hat{\sigma}_2 (D))\right], \end{aligned}$$

and by $\hat{x}_i$ the probability that the state is P and the pre-renegotiation status quo be the action observed by U_i :

$$\begin{aligned} \hat{x}_i &= (1-\alpha) \left[(1-\alpha) \chi_i (\hat{\sigma}_1 (C), \hat{\sigma}_2 (C)) + \alpha \chi_i (\hat{\sigma}_1 (C), \hat{\sigma}_2 (D))\right] \\ &\quad + \alpha \left[(1-\alpha) \chi_i (\hat{\sigma}_1 (D), \hat{\sigma}_2 (C)) + \alpha \chi_i (\hat{\sigma}_1 (D), \hat{\sigma}_2 (D))\right]. \end{aligned}$$

U_2's expected utility, v_2, is then given by

$$v_2 = \hat{t}_2 + S - \hat{x}_1 \alpha A,$$

where $S \equiv V - \alpha A$ denotes the (per user) expected joint surplus when only one user monitors. This deviation is thus not profitable only if $u_2 \geq v_2$, that is, only if

$$-c + t_2^* + (1-\alpha) V + (x_2^* - x_1^*) \alpha A \geq \hat{t}_2 + S - \hat{x}_1 \alpha A.$$

The similar deviation for U_1 (no monitoring, and "acting" as if U_2 had deviated, so that each user acts again as if he were the only monitor) is not profitable either only if

$$-c + t_1^* + (1-\alpha) V + (x_1^* - x_2^*) \alpha A \geq \hat{t}_1 + S - \hat{x}_2 \alpha A.$$

Adding those two conditions and using the fact that transfers are balanced implies

$$\begin{aligned} c &\le (1-\alpha)V - S + \frac{\hat{x}_1+\hat{x}_2}{2}\alpha A \\ &\le (1-\alpha)V - S + \alpha\frac{A}{2} \\ &= \alpha\frac{L-V}{2} + \alpha\frac{L+V}{4}. \end{aligned} \tag{A.1}$$

Conversely, if inequality (A.1) holds, giving each user the decision right with probability 1/2 (and no transfer ; $x_i \equiv 1/2, t_i \equiv 0$) implements duplicated monitoring : U_i gets

$$u_i = -c + (1-\alpha)V$$

if he monitors whereas if he does not monitor he only gets

$$v_i = S - \frac{\alpha A}{2},$$

which is indeed lower than u_i when (A.1) is satisfied.

c) *Centralized monitoring* : $m = 1$

To fix ideas, we consider a candidate equilibrium where only U_1 monitors and denote by $\widetilde{\sigma}_1(s)$ (for $s = C, D$) and $\widetilde{\sigma}_2$ the two users' continuation equilibrium strategy, by

$$\widetilde{t}_i = (1-\alpha)\tau_i(\widetilde{\sigma}_1(C), \widetilde{\sigma}_2) + \alpha\tau_i(\widetilde{\sigma}_1(D), \widetilde{\sigma}_2),$$

the expected pre-renegotiation transfers along the equilibrium path and by

$$\widetilde{x}_1 = (1-\alpha)\chi_1(\widetilde{\sigma}_1(C), \widetilde{\sigma}_2) + \alpha\chi_1(\widetilde{\sigma}_1(D), \widetilde{\sigma}_2)$$

the probability that the action observed by U_1 is the pre-renegotiation status quo. The two users' expected utilities along the equilibrium path are respectively given by

$$\begin{aligned} w_1 &= -c + \widetilde{t}_1 + S + \widetilde{x}_1\alpha A, \\ w_2 &= \widetilde{t}_2 + S - \widetilde{x}_1\alpha A. \end{aligned}$$

Suppose now that U_2 deviates and, while still not monitoring, plays the strategy $\bar{\sigma}_2$ that he is supposed to follow when no user monitors. Denoting by

$$\bar{t}_i = (1-\alpha)\tau_i(\widetilde{\sigma}_1(C), \bar{\sigma}_2) + \alpha\tau_i(\widetilde{\sigma}_1(D), \bar{\sigma}_2)$$

the corresponding expected pre-renegotiation transfers along the continuation equilibrium path and by

$$\bar{x}_1 = (1-\alpha)\,\chi_1\left(\widetilde{\sigma}_1(C),\bar{\sigma}_2\right) + \alpha\chi_1\left(\widetilde{\sigma}_1(D),\bar{\sigma}_2\right)$$

the probability that the pre-renegotiation action be the one recommended by U_1, this deviation is not profitable for U_2 only if

$$\widetilde{t}_2 + S - \widetilde{x}_1\alpha A \geq \bar{t}_2 + S - \bar{x}_1\alpha A.$$

Suppose now that U_1 does not monitor but acts as if he had ; that is, U_1 plays $(1-\alpha)\,\widetilde{\sigma}_1(C) + \alpha\widetilde{\sigma}_1(D)$ while U_2, having observed the absence of monitoring, plays his continuation equilibrium strategy $\bar{\sigma}_2$. This deviation is not profitable only if

$$-c + \widetilde{t}_1 + S + \widetilde{x}_1\alpha A \geq \bar{t}_1.$$

Adding up the two latter inequalities (since transfers are balanced)

$$\begin{aligned} c &\leq S + \bar{x}_1\alpha A \\ &\leq S + \alpha A \\ &= V. \end{aligned} \tag{A.2}$$

Conversely, the "vertical integration" contract ($x_1 \equiv 1, t_i \equiv 0$) implements centralized monitoring when condition (A.2) is satisfied.

d) *No monitoring :* $m = 0$

The implementation of $m = 0$ is straightforward : never overruling the agent ($x_i \equiv t_i \equiv 0$) ensures in that case that users have no incentives to monitor : By allocating the decision right to the agent, this contract forces any informed user to share with the other user the gains from overruling the agent, and thus to share the benefits from monitoring. Hence monitoring cannot be an equilibrium if it is not efficient.