

The Costs and Benefits of Homogeneity, with an Application to Culture Clash

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Abstract

Firms are more homogenous than society in general. This paper studies the costs and benefits of, in particular, homogeneity in beliefs and preferences. It shows that, in a world with differing priors, such homogeneity facilitates delegation and coordination, reduces monitoring and influence activities, improves the quality of communication, and increases effort and expected utility. It reduces, however, the incentives to collect new information.

Starting from the definition of culture as shared beliefs and preferences, these results have implications for an economic theory of ‘culture clash’ in mergers and acquisitions. In particular, when two firms that are each internally homogenous but different from each other, try to merge, agency problems will generally increase and hurt their performance, although the decrease in homogeneity may sometimes have beneficial effects. The paper derives specific empirical implications.

1 Introduction

Look behind any disastrous [merger] and the same word keeps popping up – culture.

The Economist 1999

Culture clash is often blamed for merger failures. With so many mergers failing,¹ that is a serious blame to take. The phenomenon of culture clash has even wider implications since it also plagues alliances and potentially even market relationships. Finally, it should also be a factor in the theory of the firm, since difficulties with mergers will make firm boundaries path-dependent.

One potential interpretation for culture clash is rooted in the stylized fact that firms are more homogenous than society. In particular, corporate culture can be defined as shared beliefs, assumptions, and values that lead to similar behavior (Schwartz and Davis 1981, Donaldson and Lorsch 1983, Schein 1985, Kotter and Heskett 1992). Culture clash is then caused by the merging of two groups that are each internally homogenous, but different from each other, in terms of their

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¹Practitioners’ studies typically estimate the failure rate of mergers to be above 50%, sometimes even as high as 85% (Copeland, Koller, and Murrin 1991, Shelton 2002). While academic studies tend to be more positive, they also imply very substantive failures (Ravenscraft and Scherer 1987, Kaplan and Weisbach 1992, Mitchell and Stafford 2000). Moreover, survey results indicate that ‘culture’ is one of the key post-merger challenges (Chang, Curtis, and Jenk 2002, Kelly, Cook, and Spitzer 1999).

beliefs and preferences. To understand the effects of culture clash, we thus need to understand the costs and benefits of homogeneity. Moreover, such understanding also allows us to evaluate the merits of ‘hiring on fit’, as many companies do. In particular, an implicit theme of Van den Steen (2004) and of this paper is that agency problems are partially endogenous, and can be reduced by selecting the right type of agents.

The purpose of this paper, then, is to study the costs and benefits of homogeneity in beliefs and preferences. It turns out that the effects are pervasive. The fundamental reason is easy to understand: agency issues are caused by differences in objectives; homogeneity in beliefs and preferences may thus eliminate agency problems at the source.

The Model. To study these issues, the paper starts from a simple model of an organization which has to choose a course of action. All members of the organization care about the outcome, but they openly differ in their beliefs about the returns to each action. This implies that I do not impose the common prior assumption, something I discuss in more detail later. By considering variations of this model, the paper derives a number of conclusions.²

- Managers will delegate more, and more important decisions, to employees with more similar beliefs. When delegating, they also monitor such employees less.
- There will be less influence activity in organizations with more similar beliefs.
- Employees will coordinate better and achieve such coordination more quickly when their beliefs are more similar.
- Employees will distort information less when they communicate with others with more similar beliefs.
- Employees will collect less information when beliefs are more similar.
- Utility, and incontractible effort that is complementary to success, will be higher in organizations with more homogenous beliefs.
- The results on delegation, monitoring, coordination, influence activities, utility, and communication, extend to the case in which the agents have differing preferences instead of differing beliefs.

Each taken by itself, none of these results is surprising. What *is* surprising, is how pervasive the effects of homogeneity actually are. This insight dovetails nicely with the importance that the management literature attributes to ‘corporate culture’, defined as shared beliefs and values (Schein 1985, Kotter and Heskett 1992). The more one thinks about it, the more it seems that homogeneity is a key force in an organization’s behavior, both because its level of homogeneity will affect the behavior of an organization and because the organization will try to affect its level of homogeneity. This also suggests that ‘culture as homogeneity’ may play an important role in our agency theory.

The results on homogeneity imply specific predictions about ‘culture clash’, i.e., the problems that emerge when two firms with differing culture merge. In particular, consider two groups of people who each are homogenous in their beliefs and values, but who are very different from each

²This list is not exhaustive. Homogeneity also has important implications for, for example, change and dynamics. These are not explored in this paper.

other. As long as each group works on its own, there will be easy coordination, few influence activities, etc. When the groups try to combine and people of the two different organizations have to cooperate, then we will suddenly see a decrease in delegation, more distortion of communication, more influence activities, less coordination, more monitoring, etc. Overall, firm performance and utility levels will drop. The paper has some specific predictions regarding behavior after mergers. A typical prediction, for example, is that managers will delegate more, and more important decisions, to employees from their own pre-merger firm than to employees who come from the other pre-merger firm, and that the average level of delegation decreases after the merger.

The Literature. The purpose of this paper is to consider the role of homogeneity on organization behavior in general. Some of the effects that are discussed have been derived earlier in the context of more specific agency models. Both Aghion and Tirole (1997) and Dessein (2002) consider the impact of ‘congruence of objectives’ in their models of delegation and show that managers delegate more when the objectives are more similar. Crawford and Sobel (1982) studied communication between agents with different objectives and concluded that communication is more informative when the agents’ preferences are more similar. This is closely related to the problems of relying on the information of an interested party (Milgrom and Roberts 1986). Crémer (1993) shows that shared information may improve the alignment of actions in a team-theoretic model. It has also been noted that different preferences may increase agents’ incentives to collect information (Rotemberg and Saloner 1995, Dewatripont and Tirole 1999), although I show here that differing beliefs introduce a truly new dimension.³ There have also been papers that consider more explicitly the role of homogeneity, but again in more specific contexts. Van den Steen (2005a) shows how alignment of beliefs between a manager and his employees improves their incentives and utility, which leads to sorting. Mello and Ruckes (forthcoming in 2006) show how more diverse teams have access to more information, which improves their performance, but again may suffer from lower effort levels. Earlier related contributions are Prendergast (1993) on Yes-men and the work of Prescott and Visscher (1980) on organizational capital.

The relationship of the economic literature on corporate culture (Kreps 1990, Crémer 1993, Lazear 1995, Carrillo and Gromb 1999, Rob and Zemsky 2002, Hermalin 2001) to the current view of culture as homogeneity is discussed in depth in Van den Steen (2004), which studies sorting and shared experience as sources of homogeneity. The only paper with a formal analysis of benefits of culture is Crémer (1993), who shows that more shared information aligns actions. I discuss this paper in more detail in the section on coordination. Weber and Camerer (2003) do an interesting experiment on culture clash, although from a very different perspective than the current paper, more in line with Crémer et al. (2003). They let groups of people (‘firms’) develop, through trial and error, a homemade language for solving problems, which they define as the firm’s culture. They then merge groups and show that their performance declines after the merger.

Contribution The main contribution of this paper is to show that one particular component of an organization’s demography, namely its homogeneity in terms of beliefs and personal preferences, affects nearly any aspect of its behavior. The reason is that it is a common, sometimes implicit, theme in all agency problems. While piecewise studies of specific agency problems improve our understanding of the detailed mechanisms of each, a systematic study of homogeneity shows that

³A variation on Baker (1992) would show that the intensity of incentive contracts and the level of effort increase when beliefs are more aligned. I left this result out, however, since it is quite opaque in the current model, while it is much more transparent in other models of differing beliefs available from the author.

what is just one factor out of many in each case, may add up to one of the most pervasive forces when looking across all agency problems. It suggests that we should take homogeneity serious. As a direct implication, and important application, of this focus on homogeneity, the paper develops an economic theory of culture clash after mergers, and an economic theory of hiring for fit. Implicit is of course also a theory on the costs and benefits of corporate cultures as shared beliefs and preferences. Third, by being more systematic about it, the paper also derives some new insights on the effects of homogeneity, and suggests important areas for further research on its effects. In particular, it shows how homogeneity in beliefs affects the incentives to collect information and how it affects the speed of coordination in two by two coordination games. The analysis also suggests a new approach to studying coordination games.

The next section introduces the basic model, variations of which are studied in the subsequent sections. In particular, sections 2.2 through 2.7 study the effects of homogeneity on delegation, monitoring, influence activities, communication, coordination, information gathering, effort, and utility. Section 2.8 shows how most of the results extend to the situation where agents have differing preferences instead of differing beliefs. Section 3 summarizes the implications for culture clash, while section 4 concludes.

2 Costs and Benefits of Homogeneity

2.1 The baseline model

I present here the baseline model, variations of which will be studied in the subsequent sections to identify costs and benefits of homogeneity. The model captures the situation of a group of people who are engaged in a joint project. While one of them is the formal leader or manager, all of them care to some degree about the final success of the project.⁴

Consider in particular an organization that consists of a manager, denoted m , and J members, denoted 1 through J . The organization will be faced with a choice between two actions, A and B . Action A is the status-quo, with net payoff equal to zero. Action B is a new course of action that generates a revenue of 1 upon success and 0 upon failure and that costs c_B to implement. The cost c_B is a random variable $c_B \sim U[0, 1]$ that will be drawn and publicly revealed prior to the choice between A and B , as indicated in figure 1. The choice will sometimes be made by an employee and sometimes by the manager, depending on the effect under study, as specified later. The probability of success of action B , ρ_B , is *unknown* to the agents, but each agent has his or her own subjective prior about ρ_B . These prior beliefs are commonly known and may differ from each other. Let $r_{B,i}$ denote the mean of agent i 's prior belief.⁵ I will assume throughout that the $r_{B,i}$ are empirically uniformly distributed, i.e., $r_{B,i} \stackrel{\text{i.i.d.}}{\sim} U[0, 1]$. Note that this is an empirical distribution and that it does not contain any information about the true ρ_B .

Each member of the organization, say i , receives a share α_i of the overall payoff, with $\sum_{i \in J \cup m} \alpha_i = 1$. To simplify notation, define $\rho_A = c_A = 0$, so that we can write agent i 's utility as $u_i = \alpha_i(\rho_a - c_a)$ where a is the action undertaken. The assumption that employees care about the firm's success reflects, for example, the fact that their future income within the firm and their future market wages depend on their firm's success. As discussed later, most of the results also obtain when

⁴Note that, while this may seem similar to the assumptions of team theory, the further assumptions on differing beliefs will introduce agency problems.

⁵In most of the paper only the mean of the beliefs matter. In section 2.4, some aspects of the full distribution matter. I will make more specific assumptions at that time.

employees do not care about firm performance but do have personal preferences for A or B .

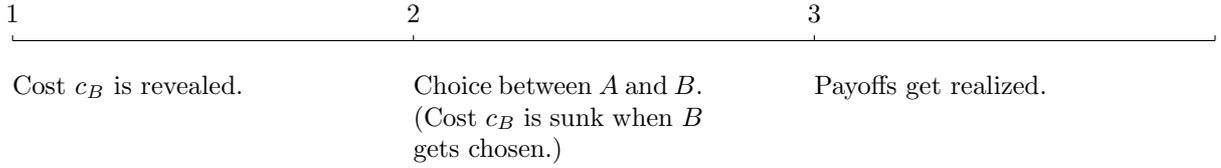


Figure 1: Timing of basic game.

As mentioned, the agents start with differing priors. Such heterogeneous priors do not contradict the economic paradigm: while rational agents should use Bayes' rule to update their prior with new information, nothing is said about those priors themselves, which are primitives of the model. In particular, absent any relevant information agents have no rational basis to agree on a prior. Harsanyi (1967), for example, observed that 'by the very nature of subjective probabilities, even if two individuals have exactly the same information and are at exactly the same high level of intelligence, they may very well assign different subjective probabilities to the very same events'.⁶

Measuring Similarity of Beliefs Since homogeneity of beliefs is at the core of this analysis, we need a measure for the similarity of two agents' beliefs. To that purpose, I will use the Euclidean distance between the means of the beliefs of i and j

$$\delta_{i,j} = |r_{B,i} - r_{B,j}|$$

Apart from being intuitive and well-known, this measure is also very effective in the current context since all results can be expressed directly in terms of $\delta_{i,j}$. Moreover, it turns out that the probability that agents i and j would undertake different actions is precisely $\delta_{i,j}$. This establishes a direct equivalence with the measure used in Van den Steen (2004).

2.2 Delegation and monitoring

Delegation is, to the first order, a trade-off between losing personal control over the decision and having the most appropriate person make the decision. The cost of losing personal control is that, due to differencing priors or preferences, the delegee may choose a different action than the delegator would, given the same information. The gain from delegating the decision to the most appropriate person can take different forms. Models such as Aghion and Tirole (1997) and Dessein (2002) have considered the particular instance that delegation may affect the incentive to collect information, and the situation that the delegee has more information. The simplest motivation is actually that making decisions takes time and effort, especially if follow-up is necessary to make sure the decision gets implemented. If lower level employees have a lower (opportunity) cost of time and effort then it is efficient to delegate. In this paper, I simply assume that centralization of the decision causes an exogenously specified cost.

⁶For a more in-depth discussion of these issues, see Morris (1995), the discussion between Gul (1998) and Aumann (1998), Yildiz (2000), or Van den Steen (2005b). The last argues explicitly that differing priors are consistent with the notion of Nash equilibrium.

Once a manager has delegated the decision, she can still influence the outcome by monitoring the delegee. Such monitoring is an intermediate option between completely centralized and completely decentralized decision making. I assume that monitoring gives the manager with some probability a chance to ‘correct’ the employee, i.e., to make sure that the employee takes the decision that the manager would have taken.

To capture this situation, consider the following variation on the model in section 2.1, with timing as in figure 2 below. At the start of the game, manager m decides whether to delegate the decision to employee i . Centralization causes cost c_c . If m decides to delegate, she can still monitor i . In particular, when she spends effort e on monitoring, at personal cost $c(e)$, m can with probability $P(e) \in [0, 1]$ force i to take the action which m prefers. Assume that $P(e)$ increases in e while $c(e)$ is strictly increasing and convex with $c(0) = 0$.

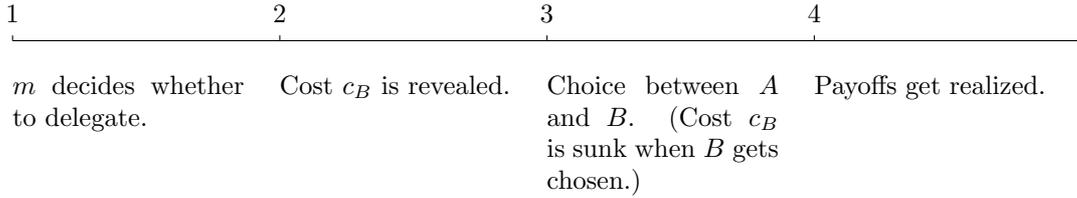


Figure 2: Timing of delegation game.

Proposition 1 *There exists a $\hat{\delta}$ such that m delegates iff $\delta_{m,i} \leq \hat{\delta}$. When the decision is delegated, the level of monitoring e increases in the belief heterogeneity $\delta_{m,i}$.*

Proof : The payoff to m from making the decision herself is

$$\alpha_m \left[\int_0^{r_{B,m}} (r_{B,m} - u) du - c_c \right] = \alpha_m \left[\frac{r_{B,m}^2}{2} - c_c \right]$$

When delegating the decision with monitoring, the payoff to the manager is

$$\begin{aligned} & \alpha_m P(e) \int_0^{r_{B,m}} (r_{B,m} - u) du + \alpha_m (1 - P(e)) \int_0^{r_{B,i}} (r_{B,m} - u) du - c(e) \\ &= \alpha_m \left[\frac{r_{B,m}^2}{2} - (1 - P(e)) \frac{(r_{B,m} - r_{B,i})^2}{2} - c(e) \right] = \alpha_m \left[\frac{r_{B,m}^2}{2} - (1 - P(e)) \frac{\delta_{m,i}^2}{2} - c(e) \right] \end{aligned}$$

Let \hat{e} denote the optimal monitoring effort level. Since this payoff function is supermodular in e and $\delta_{m,i}$, \hat{e} increases in $\delta_{m,i}$ (Milgrom and Roberts 1990). This implies the second part of the proposition. An application of the envelope theorem implies that the payoff from delegation decreases in $\delta_{m,i}$. It follows that the likelihood of delegation will decrease in $\delta_{m,i}$. ■

We can usefully extend the model by introducing a parameter β that measures the importance of the decision. In particular, assume that the payoff of agent i is $u_i = \alpha_i \left[\beta(\rho_a - c_a) - c_c I_{\text{Delegation}} \right]$. In this case, an extension of the above proof shows that more important decisions (higher β) will be less delegated and more monitored. Another interesting variation from an empirical point of view is a situation where the manager can choose among a number of employees with different $\delta_{m,i}$.

Proposition 2 *The manager will delegate to the employee with the lowest $\delta_{m,i}$, i.e. with the most similar beliefs.*

Proof : This follows immediately from the proof of proposition 1. ■

If there are multiple decisions, and each employee can be delegated only one decision, then the most important decisions will get delegated to the most similar employees.

2.3 Influence activities

When people in an organization disagree, they will spend time and effort to move decisions their way. Such actions are generically called ‘influence activities’ (Milgrom and Roberts 1988). We would expect the level of influence activities to decrease as beliefs are more homogenous.

To study this conjecture, assume that agents i and j jointly undertake an action. They can influence the action choice by spending effort on ‘influence activities’. Denote their effort on influence activities as $e_{i,i}$ and $e_{i,j}$ respectively, with $e_{i,i}, e_{i,j} \geq 0$, and assume that the organization will undertake i ’s preferred action with probability $\frac{e_{i,i}}{e_{i,i}+e_{i,j}}$. As before, agent i ’s payoff is $\alpha_i(\rho_a - c_a)$ where a denotes the organization’s action. Agent i ’s efforts have a private cost $c(e_{i,i}) = e_{i,i}$, and idem for j . The timing is indicated in figure 3.

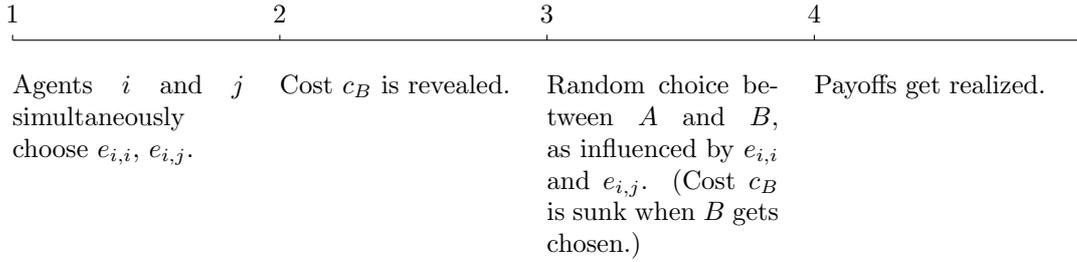


Figure 3: Timing of influence game.

Proposition 3 *Both $e_{i,i}$ and $e_{i,j}$ increase as $\delta_{i,j}$ increases.*

Proof : The payoff to agent i is

$$\begin{aligned}
 & \left[\frac{e_{i,i}}{e_{i,i} + e_{i,j}} \int_0^{r_{B,i}} (r_{B,i} - u) du + \frac{e_{i,j}}{e_{i,i} + e_{i,j}} \int_0^{r_{B,j}} (r_{B,i} - u) du \right] - e_{i,i} \\
 &= \left[\frac{e_{i,i}}{e_{i,i} + e_{i,j}} \frac{r_{B,i}^2}{2} + \frac{e_{i,j}}{e_{i,i} + e_{i,j}} \frac{r_{B,i}^2 - \delta_{i,j}^2}{2} \right] - e_{i,i} \\
 &= \frac{r_{B,i}^2}{2} - \frac{e_{i,j}}{e_{i,i} + e_{i,j}} \frac{\delta_{i,j}^2}{2} - e_{i,i}
 \end{aligned}$$

so that the FOC for $e_{i,i}$ is

$$\frac{e_{i,j}}{(e_{i,i} + e_{i,j})^2} \frac{\delta_{i,j}^2}{2} - 1 = 0$$

Analogously, the FOC for $e_{i,j}$ is

$$\frac{e_{i,i}}{(e_{i,i} + e_{i,j})^2} \frac{\delta_{i,j}^2}{2} - 1 = 0$$

Combining the two FOC conditions gives the unique solution that $e_{i,i} = e_{i,j} = \frac{\delta_{i,j}^2}{8}$ which clearly increases in $\delta_{i,j}$. This proves the proposition. ■

The intuition of the proof is that the benefit from influencing decisions is proportional to the difference in beliefs. More disagreement then leads to more effort.

Empirically, the implication is that influence activities will go up after a merger, in particular for decisions that are affected by members of both pre-merger firms.

2.4 Communication

An important form of influence activity is distortion in the communication of information. In particular, employees will try to communicate only those pieces of information that move the beliefs of the decision maker closer to their own. It makes sense to study this case separately since we get fairly precise predictions regarding the exact form of communication distortion.

To study this phenomenon, consider the following variation on the basic model. The timing of the game is that in figure 4. The manager is now the decision maker. With probability $p \in [0, 1]$, however, agent i has private information regarding ρ_B . Agent i 's (potential) information takes the form of some value $\hat{r} \in [0, 1]$ with the following interpretation: an agent with prior mean r should update that mean to $\gamma r + (1 - \gamma)\hat{r}$. If we assume, for example, that the prior of agent i was a Beta-distribution with parameters $(r_{B,i}N, N)$, then the information would be equivalent to observing $\frac{N}{\gamma}$ tries of action B of which a proportion \hat{r} were successful. Denote agent i 's prior on \hat{r} as F_i .

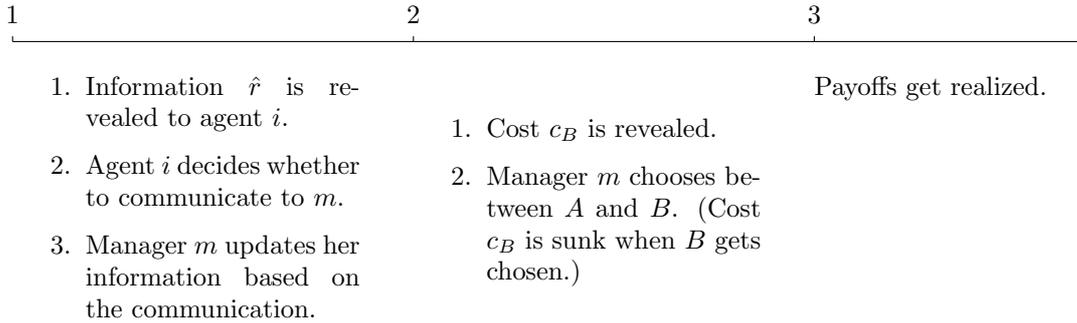


Figure 4: Timing of communication game.

Consider now first the case that $p = 1$, i.e. it is commonly known that i has new information, but communication is (costless) cheap talk. In that case, the results of Crawford and Sobel (1982) apply.⁷ In particular, agent i will partition the set of possible information and communicate only

⁷To see this, reinterpret m 's actions as a one-time choice of a level y such that m will implement B whenever $c_B \leq y$. Further redefine the signal as $m = \gamma r_{B,m} + (1 - \gamma)\hat{r}$. Using $b = \gamma(r_{B,m} - r_{B,i})$, the utility function can then be written

$$\begin{aligned}
 u_i &= \frac{m^2}{2} - \frac{(y - m)^2}{2} \\
 u_j &= \frac{(m + b)^2}{2} - \frac{(y - (m + b))^2}{2}
 \end{aligned}$$

the partition element in which his information falls. Moreover, the finest equilibrium partition, which is Pareto-preferred by both agents, gets finer as $\delta_{m,i}$ decreases. Information is thus less distorted when beliefs are more similar.

Consider next the situation that $p < 1$ but (costless) communication verifiably reveals all the available information. Agent i decides whether or not to communicate the information. Absent such communication, however, m does not know whether i actually had private information.

Proposition 4 *The probability of communication decreases in $\delta_{m,i}$.*

Proof: Let the prior mean of m and i be respectively $r_{B,m}$ and $r_{B,i}$. If i communicates the value \hat{r} , then m updates her mean belief to $\tilde{r}_{B,m} = \gamma r_{B,m} + (1 - \gamma)\hat{r}$ so that i 's expected utility is

$$\frac{(\gamma r_{B,i} + (1 - \gamma)\hat{r})^2}{2} - \frac{(\gamma r_{B,m} - \gamma r_{B,i})^2}{2}$$

Let NC denote the event that i does not communicate. If i does not communicate, then m updates to $\tilde{r}_{B,m} = E_m[\rho_B | \text{NC}]$. Defining \tilde{r} such that $E_m[\rho_B | \text{No Communication}] = \gamma r_{B,m} + (1 - \gamma)\tilde{r}$ we can write i 's utility in this case as

$$\frac{(\gamma r_{B,i} + (1 - \gamma)\hat{r})^2}{2} - \frac{(\gamma(r_{B,m} - r_{B,i}) + (1 - \gamma)(\tilde{r} - \hat{r}))^2}{2}$$

So i will want to communicate iff

$$2\gamma(1 - \gamma)(r_{B,m} - r_{B,i})(\tilde{r} - \hat{r}) + (1 - \gamma)^2(\tilde{r} - \hat{r})^2 \geq 0$$

Consider first the case that $r_{B,m} \geq r_{B,i}$. Agent i 's optimal strategy is then to communicate if and only if $\hat{r} \notin (\max(\tilde{r}, 0), \min(\tilde{r} + \Delta, 1))$ with $\Delta = \frac{2\gamma\delta_{m,i}}{(1-\gamma)}$. In this case, it turns out that there is a unique equilibrium defined as follows. Let $\hat{\Delta}$ be the unique non-negative solution to

$$r_{B,m} + \frac{p\hat{\Delta}^2}{2(1-p)} + \hat{\Delta} = 1$$

As long as $\Delta < \hat{\Delta}$, $\tilde{r} = r_{B,m} + \frac{p\Delta^2}{2(1-p)}$. Otherwise, \tilde{r} equals the unique solution to $\tilde{r} = r_{B,m} + p\frac{(1-\tilde{r})^2}{2(1-p)}$ that is smaller than one (which always exists). Note now that the probability of no communication indeed increases in $\delta_{m,i}$.

The case where $r_{B,m} < r_{B,i}$ is completely analogous. ■

In this case, the equilibrium is such that i always credibly reveals his information, except for an interval that is a strict subset of $[0, 1]$. The interval decreases in $\delta_{m,i}$ and increases in γ . In other words, there is more distortion of beliefs when beliefs are more different and when the new information is less informative. It is interesting to note that the interval is often strictly in the interior of $[0, 1]$, so that i will withhold only intermediate information, but communicate when \hat{r} is either very small or very large.

The empirical implication is that communication will be more distorted after a merger, in particular between members of different pre-merger firms.

2.5 Coordination

One of the most intriguing conjectures is that agents with similar beliefs about the optimal course of action have an easier time coordinating ((Kotter and Heskett 1992) and others).

Except for the first term and the division by 2 of the second term, these are the same utility functions as in example 4 of Crawford and Sobel (1982). Since these terms are constant once the signal is determined (even before it is revealed to i), they do not influence the solution. It follows that all results of that example go through.

Although it is often said that both coordination and motivation are the key tasks for any organization ((Milgrom and Roberts 1992) and others), economics has much more to say about ‘motivation’ than about ‘coordination’.⁸ Without understanding both, however, we will not be able to develop a complete theory of organizations and organization boundaries.

A simple approach to coordination is to conceptualize it as the alignment of two actions in a continuous space. This is often done in team theory. The typical formulation is one in which the joint objective function of two agents i and j has a term $-(x_i - x_j)^2$ where $x_i, x_j \in \mathbb{R}$ are the simultaneous action choices of the agents. Using such model, Crémer (1993) shows how shared information may improve alignment. His model can be reinterpreted to imply that the agent’s actions will be more aligned when their prior beliefs are more similar, as measured by $\delta_{i,j}$.

A more game-theory-type approach is to start from a non-cooperative 2-by-2 coordination game, as in figure 5. In this case, two agents simultaneously and non-cooperatively choose between two possible action, A and B . They only get a payoff if they choose the same action. The problem is that they may have differing beliefs about the values of ρ_A and ρ_B . In particular, agent 1 may think that $E[\rho_A] > E[\rho_B]$, while 2 believes that $E[\rho_B] > E[\rho_A]$. The overall conjecture would now be that coordination is easier if their beliefs are more similar. Analytically, the challenge is that we have no established methodology to measure the ‘difficulty of coordination’ for this setting. The purpose of this section is to suggest and apply a method to do exactly that: measure the difficulty of coordination when there are multiple equilibria. The approach is based on the theoretical and experimental literature on equilibrium selection and on learning to play equilibria. While the focus of that literature is to determine *which* equilibrium will be selected, these theories also inform us implicitly about the *difficulty* of actually reaching the selected equilibrium. I suggest a measure for the difficulty of coordination which combines ideas of both literatures and which is easily tractable. To that purpose, consider the general coordination game in figure 6 where $\min(u_1(AA), u_1(BB)) > \max(u_1(AB), u_1(BA))$ and idem for player 2 so that both AA and BB are the two equilibria.

		Player 2	
		A	B
Payer 1	A	ρ_A, ρ_A	0, 0
	B	0, 0	ρ_B, ρ_B

Figure 5: Coordination Game

The work of Harsanyi and Selten (1988) on risk-dominance and the tracing procedure is among the most influential theories of equilibrium selection. In this 2-by-2 game of figure 6, the theory predicts that players will select equilibrium AA if and only if the Nash product of AA is larger than that of BB , i.e. if

$$(u_1(AA) - u_1(BA))(u_2(AA) - u_2(AB)) > (u_1(BB) - u_1(AB))(u_2(BB) - u_2(BA))$$

⁸At least if we focus on non-price coordination.

		Player 2	
		A	B
Payer 1	A	$u_1(AA), u_2(AA)$	$u_1(AB), u_2(AB)$
	B	$u_1(BA), u_2(BA)$	$u_1(BB), u_2(BB)$

Figure 6: Coordination Game

or

$$\frac{(u_1(AA) - u_1(BA))}{(u_1(BB) - u_1(AB))} > \frac{(u_2(BB) - u_2(BA))}{(u_2(AA) - u_2(AB))} \quad (1)$$

Given this theory, a good measure for the difficulty of coordination should be related to the above expression.

A different approach is to look at the theory of learning. I focus in particular on models of belief-based learning, which correspond to $\delta = 1$ in the EWA model (Camerer and Ho 1998). In such belief-based learning models, each agent tries to form beliefs regarding the other player's behavior, based on the other's past behavior. A typical example, which I rely on in what follows, is the following. Each player starts from the belief that the other will play each action with equal probability. Each player then chooses his best response to these beliefs. Upon observing the other player's action, each player updates his beliefs about what the other actually does. When updating, both attach strictly positive and identical weights to their priors. Each could, for example, assume that his prior beliefs correspond to N previous observations of action choices. Given their new beliefs, the players choose again actions and update their beliefs. They continue to do so until they coordinate on an equilibrium. Given such learning process, one can show that the agents will coordinate on the risk-dominant equilibrium as $N \rightarrow \infty$ i.e. as they learn sufficiently slowly. Moreover, if player 1 originally chooses B and player 2 originally chooses A , then the time to reach an equilibrium equals

$$\min \left(\frac{u_1(AA) - u_1(BA)}{u_1(BB) - u_1(AB)} - 1, \frac{u_2(BB) - u_2(BA)}{u_2(AA) - u_2(AB)} - 1 \right) \quad (2)$$

An analogous result holds when 1 chooses A and 2 chooses B . Finally, the time is zero when they prefer the same action. Comparing equations (1) and (2), it is clear that both approaches result in closely related measures. I will therefore measure the difficulty to coordinate by the time it takes to reach an equilibrium as derived above.

To study now coordination in this particular context, consider the following situation. Agents i and j have to decide independently whether to implement action B . Their payoffs are as before, with one key difference: when their actions match, they get an extra payoff of 1. The payoff matrix is thus as in figure 7.⁹

Proposition 5 *The expected time to coordination increases in the level of heterogeneity $\delta_{i,j}$.*

⁹Alternatively, we could assume that all off-diagonal payoffs are zero. The same result then holds.

		Player j	
		L	R
Payer i	U	$1 + r_{B,i} - c_B, 1 + r_{B,j} - c_B$	$r_{B,i} - c_B, 0$
	D	$0, r_{B,j} - c_B$	$1, 1$

Figure 7: Payoff Matrix

Proof :

Denote $r_{B,i} - c_B = \Delta_i$ and analogous for Δ_j . The respective elements of expression (2) are

$$\frac{(1 + r_{B,i} - c_B - 0) - (1 - (r_{B,i} - c_B))}{(1 - (r_{B,i} - c_B))} = \frac{1 + \Delta_i}{1 - \Delta_i} - 1$$

$$\frac{1 - (r_{B,j} - c_B)}{1 + (r_{B,j} - c_B) - 0} - 1 = \frac{1 - \Delta_j}{1 + \Delta_j} - 1$$

Note that the c_B where we switch from one equilibrium to the other is such that

$$\frac{1 + \Delta_i}{1 - \Delta_i} = \frac{1 - \Delta_j}{1 + \Delta_j}$$

or $r_{B,i} + r_{B,j} = 2c_B$.

Assume now that $r_{B,i} > r_{B,j}$. In that case, the expected time to coordination is

$$\int_{r_{B,j}}^{\frac{r_{B,i} + r_{B,j}}{2}} \left(\frac{1 - (r_{B,j} - u)}{1 + (r_{B,j} - u)} - 1 \right) du + \int_{\frac{r_{B,i} + r_{B,j}}{2}}^{r_{B,i}} \left(\frac{1 + (r_{B,i} - u)}{1 - (r_{B,i} - u)} - 1 \right) du$$

$$= \int_{1 - \frac{r_{B,i} - r_{B,j}}{2}}^1 \left(\frac{2}{v} \right) dv + \int_{1 - \frac{r_{B,i} - r_{B,j}}{2}}^1 \left(\frac{2}{v} \right) dv - 2(r_{B,i} - r_{B,j})$$

$$= 2 \left[2 \log(v) \Big|_{1 - \frac{\delta_{i,j}}{2}}^1 - \delta_{i,j} \right]$$

$$= 2 \left[-2 \log \left(1 - \frac{\delta_{i,j}}{2} \right) - \delta_{i,j} \right]$$

This is zero at $\delta_{i,j} = 0$ and the derivative for $\delta_{i,j}$ is

$$2 \left[-2 \frac{1}{1 - \frac{\delta_{i,j}}{2}} \left(-\frac{1}{2} \right) - 1 \right] = 2 \left[\frac{1}{1 - \frac{\delta_{i,j}}{2}} - 1 \right] = 2 \left[\frac{2}{2 - \delta_{i,j}} - 1 \right]$$

which is positive for $0 < \delta_{i,j} < 1$. So it follows that the time to coordination increases in $\delta_{i,j}$, or that coordination is easier when beliefs are more similar. The argument for $r_{B,i} < r_{B,j}$ is analogous. ■

The empirical implications are thus that

- Coordination will on average become more difficult after a merger.
- Coordination will be more difficult between members of different pre-merger firms than between members from the same pre-merger firm.

2.6 Information Generation

When agents in a joint project have differing priors, they have extra incentives to collect information. The reason is that each agent expects his prior to be confirmed in the data and thus to be able to move the belief of the others closer to his own, i.e. he believes that new data will ‘convince’ the other agent that he was right to begin with. This ‘convincing’ effect is unique to a situation with differing priors, and is very different from the effects in influence-type models such as Rotemberg and Saloner (1995), Milgrom and Roberts (1986), or Dewatripont and Tirole (1999).¹⁰

To see this formally, consider the following variation on the basic model. There are two agents i and j . Agent j will make the decision. Agent i can publicly collect new information. Assume in particular that when i spends effort e , at private cost $c(e)$, then with probability $P(e)$ both i and j will observe the outcome of an experiment on B .

Proposition 6 *For given $r_{B,j}$, the effort e increases in the level of heterogeneity $\delta_{i,j}$.*

Proof : Let $\hat{r}_{B,j}(r_{B,j}, X)$ with $X \in (S, F)$ denote j 's updated belief after a success (S) or failure (F). Remember that the agents have Beta priors that corresponded to N observations, so that $\hat{r}_{B,j}(r_{B,j}, S) = \frac{Nr_{B,j}+1}{N+1}$. Agent j 's expected utility upon a success is

$$(\hat{r}_{B,j}(r_{B,j}, S)\hat{r}_{B,i}(r_{B,i}, S) - \frac{\hat{r}_{B,i}(r_{B,i}, S)^2}{2}) = \frac{(Nr_{B,j} + 1)(Nr_{B,i} + 1) - \frac{(Nr_{B,i}+1)^2}{2}}{(N + 1)^2}$$

while upon a failure it is

$$(\hat{r}_{B,j}(r_{B,j}, F)\hat{r}_{B,i}(r_{B,i}, F) - \frac{\hat{r}_{B,i}(r_{B,i}, F)^2}{2}) = \frac{(Nr_{B,j})(Nr_{B,i}) - \frac{(Nr_{B,i})^2}{2}}{(N + 1)^2}$$

So the expected utility from generating information is

$$\begin{aligned} & r_{B,j} \frac{(Nr_{B,j} + 1)(Nr_{B,i} + 1) - \frac{(Nr_{B,i}+1)^2}{2}}{(N + 1)^2} + (1 - r_{B,j}) \frac{(Nr_{B,j})(Nr_{B,i}) - \frac{(Nr_{B,i})^2}{2}}{(N + 1)^2} \\ &= \frac{r_{B,j}(N(r_{B,i} + r_{B,j}) + 1) - r_{B,j} \frac{2Nr_{B,i}+1}{2} + (N^2 r_{B,i} r_{B,j}) - \frac{(Nr_{B,i})^2}{2}}{(N + 1)^2} \\ &= \frac{1}{2(N + 1)^2} (2Nr_{B,j}^2 + r_{B,j} + 2N^2 r_{B,i} r_{B,j} - N^2 r_{B,i}^2) \\ &= \frac{1}{2(N + 1)^2} ((N + 1)^2 r_{B,j}^2 + r_{B,j}(1 - r_{B,j}) - N^2 (r_{B,j} - r_{B,i})^2) \end{aligned}$$

Without that extra information, the utility would have been

$$(r_{B,j} r_{B,i} - \frac{r_{B,i}^2}{2}) = \frac{1}{2(N + 1)^2} (2(N + 1)^2 r_{B,j} r_{B,i} - (N + 1)^2 r_{B,i}^2)$$

So the gain from extra information is

$$\begin{aligned} & \frac{1}{2(N + 1)^2} ((N + 1)^2 r_{B,j}^2 + r_{B,j}(1 - r_{B,j}) - N^2 (r_{B,j} - r_{B,i})^2 - 2(N + 1)^2 r_{B,j} r_{B,i} + (N + 1)^2 r_{B,i}^2) \\ &= \frac{1}{2(N + 1)^2} (((N + 1)^2 - N^2) (r_{B,j} - r_{B,i})^2 + r_{B,j}(1 - r_{B,j})) \\ &= \frac{1}{2(N + 1)^2} (r_{B,j}(1 - r_{B,j}) + ((N + 1)^2 - N^2) \delta_{i,j}^2) \end{aligned}$$

¹⁰These models rely either on the fact that the agents can bias the information collection (by choosing from biased sources or by only reporting favorable information) or on the fact that collecting extra information introduces an element of randomness, which is good if your favorite action is currently lagging.

which is strictly positive and strictly increasing in $\delta_{i,j}$. ■

Note that the gain from information collection consists of two terms. The first term, which contains the factor $r_{B,j}(1 - r_{B,j})$ is the benefit from reducing the variance of the beliefs. The second term, with the $\delta_{i,j}$ -factor, is the gain from convincing the other agent.

In this case, the empirical implication is that information collection, for information that helps the action choice, will increase after the merger, in particular when the decision-maker and information-collector are from different pre-merger firms.

2.7 Effort and Utility

When everyone cares about the outcome, people in an organization with more disagreement will have lower expected utility since they will more often believe that the ‘wrong’ action was taken. At the same time, if agents can spend incontractible personal effort to increase the payoffs, then they will spend less such effort in an organization with more disagreement, since they will more often feel that their effort is spent on the wrong projects.

To consider these ideas more formally focus on the situation of one agent i . Consider first how his utility depends on the belief $r_{B,j}$ of the decision maker j .

Proposition 7 *For given agent i with belief $r_{B,i}$, i 's utility decrease in $\delta_{i,j}$.*

Proof : Agent i utility is $\alpha_i \frac{r_{B,i}^2 - \delta_{i,j}^2}{2}$, which implies the result. ■

Assume next that i can spend effort $e \geq 0$ on increasing the payoff, at a private cost $c(e)$, which is increasing and convex. In particular, let the organizational payoff be $Q(e)(\rho_a - c_a)$. Assume that $Q(e)$ is increasing and $c(e)$ is increasing and convex. Again, as before, j is the decision maker.

Proposition 8 *For given agent i with belief $r_{B,i}$, i 's effort decreases in $\delta_{i,j}$.*

Proof : Agent i utility is now $\alpha_i Q(e) \frac{r_{B,i}^2 - \delta_{i,j}^2}{2} - c(e)$, which implies the result by monotone comparative statics. ■

The empirical implication is that mergers lead to lower effort and utility, especially when the focal person's situation is affected by the decisions of someone from the other pre-merger firm.

2.8 Beliefs versus utility

Many of the results extend to homogeneity of preferences. In particular, we can reinterpret the model as follows. Let $r_{B,i}$ denote the utility that i gets when the firm undertakes action B and let $\alpha_i = 1$. The action could, for example, be the implementation of a more environmentally friendly approach to production. The cost c_B is now the benefit/cost of implementing this new approach. With this modification, we get the following results for homogeneity of preferences or ‘values’.

- Managers will delegate more, and more important decisions, to employees with more similar preferences. When delegating, they also monitor such employees less.
- There will be less influence activity in organizations with more similar preferences.

- Employees will distort information less when they communicate with others with more similar preferences.
- Employees will coordinate more easily when their preferences are more similar.
- Utility will be higher in organizations with more homogenous preferences.

The other results either do not extend or require more fundamental modifications to the model.

The reason to formulate the original model in the paper in terms of beliefs is twofold. First of all, it seemed that more utility-related results can be obtained by reinterpreting the belief-based model than the other way around. Second, the idea that agency problems originate in honest disagreement about the right course of action is quite appealing when one looks at managerial and board discussions.

3 Mergers and Culture Clash

The theory has specific implications for the effect of mergers on firm behavior and performance. In particular, Van den Steen (2004) shows that firms will be more homogenous than society at large through two mechanisms:

1. People prefer to work with others who have similar beliefs and preferences since such others will ‘make the right decisions’.
2. People who are part of the same organizations have shared experiences, which make their beliefs converge.

Two randomly picked employees of the same firm are thus more likely to agree than two randomly picked employees from different firms. In other words, firms are internally homogenous but different from each others.

When two firms that each have their own shared beliefs merge, the theory makes some specific predictions:

1. The overall level of delegation will decrease and the overall level of monitoring will increase. When a manager and her subordinate are originally from different firms then the manager is less likely to delegate and more likely to monitor than when manager and subordinate are originally from the same firm.
2. The overall level of influence activities will increase. When two employees are originally from different firms then they are more likely to engage in influence activities than when they are originally from the same firm.
3. The overall level of coordination will decrease and will take more time. When two employees are originally from different firms then they will have more difficulty coordinating than when they are originally from the same firm.
4. The overall distortion of communication will increase. When two employees are originally from different firms then communication between them is more likely to be distorted than when they are originally from the same firm.

5. The overall level of information collection will increase. When a manager and her subordinate are originally from different firms then the subordinate will collect more information than when they are originally from the same firm.
6. The overall level of satisfaction and motivation will decrease. When a manager and her subordinate are originally from different firms then the subordinate will be less satisfied and less motivated than when they are originally from the same firm.

Note that the costs of culture clash that are identified above will be felt immediately. In particular, the organization will function less smoothly than before, which will immediately reduce its performance. The benefits of culture clash, on the other hand, seem to be more long-term. This is true for the increase in information collection identified above, but also for other positive effects of heterogeneity that are sometimes mentioned but that are not formally studied in this paper, such as higher flexibility and less resistance to change. Overall, culture clash will reduce operational performance of the firm, but may lead over time to a better fit with the environment.

4 Conclusion

The key argument of this paper is that homogeneity is a pervasive force in agency problems. As a consequence, merging two internally homogenous organizations will lead to a drastic increase in the level of agency problems. However, such a merger may also be a catalyst for more information collection and communication, which may over time improve its fit with the environment.

The paper clearly misses some important parts of the puzzle. Some are missing since their theoretical treatment requires a very different analytical context, which would muddy the current analysis. Others seem (for now) difficult to cast in economic terms. Potential issues that come to mind are the role of culture in identity and in influencing one's preferences. Still others await discovery.

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